7.3 *Additional Geotechnical Investigation Reports*

Tenderer shall download Additional Geotechnical Investigation Reports from HRIDC website for their reference. Additional Geotechnical Investigation Reports are available for downloading under Active Tender Section on HRIDC website (https://hridc.co.in/active-tender.php).

Alternate Link for downloading Additional Geotechnical Reports is given below:

https://drive.google.com/file/d/1bftmPZhYcSGwm6hYhKVEX41Zs_Payk68/view?usp=drive_web

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	Report No: 1901-HORC-I	*1-115*
	Report No: 1901-HORC-II	*1-147*
	Report No: 1901-HORC-III	*1-317*
	Report No: 1901-HORC-IV	*1-313*
	Report No: 1901-HORC-V	*1-312*
	Report No: 1901-HORC-VI	*1-129*
	Report No: 1901-HORC-VII	*1-57*
	Report No: 1901-HORC-VIII	*1-61*
	Report No: 1901-HORC-X	*1-67*

Note: Additional Geotechnical Investigation Report (indicative report) for 87 Nos. of boreholes included with these reports for Tenderer's reference.

Report No: 1901-HORC-I

Report No.: 1901-HORC-I

Date: Oct 16th; 2023

GEOTECHNICAL INVESTIGATION REPORT

ULR No.: TC916923000000032P
REVISION-R1

AT THE SITE FOR

HORC VIADUCT BETWEEN SOHANA & DHULAWAT STATIONS OF HARYANA ORBITAL RAIL CORRIDOR (HORC) PROJECT, HARYANA

FROM BOREHOLES A1 TO P20

CLIENT

HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LTD.

Plot No. 143, 5th floor RailTel tower, Sector-44,
Gurugram, Haryana 122003

GENERAL CONSULTANTS

RITES-SMEC JV

Gurugram, Haryana

GEOTECHNICAL CONSULTANTS

TECHPRO ENGINEERS PVT. LTD.

114, RAM GANGA HOUSING SOCIETY, NARAMAU, G T ROAD, KANPUR-209 217, Phone: 9793209918

e-mail: info@techproindia.com

TC-9169

REVISION NOTES

REVISION NO.	DATE	DESCRIPTION
R1	09.12.23	• Vertical and Lateral pile load capacity in Table 1 to 4 of Appendix-H and recommendations revised. • Field bore log charts added in Appendix-K.

TECHPRO ENGINEERS PVT.LTD.
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Web site: www.techproindia.com

REPORT FORMAT

Report No.	Bore included	Total Number of Bores
1901-HORC-I	A1 to P20	21
1901-HORC-II	P21 to P40	20
1901-HORC-III	P41 to P60	20
1901-HORC-IV	P61 to P80	20
1901-HORC-V	P81 to P100	20
1901-HORC-VI	P101 to P113	13
1901-HORC-VII	P114A to P133A	20
1901-HORC-VIII	P134A to A2A	16
1901-HORC-IX	P114B to P133B	20
1901-HORC-X	P134B to A2B	16

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TESTING

Certificate Number: TC-9169

Issue Date: 23/12/2022 **Valid Until:** 22/12/2024

This certificate remains valid for the Scope of Accreditation as specified in the annexure subject to continued satisfactory compliance to the above standard & the relevant requirements of NABL.
(To see the scope of accreditation of this laboratory, you may also visit NABL website www.nabl-india.org)

Name of Legal Identity : Techpro Engineers Private Limited

Signed for and on behalf of NABL

N. Venkateswaran
Chief Executive Officer

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Oct 16th; 2023

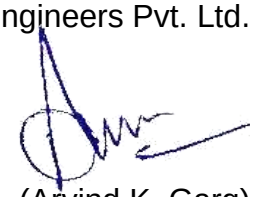
ACKNOWLEDGEMENTS

We are pleased to submit the part-1 of the report of Geotechnical investigation, conducted for the boreholes A1 and P1 to P20 for the design of foundations for HORC Viaduct between Sohana & Dhulawat stations of Haryana Orbital Rail Corridor (HORC) project in the state of Haryana, India.

We hereby, convey our sincere thanks to Mr. Neeraj Bhandari (CPM/South) and Mr. Raju Solanki (DGM/C/South), HRIDCL for trust and support during the investigation. We also acknowledge our thanks to Mr. Uma Maheshwara Rao B, DGM/C/West, HRIDCL for awarding the said work to us. We are also grateful Mr. Ravindra Dutta Upadhyay (Geotech Expert), Mr. PS Gautam & Mr. Jitender Parashar, Site Engineer from the RITES- SMEC JV and Mohd. Ishak (Executive/Civil) from HRIDCL, for their help rendered during and prior to the investigation work.

We are also thankful to our staff members for conducting field and laboratory test, preparing sketches, and typing the report.

for Techpro Engineers Pvt. Ltd.



(Arvind K. Garg)
B.Tech. (Civil), M.Tech.
Principal Consultant &
Managing Director

1. INTRODUCTION:

Haryana Rail Infrastructure Development Corporation Ltd. (HRIDC) and Ministry of Railways, Govt. of India has come together to form a new company namely Haryana Orbital Rail Corporation Limited (HORCL), to design and construction of new BG line from Palwal to Sonipat named Haryana Orbital Rail Corridor (HORC), in the state of Haryana, India. In this connection, a Geotechnical investigation has been planned for the design of foundations of Viaduct between Sohana & Dhulawat stations of Haryana Orbital Rail Corridor (HORC) Project in the state of Haryana. The work of conducting the detailed Geotechnical Investigation has been awarded to us by HRIDC, through work order No. HRIDC/HORC/GTI/211/2023-2024/Vol-0 dated 02-09-2023, which includes investigation in field, laboratory testing of disturbed and undisturbed samples, collected from the field, and submission of the geotechnical **investigation** test report.

A geotechnical investigation was carried out, with the locations, planned by the client. Purpose of the investigation is to determine the nature and properties of soil and rock strata across the bore holes and representing them through log sections showing the levels, nature, and properties of various strata up to a sufficient depth below the founding level, proneness of site to artesian conditions, seismic disturbance and other engineering properties of soil and rock strata.

This part -1 of the report includes the detailed methodology of investigation, collection of samples, field and laboratory test result including their interpretation/ analysis, recommendations on the properties of soils and rock required for design of foundation and suggesting suitable type and depth of foundation with allowable bearing capacity for safe and strong foundations for the Bore Hole numbers A1 and P1 to P20.

2. SCOPE OF WORK:

For the design of foundation of viaduct, it is required to determine the allowable bearing capacity together with necessary engineering characteristics of underlying soil & rock strata. In general, the geotechnical investigation has been planned as per IS:1892-2021 and further extended to IS: 1904, IS:2911 (part-1/Sec 2) & IRC 78:2014 for planning the laboratory testing and computing the allowable bearing capacity, hence the scope of work is as follows:

2.1. Mobilisation of all tools & plants along with accessories, materials, labours etc. at site of work for drilling and testing work, including setting up boring and shifting to different bore holes point etc.

2.2. Exploratory drilling of 150 mm diameter bore holes through soil deposits and 75 mm in rock within the proposed alignment upto the required depth.

2.3. Collection of disturbed soil samples at an interval of 3.00 meter in all the bore holes.

2.4. Collection of undisturbed soil samples at every 3.00 m interval or at change of stratum from all the boreholes.

2.5. To conduct Standard Penetration Test (SPT) at an interval of 3.00 m or noticeable change of stratum in soil deposits in all bore holes.

2.6. Collection of rock core samples and preserving them in core boxes.

2.7. To collect ground water sample on completion of bore holes.

2.8. To record the ground water table in all the bore holes.

2.9. Transporting all the disturbed, undisturbed soil and rock core samples collected during the field investigation to our NABL accredited Geotech Engineering laboratory at Kanpur.

2.10. To conduct the laboratory tests on all the soil and rock core samples collected during field investigation for determination of their engineering characteristics.

2.11. To compile of field and laboratory test results, working out the allowable bearing capacity and preparing the report including detailed recommendations and necessary precautions.

3. GEOLOGICAL INFORMATION OF THE REGION:

3.1. Geography:

The project location is in the bordering area of Gurugram and Nuh (recent old name-Mewat), districts in the Indian state of Haryana. The stretch of the alignment of the proposed corridor starts from southmost part of Gurugram in the town of Sohna and ends at Dhulawat, which is a village lying at the north of Nuh district.

Haryana is a state located in the northern part of India. Gurugram is among one

of the districts in Haryana which is also the part of National Capital Region (30km south of New Delhi). It lies at an elevation of 217 m above msl. Sohna is a small town located 25km in the south of Gurugram. Sohna is well known for its hot water springs and famous Shiva temple. Sohna is located in between 28°15' N latitude and 77°40' E longitude at the elevation of 212.14m above msl. Mewat district is located at 28 °12′ N latitude, 77 °3′ E longitude, at the south of Gurugram at an elevation of 199 m above msl. The location is bordered by Rewari district on west and Faridabad & Palwal district on the east.

3.2. Geology:

The Gurugram district is having of almost flat topography, however, in the north-eastern part small isolated hillocks of Precambrian rocks are exposed. Small hill ranges which are part of the Aravali and Mangar Bani ranges exists in the district. The major part of district is underlain by Quaternary alluvium consisting of sand, clay and silt. The alluvial plain is formed by the Sahibi river which is a tributary of River Yamuna. Soils of the Gurgaon district is classified as tropical and brown soils, existing in the north western extreme, northern and north eastern parts of the district and water logged and salt affected soils in the southern parts of the district. The soils are medium textured loamy sand is the average texture in Gurgaon and Sohna blocks.

3.3. Rainfall and Climate:

The area has hot semi-arid type of climate characterising extreme dryness of the air except in the monsoon season. Intense hot summer and cold winters. The total annual rainfall in the region is about 596 mm, of which 75 to 80% is because of the south-west monsoon.

3.4. Seismicity:

The site under consideration exists in the district of Gurugram and Mewat which lies in the Seismic Zone IV (high damage risk zone), as per the current seismic zonation map of India (IS 1893-2016): RA 2021 and have a zone factor of 0.24 for design basis earthquake. The region is surrounded by many in-homogeneities in the form of faults and ridges like Sohna Fault, Moradabad Fault, Delhi-Moradabad Fault, Delhi-Haridwar ridge, junction of Aravalli and Alluvium near Delhi. The Sohna fault line lies between the Delhi ridge and Sohna town and falls between the Arjangarh and

Manesar outcrops. All the developed area in Gurugram comes within 200 km of the fault line. The Sohna fault line is located at the junction between the hard rock terrain of the Aravalli hills and the sandy formation of the Yamuna River and is currently inactive from several years and is capable of a disastrous earthquake.

The project location has been marked in Fig.1 Seismic zone map of India.

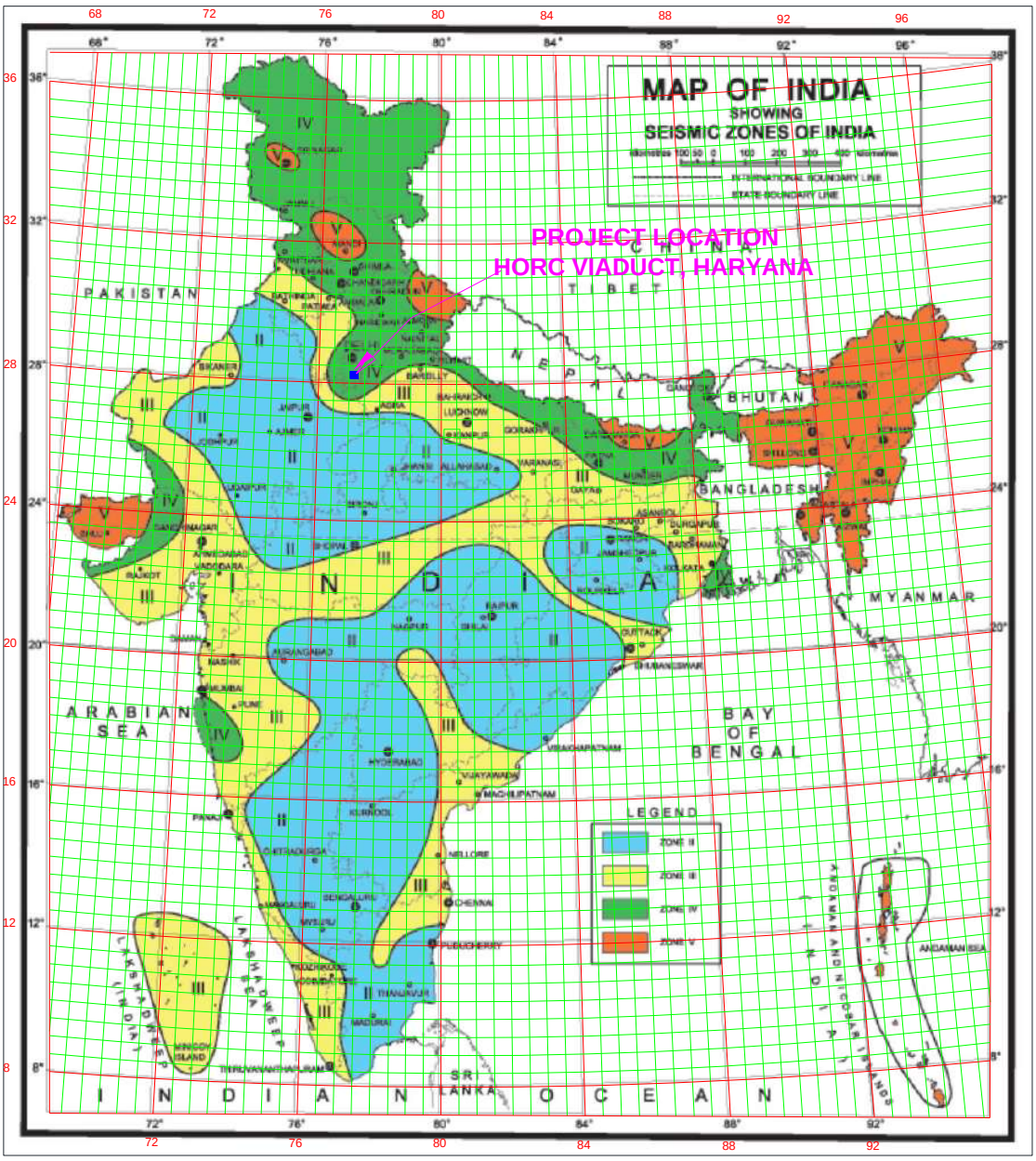


Fig.1: Seismic Zone Map of India

4. FIELD INVESTIGATION:

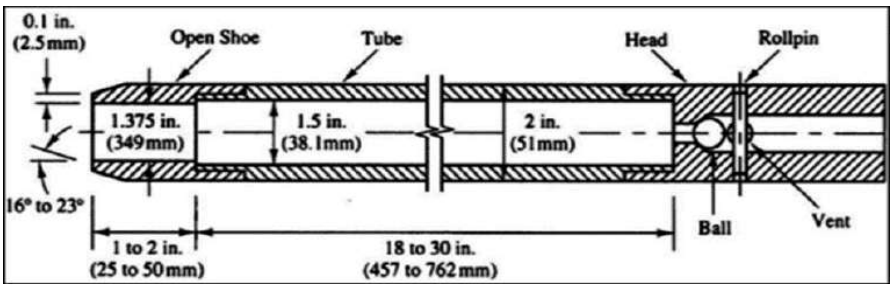
The field investigation work at this site was carried out from Sep 20th; 2023 to Sep 23rd; 2023 & Oct 15th; 2023 to Oct 22nd; 2023. The following investigation

work was carried out:

4.1. **Six number** of **boreholes** (marked as A1, P6, P12, P13, P17 & P18) of diameter 150 mm in soil were made within the proposed alignment for conducting Standard Penetration Test and collection of disturbed and undisturbed soil samples. The boreholes were progressed using power operated winch machine under percussion method of drilling. Casing was used to keep the borehole stable, and Bentonite was also used as drilling mud to help prevent wall collapse of boreholes at deeper depth. The records of achieved depth of bore holes have been given in Para No. 6, the details of drilled bores along with depth of casing used have been reported in Appendix B. Locations of boreholes have been reported in "TEST LOCATION PLAN" in Appendix A.

4.2. **Standard Penetration Tests** were conducted at 1.00 to 2.00 metre interval upto the depth of 12.00 meter and 3.00 metre interval, beyond 12.00 metre depth, as per the procedure in IS: 2131-1981-(RA: 2021) in all the bore holes. The **standard SPT sampler** (without liner and with no space for liner) and **auto-trip hammer** of standard weight of 63.50 kg have been used to perform the test.

For conducting the test, the bottom of the borehole was properly cleaned, and split spoon sampler was properly seated in position in the borehole. The split spoon sampler resting on the bottom of borehole was allowed to sink under its own weight; then the sampler was allowed to penetrate 15 cm with the blows of the hammer 63.50 kg weight falling free through 75cm, thereafter the split spoon sampler was further driven by another 15 cm. For the 3rd and final drive, the sampler was further allowed to penetrate 15 cm. The number of blows required to get each 15 cm of penetration, was recorded. The first 15 cm of drive is seating drive.



Structure of SPT Sampler

The total blows of penetration for the second and third 15 cm of penetration is

termed the penetration resistance N. The N' values are indicative of the compactness/ relative density of cohesion less soils and consistency of cohesive soils.

In case the blows count of SPT in soil (including the number of blows of seating) exceeds 100, the corresponding penetration was recorded and this particular test at that depth stopped. If the total penetration is more than the seating penetration of 15 cm, then breakup of blow counts for 15 cm seating penetration and for remaining portion of penetration is also given.

SPT 'N' values are correlated with non-cohesive stratum as per BS: 5930 (1999) – for sandy strata and with consistency of cohesive stratum.

Correlation For Clay/Plastic Silt		**Correlation For Sand/Non-Plastic Silt**	
Consistency of clays	**Penetration Value**	**Relative Density of sand**	**Penetration Value**
Very Soft	0 to 2 Blows	Very loose	0 to 4 Blows
Soft	3 to 4 Blows	Loose	5 to 10 Blows
Medium Stiff	5 to 8 Blows	Medium	11 to 30 Blows
Stiff	9 to 16 Blows	Dense	31 to 50 Blows
Very Stiff	17 to 32 Blows	Very Dense	Above 50
Hard	Above 32		

In this method, the sampler acts as a probe and the driving energy is supplied by the fall of the drop weight. The values of 'N' depend on the compactness or relative density of the material. In hard formations, the testing is discontinued if 'N' value is found to be more than 100. It is termed as 'Refusal'. Refusal is also recorded when SPT blow count records 50 or more for any of the single drive of 15 cm.

'N' value depends upon degree of saturation and over burden pressure of the formation. Silty fine sand and fine sand below the water table develop pore water pressure depending on the in-situ void ratio which in turn affects the effective stress. This change in effective stress influences the 'N' value considerably.

Depth of overburden affects the SPT values in none to low cohesive soils and hence need correction. The SPT value after the overburden correction, N' is as follows:

$$N' = 0.77x \log (2000/q) \times N$$

Where, q= Overburden Pressure (kN/m^2) and N = observed SPT value

N' is corrected further for dilatancy in case of saturated fine sands and silts for the values of N' greater than 15.

Modified value after dilatancy correction N" = 15+ (N'-15)/2

Soil samples obtained from split spoon sampler were collected in the polythene bags of suitable size. These samples were property sealed, labelled, and carefully transported to the laboratory for testing. The results have been reported in Table 1 to 6 of Appendix B under the title "SUMMARY OF TEST RESULTS".

4.3. **Disturbed soil samples** were collected at 0.50 metre, then at 1.00 to 2.00 metre interval upto the depth of 12.00 meter and 3.00 metre interval, beyond 12.00 metre depth and at significant change of stratum. Soil from cutting edge of SPT samplers and retained in split spoon, used for Standard Penetration Tests was taken as disturbed samples. These samples were placed without delay in adequately sealed polythene bags. Where the collection of disturbed soil samples could not be collected from SPT samples, Shelby tubes were driven and retained soil samples were obtained. The laboratory tests were conducted on the collected soil samples and reported in Table 1 to 6 of Appendix-B under the title "SUMMARY OF TEST RESULTS".

4.4. **Undisturbed soil samples** were collected in accordance with IS: 2132-1986-(RA: 2021) at an interval of 3.00 metre or at change of stratum, starting from the depth of 1.00 or 2.00 m, by using 100 mm dia. and 450 mm long MS tubes provided with sampler head with ball check arrangement. However, the some of the samples could not be extracted due to the partial penetration or slippage during the evacuation.

Moreover, collection of Undisturbed samples in very hard cohesive soils/ dense granular soils/gravels/ cobbles/ pebbles/ boulders, refusal strata is practically not possible and such collected samples will not truly represent the undisturbed conditions.

Immediately after taking undisturbed sample in the tube, the adopter head was removed along with the disturbed material. The visible ends of the samples shall then be trimmed off any wet disturbed soil. The ends will then be coated alternately with four layers of molten wax. More molten wax will then be added to give a total thickness

of not less than 25 mm. The laboratory test results have been reported in Table 1 to 6 of Appendix-B.

4.5. The **ground water table** in the borehole was allowed to stabilize and measured after 8, 16, 24 and 48 hours after completion of the bore hole. It was ensured that last two reading were identical. The records of ground water table have been given in Para No.6.

4.6. **Ground water samples** were collected from borehole as per IS: 6935-1973-(RA:2019) for chemical analysis to determine aggressiveness in relation to attack on concrete / reinforcement including determination of pH value.

5. LABORATORY TESTS:

The following laboratory tests were conducted to determine the engineering characteristics of sub-soils:

5.1. **Field moisture contents** were determined by oven drying method as per IS: 2720 (part II)-1973-(RA: 2020). The results have been reported in Table 1 to 6: "SUMMARY OF TEST RESULTS" of Appendix B.

5.2. **Bulk density** of soil strata was obtained using Shelby tubes in accordance with IS 2720 (part XXIX)-1975-(RA: 2020). The results have been reported in Table 1 to 6: "SUMMARY OF TEST RESULTS" of Appendix B.

5.3. **Mechanical sieve analysis** test was performed in accordance with IS: 2720 (Part IV) – 1985-(RA: 2020), for the purpose of identification by grain size analysis, on coarse part of the soil samples and the results have been reported in Table 1 to 6: "SUMMARY OF TEST RESULTS" of Appendix B.

5.4. **Particle size analysis** test by **Hydrometer method** were performed in accordance with IS: 2720 (Part IV) -1985-(RA: 2020) on the part of soil samples obtained after the sieve analysis. The results have been reported in Table 1 to 6: "SUMMARY OF TEST RESULTS" of Appendix B.

5.5. **Atterbergs' limits tests** were performed in accordance with IS: 2720 (part V)-1985-(RA: 2020) and results have been reported in Table 1 to 6: "SUMMARY OF TEST RESULTS" of Appendix B.

5.6. **Specific gravity tests** were performed in accordance with IS 2720 (part III-sec. 1) -1980-(RA: 2021) and the results have been reported in Table 1 to 6: "SUMMARY OF TEST RESULTS" of Appendix B.

5.7. **Consolidation tests** were performed on cohesive soil samples in accordance with IS: 2720 (part XV)-1965-(RA: 2021). The results have been reported in Table 1 to 6: "SUMMARY OF TEST RESULTS" of Appendix B.

5.8. **Direct shear tests** were performed as per IS: 2720 (part XIII)-1986-(RA: 2021), on the undisturbed soil samples obtained during the field investigation. The results and the density of samples have been reported in Table 1 to 6: "SUMMARY OF TEST RESULTS" of Appendix B.

5.9. **Tri-axial Compression Test** under Unconsolidated Un-drained (UU) condition as per IS: 2720 (Part-XI)-1993-(RA: 2021) were performed on the selected undisturbed soil samples, obtained during the field investigation. The results have been reported in Table 1 to 6: "SUMMARY OF TEST RESULTS" of Appendix B.

5.10. **Unconfined Compressive strength tests** were performed in accordance with IS 2720 (Part-X) -1991-(RA:2020) on selected undisturbed soil samples and the results have been reported in Table 9 of Appendix B

5.11. **Shrinkage Limit tests** were performed in accordance with IS 2720 (part-VI) -1972-(RA: 2021) and the results have been reported in Table 1 to 6: "SUMMARY OF TEST RESULTS" of Appendix B.

5.12. **Free Swell Index** were performed in accordance with IS 2720 (part-XL) -1977-(RA: 2021) and the results have been reported in Table 1 to 6: "SUMMARY OF TEST RESULTS" of Appendix B.

5.13. **Chemical analysis on soil samples** was performed in accordance with IS: 2720 (Part-XXVI)-1987-(RA: 2021) for pH value, IS: 2720 (Part-XXVII)-1977-(RA: 2020) for Sulphate & BS:1377-3-2018 for chlorides and results have been reported in Table 7 "CHEMICAL TEST ON SOIL SAMPLES" of Appendix B.

5.14. **Chemical analysis on Ground Water sample** was performed in accordance with IS: 3025 (Part-XI)-2022 for pH value, IS: 3025 (Part-XXIV: Sec-1)-2022 for Sulphate & IS: 3025-(Part-XXXII)-1988-(RA: 2019) for chlorides and results have been reported in

Table 8 “CHEMICAL TEST ON GROUND WATER SAMPLES” of Appendix B.

6. GROUND WATER TABLE:

The water table at this site was encountered during the drilling operation up to the depth of investigation.

Borehole No.	Chainage	Global Co-ordinates (UTM format)		Reduced level (m)	Depth of Borehole (m)	Water table (m)
		Easting	Northing			
A1	20915.887	702633.931	3118903.449	191.636	40.00	0.50
P6	21073.087	702477.831	3118922.470	192.181	40.00	1.20
P12	21230.287	702321.763	3118941.487	191.831	40.00	1.50
P13	21256.487	702295.755	3118944.656	191.690	40.00	1.50
P17	21361.287	702191.763	3118957.327	191.107	40.00	1.20
P18	21387.487	702165.761	3118960.484	191.128	40.00	1.20

7. DESCRIPTION OF STRATA:

The classification of soil stratum has been done with the help of soil characteristics obtained in laboratory tests as per IS 1498-1970-(RA:2021). The classification of rock masses has been done based on RMR as per IS: 4464-1985, IS: 13365-1. The detailed nature of the strata has been reported in Table 1 to 6: “SUMMARY OF TEST RESULTS” of Appendix-B and represented through Lithological plots in Appendix-C.

The strata exhibited in the bore holes, is predominantly comprising of inorganic silty clays of low plasticity and inorganic silts of non to low plastic category. Silty sands were encountered at variable depth and thickness of 4 to 18 meters. Some lenses consisting of Inorganic silts and silty clays of intermediate plasticity were also found in some of the bores.

8. SAFE BEARING CAPACITY COMPUTATIONS:

For the construction of viaducts, deep foundation **(Bored Cast-In-Situ RCC piles)** have been considered for computation of load bearing capacity of the underlying soil strata. The computation of load bearing capacity

of bored cast-in-situ RCC piles have been done as per IS 2911 (part-1, section-2)-2010-(RA: 2020) with due consideration of effects of liquefaction.

8.1. Design Parameters:

Factor of safety in compression	=	2.50
Factor of safety in tension	=	3.00
Depth of critical water table	=	0.00 m
Diameter of pile	=	1.00 & 1.20 m
Cut off length	=	2.50 m
Type of pile head consider	=	Fixed

8.2. Computation of friction along pile stem:

$$Q_{uf} = \sum K_i . P_{di} . \tan\delta_i . A_{si}$$

where,

Q_{uf} = Ultimate shaft friction (kN/m^2)

K_i = Coefficient of earth pressure at mid-depth of ith layer

P_{di} = Effective overburden pressure at mid-depth of ith layer (kN/m^2)

A_{si} = Surface area of pile stem in i^{th} layer (m^2)

δ_i = Angle of wall friction between pile and soil of ith layer (= ϕ) (degree)

ϕ_i = Angle of internal friction of soil in i^{th} layer (degree)

$\sum$ = Sum of all layers up to i^{th} layer

8.3. Computation of Cohesion along the stem of pile:

$$Q_{uc} = \sum \alpha_i . c_i . A_{si}$$

where,

c_i = Cohesion in i^{th} layer

A_{si} = Surface area of pile stem in i^{th} layer (m^2)

α_i = Adhesion factor for i^{th} layer of soil depending of consistency of soils

$\sum$ = Sum of cohesion of all layers considered

8.4. Computation of end bearing resistance:

Q_{ub} = A_p (c.Nc + q.Nq + 0.5. γ.B.Nγ)

where,

A_p = Area of the pile toe (m^2)

c = cohesion of soils at pile toe (kN/m^2)

γ = Effective Unit weight of soils at pile toe (kN/m^3)

B = Diameter of pile (m)

q = Effective overburden pressure at pile toe (kN/m^2)

N_c = Bearing Capacity Factor (Recommended equal to 9)

Nq, Nγ = Bearing Capacity Factor

8.5. Lateral load capacity of piles in soils:

$Q_u = 12.E.I.\delta/(L_1+L_f)^3$

where,

Q_u = Ultimate lateral load capacity of pile (kN)

δ = Permissible deflection (m) = 5 mm

E = Young Modulus of pile material (kN/m^2)

I = Moment of Inertia of the pile cross section (m^4)

L_1 = Cantilever Length of pile (m)

L_f = Length of fixity (m)

Detailed calculations of pile load carrying capacity in compression & uplift in soil have been reported in **Table-1 to 2** of **Appendix-H.**

Pile lateral Load capacity has been given in **Table-3 to 4** of **Appendix-H**.

9. LIQUEFACTION ANALYSIS:

Liquefaction is the sudden loss of shear strength of the loose fine sands due to earthquake-induced vibration under saturated conditions. Liquefaction generally takes place in loose fine sands (fines < 10 %, D_{60}= 0.20 mm to 1.0 mm and C_u between 2 to 5) with N value less than 15. In case of soil strata having N>15, liquefaction of soil will not take place, normally.

The present site falls in **seismic zone – IV.** Considering the history of past

earthquakes and available seismic data, an earthquake of **magnitude 7.0** having peak ground acceleration $\mathbf{a_{max}}$**= 0.24 g** is considered in the present analysis.

Preliminary assessment of liquefaction potential of foundation strata is made by simplified approach proposed by IS: 1893 (part-1)-2016-(RA: 2021) from the data obtained in Standard Penetration Test.

In this method, cyclic shear stress likely to be induced in the foundation strata by Design Basis Earthquake is first evaluated. Next threshold cyclic shear stress, which is good enough to cause liquefaction, is determined from SPT data and the empirical relations. Finally, comparison of these two stresses is used in the estimation of liquefaction susceptibility of the foundation strata.

Cyclic Stress Ratio (CSR):

The equivalent average of shear stress likely to be induced in the foundation material due to an earthquake is calculated by using the equations

Cyclic Resistance Ratio (CRR):

It expresses capacity of soil to resist liquefaction. CRR is determined using correlation between corrected blow count $(N_1)_{60}$ and CRR for earthquake of magnitude 7.5. $(N_1)_{60}$ is the SPT blow count corrected to an effective overburden pressure of 100 kPa and to hammer energy efficiency of 60 %.

Following variable have been adopted in calculation of N_{60} (SPT value for 60% efficiency)

Energy correction to SPT values:

C_{60} = 1.00 (Energy correction factor)

Design Earthquake Base:

Earthquake zone	= IV
Magnitude of earthquake	= 7
Seismic Zone factor	= 0.24

Status of Liquefaction:

The value of CSR and CRR are computed at different depth and then the ratio of CRR to CSR to get the factor of safety towards the susceptibility of the stratum towards liquefaction potential.

If factor of safety:

< 1.00 : Stratum is to be considered as liquefiable

> 1.00 : Non-Liquefiable

The detailed calculations of liquefaction, have been reported in **Table-5** of **Appendix-H.**

10. RECOMMENDATIONS:

Keeping in mind, the field test results, laboratory test results and IS codes of practice the following recommendations are hereby made:

10.1. **Bored Cast-In-Situ RCC Piles** of diameter 1000 and 1200 mm have been adopted for SBC computations of foundation for Viaduct.

10.2. **Cut off length** of piles have been considered as 2.50 m from the existing ground level for the purpose of computation of SBC.

10.3. **Pile length** recommended in the table below, shall be measured **after the cut-off depth.**

10.4. **Allowable load carrying capacity** of pile corresponding to the length and diameter of pile shall be read from the tables below:

10.4.1. For Pile diameter = 1000 mm

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
A1	25.00	1950	1500	45
	27.50	2300	1700	
	30.00	2950	1900	
	32.50	3850	2150	
	35.00	3100	2400	
P6	25.00	2200	1700	160
	27.50	2450	1900	
	30.00	2650	2150	
	32.50	2850	2300	
	35.00	3300	2500	

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
P12	25.00	2350	1850	120
	27.50	3350	2050	
	30.00	3900	2300	
	32.50	4150	2550	
	35.00	4450	2800	
P13	25.00	1850	1400	35
	27.50	2100	1650	
	30.00	2900	1850	
	32.50	3150	2050	
	35.00	3350	2250	
P17	25.00	1950	1500	40
	27.50	2200	1750	
	30.00	3250	1950	
	32.50	2950	2200	
	35.00	3750	2400	
P18	25.00	1950	1550	135
	27.50	3200	1700	
	30.00	3350	1950	
	32.50	2600	2150	
	35.00	2900	2300	

***** *Indicates Grade of Concrete*

10.4.2. Pile diameter = 1200 mm

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
A1	25.00	2500	1900	75
	27.50	3000	2150	
	30.00	4000	2400	
	32.50	5300	2750	
	35.00	4100	3100	

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
P6	25.00	2850	2200	225
	27.50	3200	2450	
	30.00	3450	2750	
	32.50	3650	2950	
	35.00	4450	3200	
P12	25.00	3000	2300	180
	27.50	4800	2600	
	30.00	5700	2950	
	32.50	6000	3300	
	35.00	6500	3700	
P13	25.00	2450	1850	55
	27.50	2800	2100	
	30.00	4150	2400	
	32.50	4450	2700	
	35.00	4750	3000	
P17	25.00	2500	1900	65
	27.50	2800	2150	
	30.00	4400	2500	
	32.50	3900	2800	
	35.00	5100	3100	
P18	25.00	2600	2000	190
	27.50	4750	2250	
	30.00	4950	2550	
	32.50	3550	2850	
	35.00	3950	3100	

***** *Indicates Grade of Concrete*

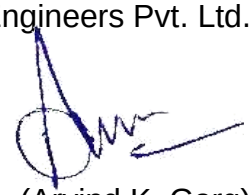
10.5. Liquefaction Potential: All the bore holes have been analysed for Liquefaction potential as per IS: 1893 (part-1)-2016-(RA: 2021) with Seismic Zone IV, earthquake intensity of 7.0 on Richter scale and critical ground water table at existing ground level. Out of which several boreholes show the potential at various depths mentioned

in the table below:

Bore No.	Liquefiable depth zone (meter)
A1	Top 1.00, 3.00 to 4.00 & 6.00 to 7.00
P6	Top 1.00
P12	Top 1.00
P13	Top 1.00, 2.00 to 3.00, 4.00 to 6.00, 7.00 to 10.00
P17	2.00 to 9.00
P18	Top 3.00

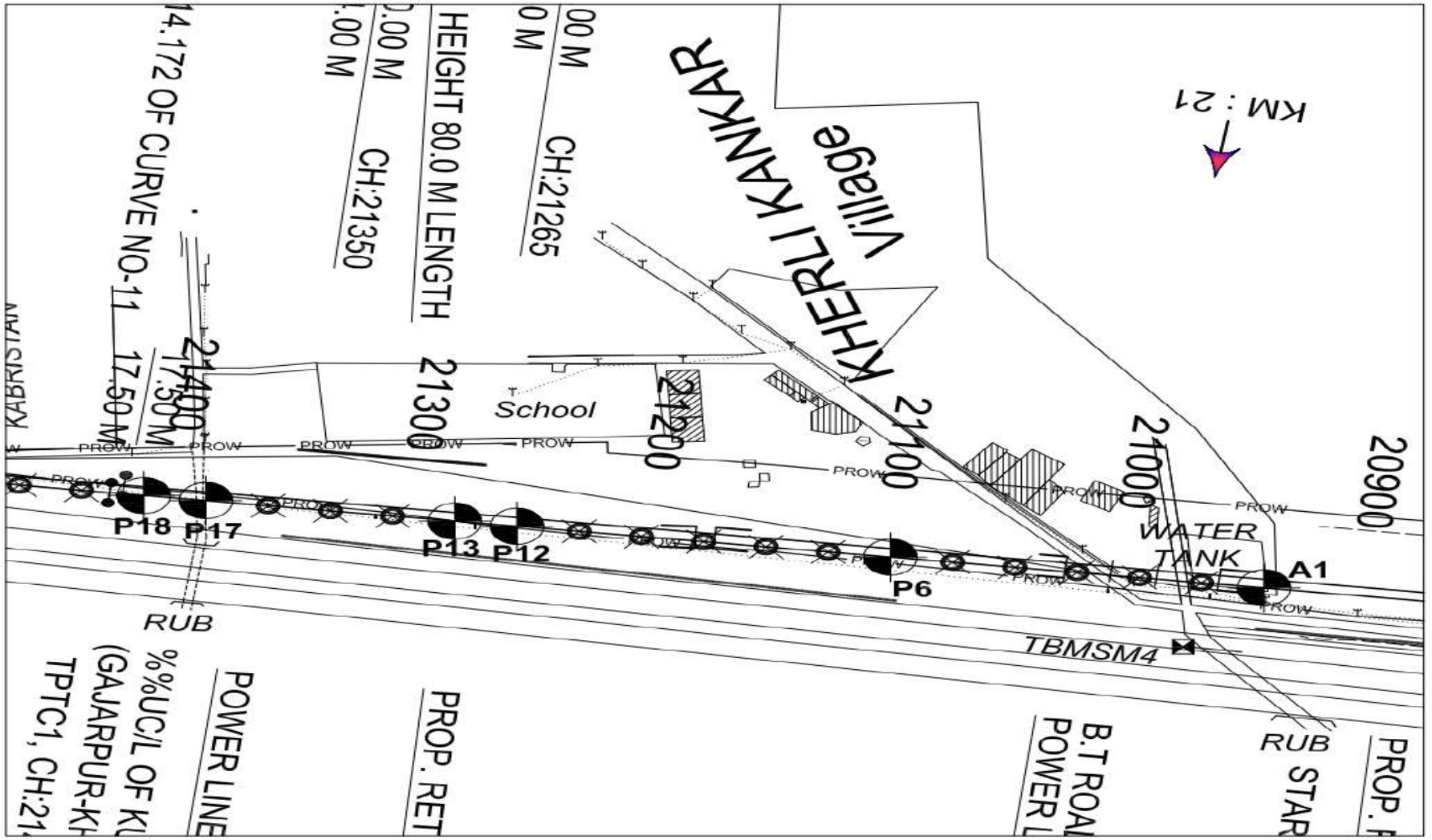
10.6. Type of cement to be used: Chloride content in the soil sample is slightly higher but still within the permissible limits. Other harmful salt sulphite is much low to the permissible limits. Hence, Ordinary Portland Cement or Portland Pozzolana Cement may be used for all civil constructions.

for Techpro Engineers Pvt. Ltd.



(Arvind K. Garg)
B.Tech.(Civil), M.Tech.
Principal Consultant &
Managing Director

APPENDIX-A
TEST LOCATION PLAN



APPENDIX "B"

TABLE 1: SUMMARY OF TEST RESULTS

Bore No: A1	**Ground Elevation: RL 191.636 m**	**Method of drilling: Percussion**	**Depth of Water: 0.50 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 20/09/2023**	**SPT Sampler: Standard**
Location / Chainage: 20915.887	**Casing Lowered: 24.00 m**	**Ending Date: 23/09/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen												
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	0.50	D	1	-	-	-	-	-	ML	0	0	0	39	57	4	16.43	-	-	24.0	20.0	4.0	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity										
	1.00	D	2	1	1	3	4	4.19	CL	0	0	1	42	44	13	21.52	-	-	29.0	18.0	11.0	-	-	-	-	-	-	-	30	16	-	Inorganic clays of low plasticity										
	2.00	D	3	-	-	-	-	-	-	-	-	-	-	-	-	24.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	3.00	D	4	2	3	3	6	10.68	ML	0	0	1	48	51	0	20.72	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity										
	4.00	D	5	3	5	6	11	17.17	SM	1	0	0	62	37	0	27.56	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	5.00	U	6	-	-	-	-	-	SM	3	0	1	67	29	0	20.79	1.88	1.56	Non-Plastic			2.64	DST	2.0	23.6	-	0.692	-	-	-	-										
	6.00	D	7	5	6	6	12	16.85	-	-	-	-	-	-	-	20.77	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	7.00	D	8	4	6	7	13	18.04	-	-	-	-	-	-	-	19.94	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	8.00	U	9	-	-	-	-	-	ML	0	1	0	46	49	4	19.13	2.03	1.70	23.0	20.0	3.0	2.64	-	-	-	-	0.553	-	-	-	-	Inorganic Silts of low plasticity										
	9.00	D	10	5	6	8	14	17.43	CL	1	1	2	32	57	7	20.16	-	-	26.0	19.0	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	10.00	D	11	4	5	5	10	13.27	CL	3	2	2	36	48	9	16.13	-	-	28.0	19.0	9.0	-	-	-	-	-	-	-	-	-	-										
	11.00	U	12	-	-	-	-	-	CL	2	1	2	22	64	9	20.75	2.13	1.76	27.0	18.0	9.0	-	UU	37.0	10.4	-	-	-	-	-	-										
	12.50	D	13	6	10	11	21	20.57	CL-ML	1	2	2	34	56	5	20.60	-	-	25.0	20.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	14.00	U	14	-	-	-	-	-	CL	4	2	3	30	51	10	18.09	2.00	1.69	29.0	18.0	11.0	2.67	-	-	-	-	0.580	-	-	-	-	Inorganic clays of low plasticity										
	15.50	D	15	4	7	12	19	26.53	-	-	-	-	-	-	-	20.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	17.00	U	16	-	-	-	-	-	CL	4	4	5	13	61	13	15.62	1.99	1.72	33.5	19.0	14.5	2.68	UU	45.0	8.6	0.192	0.558	-	25	14	-										

APPENDIX "B"

TABLE 1: SUMMARY OF TEST RESULTS

Bore No: A1	**Ground Elevation: RL 191.636 m**	**Method of drilling: Percussion**	**Depth of Water: 0.50 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 20/09/2023**	**SPT Sampler: Standard**
Location / Chainage: 20915.887	**Casing Lowered: 24.00 m**	**Ending Date: 23/09/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	18.50	D	17	8	15	20	35	48.88	-	-	-	-	-	-	-	16.56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	20.00	U	18	-	-	-	-	-	CL	6	3	4	19	58	10	16.50	2.03	1.74	28.5	19.5	9.0	2.67	-	-	-	-	0.534	-	-	-	-												
	21.50	D	19	8	17	22	39	54.46	CL	4	3	4	16	61	12	18.56	-	-	31.0	18.0	13.0	-	-	-	-	-	-	-	-	-	-												
	23.00	D	20	-	-	-	-	-	-	-	-	-	-	-	-	19.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	24.50	D	21	11	13	17	30	41.90	-	-	-	-	-	-	-	15.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	26.00	U	22	-	-	-	-	-	CL	1	1	1	16	72	9	21.80	2.09	1.72	28.5	20.5	8.0	2.66	UU	39.0	13.8	-	0.547	-	9	20	-												
	27.50	D	23	10	14	18	32	44.69	CL	3	2	1	18	64	12	18.79	-	-	30.0	18.0	12.0	-	-	-	-	-	-	-	-	-	-												
	29.00	U	24	-	-	-	-	-	CL-ML	3	3	1	38	49	6	18.96	1.89	1.59	25.0	20.0	5.0	2.66	DST	14.0	24.4	-	0.673	-	-	-	-	Inorganic Silty Clays of low plasticity											
	30.50	D	25	11	15	20	35	48.88	CL	3	2	2	28	56	9	20.80	-	-	27.0	18.0	9.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	32.00	D	26	35	65	-	R	-	SM	0	0	1	52	47	0	19.09	-	-		Non-Plastic		-	-	-	-	-	-	-	-	-	-	Silty Sands											
	33.50	D	27	15	35	45	80	38.10	SM	0	0	0	62	38	0	25.02	-	-		Non-Plastic		-	-	-	-	-	-	-	-	-	-												
	35.00	D	28	10	37	42	79	37.13	-	-	-	-	-	-	-	21.73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	36.50	D	29	8	17	27	44	61.45	CL	4	3	5	17	59	12	14.81	-	-	28.5	18.5	10.0	-	-	-	-	-	-	-	8	18	-	Inorganic clays of low plasticity											
	38.00	D	30	-	-	-	-	-	-	-	-	-	-	-	-	22.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	40.00	D	31	9	18	30	48	24.44	CL-ML	0	1	1	32	60	6	17.71	-	-	24.0	19.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 2: SUMMARY OF TEST RESULTS

Bore No: P6	**Ground Elevation: RL 192.181 m**	**Method of drilling: Percussion**	**Depth of Water: 1.20 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 21/09/2023**	**SPT Sampler: Standard**
Location / Chainage: 21073.087	**Casing Lowered: 18.00 m**	**Ending Date: 23/09/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen												
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	0.50	D	1	-	-	-	-	-	SM	0	0	1	62	37	0	6.02	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	1.00	U	2	-	-	-	-	-	CL	8	1	1	20	55	15	20.52	2.06	1.71	31.0	19.0	12.0	2.67	UU	44.0	6.4	0.152	0.561	-	0	14	-	Inorganic clays of low plasticity										
	2.00	D	3	2	3	4	7	7.33	CL	2	1	1	16	67	13	28.83	-	-	32.0	19.0	13.0	-	-	-	-	-	-	-	-	-	-										
	3.00	D	4	2	4	6	10	15.41	ML	0	0	0	38	62	0	22.35	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity										
	4.00	D	5	-	-	-	-	-	SM	0	0	0	69	31	0	21.18	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	5.00	D	6	4	9	12	21	22.95	SM	0	0	0	70	30	0	22.29	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-										
	6.00	D	7	5	7	11	18	19.78	-	-	-	-	-	-	-	26.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	7.00	D	8	-	-	-	-	-	SM	0	0	2	66	32	0	28.06	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-										
	8.00	D	9	7	12	17	29	27.04	-	-	-	-	-	-	-	27.49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	9.00	D	10	9	12	18	30	26.70	SM	0	1	1	65	33	0	26.27	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-										
	10.00	D	11	-	-	-	-	-	-	-	-	-	-	-	-	27.14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	11.00	D	12	8	10	14	24	33.52	CL	3	2	3	8	73	11	18.15	-	-	27.5	19.5	8.0	-	-	-	-	-	-	-	0	18	-	Inorganic clays of low plasticity										
	12.00	D	13	6	10	12	22	30.72	-	-	-	-	-	-	-	19.15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	13.00	U	14	-	-	-	-	-	CL	4	2	2	7	76	9	17.17	2.09	1.78	27.0	19.5	7.5	2.66	UU	41.0	12.4	0.115	0.494	-	0	18	-										
	14.50	D	15	7	14	18	32	44.69	-	-	-	-	-	-	-	17.98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	16.00	D	16	-	-	-	-	-	CL	2	1	1	9	75	12	23.93	-	-	30.0	18.0	12.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	17.50	D	17	6	10	15	25	34.91	-	-	-	-	-	-	-	19.80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										

APPENDIX "B"
TABLE 2: SUMMARY OF TEST RESULTS

Bore No: P6	**Ground Elevation: RL 192.181 m**	**Method of drilling: Percussion**	**Depth of Water: 1.20 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 21/09/2023**	**SPT Sampler: Standard**
Location / Chainage: 21073.087	**Casing Lowered: 18.00 m**	**Ending Date: 23/09/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																												
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen									
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK																			Classification of SOIL
	19.00	D	18	-	-	-	-	-	-	-	-	-	-	-	-	16.82	-	-	-	-	-	-	-	-	-	-	-	-	-	-											Inorganic clays of low plasticity
	20.50	D	19	8	22	40	62	86.58	CL	2	2	3	25	59	9	17.42	-	-	28.0	19.0	9.0	-	-	-	-	-	-	-	-	-										
	22.00	U	20	-	-	-	-	-	CL	1	2	2	23	64	8	20.12	1.81	1.51	27.5	18.0	9.5	2.66	UU	40.0	11.5	-	0.762	-	0	17	-										
	23.50	D	21	9	23	38	61	85.19	CL	3	2	1	12	69	13	13.13	-	-	30.0	18.0	12.0	-	-	-	-	-	-	-	-	-										
	25.00	U	22	-	-	-	-	-	CL	0	0	1	16	75	8	21.17	2.11	1.74	26.0	18.0	8.0	-	-	-	-	-	-	-	-	-										
	26.50	D	23	10	19	26	45	62.84	-	-	-	-	-	-	-	21.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	28.00	U	24	-	-	-	-	-	MI	1	1	1	1	73	23	25.08	1.99	1.59	44.0	28.0	16.0	-	UU	48.0	11.8	-	-	-	-	-	-										Inorganic Silts of Intermediate plasticity
	29.50	D	25	10	17	20	37	51.67	-	-	-	-	-	-	-	26.61	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	31.00	U	26	-	-	-	-	-	CL-ML	2	0	2	34	55	7	23.75	2.09	1.69	24.5	18.0	6.5	2.65	DST	10.0	24.7	-	0.568	-	0	18	-										Inorganic Silty Clays of low plasticity
	32.50	D	27	11	19	22	41	57.26	MI	0	1	1	2	83	13	31.36	-	-	38.0	28.0	10.0	-	-	-	-	-	-	-	-	-	-										Inorganic Silts of Intermediate plasticity
	34.00	D	28	-	-	-	-	-	-	-	-	-	-	-	-	24.84	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	35.50	D	29	16	19	26	45	23.53	CL-ML	8	3	4	21	60	4	19.57	-	-	23.0	18.0	5.0	-	-	-	-	-	-	-	-	-	-										Inorganic Silty Clays of low plasticity
	37.00	D	30	-	-	-	-	-	ML	0	2	2	44	52	0	20.01	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-										Inorganic Silts of low plasticity
	38.50	D	31	19	26	33	59	27.67	-	-	-	-	-	-	-	24.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-										Inorganic Silts of low plasticity
	40.00	D	32	22	30	40	70	30.98	-	-	-	-	-	-	-	23.08	-	-	-	-	-	-	-	-	-	-	-	-	-	-										

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed samples.

APPENDIX "B"
TABLE 3: SUMMARY OF TEST RESULTS

Bore No: P12	**Ground Elevation: RL 191.831 m**	**Method of drilling: Percussion**	**Depth of Water: 1.50 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 15/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 21230.287	**Casing Lowered: 21.00 m**	**Ending Date: 18/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen												
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK																				Classification of SOIL
	0.50	D	1	-	-	-	-	-	ML	0	0	0	46	54	0	13.72	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-											Inorganic Silts of low plasticity
	1.00	D	2	1	2	2	4	6.21	CL-ML	0	0	0	42	52	6	13.77	-	-	26.0	20.0	6.0	-	-	-	-	-	-	-	-	-	-											Inorganic Silty Clays of low plasticity
	2.00	U	3	-	-	-	-	-	MI	3	2	1	4	79	11	29.02	1.93	1.50	42.0	28.0	14.0	2.69	UU	64.0	7.9	-	0.798	-	8	21	-											Inorganic Silts of Intermediate plasticity
	3.00	D	4	2	2	3	5	6.42	CL	2	1	2	24	66	5	27.58	-	-	27.0	20.0	7.0	-	-	-	-	-	-	-	-	-	-											Inorganic clays of low plasticity
	4.00	D	5	2	3	4	7	8.53	-	-	-	-	-	-	-	25.60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	5.00	D	6	-	-	-	-	-	MI	0	0	0	4	85	11	26.96	-	-	38.0	27.0	11.0	-	-	-	-	-	-	-	-	-	-											Inorganic Silts of Intermediate plasticity
	6.00	D	7	4	7	8	15	15.95	ML	6	1	0	24	69	0	18.31	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-											Inorganic Silts of low plasticity
	7.00	D	8	3	8	10	18	17.26	-	-	-	-	-	-	-	17.20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	8.00	D	9	-	-	-	-	-	SM	0	0	0	71	29	0	21.54	1.92	1.58	Non-Plastic			2.65	RDST	0.0	25.9	-	0.677	-	-	-	-											Silty Sands
	9.00	D	10	4	8	11	19	17.13	-	-	-	-	-	-	-	22.19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	10.00	D	11	5	9	12	21	17.82	-	-	-	-	-	-	-	22.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	11.00	U	12	-	-	-	-	-	CL-ML	1	1	1	20	69	8	18.99	2.03	1.71	28.0	21.5	6.5	2.66	DST	15.0	24.5	-	0.556	-	9	17	-											Inorganic Silty Clays of low plasticity
	12.50	D	13	4	8	11	19	19.00	CL	0	0	1	14	74	11	20.45	-	-	30.0	19.0	11.0	-	-	-	-	-	-	-	-	-	-											Inorganic clays of low plasticity
	14.00	U	14	-	-	-	-	-	CL	0	0	1	16	71	12	18.75	2.03	1.71	31.0	19.5	11.5	2.67	UU	56.0	8.5	0.119	0.561	-	-	-	-											
	15.50	D	15	6	10	12	22	22.00	-	-	-	-	-	-	-	21.61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	17.00	U	16	-	-	-	-	-	CL	8	6	6	14	53	13	16.06	1.90	1.64	32.0	20.5	11.5	2.67	UU	54.0	11.5	-	0.628	-	-	-	-											

APPENDIX "B"
TABLE 3: SUMMARY OF TEST RESULTS

Bore No: P12	**Ground Elevation: RL 191.831 m**	**Method of drilling: Percussion**	**Depth of Water: 1.50 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 15/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 21230.287	**Casing Lowered: 21.00 m**	**Ending Date: 18/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	18.50	D	17	7	13	19	32	32.00	-	-	-	-	-	-	-	16.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity									
	20.00	U	18	-	-	-	-	-	CL	8	4	5	11	60	12	16.22	2.06	1.77	30.0	19.5	10.5	2.68	UU	59.0	10.8	-	0.514	-	0	15	-											
	21.50	D	19	9	17	24	41	41.00	-	-	-	-	-	-	-	14.51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	23.00	D	20	-	-	-	-	-	CL	6	4	4	13	59	14	16.81	2.04	1.75	33.0	19.5	13.5	2.67	UU	61.0	9.1	-	0.526	-	-	-	-											
	24.50	D	21	8	19	25	44	44.00	-	-	-	-	-	-	-	17.96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	26.00	U	22	-	-	-	-	-	CL	3	2	1	14	68	12	17.96	2.06	1.75	32.0	20.5	11.5	2.67	UU	53.0	9.5	-	0.526	-	-	-	-											
	27.50	D	23	11	22	27	49	49.00	-	-	-	-	-	-	-	18.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	29.00	D	24	17	28	32	60	26.51	SM	0	0	0	56	44	0	22.66	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	-	-	Silty Sands									
	30.50	D	25	18	30	36	66	27.92	-	-	-	-	-	-	-	19.95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	32.00	D	26	19	35	44	79	31.38	SM	0	0	0	64	36	0	19.55	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	-	-										
	33.50	D	27	17	33	41	74	29.31	SM	0	0	2	60	38	0	19.02	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	-	-										
	35.00	D	28	-	-	-	-	-	-	-	-	-	-	-	-	19.35	2.01	1.68	-	-	-	2.65	RDST	3.0	30.4	-	0.577	-	-	-	-											
	36.50	D	29	19	34	43	77	29.11	SM	0	0	0	63	37	0	18.32	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	-	-										
	38.00	D	30	-	-	-	-	-	-	-	-	-	-	-	-	20.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	40.00	D	31	21	37	48	85	30.19	SM	0	1	1	58	40	0	19.68	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	-	-										

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed samples.

APPENDIX "B"
TABLE 4: SUMMARY OF TEST RESULTS

Bore No: P13	**Ground Elevation: RL 191.69 m**	**Method of drilling: Percussion**	**Depth of Water: 1.50 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 19/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 21256.487	**Casing Lowered: 22.00 m**	**Ending Date: 22/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																														
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen										
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	0.50	D	1	-	-	-	-	-	SM	0	0	1	55	44	0	8.05	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	1.00	U	2	-	-	-	-	-	CL	0	1	1	22	66	10	19.44	1.97	1.65	29.0	20.5	8.5	2.67	UU	44.0	9.5	-	0.618	-	8	17	-	Inorganic clays of low plasticity										
	2.00	D	3	1	2	2	4	5.43	SM	0	0	1	56	43	0	17.30	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	3.00	D	4	2	2	3	5	5.00	CL	0	1	1	24	65	9	19.11	-	-	28.0	20.0	8.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	4.00	U	5	-	-	-	-	-	ML	2	1	2	42	48	5	15.13	1.95	1.69	25.0	21.0	4.0	2.64	DST	5.0	26.3	-	0.562	-	-	-	-	Inorganic Silts of low plasticity										
	5.00	D	6	1	2	2	4	4.62	-	-	-	-	-	-	-	22.13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	6.00	D	7	2	3	3	6	6.66	CL-ML	0	0	1	18	74	7	23.64	-	-	27.0	21.0	6.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts Clays of low plasticity										
	7.00	D	8	-	-	-	-	-	ML	0	0	1	34	65	0	17.91	1.91	1.62	Non-Plastic			2.64	RDST	10.0	24.7	-	0.630	-	-	-	-	Inorganic Silts of low plasticity										
	8.00	D	9	2	3	5	8	8.28	SM	0	0	1	52	47	0	14.59	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	9.00	D	10	4	5	7	12	12.03	-	-	-	-	-	-	-	14.80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	10.00	U	11	-	-	-	-	-	CL	3	1	3	9	75	9	15.68	2.04	1.76	29.0	20.0	9.0	2.67	UU	48.0	10.5	0.114	0.517	-	0	19	-	Inorganic clays of low plasticity										
	11.00	D	12	9	14	17	31	31.00	-	-	-	-	-	-	-	16.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	12.00	D	13	8	15	19	34	34.00	-	-	-	-	-	-	-	17.49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	13.00	U	14	-	-	-	-	-	SM	0	0	0	61	39	0	12.29	1.95	1.74	Non-Plastic			2.63	DST	2.0	28.0	-	0.511	-	-	-	-	Silty Sands										
	14.50	D	15	9	16	20	36	22.91	-	-	-	-	-	-	-	17.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	16.00	U	16	-	-	-	-	-	CL	1	0	2	8	80	9	16.77	2.05	1.75	28.0	20.5	7.5	2.66	UU	49.0	10.2	-	0.516	-	-	-	-	Inorganic clays of low plasticity										
	17.50	D	17	8	13	16	29	29.00	-	-	-	-	-	-	-	19.19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										

APPENDIX "B"
TABLE 4: SUMMARY OF TEST RESULTS

Bore No: P13	**Ground Elevation: RL 191.69 m**	**Method of drilling: Percussion**	**Depth of Water: 1.50 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 19/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 21256.487	**Casing Lowered: 22.00 m**	**Ending Date: 22/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																												
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen									
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL									
	19.00	U	18	-	-	-	-	-	CL	1	1	1	24	65	8	20.85	2.10	1.74	28.0	20.0	8.0	2.66	UU	47.0	10.8	-	0.529	-	-	-	-	Inorganic clays of low plasticity									
	20.50	D	19	11	20	22	42	42.00	-	-	-	-	-	-	-	18.91	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	22.00	D	20	-	-	-	-	-	-	-	-	-	-	-	-	19.86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	23.50	D	21	13	26	33	59	59.00	CL	9	2	3	9	67	10	16.78	-	-	29.0	21.0	8.0	-	-	-	-	-	-	-	-	-	-									
	25.00	D	22	15	27	35	62	62.00	-	-	-	-	-	-	-	16.32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	26.50	D	23	17	34	41	75	75.00	-	-	-	-	-	-	-	18.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	28.00	D	24	14	32	39	71	30.60	CL	9	5	3	12	62	9	21.02	-	-	27.5	20.5	7.0	-	-	-	-	-	-	-	-	-	-									
	29.50	D	25	11	28	31	59	26.23	-	-	-	-	-	-	-	19.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	31.00	D	26	10	25	30	55	55.00	CL	2	1	2	18	69	8	19.16	-	-	28.0	20.0	8.0	-	-	-	-	-	-	-	-	-	-									
	32.50	D	27	10	27	31	58	24.99	SM	0	0	1	60	39	0	20.35	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands									
	34.00	D	28	-	-	-	-	-	-	-	-	-	-	-	-	19.90	2.10	1.75	-	-	-	2.65	RDST	3.0	28.6	-	0.514	-	-	-	-									
	35.50	D	29	8	24	29	53	22.64	-	-	-	-	-	-	-	17.76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	37.00	D	30	-	-	-	-	-	SM	0	0	1	59	40	0	17.68	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-									
	38.50	D	31	10	26	31	57	23.08	SM	0	1	2	54	43	0	19.69	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-									
	40.00	D	32	11	27	32	59	23.30	-	-	-	-	-	-	-	16.95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample

APPENDIX "B"
TABLE 5: SUMMARY OF TEST RESULTS

Bore No: P17	**Ground Elevation: RL 191.107 m**	**Method of drilling: Percussion**	**Depth of Water: 1.20 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 18/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 21361.287	**Casing Lowered: 15.00 m**	**Ending Date: 21/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	0.50	D	1	-	-	-	-	-	CL-ML	0	0	1	48	44	7	12.34	-	-	26.0	19.5	6.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity									
	1.00	D	2	1	1	2	3	4.63	-	-	-	-	-	-	-	11.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	2.00	U	3	-	-	-	-	-	SM-SC	0	0	1	50	43	6	12.14	1.98	1.77	25.0	20.0	5.0	2.65	DST	8.0	26.5	-	0.497	-	0	15	-	Silty Sands with clay binder										
	3.00	D	4	1	2	2	4	5.18	SM	0	0	0	58	42	0	21.89	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	4.00	D	5	2	3	3	6	7.35	-	-	-	-	-	-	-	22.66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	5.00	D	6	-	-	-	-	-	SM	1	2	2	72	23	0	22.66	1.94	1.58	Non-Plastic			2.63	RDST	0.0	24.1	-	0.665	-	-	-	-										
	6.00	D	7	3	4	5	9	10.08	SM	1	1	3	70	25	0	21.57	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-										
	7.00	D	8	3	4	6	10	10.78	-	-	-	-	-	-	-	21.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	8.00	D	9	-	-	-	-	-	SP-ML	2	2	3	84	9	0	22.58	1.98	1.61	Non-Plastic			2.62	RDST	0.0	29.5	-	0.623	-	-	-	-	Poorly Graded Sands with inorganic Silts of low plasticity										
	9.00	D	10	5	10	15	25	20.06	-	-	-	-	-	-	-	24.46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	10.00	D	11	8	12	22	34	24.05	SM	0	0	0	74	26	0	25.29	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	11.00	U	12	-	-	-	-	-	-	-	-	-	-	-	-	18.25	1.85	1.57	-	-	-	2.62	DST	0.0	28.3	-	0.671	-	-	-	-										
	12.50	D	13	6	11	16	27	27.00	CL	2	1	0	11	74	12	16.27	-	-	31.0	21.5	9.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	14.00	U	14	-	-	-	-	-	CL-ML	3	2	2	24	62	7	17.04	1.90	1.62	27.0	21.5	5.5	2.66	DST	14.0	24.5	-	0.642	-	8	18	-	Inorganic Silty Clays of low plasticity										
	15.50	D	15	7	13	17	30	30.00	CL	2	1	0	9	75	13	19.56	-	-	32.0	20.5	11.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	17.00	U	16	-	-	-	-	-	CL	3	2	3	12	69	11	19.62	2.02	1.69	30.0	21.5	8.5	2.67	UU	50.0	9.5	0.136	0.580	-	-	-	-										

APPENDIX "B"
TABLE 5: SUMMARY OF TEST RESULTS

Bore No: P17	**Ground Elevation: RL 191.107 m**	**Method of drilling: Percussion**	**Depth of Water: 1.20 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 18/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 21361.287	**Casing Lowered: 15.00 m**	**Ending Date: 21/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen													
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	18.50	D	17	15	18	20	38	38.00	CI	5	2	3	8	65	17	14.24	-	-	38.0	23.0	15.0	-	-	-	-	-	-	-	-	-												
	20.00	U	18	-	-	-	-	-	-	-	-	-	-	-	-	17.27	1.91	1.63	-	-	-	2.68	UU	64.0	8.5	-	0.644	-	-	-	-	Inorganic clays of Intermediate plasticity										
	21.50	D	19	16	30	35	65	65.00	CI	2	1	3	6	73	15	16.84	-	-	36.0	22.5	13.5	-	-	-	-	-	-	-	-	-												
	23.00	U	20	-	-	-	-	-	CL	2	1	1	11	72	13	13.47	2.03	1.79	34.0	22.0	12.0	2.68	UU	57.0	8.9	-	0.497	-	17	20	-												
	24.50	D	21	17	32	38	70	70.00	-	-	-	-	-	-	-	12.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	26.00	D	22	15	25	27	52	52.00	CL	0	1	2	8	78	11	20.70	-	-	32.0	21.5	10.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	27.50	D	23	7	15	26	41	41.00	CL	1	1	1	9	79	9	11.87	-	-	29.0	20.0	9.0	-	-	-	-	-	-	-	-	-	-												
	29.00	U	24	-	-	-	-	-	-	-	-	-	-	-	-	12.31	2.04	1.82	-	-	-	2.67	UU	54.0	8.3	-	0.467	-	-	-	-												
	30.50	D	25	16	22	34	56	25.00	SM	2	1	1	54	42	0	12.37	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	32.00	D	26	20	27	38	65	27.28	-	-	-	-	-	-	-	17.36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	33.50	D	27	14	26	35	61	25.67	ML	0	0	1	48	51	0	14.95	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity										
	35.00	D	28	17	32	36	68	27.36	-	-	-	-	-	-	-	11.84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	36.50	D	29	19	38	45	83	31.29	SM	0	0	2	52	46	0	10.87	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	38.00	D	30	18	25	30	55	55.00	CL	3	2	1	14	69	11	9.85	-	-	31.0	20.5	10.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	40.00	D	31	18	27	36	63	63.00	CL	0	0	1	22	68	9	15.14	-	-	29.0	21.5	7.5	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed samples.

APPENDIX "B"

TABLE 6: SUMMARY OF TEST RESULTS

Bore No: P18	**Ground Elevation: RL 191.128 m**	**Method of drilling: Percussion**	**Depth of Water: 1.20 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 15/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 21387.487	**Casing Lowered: 27.00 m**	**Ending Date: 18/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	SM	1	1	1	54	43	0	8.63	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	1.00	U	2	-	-	-	-	-	-	-	-	-	-	-	-	14.35	1.91	1.67	-	-	-	2.64	DST	0.0	23.6	-	0.581	-	-	-	-												
	2.00	D	3	3	4	5	9	12.62	SM-SC	0	0	0	64	31	5	16.52	-	-	25.5	20.0	5.5	-	-	-	-	-	-	-	0	16	-	Silty Sands with clay binder											
	3.00	D	4	4	5	5	10	13.14	SM	0	0	0	68	32	0	22.58	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	4.00	U	5	-	-	-	-	-	-	-	-	-	-	-	-	23.27	1.99	1.61	-	-	-	2.62	DST	0.0	28.0	-	0.623	-	-	-	-												
	5.00	D	6	5	7	8	15	16.33	SM	0	0	0	70	30	0	23.77	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	6.00	D	7	6	9	10	19	18.20	-	-	-	-	-	-	-	23.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	7.00	D	8	-	-	-	-	-	SM	1	0	0	68	31	0	21.81	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	8.00	D	9	4	6	11	17	16.40	SM	0	0	1	66	33	0	19.82	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	9.00	D	10	5	8	13	21	18.19	-	-	-	-	-	-	-	20.90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	10.00	U	11	-	-	-	-	-	SM	0	1	0	71	28	0	19.70	1.79	1.50	Non-Plastic			2.62	DST	0.0	28.3	-	0.753	-	-	-	-												
	11.00	D	12	5	9	15	24	19.10	-	-	-	-	-	-	-	19.98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	12.00	D	13	6	11	17	28	20.71	SM	0	1	0	65	34	0	23.31	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	13.00	U	14	-	-	-	-	-	-	-	-	-	-	-	-	18.45	1.97	1.66	-	-	-	2.63	DST	0.0	28.6	-	0.584	-	-	-	-												
	14.50	D	15	4	7	10	17	14.99	SM	0	0	0	58	42	0	11.76	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	16.00	U	16	-	-	-	-	-	SM	4	1	2	74	19	0	16.81	2.00	1.71	Non-Plastic			2.61	DST	0.0	29.1	-	0.525	-	-	-	-												
	17.50	D	17	5	8	12	20	20.00	CL	0	0	0	8	80	12	20.61	-	-	29.5	18.5	11.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											

APPENDIX "B"
TABLE 6: SUMMARY OF TEST RESULTS

Bore No: P18	**Ground Elevation: RL 191.128 m**	**Method of drilling: Percussion**	**Depth of Water: 1.20 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 15/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 21387.487	**Casing Lowered: 27.00 m**	**Ending Date: 18/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	19.00	U	18	-	-	-	-	-	CL	0	0	0	12	77	11	21.12	2.06	1.70	28.5	19.0	9.5	2.67	UU	54.0	9.5	-	0.570	-	8	16	-	Inorganic clays of low plasticity										
	20.50	D	19	9	15	18	33	33.00	-	-	-	-	-	-	-	20.64	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	22.00	U	20	-	-	-	-	-	-	-	-	-	-	-	-	21.45	1.99	1.64	-	-	-	2.67	UU	46.0	10.0	-	0.628	-	-	-	-										
	23.50	D	21	8	17	19	36	36.00	CL	0	0	1	14	75	10	22.41	-	-	28.0	20.0	8.0	-	-	-	-	-	-	-	-	-	-										
	25.00	U	22	-	-	-	-	-	CL	3	3	1	28	56	9	23.95	2.08	1.68	27.5	20.0	7.5	2.66	UU	42.0	11.5	-	0.585	-	-	-	-										
	26.50	D	23	8	15	19	34	34.00	MI	0	0	1	12	73	14	28.39	-	-	38.0	27.0	11.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of Intermediate plasticity										
	28.00	U	24	-	-	-	-	-	CL-CI	2	0	2	16	66	14	24.40	2.09	1.68	35.0	22.0	13.0	2.67	UU	44.0	11.0	-	0.589	-	-	-	-	Inorganic Clays of low to Intermediate plasticity										
	29.50	D	25	19	38	45	83	33.84	SM	0	0	1	58	41	0	19.79	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	31.00	D	26	22	48	52	R	-	-	-	-	-	-	-	-	18.59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	32.50	D	27	17	35	42	77	30.73	SM-SC	0	1	1	55	39	4	17.38	-	-	24.0	20.0	4.0	-	-	-	-	-	-	-	-	-	-	Silty Sands with clay binder										
	34.00	D	28	19	39	47	86	32.85	CL-ML	0	1	1	18	74	6	20.13	-	-	26.5	21.0	5.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	35.50	D	29	16	31	35	66	26.56	-	-	-	-	-	-	-	15.24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	37.00	D	30	14	28	40	68	26.70	CL	1	1	1	28	61	8	20.31	-	-	27.5	20.5	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	38.50	D	31	15	32	35	67	25.99	-	-	-	-	-	-	-	22.78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	40.00	D	32	14	33	41	74	74.00	CL	0	1	2	12	74	11	19.80	-	-	30.0	20.0	10.0	-	-	-	-	-	-	-	-	-	-										

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed samples.

APPENDIX-B
TABLE 7: CHEMICAL TEST ON SOIL SAMPLES

BH No.	DEPTH (m)	SULPHATE CONTENT AS SO_3 (%)	CHLORIDE CONTENT (%)	pH VALUE
A1	1.00	0.055	0.121	8.23
P6	1.00	0.051	0.200	8.23

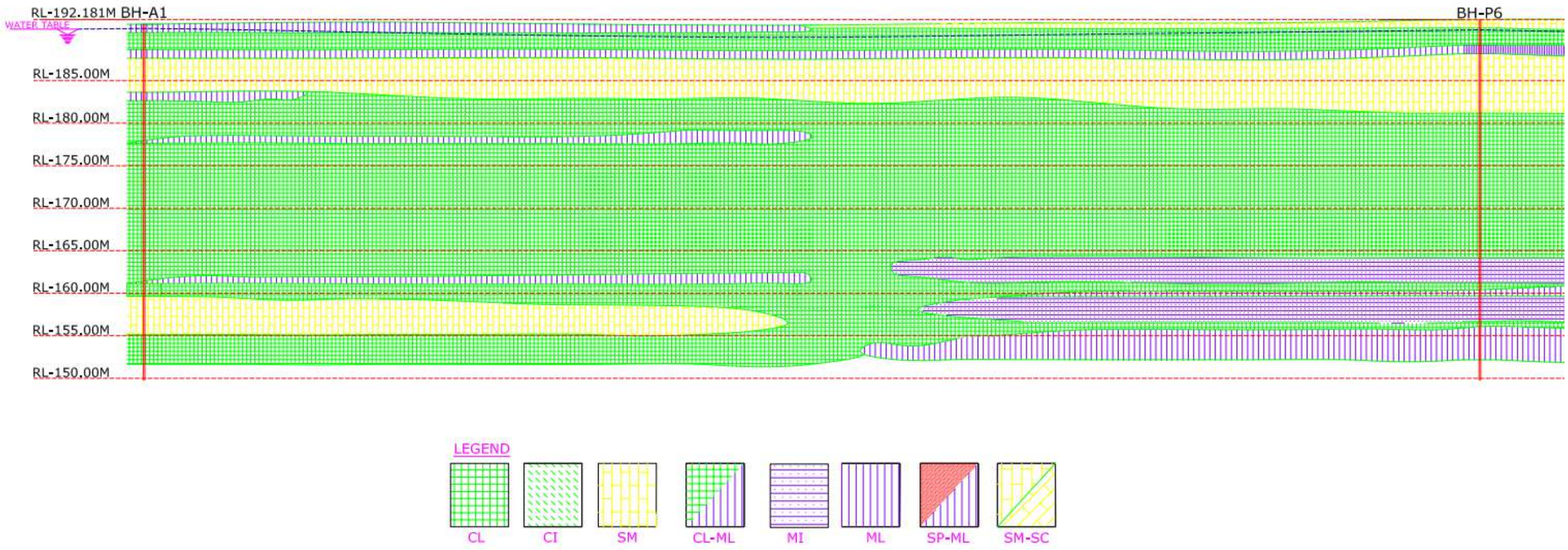
APPENDIX-B
TABLE 8: CHEMICAL TEST ON GROUND WATER SAMPLES

BH No.	SULPHATE CONTENT AS SO_3 (mg/l)	CHLORIDE CONTENT (mg/l)	pH VALUE
A1	246.900	797.753	7.16
P6	82.300	647.799	7.09

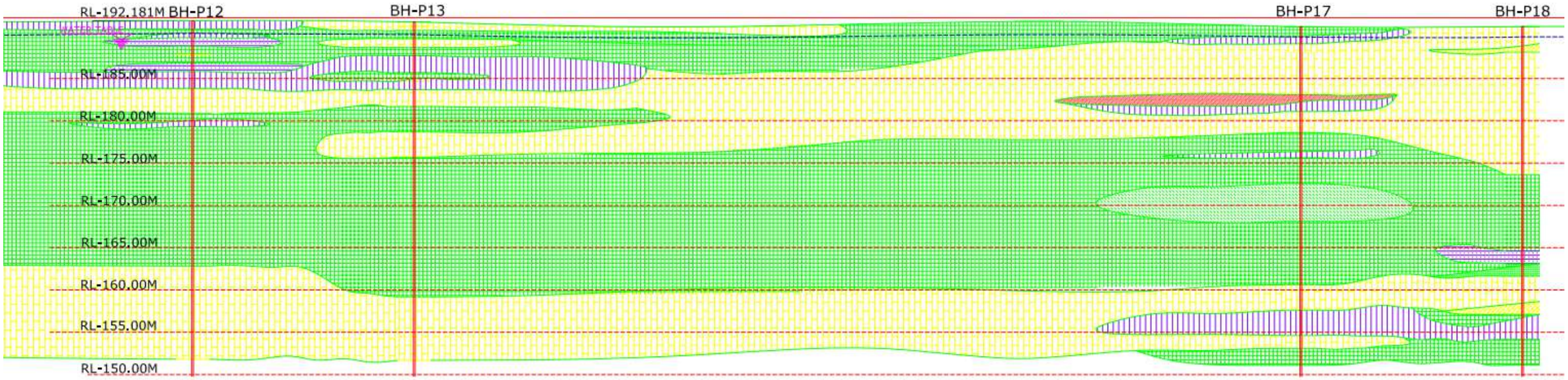
APPENDIX-B
TABLE 9: UCS TEST ON SOIL SAMPLES

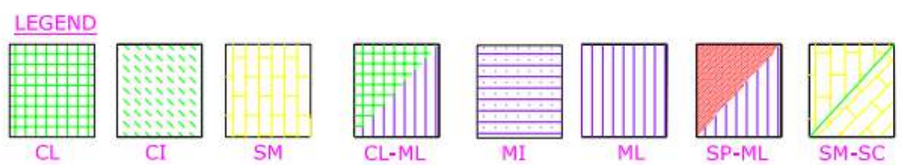
BH No.	DEPTH (m)	UCS (kg/cm²)
A1	11.00	0.45
	17.00	0.60
	26.00	0.68
P6	1.00	0.60
	13.00	0.64
	28.00	1.31
P12	2.00	0.81
	14.00	0.73
	17.00	0.68
	20.00	0.77
	23.00	0.71
	26.00	0.64
P13	1.00	0.47
	10.00	0.54
	16.00	0.56
	19.00	0.53
P17	17.00	0.63
	20.00	0.89
	23.00	0.76
	29.00	0.72
P18	19.00	0.82
	22.00	0.67
	25.00	0.62
	28.00	0.57

APPENDIX-C
PLOT 1: LITHOLOGICAL PROFILE-01



APPENDIX-C
PLOT 2: LITHOLOGICAL PROFILE-02





APPENDIX-C
PLOT 3: LITHOLOGICAL PLOTS

BH-A1-20915.8870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Inorganic Silts of low plasticity	ML		0.50	D		-	-
			1.00	D	4	-	-
Inorganic clays of low plasticity	CL		2.00	D		-	-
Inorganic Silts of low plasticity	ML		3.00	D	6	-	-
			4.00	D	11	-	-
			5.00	U		-	-
Silty Sands	SM		6.00	D	12	-	-
			7.00	D	13	-	-
Inorganic Silts of low plasticity	ML		8.00	U		-	-
			9.00	D	14	-	-
			10.00	D	10	-	-
Inorganic clays of low plasticity	CL		11.00	U		-	-
			12.50	D	21	-	-
Inorganic Silty Clays of low plasticity	CL-ML		14.00	U		-	-
			15.50	D	19	-	-
Inorganic clays of low plasticity	CL		17.00	U		-	-
			18.50	D	35	-	-
			20.00	U		-	-

BH-A1-20915.8870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			20.00	U		-	-
			21.50	D	39	-	-
			23.00	D		-	-
Inorganic clays of low plasticity	CL		24.50	D	30	-	-
			26.00	U		-	-
			27.50	D	32	-	-
Inorganic Silty Clays of low plasticity	CL-ML		29.00	U		-	-
			30.50	D	35	-	-
Inorganic clays of low plasticity	CL		32.00	D	R	-	-
			33.50	D	80	-	-
Silty Sands	SM		35.00	D	79	-	-
			36.50	D	44	-	-
Inorganic clays of low plasticity	CL		38.00	D		-	-
			40.00	D	48	-	-

APPENDIX-C
PLOT 4: LITHOLOGICAL PLOTS

BH-P6-21073.0870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Silty Sands	SM		0.50	D		-	-
			1.00	U		-	-
Inorganic clays of low plasticity	CL		2.00	D	7	-	-
Inorganic Silts of low plasticity	ML		3.00	D	10	-	-
			4.00	D		-	-
			5.00	D	21	-	-
			6.00	D	18	-	-
Silty Sands	SM		7.00	D		-	-
			8.00	D	29	-	-
			9.00	D	30	-	-
			10.00	D		-	-
			11.00	D	24	-	-
			12.00	D	22	-	-
			13.00	U		-	-
			14.50	D	32	-	-
Inorganic clays of low plasticity	CL		16.00	D		-	-
			17.50	D	25	-	-
			19.00	D		-	-
			20.00	D	62	-	-

BH-P6-21073.0870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			20.50	D	62	-	-
			22.00	U		-	-
Inorganic clays of low plasticity	CL		23.50	D	61	-	-
			25.00	U		-	-
			26.50	D	45	-	-
			28.00	U		-	-
Inorganic Silts of Intermediate plasticity	MI		29.50	D	37	-	-
			31.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML		32.50	D	41	-	-
Inorganic Silts of Intermediate plasticity	MI		34.00	D		-	-
			35.50	D	45	-	-
Inorganic Silty Clays of low plasticity	CL-ML		37.00	D		-	-
Inorganic Silts of low plasticity	ML		38.50	D	59	-	-
			40.00	D	70	-	-

APPENDIX-C
PLOT 5: LITHOLOGICAL PLOTS

BH-P12-21230.2870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Inorganic Silts of low plasticity	ML		0.50	D		-	-
Inorganic Silty Clays of low plasticity	CL-ML		1.00	D	4	-	-
			2.00	U		-	-
Inorganic Silts of Intermediate plasticity	MI		3.00	D	5	-	-
Inorganic clays of low plasticity	CL		4.00	D	7	-	-
			5.00	D		-	-
Inorganic Silts of Intermediate plasticity	MI		6.00	D	15	-	-
Inorganic Silts of low plasticity	ML		7.00	D	18	-	-
			8.00	D		-	-
Silty Sands	SM		9.00	D	19	-	-
			10.00	D	21	-	-
			11.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML		12.50	D	19	-	-
			14.00	U		-	-
Inorganic clays of low plasticity	CL		15.50	D	22	-	-
			17.00	U		-	-
			18.50	D	32	-	-
			20.00	U		-	-

BH-P12-21230.2870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			20.00	U		-	-
			21.50	D	41	-	-
			23.00	D		-	-
Inorganic clays of low plasticity	CL		24.50	D	44	-	-
			26.00	U		-	-
			27.50	D	49	-	-
			29.00	D	60	-	-
			30.50	D	66	-	-
			32.00	D	79	-	-
			33.50	D	74	-	-
Silty Sands	SM		35.00	D		-	-
			36.50	D	77	-	-
			38.00	D		-	-
			40.00	D	85	-	-

APPENDIX-C
PLOT 6: LITHOLOGICAL PLOTS

BH-P13-21256.487

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Silty Sands	SM		0.50	D		-	-
			1.00	U		-	-
Inorganic clays of low plasticity	CL						
Silty Sands	SM		2.00	D	4	-	-
Inorganic clays of low plasticity	CL		3.00	D	5	-	-
			4.00	U		-	-
Inorganic Silts of low plasticity	ML		5.00	D	4	-	-
Inorganic Silty Clays of low plasticity	CL-ML		6.00	D	6	-	-
Inorganic Silts of low plasticity	ML		7.00	D		-	-
			8.00	D	8	-	-
Silty Sands	SM		9.00	D	12	-	-
			10.00	U		-	-
Inorganic clays of low plasticity	CL		11.00	D	31	-	-
			12.00	D	34	-	-
			13.00	U		-	-
Silty Sands	SM		14.50	D	36	-	-
			16.00	U		-	-
Inorganic clays of low plasticity	CL		17.50	D	29	-	-
			19.00	U		-	-
			20.00	D	42	-	-

BH-P13-21256.487

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			20.50	D	42	-	-
			22.00	D		-	-
			23.50	D	59	-	-
			25.00	D	62	-	-
Inorganic clays of low plasticity	CL		26.50	D	75	-	-
			28.00	D	71	-	-
			29.50	D	59	-	-
			31.00	D	55	-	-
			32.50	D	58	-	-
			34.00	D		-	-
			35.50	D	53	-	-
Silty Sands	SM		37.00	D		-	-
			38.50	D	57	-	-
			40.00	D	59	-	-

APPENDIX-C
PLOT 7: LITHOLOGICAL PLOTS

BH-P17-21361.2870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Inorganic Silty Clays of low plasticity	CL-ML		0.50	D		-	-
			1.00	D	3	-	-
Silty Sands with clay binder	SM-SC		2.00	U		-	-
			3.00	D	4	-	-
			4.00	D	6	-	-
Silty Sands	SM		5.00	D		-	-
			6.00	D	9	-	-
			7.00	D	10	-	-
			8.00	D		-	-
Poorly Graded Sands with inorganic Silts of low plasticity	SP-ML		9.00	D	25	-	-
			10.00	D	34	-	-
Silty Sands	SM		11.00	U		-	-
Inorganic clays of low plasticity	CL		12.50	D	27	-	-
Inorganic Silty Clays of low plasticity	CL-ML		14.00	U		-	-
			15.50	D	30	-	-
Inorganic clays of low plasticity	CL		17.00	U		-	-
Inorganic clays of Intermediate plasticity	CI		18.50	D	38	-	-
			20.00	U		-	-

BH-P17-21361.2870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			20.00	U		-	-
Inorganic clays of Intermediate plasticity	CI		21.50	D	65	-	-
			23.00	U		-	-
			24.50	D	70	-	-
Inorganic clays of low plasticity	CL		26.00	D	52	-	-
			27.50	D	41	-	-
			29.00	U		-	-
Silty Sands	SM		30.50	D	56	-	-
			32.00	D	65	-	-
			33.50	D	61	-	-
Inorganic Silts of low plasticity	ML		35.00	D	68	-	-
Silty Sands	SM		36.50	D	83	-	-
			38.00	D	55	-	-
Inorganic clays of low plasticity	CL		40.00	D	63	-	-

APPENDIX-C
PLOT 8: LITHOLOGICAL PLOTS

BH-P18-21387.4870

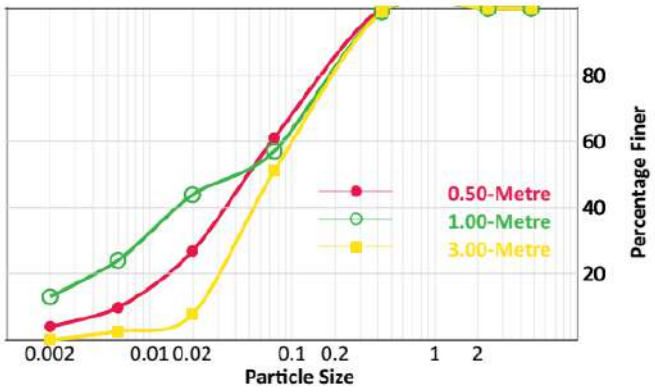
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Silty Sands	SM		0.50	D		-	-
			1.00	U		-	-
Silty Sands with clay binder	SM-SC		2.00	D	9	-	-
			3.00	D	10	-	-
			4.00	U		-	-
			5.00	D	15	-	-
			6.00	D	19	-	-
			7.00	D		-	-
			8.00	D	17	-	-
			9.00	D	21	-	-
Silty Sands	SM		10.00	U		-	-
			11.00	D	24	-	-
			12.00	D	28	-	-
			13.00	U		-	-
			14.50	D	17	-	-
			16.00	U		-	-
			17.50	D	20	-	-
Inorganic clays of low plasticity	CL		19.00	U		-	-
			20.00	D	33	-	-

BH-P18-21387.4870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			20.50	D	33	-	-
			22.00	U		-	-
Inorganic clays of low plasticity	CL		23.50	D	36	-	-
			25.00	U		-	-
			26.50	D	34	-	-
Inorganic Silts of Intermediate plasticity	MI						
Inorganic Clays of low to Intermediate plasticity	CL-CI		28.00	U		-	-
			29.50	D	83	-	-
Silty Sands	SM		31.00	D	100	-	-
			32.50	D	77	-	-
Silty Sands with clay binder	SM-SC		34.00	D	86	-	-
Inorganic Silty Clays of low plasticity	CL-ML		35.50	D	66	-	-
			37.00	D	68	-	-
Inorganic clays of low plasticity	CL		38.50	D	67	-	-
			40.00	D	74	-	-

APPENDIX-D
PLOT 1: GRAIN SIZE DISTRIBUTION PLOTS

BH- A1-CH.20915.8870



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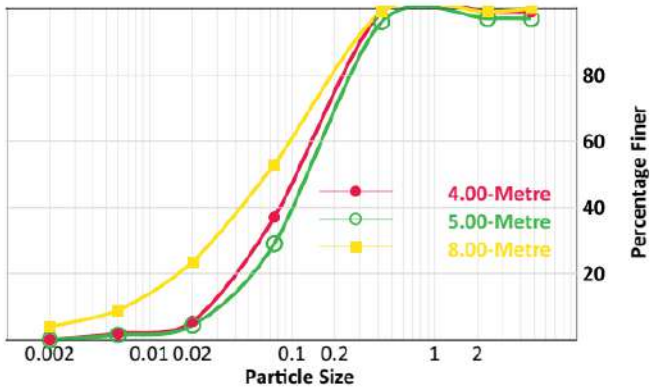

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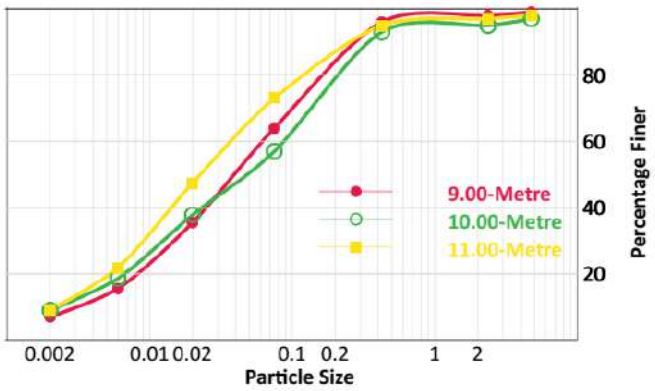

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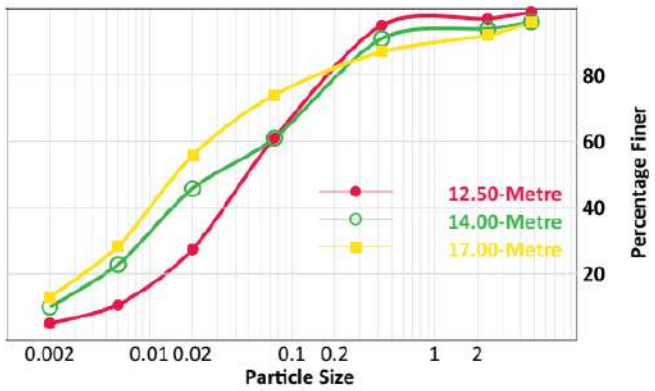

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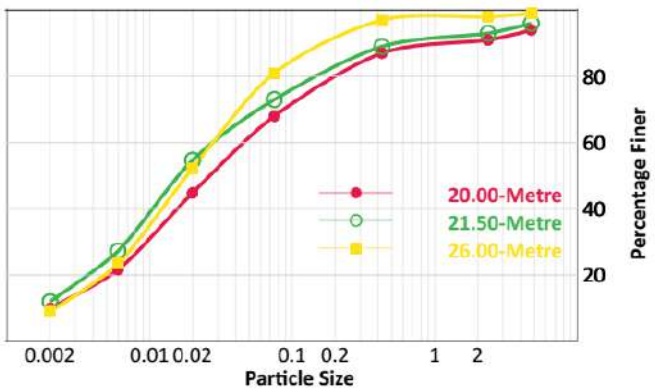

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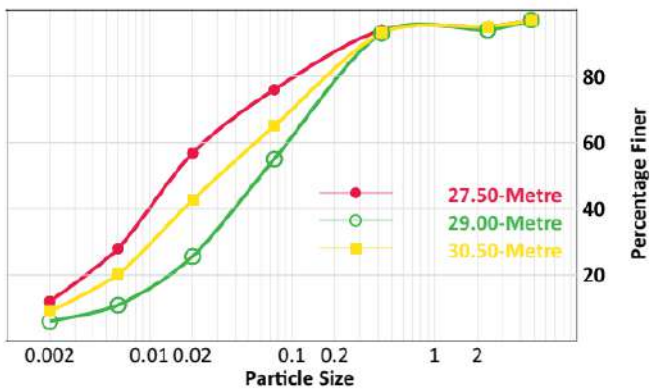

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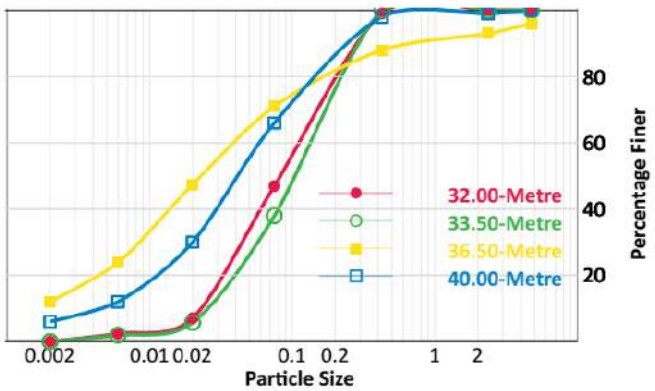
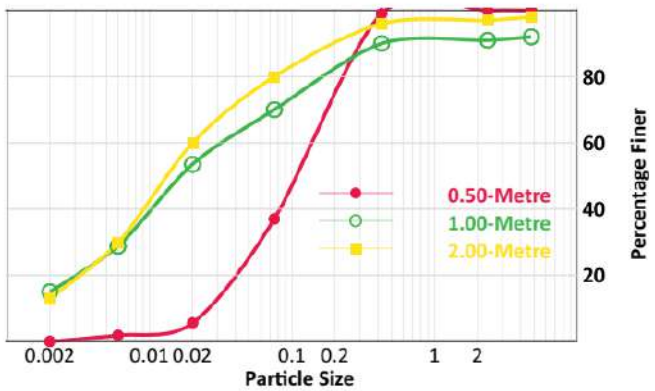
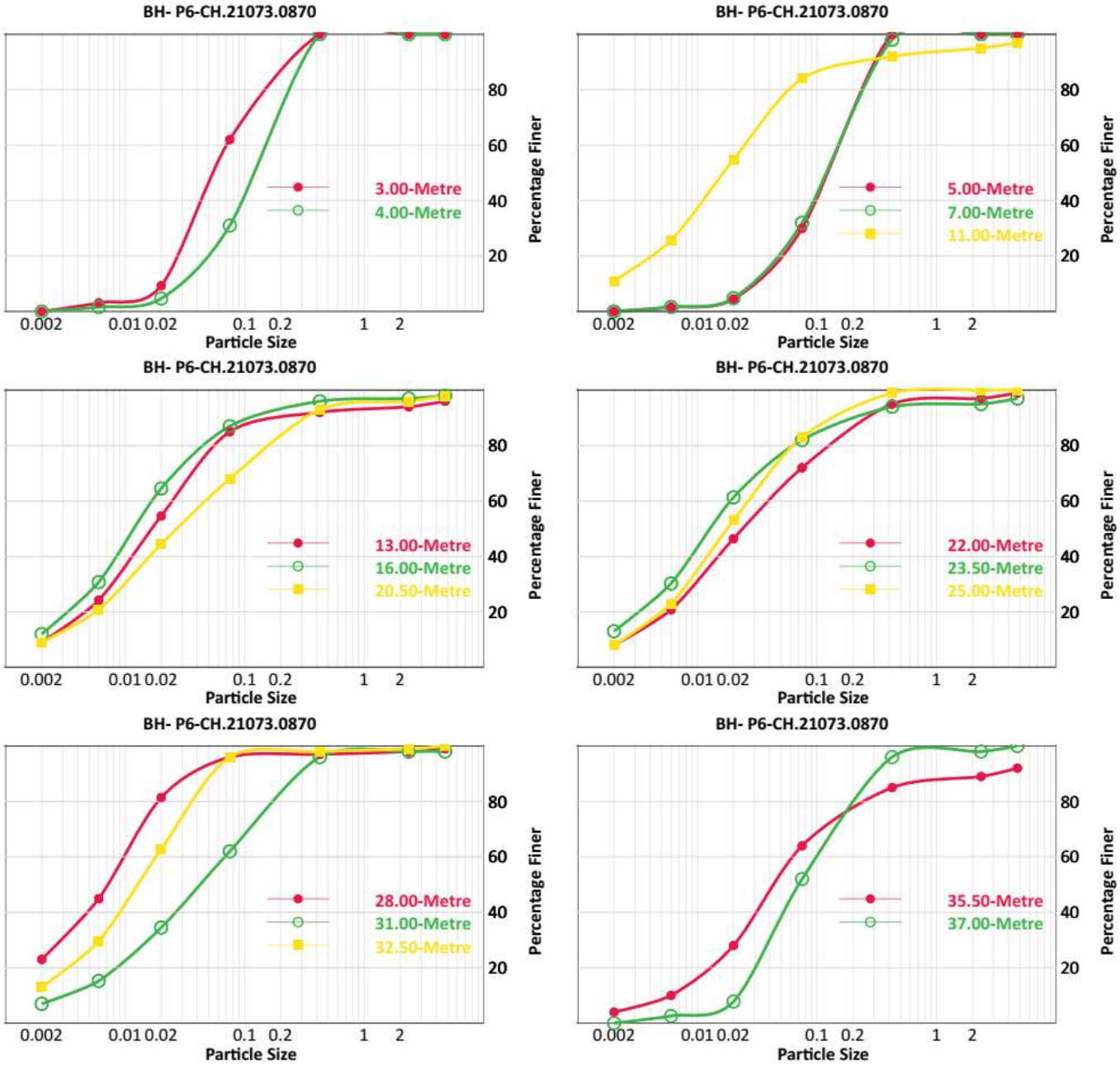


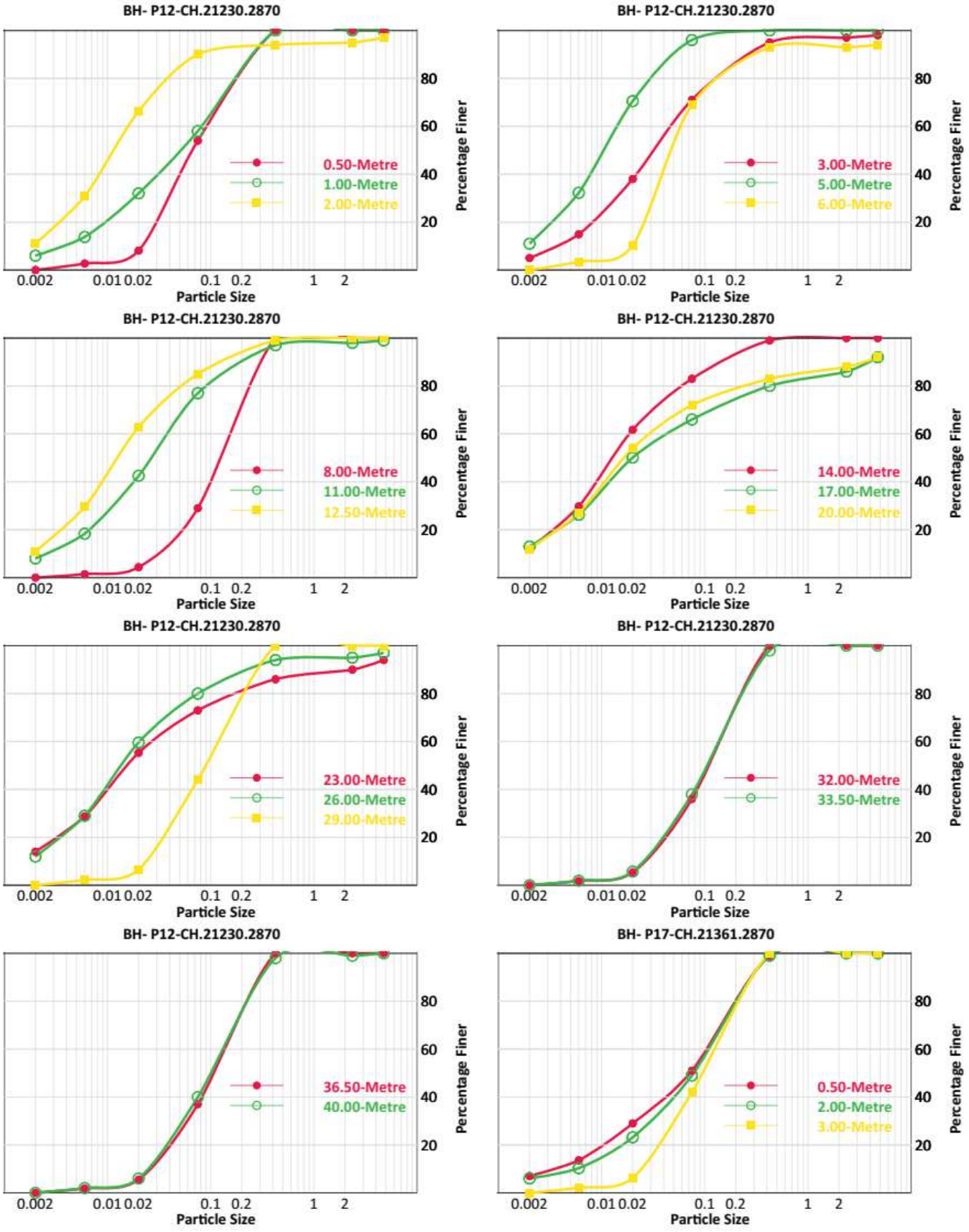
BH- P6-CH.21073.0870



APPENDIX-D
PLOT 2: GRAIN SIZE DISTRIBUTION PLOTS

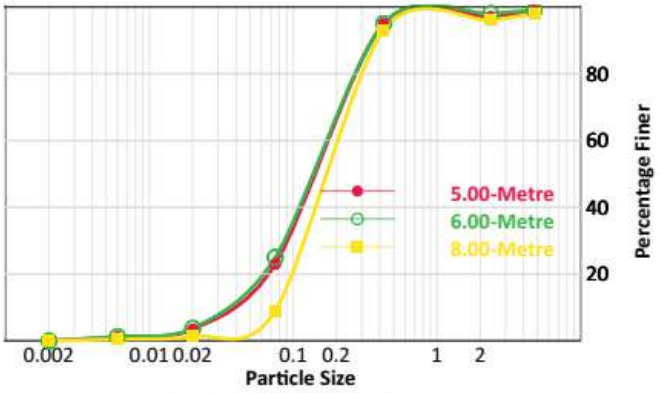


APPENDIX-D
PLOT 3: GRAIN SIZE DISTRIBUTION PLOTS



APPENDIX-D
PLOT 4: GRAIN SIZE DISTRIBUTION PLOTS

BH- P17-CH.21361.2870



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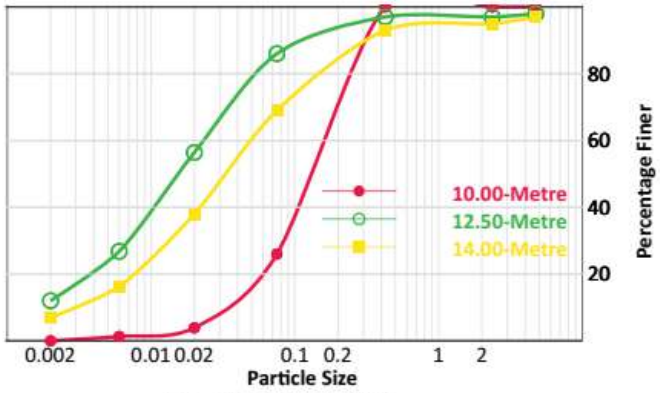
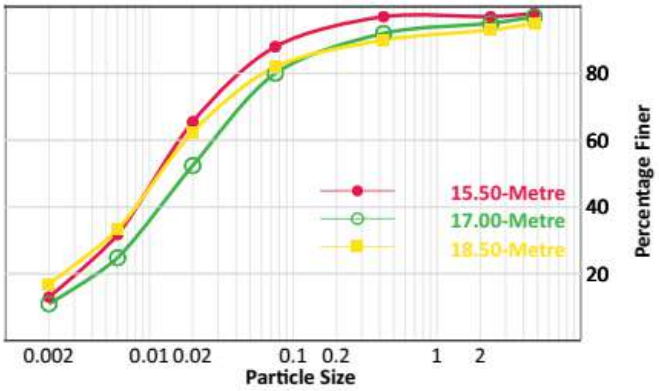
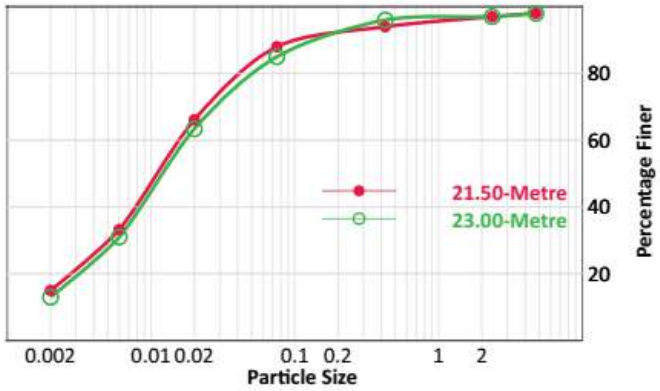


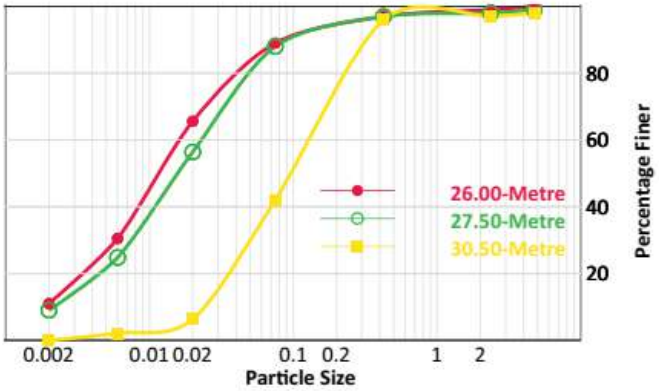
BH- P17-CH.21361.2870



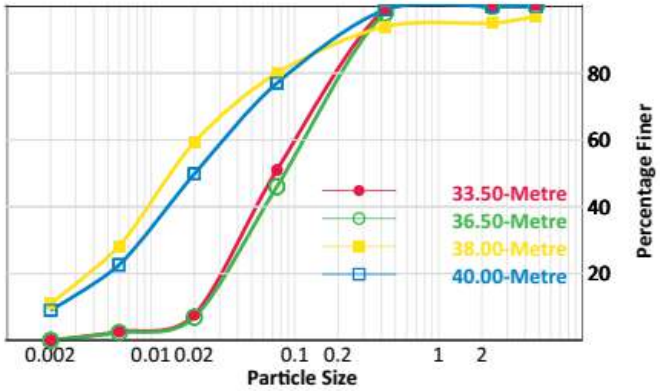
BH- P17-CH.21361.2870



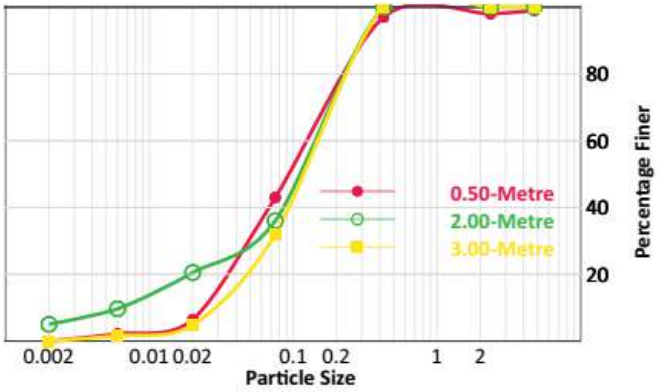
BH- P17-CH.21361.2870



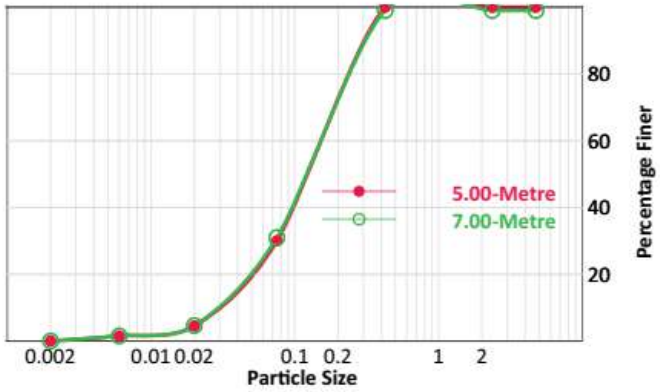
BH- P17-CH.21361.2870



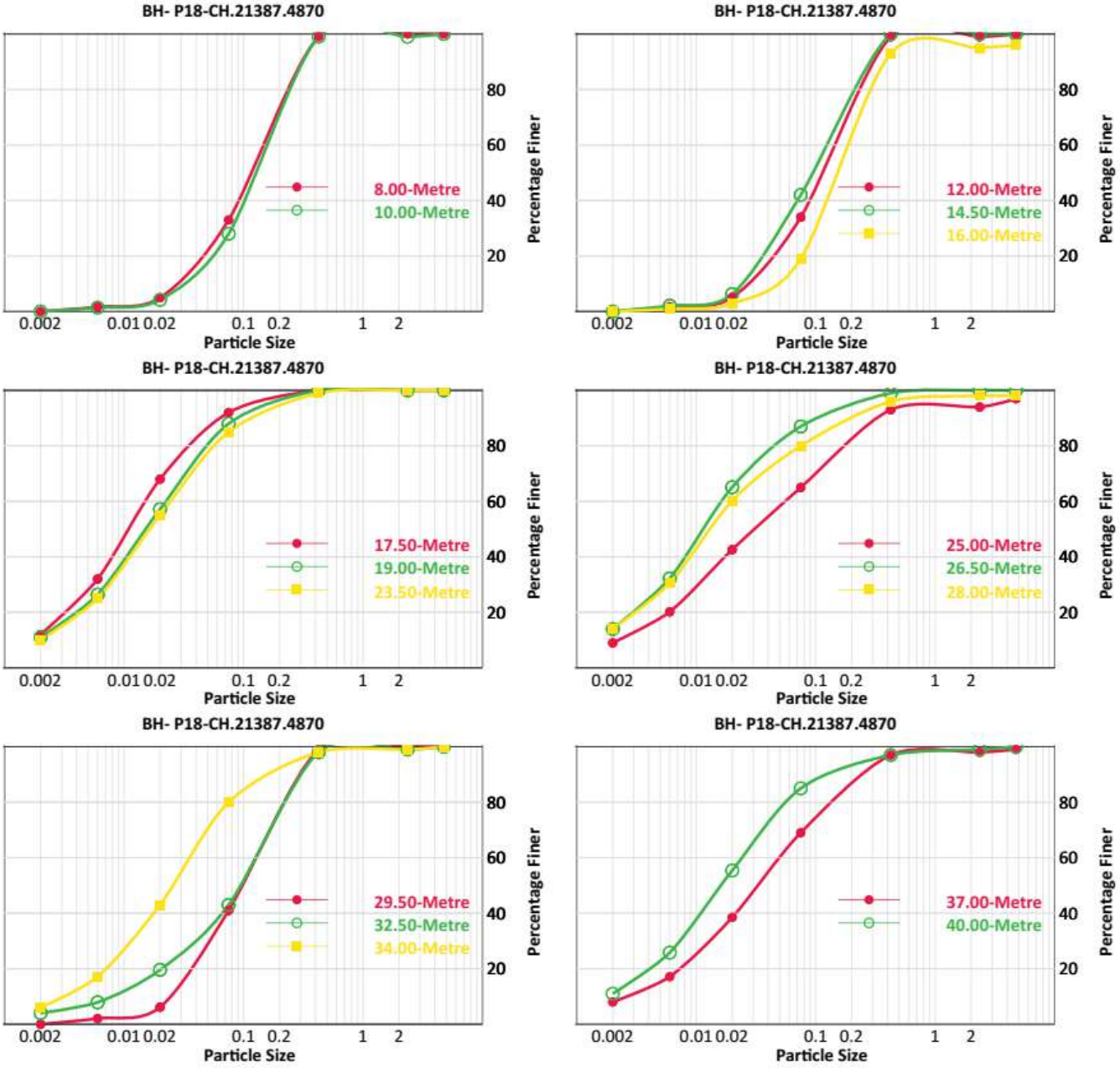
BH- P18-CH.21387.4870



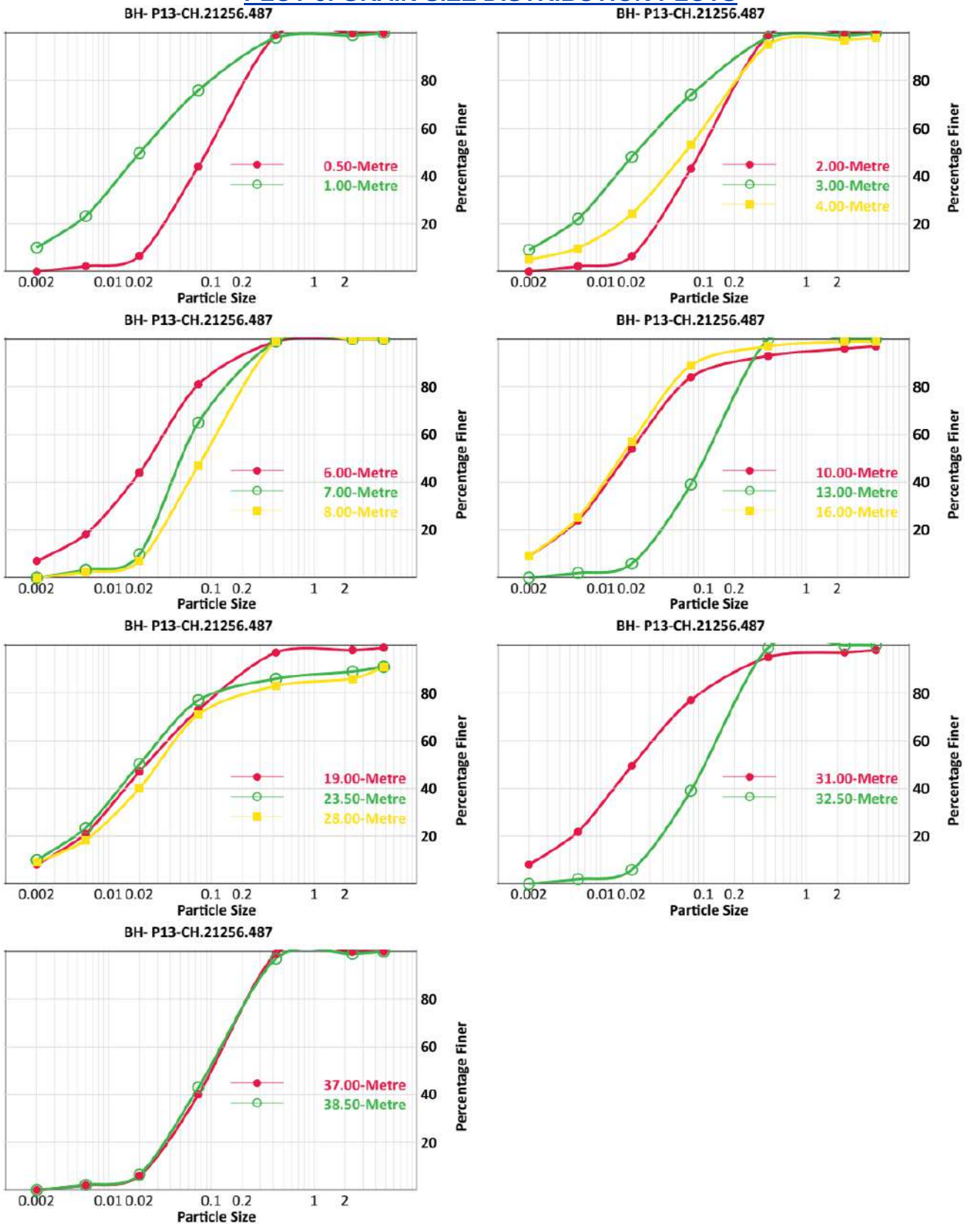
BH- P18-CH.21387.4870



APPENDIX-D
PLOT 5: GRAIN SIZE DISTRIBUTION PLOTS

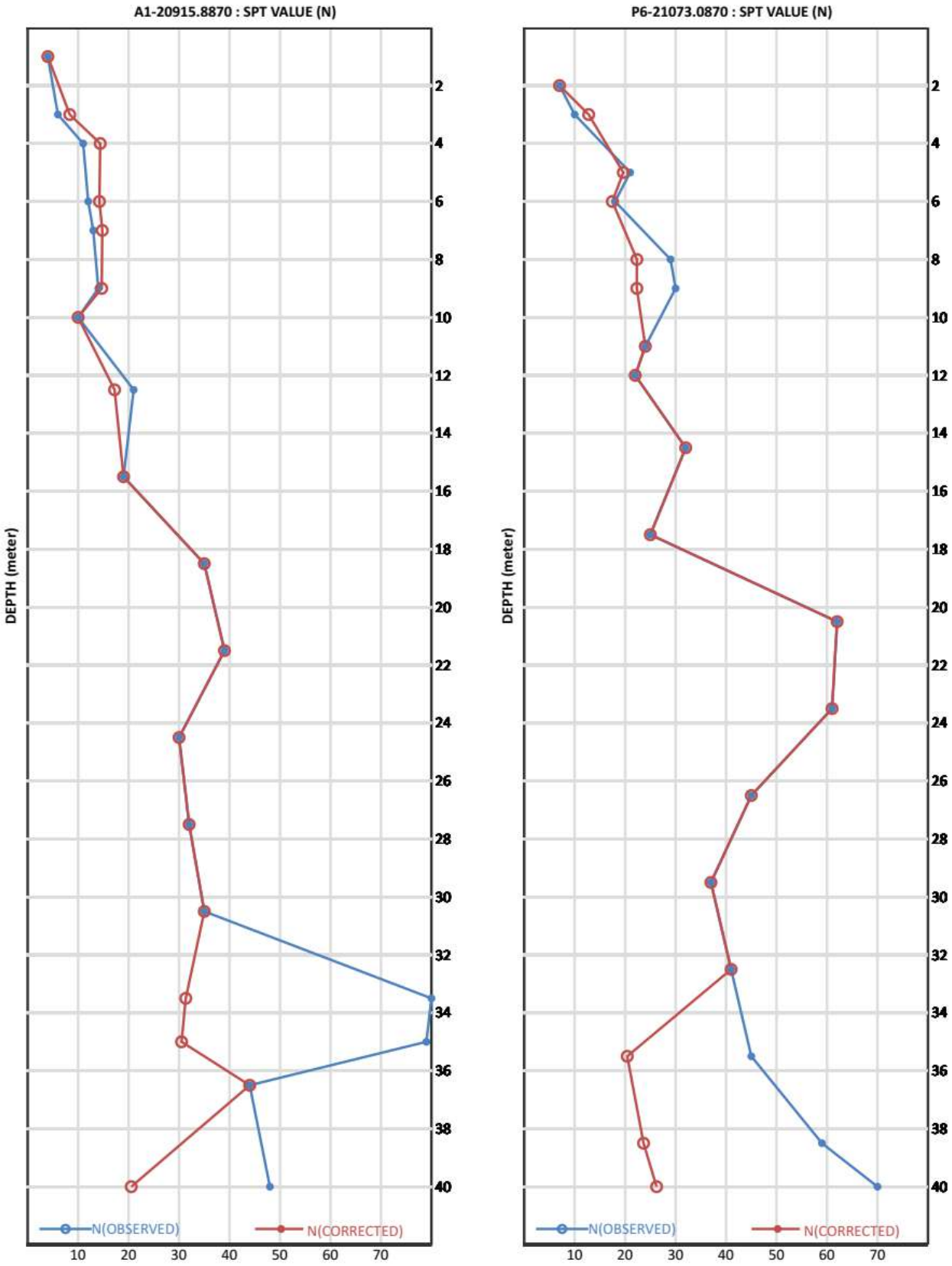


APPENDIX-D
PLOT 6: GRAIN SIZE DISTRIBUTION PLOTS

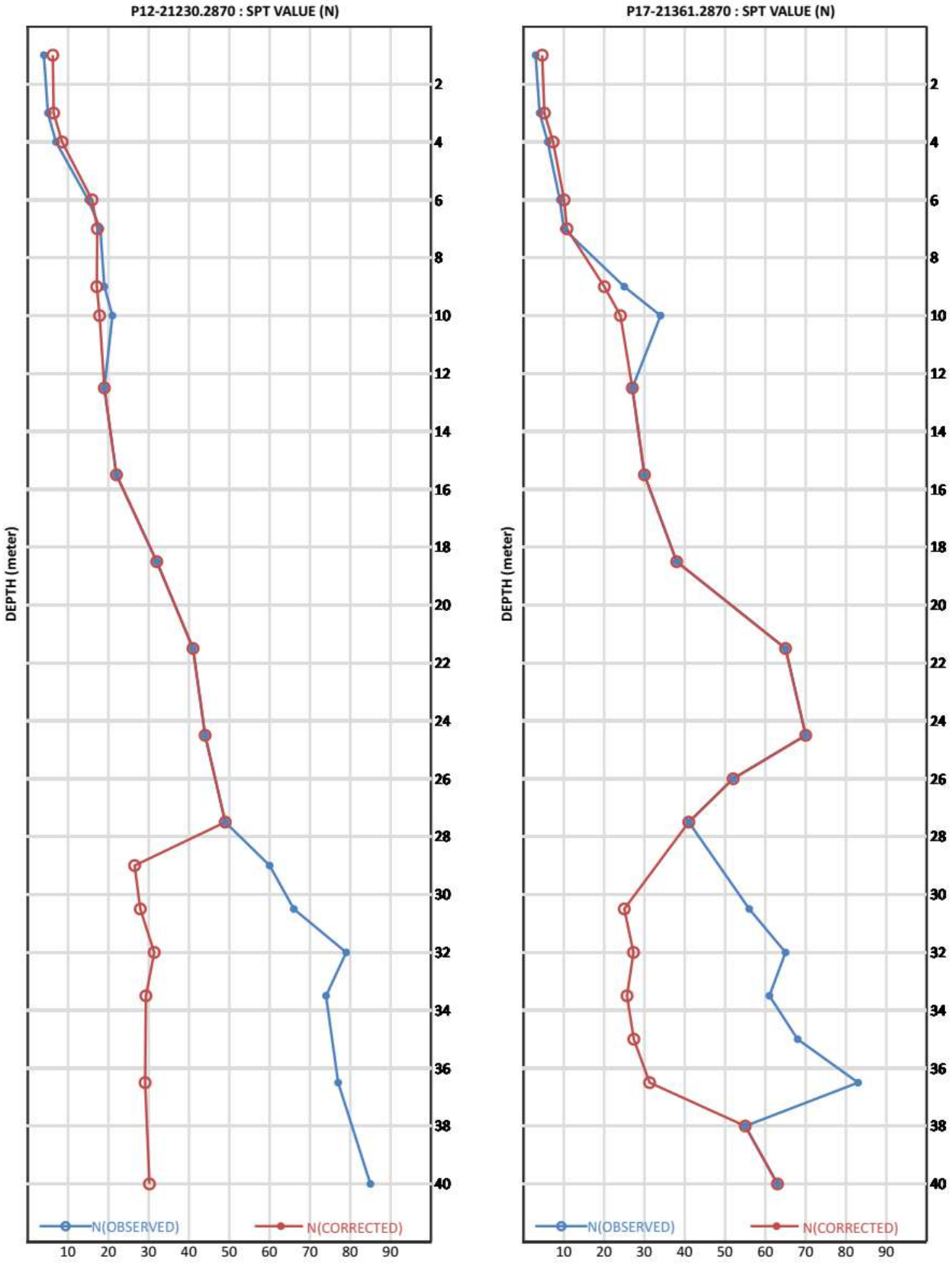


APPENDIX-E

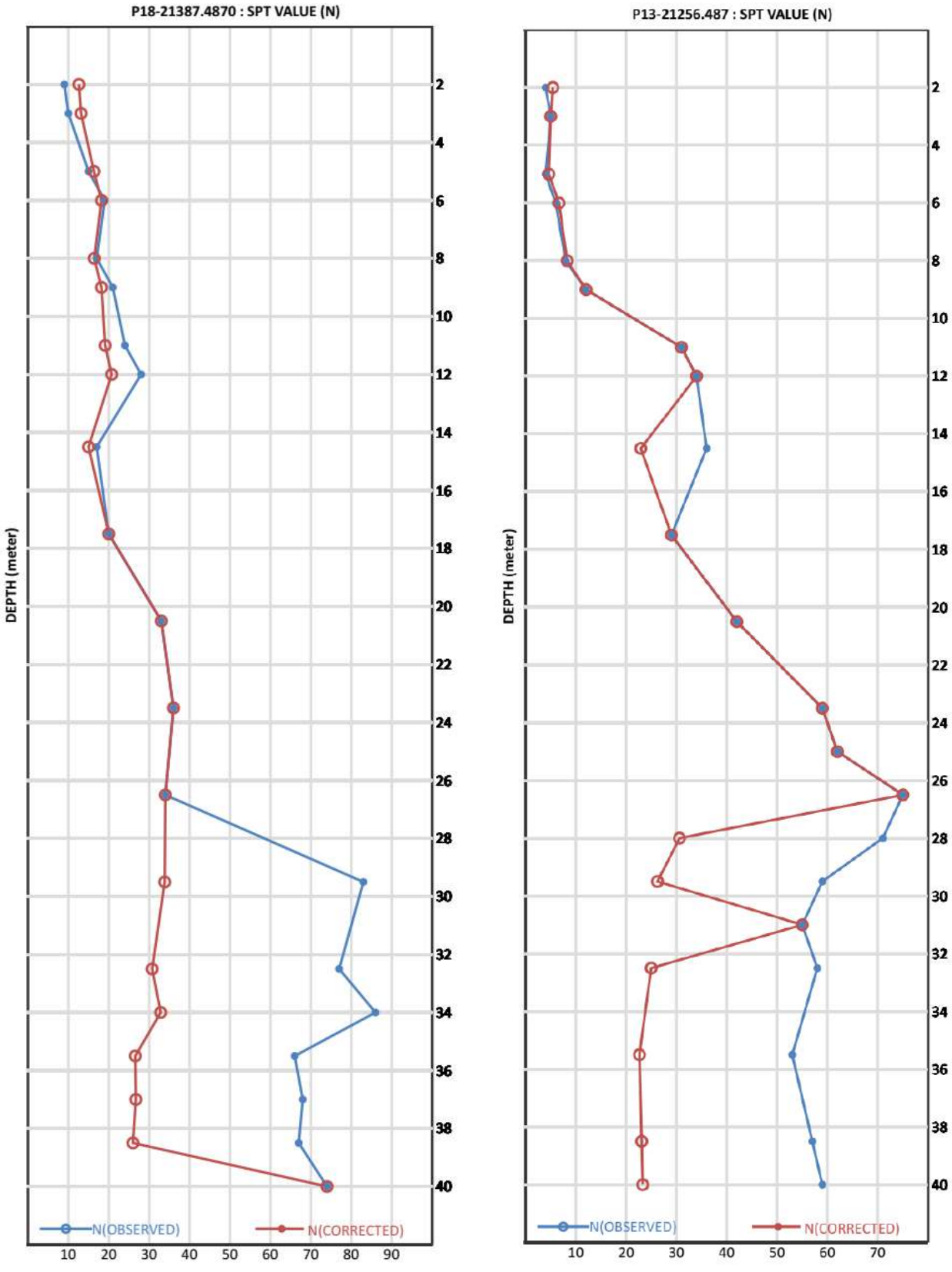
PLOT 1: RECORDED SPT Vs CORRECTED SPT



APPENDIX-E
PLOT 2: RECORDED SPT Vs CORRECTED SPT

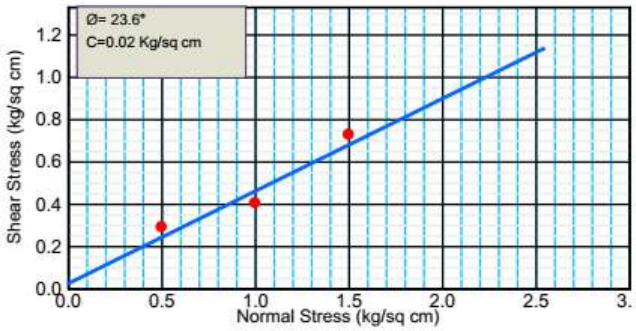


APPENDIX-E
PLOT 3: RECORDED SPT Vs CORRECTED SPT

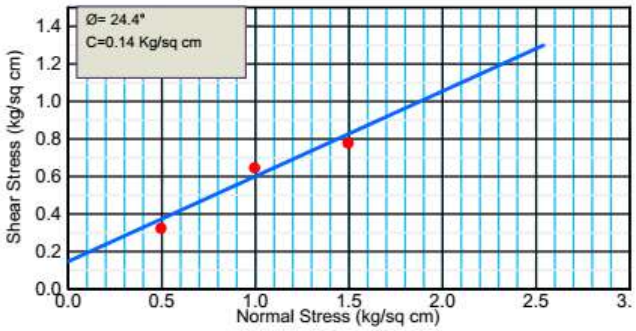


APPENDIX-F
GRAPH 1: DST GRAPH

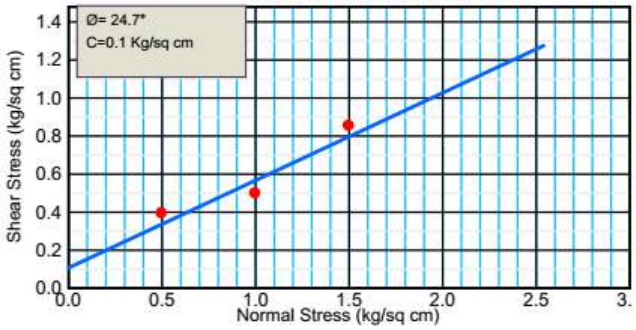
1901-HRIDC-I-20915.8870
BH-A1, DEPTH=5.00M, DIRECT SHEAR TEST



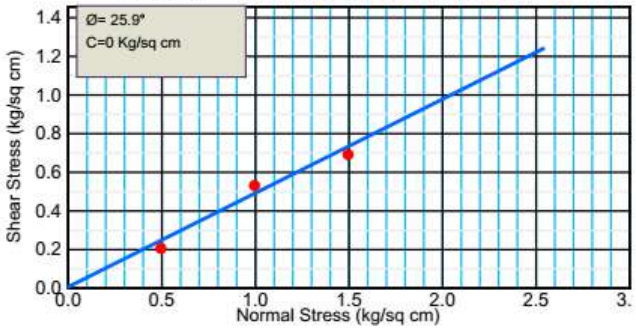
1901-HRIDC-I-20915.8870
BH-A1, DEPTH=29.00M, DIRECT SHEAR TEST



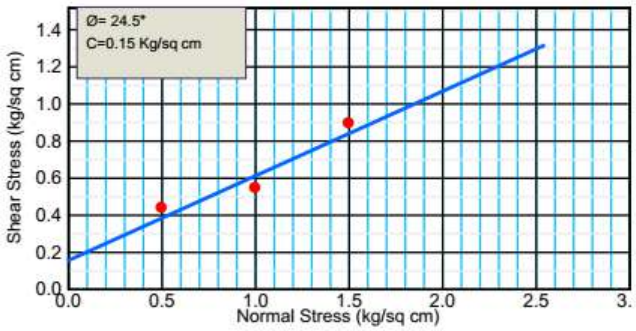
1901-HRIDC-I-21073.0870
BH-P6, DEPTH=31.00M, DIRECT SHEAR TEST



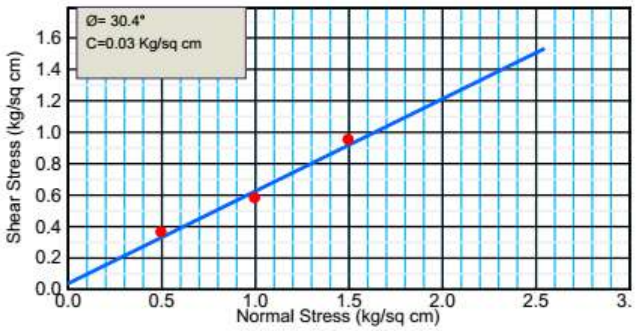
1901-HRIDC-I-21230.2870
BH-P12, DEPTH=8.00M, DIRECT SHEAR TEST



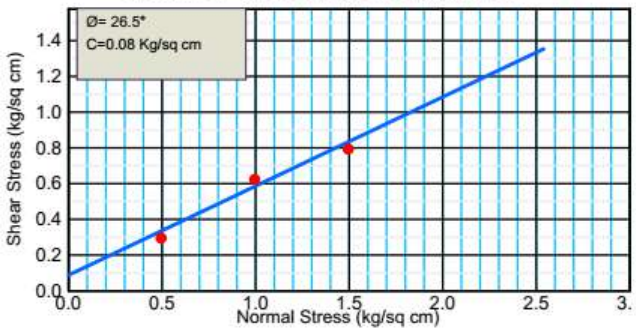
1901-HRIDC-I-21230.2870
BH-P12, DEPTH=11.00M, DIRECT SHEAR TEST



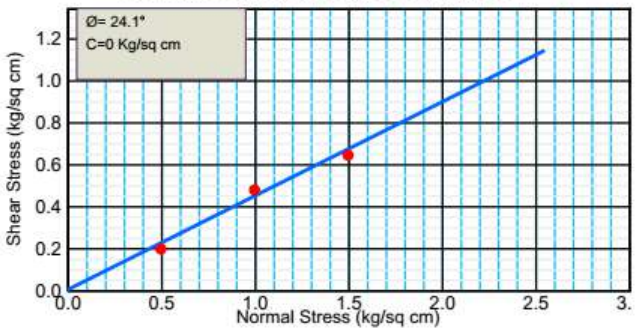
1901-HRIDC-I-21230.2870
BH-P12, DEPTH=35.00M, DIRECT SHEAR TEST



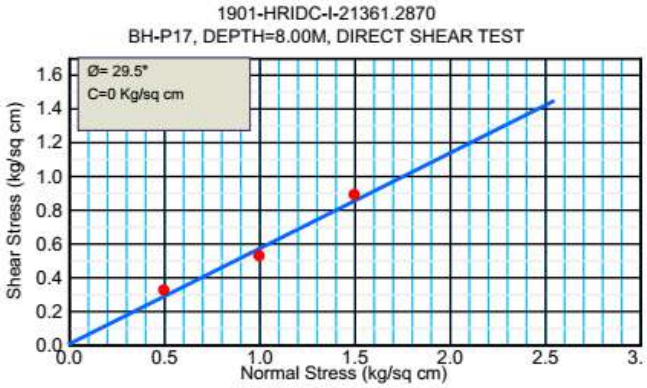
1901-HRIDC-I-21361.2870
BH-P17, DEPTH=2.00M, DIRECT SHEAR TEST

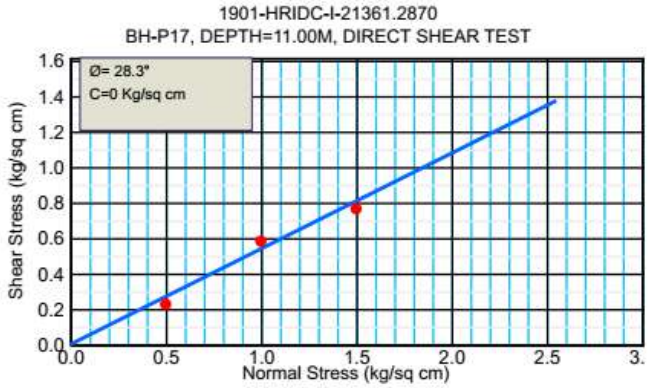


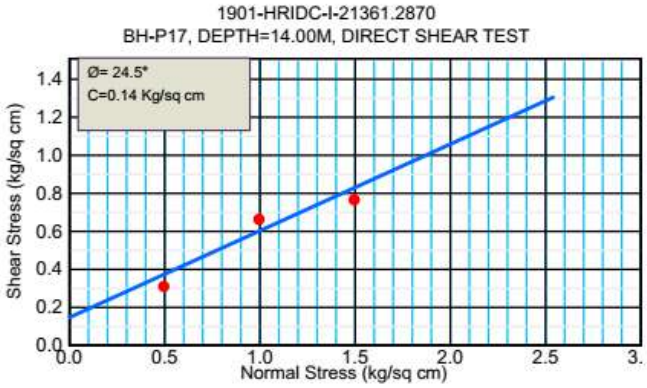
1901-HRIDC-I-21361.2870
BH-P17, DEPTH=5.00M, DIRECT SHEAR TEST

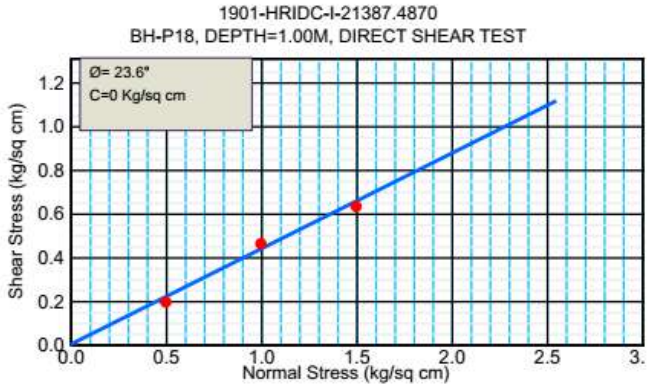


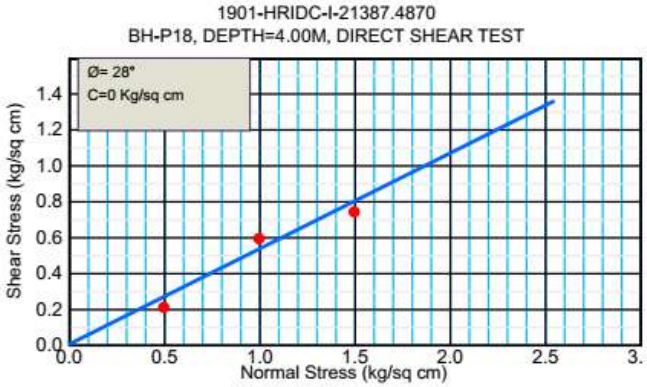
APPENDIX-F
GRAPH 2: DST GRAPH

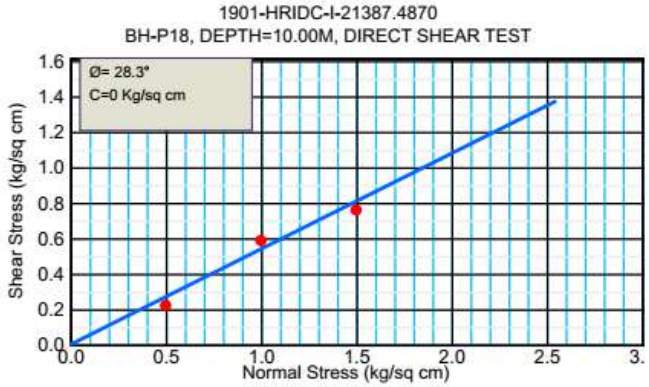


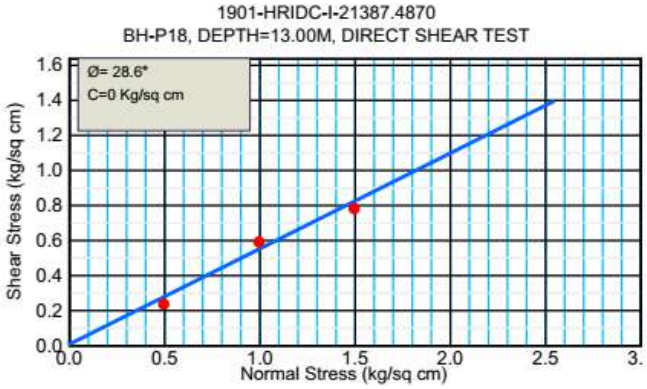


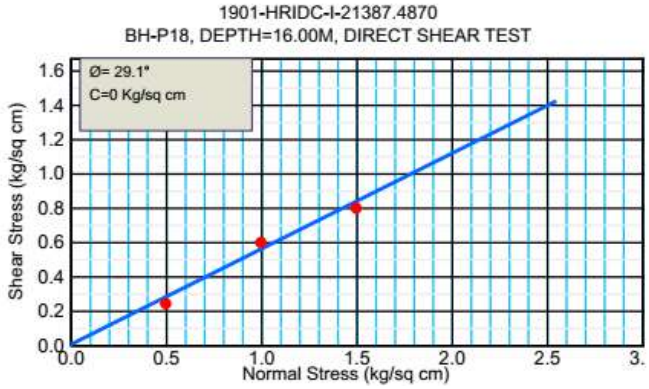




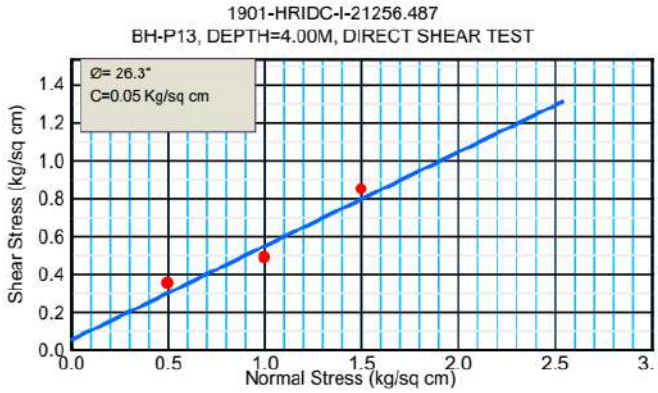


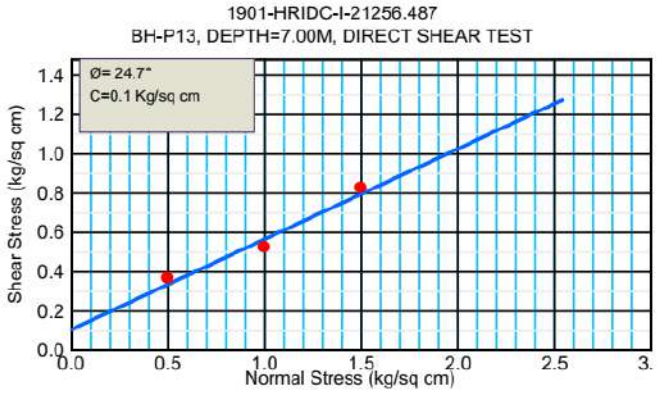


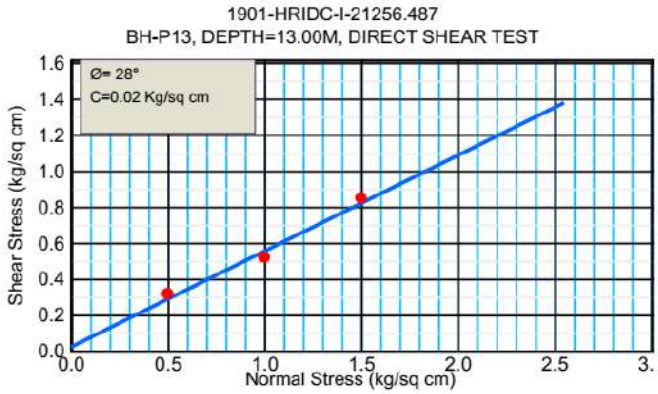


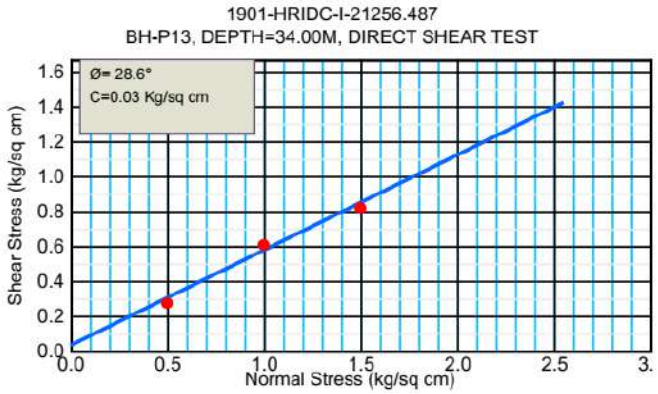


APPENDIX-F
GRAPH 3: DST GRAPH



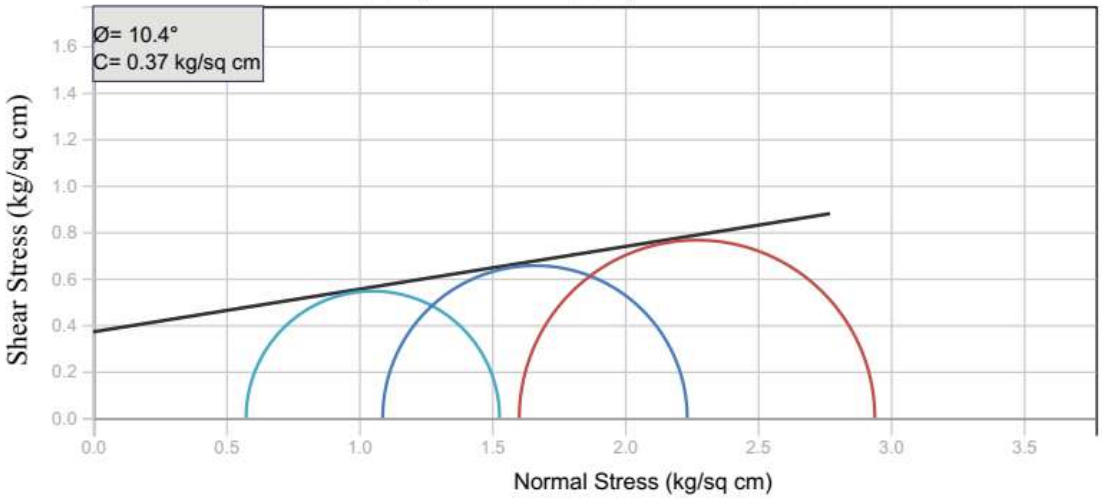




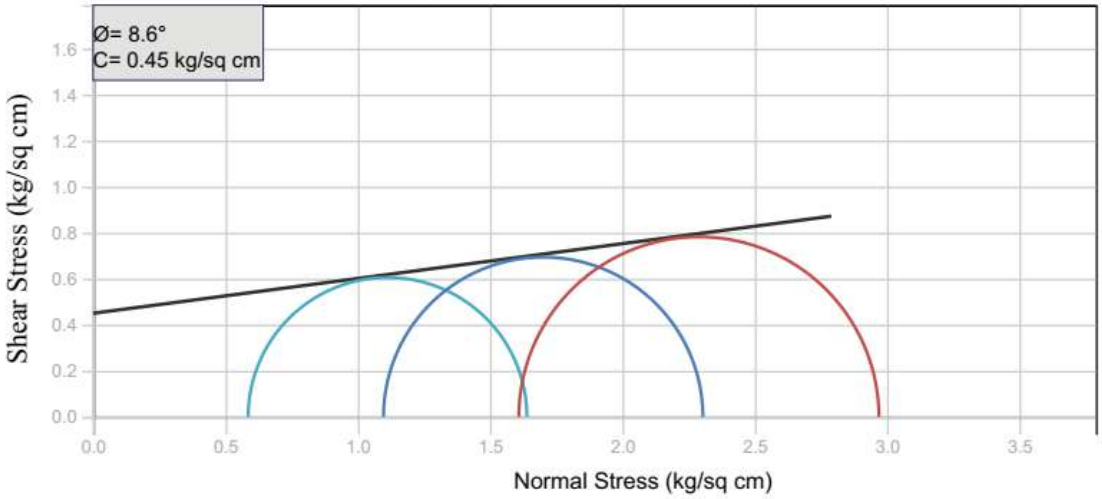


APPENDIX-G
GRAPH 1: UU GRAPH

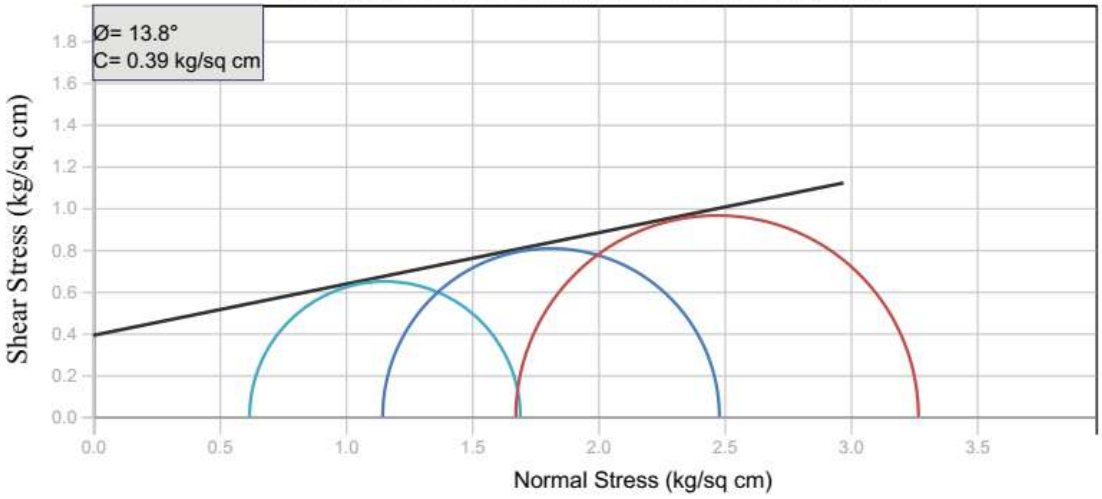
1901-HRIDC-I-20915.8870
BH-NO.A1, DEPTH-11.00M, TRIAXIAL GRAPH



1901-HRIDC-I-20915.8870
BH-NO.A1, DEPTH-17.00M, TRIAXIAL GRAPH

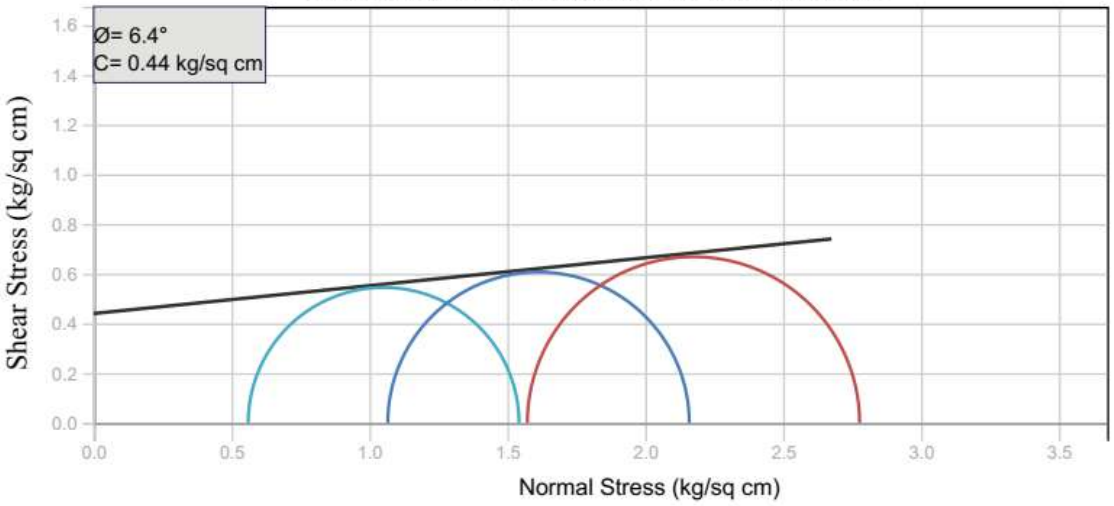


1901-HRIDC-I-20915.8870
BH-NO.A1, DEPTH-26.00M, TRIAXIAL GRAPH

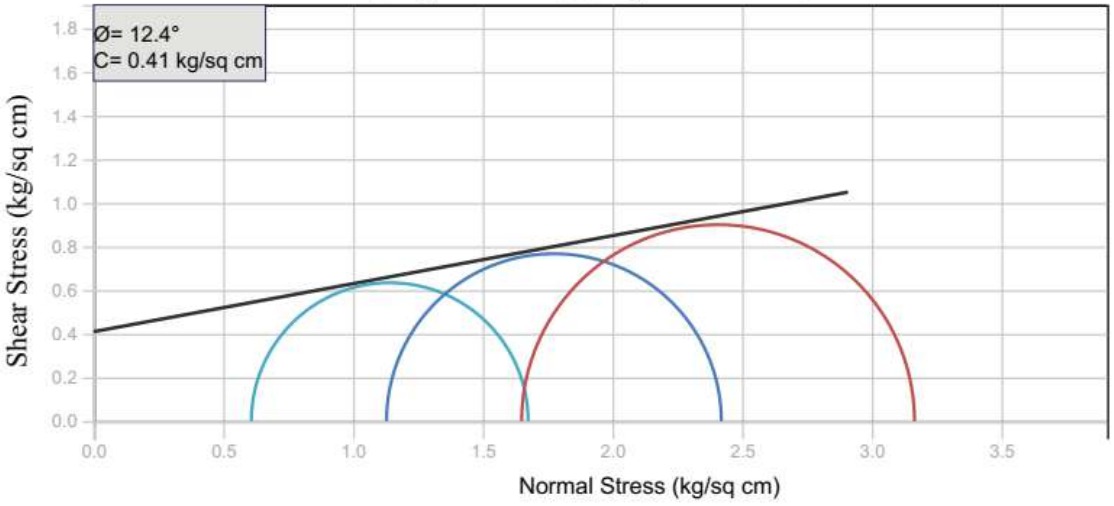


APPENDIX-G
GRAPH 2: UU GRAPH

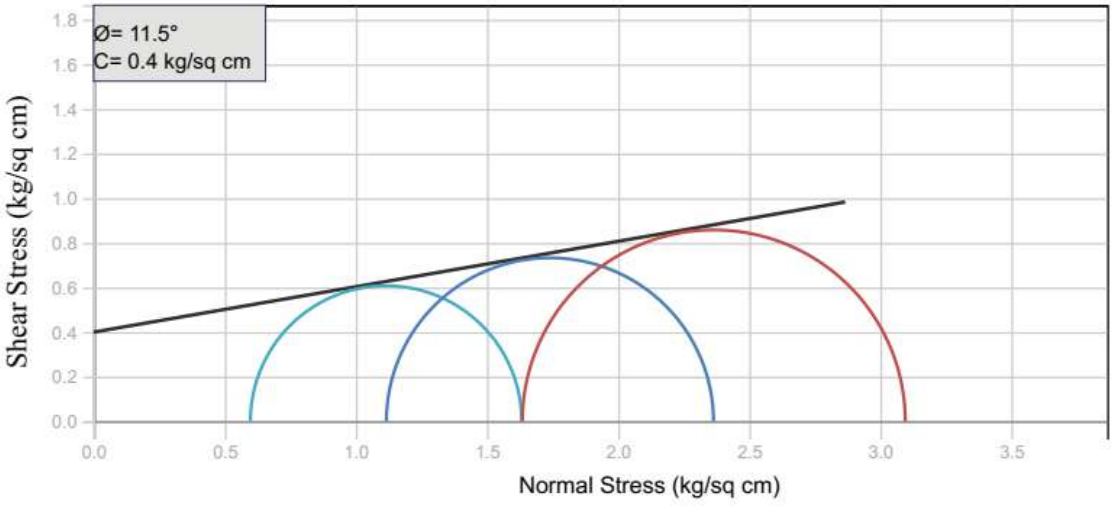
1901-HRIDC-I-21073.0870
BH-NO.P6, DEPTH-1.00M, TRIAXIAL GRAPH



1901-HRIDC-I-21073.0870
BH-NO.P6, DEPTH-13.00M, TRIAXIAL GRAPH

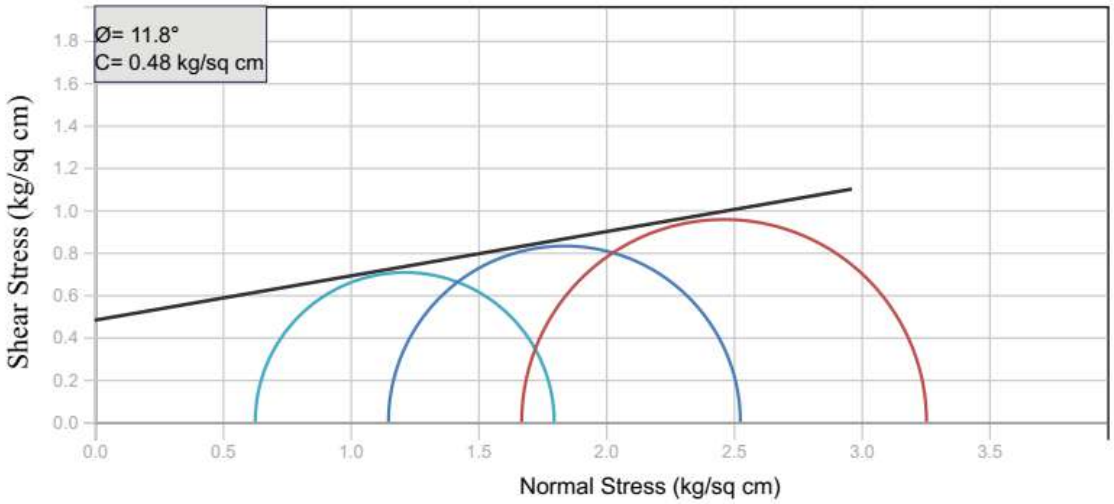


1901-HRIDC-I-21073.0870
BH-NO.P6, DEPTH-22.00M, TRIAXIAL GRAPH

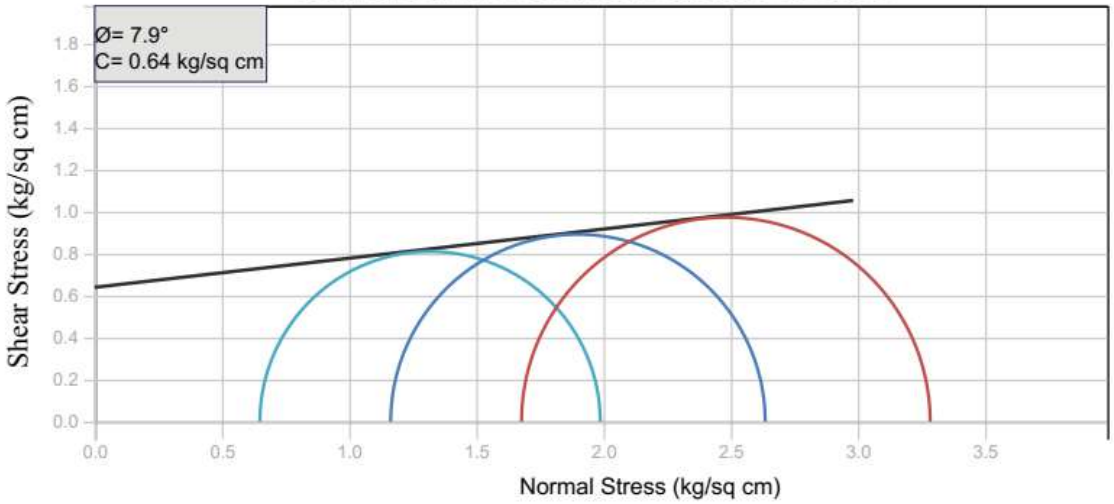


APPENDIX-G
GRAPH 3: UU GRAPH

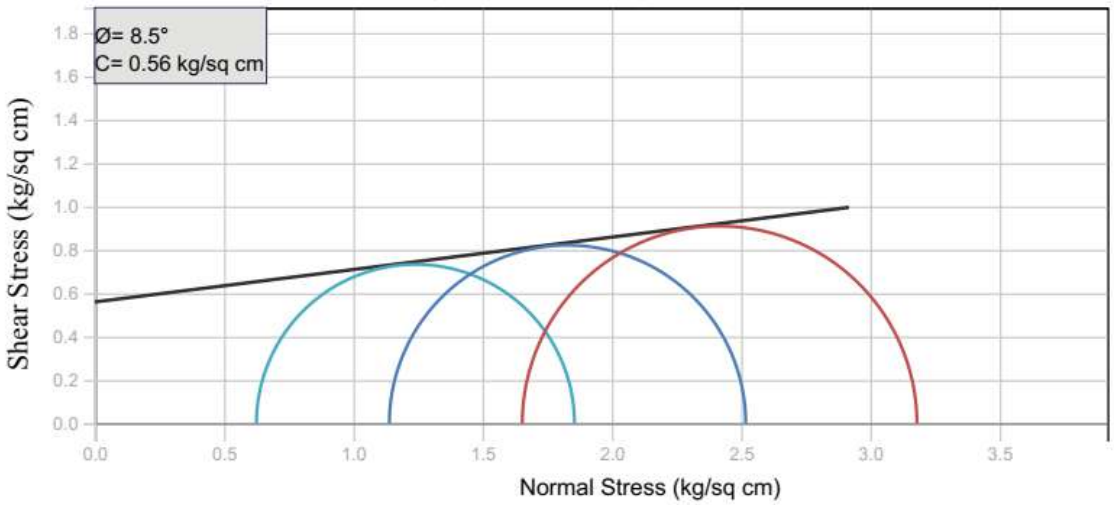
1901-HRIDC-I-21073.0870
BH-NO.P6, DEPTH-28.00M, TRIAXIAL GRAPH



1901-HRIDC-I-21230.2870
BH-NO.P12, DEPTH-2.00M, TRIAXIAL GRAPH

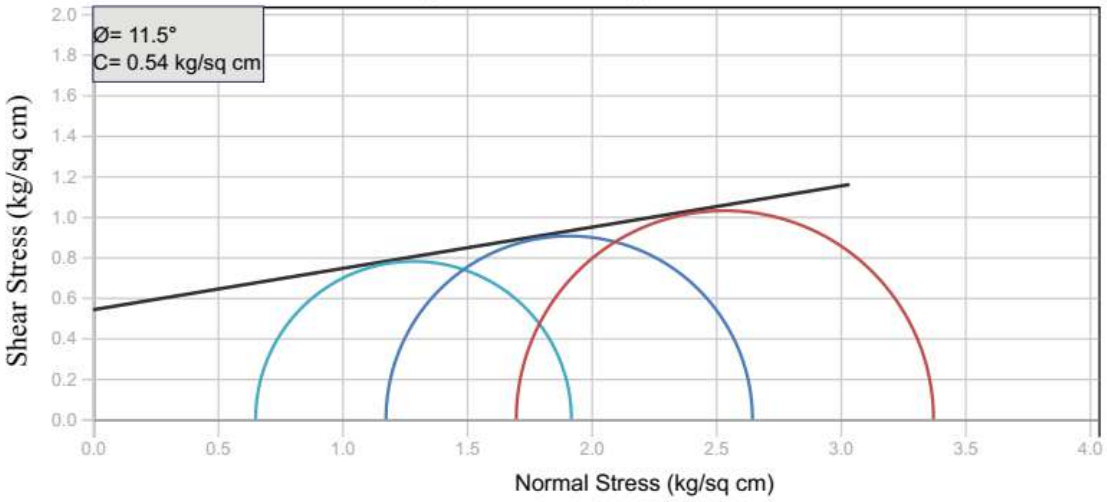


1901-HRIDC-I-21230.2870
BH-NO.P12, DEPTH-14.00M, TRIAXIAL GRAPH

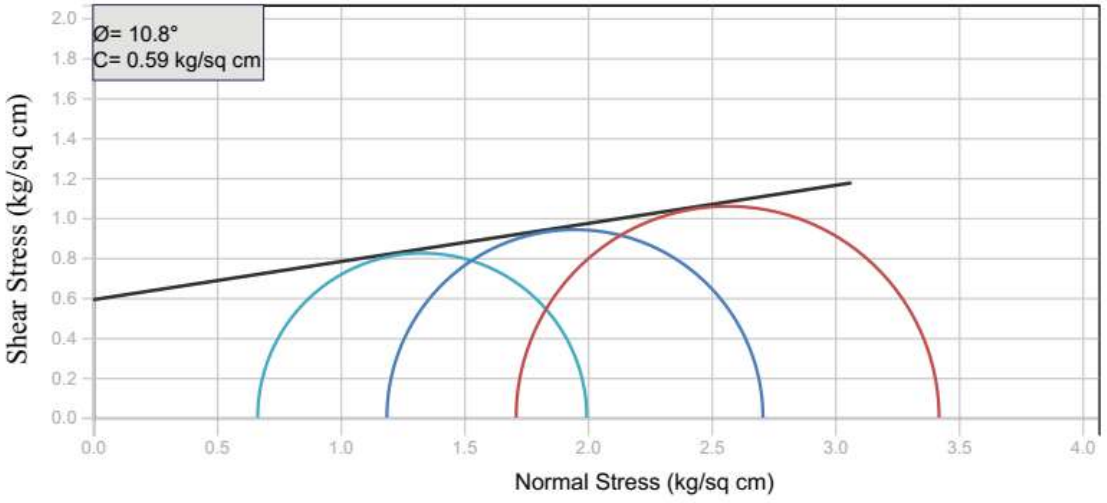


APPENDIX-G
GRAPH 4: UU GRAPH

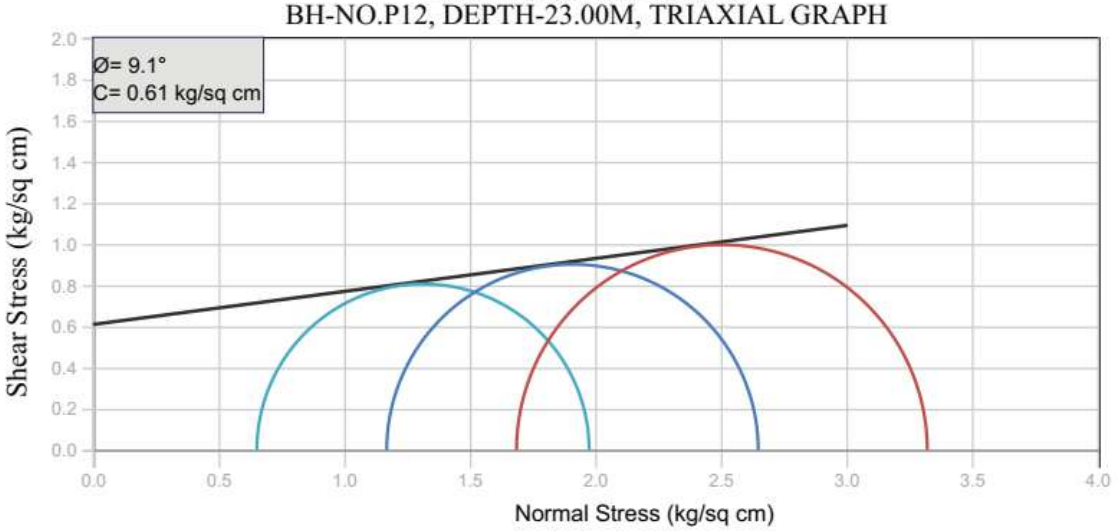
1901-HRIDC-I-21230.2870
BH-NO.P12, DEPTH-17.00M, TRIAXIAL GRAPH



1901-HRIDC-I-21230.2870
BH-NO.P12, DEPTH-20.00M, TRIAXIAL GRAPH

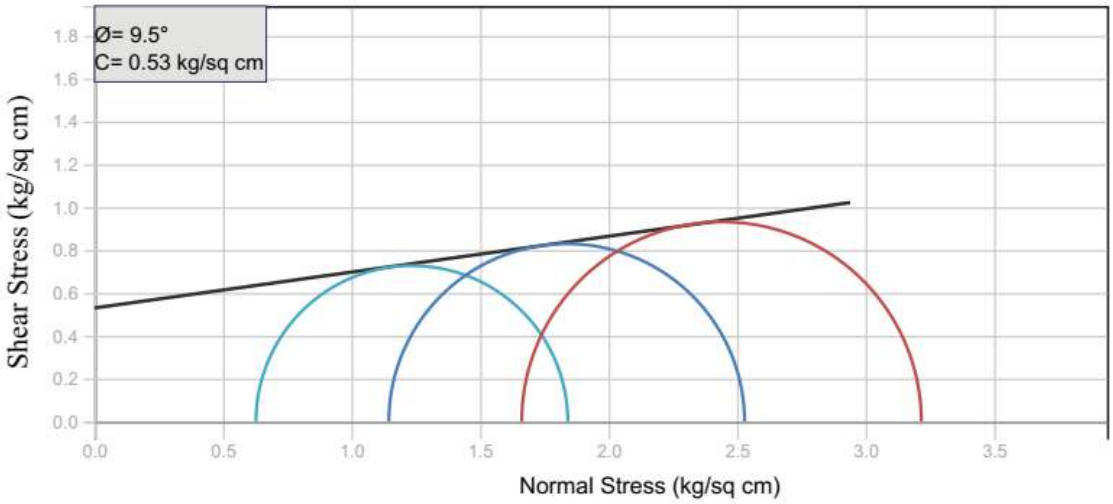


1901-HRIDC-I-21230.2870
BH-NO.P12, DEPTH-23.00M, TRIAXIAL GRAPH

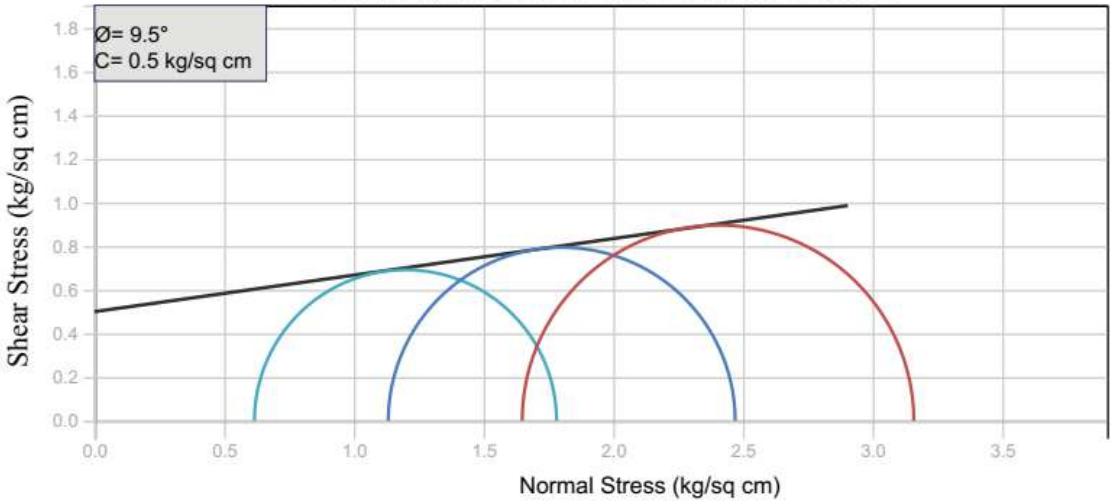


APPENDIX-G
GRAPH 5: UU GRAPH

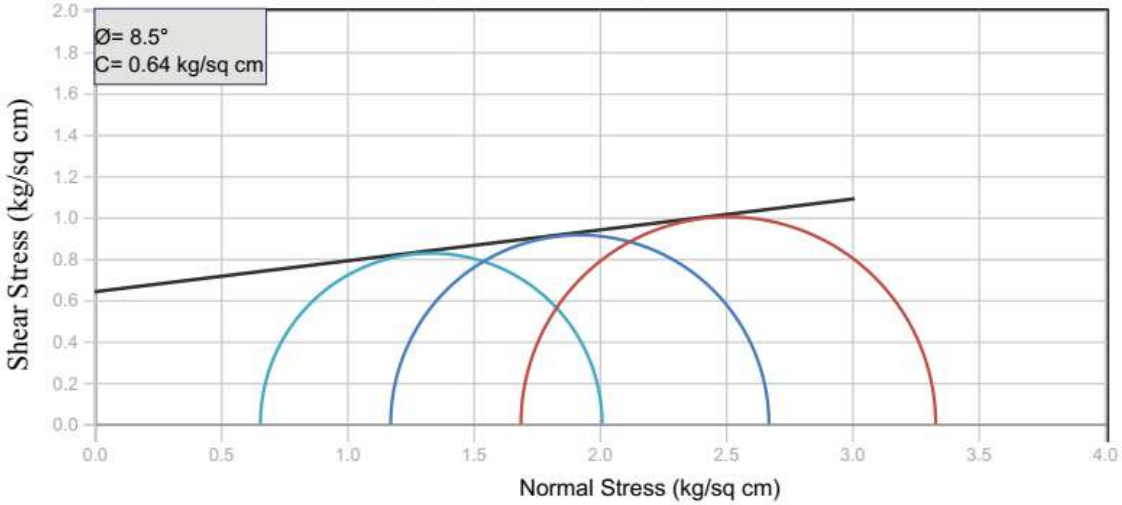
1901-HRIDC-I-21230.2870
BH-NO.P12, DEPTH-26.00M, TRIAXIAL GRAPH



1901-HRIDC-I-21361.2870
BH-NO.P17, DEPTH-17.00M, TRIAXIAL GRAPH

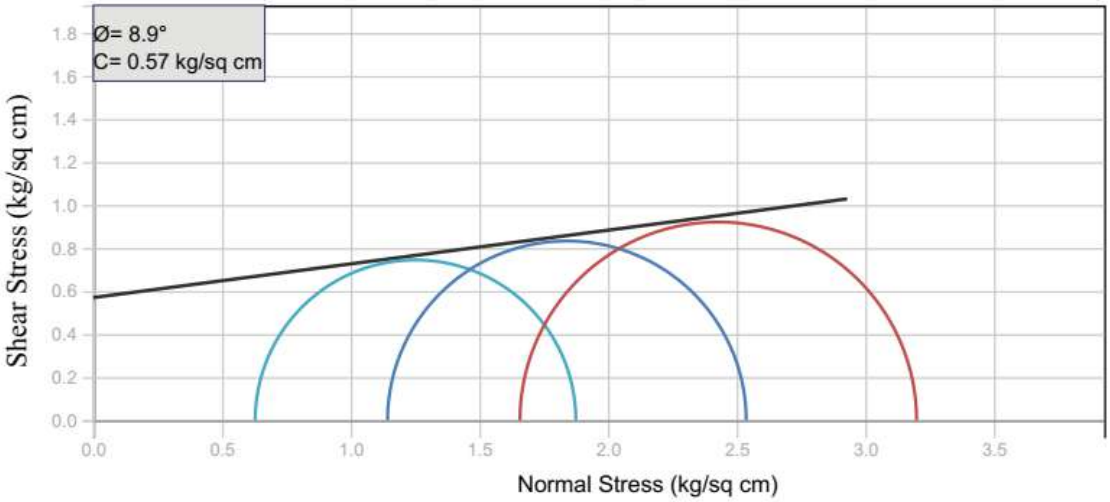


1901-HRIDC-I-21361.2870
BH-NO.P17, DEPTH-20.00M, TRIAXIAL GRAPH

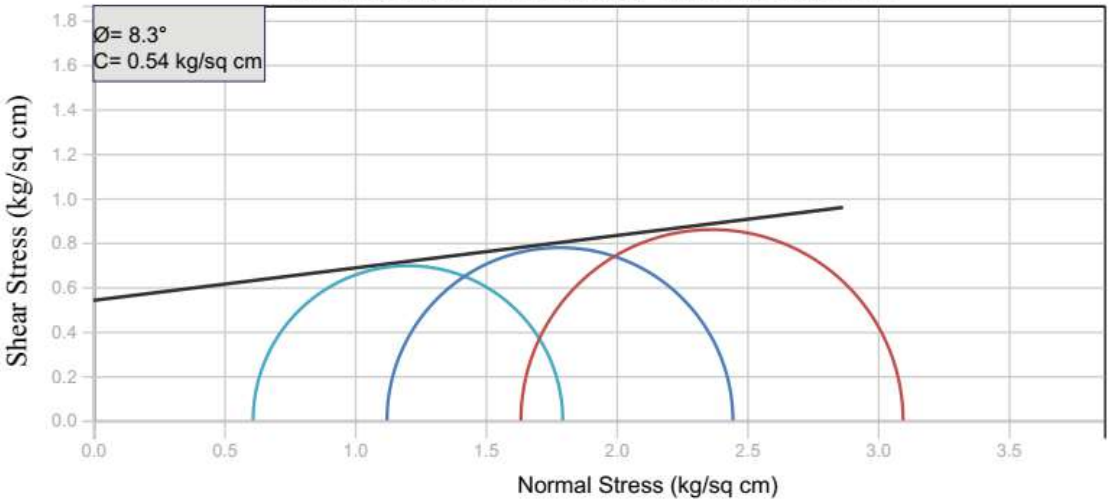


APPENDIX-G
GRAPH 6: UU GRAPH

1901-HRIDC-I-21361.2870
BH-NO.P17, DEPTH-23.00M, TRIAXIAL GRAPH



1901-HRIDC-I-21361.2870
BH-NO.P17, DEPTH-29.00M, TRIAXIAL GRAPH



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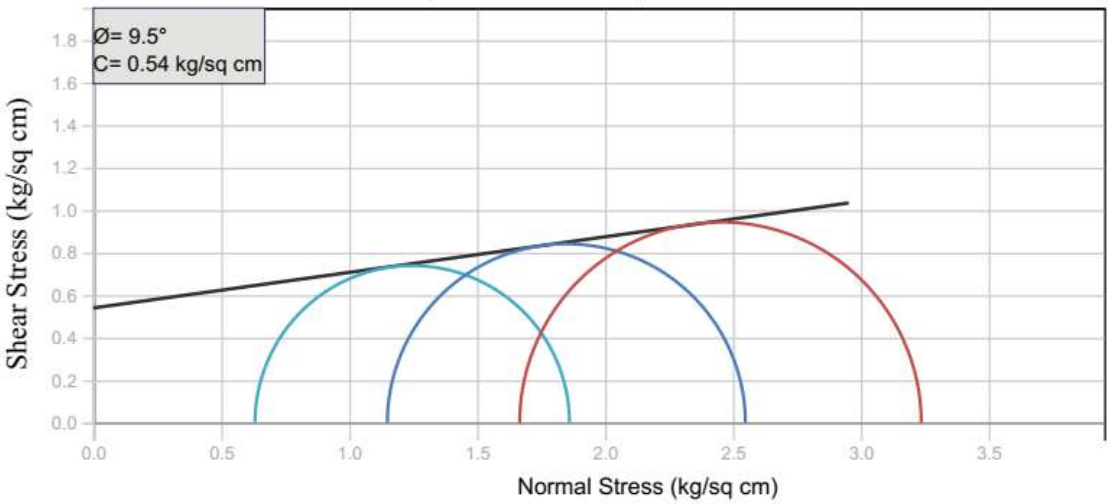
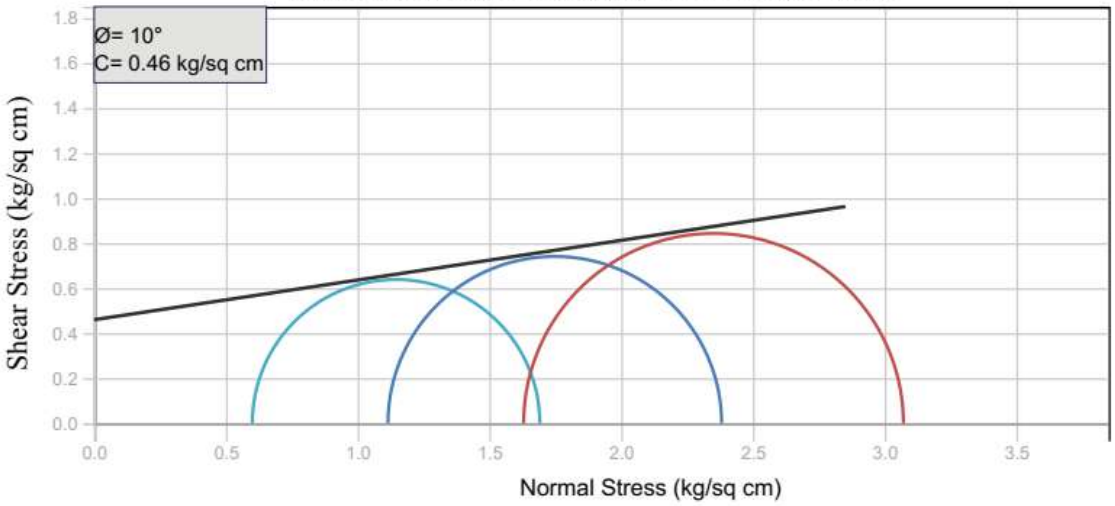


APPENDIX-G
GRAPH 7: UU GRAPH

1901-HRIDC-I-21387.4870
BH-NO.P18, DEPTH-22.00M, TRIAXIAL GRAPH



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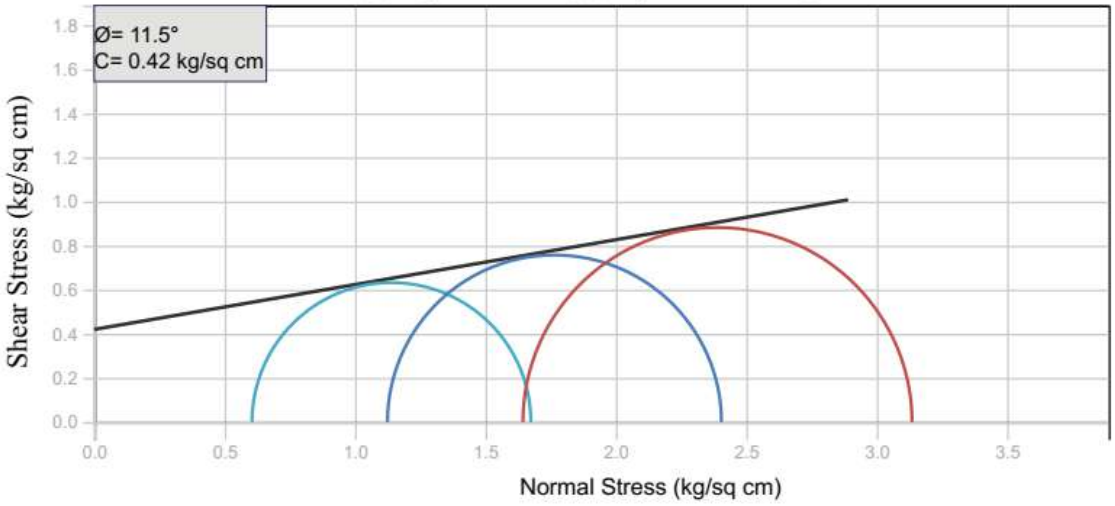

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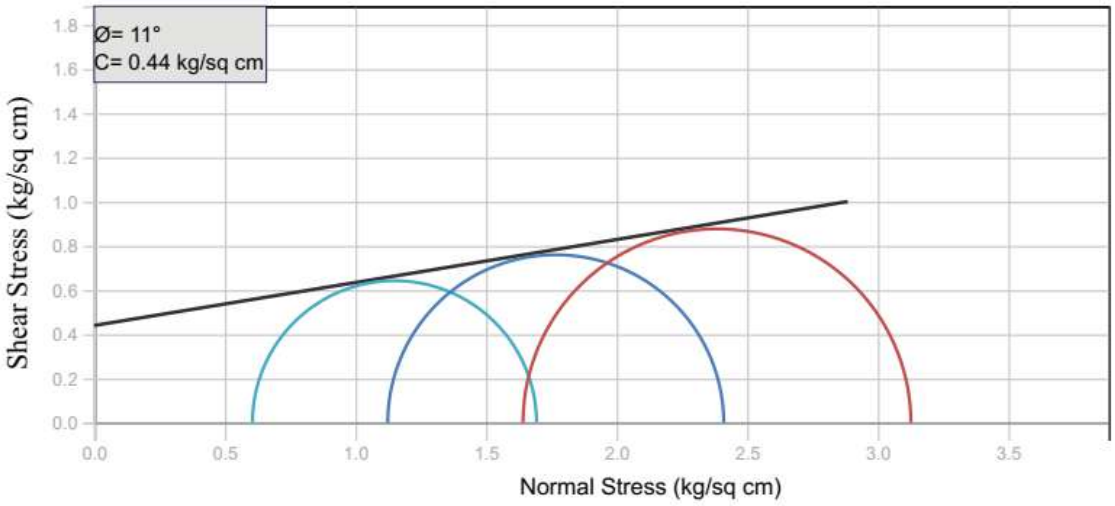
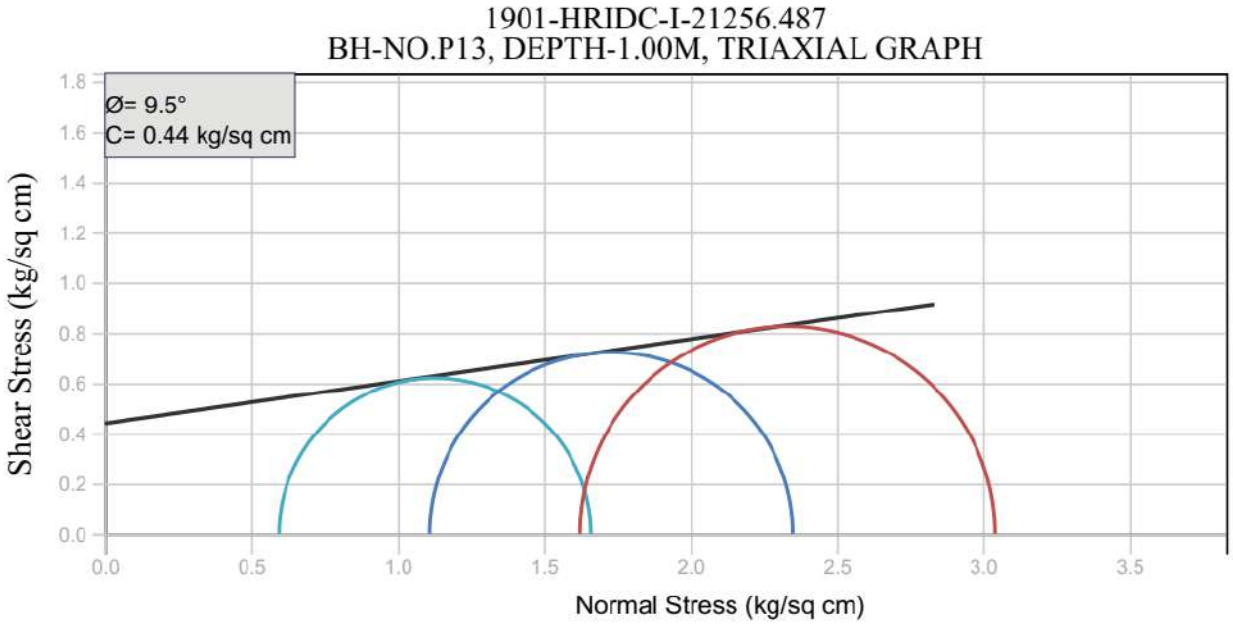
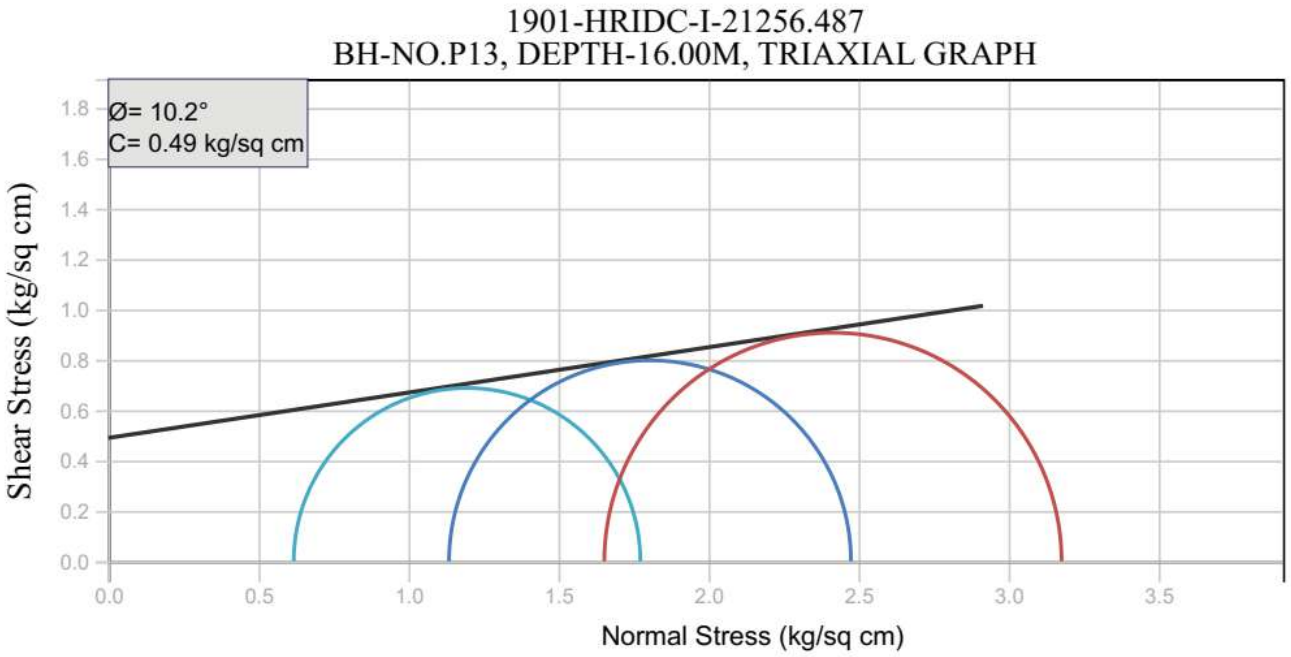
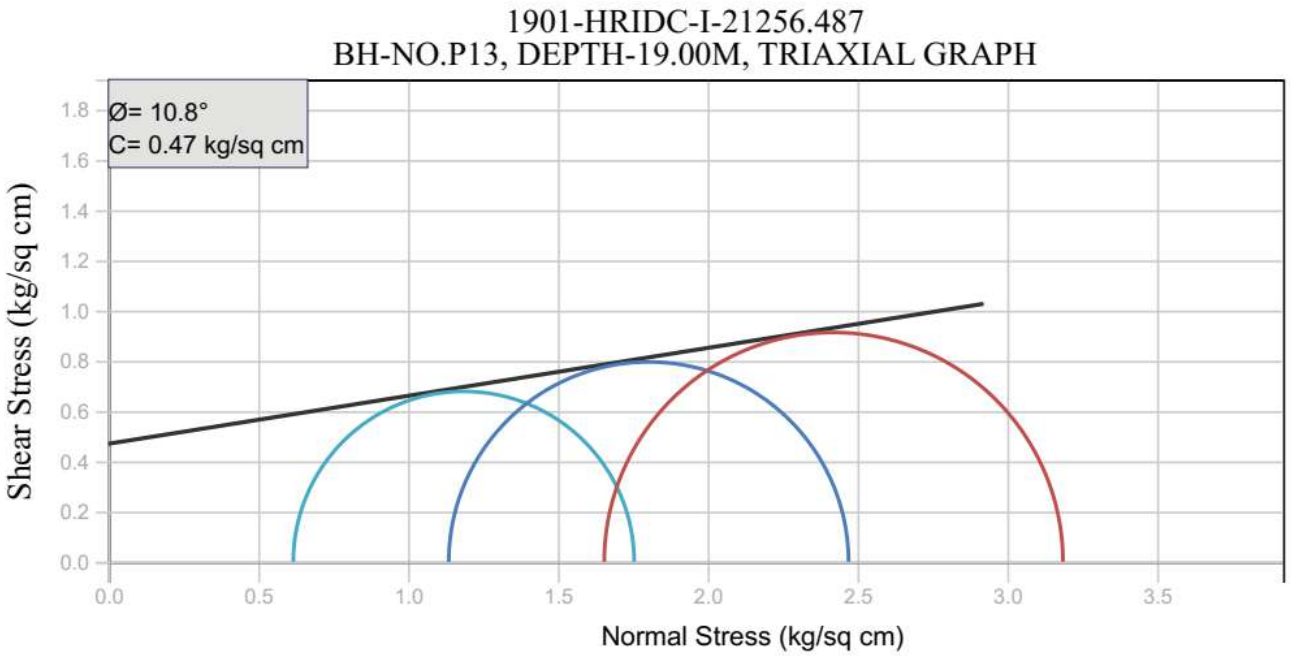


APPENDIX-G
GRAPH 8: UU GRAPH



APPENDIX-G
GRAPH 9: UU GRAPH





APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Q_b	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
BORE NO: A1, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	18.84	8.84	24.31	1.57	12.9	12.9	1.0	8.75	0	42	1.0	66.0	0	3.0	18.9	0	8.84	5.82	4.79	26.5	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.50	18.84	8.84	30.94	3.14	18.9	18.9	1.0	33.29	0	0	1.0	0.0	0	4.0	23.6	2	8.84	8.99	9.34	35.4	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	6.00	5.00	2.00	3.50	18.84	8.84	44.20	6.29	23.6	23.6	1.0	121.38	0	2	1.0	12.6	0	6.0	23.6	2	8.84	8.99	9.34	53.0	0	0.0	41.2	41.2	**0.00**	**13.74**
6.00	7.00	6.50	1.00	4.50	18.84	8.84	57.46	3.14	23.6	23.6	1.0	78.90	0	2	1.0	6.3	0	7.0	28.5	0	8.84	17.88	18.94	61.9	935.2	935.2	53.0	53.0	**374.08**	**17.67**
7.00	8.00	7.50	1.00	5.50	18.84	8.84	66.30	3.14	28.5	28.5	1.0	113.14	113.14	0	1.0	0.0	0.00	8.0	19.3	10	10.25	6.03	5.01	70.7	425.8	538.9	64.8	177.9	**215.58**	**59.31**
8.00	9.00	8.50	1.00	6.50	20.25	10.25	75.85	3.14	19.3	19.3	1.0	83.48	196.61	10	1.0	31.4	31.43	9.0	13.5	40	10.25	3.50	2.22	81.0	514.5	742.5	76.6	304.6	**297.00**	**101.54**
9.00	10.00	9.50	1.00	7.50	20.25	10.25	86.10	3.14	13.5	13.5	1.0	64.96	261.57	40	1.0	125.7	157.14	10.0	10.4	37	11.25	2.59	1.33	91.2	453.0	871.7	88.4	507.1	**348.69**	**169.02**
10.00	12.50	11.25	2.50	10.00	21.25	11.25	105.28	7.86	10.4	10.4	1.0	151.82	413.40	37	1.0	290.7	447.86	12.5	18.6	11	11.25	5.69	4.62	119.3	631.5	1492.8	117.8	979.1	**597.11**	**326.35**
12.50	14.00	13.25	1.50	11.50	21.25	11.25	127.78	4.71	18.6	18.6	1.0	202.73	616.13	11	1.0	51.9	499.71	14.0	12.6	45	9.96	3.23	1.96	136.2	671.9	1787.8	135.5	1251.3	**715.12**	**417.11**
14.00	15.50	14.75	1.50	13.00	19.96	9.96	143.69	4.71	12.6	12.6	1.0	151.42	767.54	45	1.0	212.1	711.86	15.5	8.6	45	9.89	2.22	1.00	136.2	559.5	2038.9	153.2	1632.6	**815.56**	**544.18**
15.50	18.50	17.00	3.00	16.00	19.89	9.89	143.69	9.43	8.6	8.6	1.0	204.89	972.44	45	1.0	424.3	1136.14	18.5	8.6	45	10.27	2.22	1.00	136.2	559.7	2668.2	188.5	2297.1	**1067.30**	**765.69**
18.50	21.50	20.00	3.00	19.00	20.27	10.27	143.69	9.43	8.6	8.6	1.0	204.89	1177.33	45	1.0	424.3	1560.43	21.5	11.5	52	10.27	2.91	1.65	136.2	685.9	3423.7	223.8	2961.6	**1369.48**	**987.20**
21.50	24.50	23.00	3.00	22.00	20.27	10.27	143.69	9.43	11.5	11.5	1.0	275.64	1452.97	52	1.0	490.3	2050.71	24.5	11.5	52	10.95	2.91	1.65	136.2	686.4	4190.1	259.2	3762.9	**1676.02**	**1254.29**
24.50	27.50	26.00	3.00	25.00	20.95	10.95	143.69	9.43	11.5	11.5	1.0	275.64	1728.60	52	1.0	490.3	2541.00	27.5	12.0	48	10.95	3.06	1.79	136.2	674.4	4944.0	294.5	4564.1	**1977.61**	**1521.38**
27.50	29.00	28.25	1.50	26.50	20.95	10.95	143.69	4.71	12.0	12.0	1.0	143.98	1872.59	48	1.0	226.3	2767.29	29.0	22.5	0	8.91	8.20	8.14	136.2	906.1	5546.0	312.2	4952.1	**2218.40**	**1650.69**
29.00	30.00	29.50	1.00	27.50	18.91	8.91	143.69	3.14	22.5	22.5	1.0	187.06	2059.64	0	1.0	0.0	2767.29	30.0	22.5	0	8.91	8.20	8.14	136.2	906.1	5733.1	324.0	5150.9	**2293.22**	**1716.97**
30.00	30.50	30.25	0.50	28.00	18.91	8.91	143.69	1.57	22.5	22.5	1.0	93.53	2153.17	0	1.0	0.0	2767.29	30.5	12.3	45	8.91	3.15	1.88	136.2	661.5	5581.9	329.9	5250.3	**2232.77**	**1750.11**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Q_b	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
30.50	32.00	31.25	1.50	29.50	18.91	8.91	143.69	4.71	12.3	12.3	1.0	147.70	2300.87	45	1.0	212.1	2979.43	32.0	27.1	0	8.91	14.73	15.72	136.2	1631.5	6911.8	347.5	5627.8	**2764.70**	**1875.95**
32.00	32.50	32.25	0.50	30.00	18.91	8.91	143.69	1.57	27.1	27.1	1.0	115.55	2416.42	0	1.0	0.0	2979.43	32.5	28.9	0	7.27	18.78	19.87	136.2	2067.0	7462.9	353.4	5749.3	**2985.15**	**1916.42**
32.50	33.50	33.00	1.00	31.00	17.27	7.27	143.69	3.14	28.9	28.9	1.0	249.30	2665.71	0	1.0	0.0	2979.43	33.5	31.5	0	10.00	28.82	30.09	136.2	3202.3	8847.5	365.2	6010.3	**3538.99**	**2003.45**
33.50	35.00	34.25	1.50	32.50	20.00	10.00	143.69	4.71	31.5	31.5	1.1	446.24	3111.95	0	1.0	0.0	2979.43	35.0	32.1	0	9.48	31.84	33.16	136.2	3531.1	9622.5	382.9	6474.3	**3849.01**	**2158.09**
35.00	36.50	35.75	1.50	34.00	19.48	9.48	143.69	4.71	32.1	32.1	1.1	469.55	3581.50	0	1.0	0.0	2979.43	36.5	14.5	40	8.37	3.80	2.51	136.2	697.3	7258.2	400.6	6961.5	**2903.28**	**2320.49**
36.50	37.50	37.00	1.00	35.00	18.37	8.37	143.69	3.14	14.5	14.5	1.0	116.79	3698.29	40	1.0	125.7	3105.14	37.5	23.1	10	8.37	8.63	8.79	136.2	1023.5	7826.9	412.3	7215.8	**3130.78**	**2405.26**
37.50	40.00	38.75	2.50	37.50	18.37	8.37	143.69	7.86	23.1	23.1	1.0	481.56	4179.85	10	1.0	78.6	3183.71	40.0	23.1	10	8.37	8.63	8.79	136.2	1023.5	8387.1	441.8	7805.3	**3354.83**	**2601.78**
BORE NO: P6, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	20.61	10.61	29.18	1.57	6.4	6.4	1.0	5.14	5.14	44	1.0	69.1	69.1	3.0	22.3	0	10.61	8.06	7.92	31.8	234.5	308.8	5.9	80.2	**123.50**	**26.73**
3.00	4.00	3.50	1.00	1.5	20.61	10.61	37.14	3.14	22.3	22.3	1.0	47.87	53.01	0	1.0	0.0	69.1	4.0	29.2	0	10.61	19.46	20.56	42.4	734.5	856.7	17.7	139.8	**342.67**	**46.61**
4.00	5.00	4.50	1.00	2.5	20.61	10.61	47.75	3.14	29.2	29.2	1.0	83.86	136.87	0	1.0	0.0	69.1	5.0	28.6	0	9.57	18.11	19.17	53.1	826.8	1032.8	29.5	235.5	**413.13**	**78.49**
5.00	6.00	5.50	1.00	3.5	19.57	9.57	57.84	3.14	28.6	28.6	1.0	99.10	235.98	0	1.0	0.0	69.1	6.0	30.4	0	10.19	23.27	24.45	62.6	1243.0	1548.1	41.2	346.4	**619.25**	**115.45**
6.00	8.00	7.00	2.00	5.5	20.19	10.19	72.81	6.29	30.4	30.4	1.0	273.88	509.85	0	1.0	0.0	69.1	8.0	30.1	0	10.40	21.76	22.91	83.0	1512.9	2091.9	64.8	643.8	**836.76**	**214.60**
8.00	9.00	8.50	1.00	6.5	20.40	10.40	88.20	3.14	30.1	30.1	1.0	161.49	671.35	0	1.0	0.0	69.1	9.0	31.6	0	10.86	29.32	30.60	93.4	2282.2	3022.7	76.6	817.1	**1209.07**	**272.35**
9.00	11.00	10.00	2.00	8.5	20.86	10.86	104.26	6.29	31.6	31.6	1.1	435.43	1106.77	0	1.0	0.0	69.1	11.0	12.4	45	10.86	3.17	1.91	115.1	613.5	1789.4	100.1	1276.1	**715.77**	**425.35**
11.00	12.00	11.50	1.00	9.5	20.86	10.86	120.55	3.14	12.4	12.4	1.0	83.30	1190.07	45	1.0	141.4	210.6	12.0	12.4	41	10.86	3.17	1.91	126.0	612.3	2013.0	111.9	1512.6	**805.18**	**504.19**
12.00	14.50	13.25	2.50	12.0	20.86	10.86	139.56	7.86	12.4	12.4	1.0	241.08	1431.15	41	1.0	322.1	532.7	14.5	12.4	41	10.86	3.17	1.91	153.1	680.0	2643.9	141.4	2105.2	**1057.56**	**701.75**
14.50	17.50	16.00	3.00	15.0	20.86	10.86	139.56	9.43	12.4	12.4	1.0	289.30	1720.45	41	1.0	386.6	919.3	17.5	11.0	48	8.14	2.76	1.51	153.1	676.8	3316.5	176.7	2816.5	**1326.62**	**938.82**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	N_γ	q	Q_b	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
17.50	20.50	19.00	3.00	18.0	18.14	8.14	139.56	9.43	11.0	11.0	1.0	255.77	1976.22	48	1.0	452.6	1371.9	20.5	11.5	40	8.14	2.91	1.65	153.1	638.4	3986.4	212.1	3560.1	**1594.58**	**1186.71**
20.50	23.50	22.00	3.00	21.0	18.14	8.14	139.56	9.43	11.5	11.5	1.0	267.70	2243.92	40	1.0	377.1	1749.0	23.5	8.5	52	11.08	2.20	0.99	153.1	636.7	4629.6	247.4	4240.3	**1851.86**	**1413.44**
23.50	26.50	25.00	3.00	24.0	21.08	11.08	139.56	9.43	8.5	8.5	1.0	196.65	2440.57	52	1.0	490.3	2239.3	26.5	8.5	48	11.08	2.20	0.99	153.1	608.4	5288.3	282.7	4962.6	**2115.31**	**1654.20**
26.50	27.50	27.00	1.00	25.0	21.08	11.08	139.56	3.14	8.5	8.5	1.0	65.55	2506.12	48	1.0	150.9	2390.1	27.5	8.5	48	11.08	2.20	0.99	153.1	608.4	5504.7	294.5	5190.8	**2201.88**	**1730.26**
27.50	28.00	27.75	0.50	25.5	21.08	11.08	139.56	1.57	8.5	8.5	1.0	32.77	2538.90	48	1.0	75.4	2465.6	28.0	11.8	48	9.89	3.00	1.73	153.1	707.0	5711.5	300.4	5304.9	**2284.60**	**1768.29**
28.00	29.50	28.75	1.50	27.0	19.89	9.89	139.56	4.71	11.8	11.8	1.0	137.44	2676.34	48	1.0	226.3	2691.9	29.5	11.8	48	9.89	3.00	1.73	153.1	707.0	6075.2	318.1	5686.3	**2430.09**	**1895.43**
29.50	30.00	29.75	0.50	27.5	19.89	9.89	139.56	1.57	11.8	11.8	1.0	45.81	2722.15	48	1.0	75.4	2767.3	30.0	11.8	48	9.89	3.00	1.73	153.1	707.0	6196.5	324.0	5813.4	**2478.58**	**1937.80**
30.00	31.00	30.50	1.00	28.5	19.89	9.89	139.56	3.14	11.8	11.8	1.0	91.63	2813.78	48	1.0	150.9	2918.1	31.0	24.7	11	10.91	9.78	10.55	153.1	1300.2	7032.1	335.8	6067.7	**2812.84**	**2022.56**
31.00	32.50	31.75	1.50	30.0	20.91	10.91	139.56	4.71	24.7	24.7	1.0	302.60	3116.38	11	1.0	51.9	2970.0	32.5	8.3	40	10.91	2.16	0.96	153.1	547.3	6633.7	353.4	6439.8	**2653.48**	**2146.60**
32.50	35.00	33.75	2.50	32.5	20.91	10.91	139.56	7.86	8.3	8.3	1.0	159.96	3276.34	40	1.0	314.3	3284.3	35.0	8.0	40	11.02	2.11	0.91	153.1	540.7	7101.3	382.9	6943.5	**2840.52**	**2314.50**
35.00	35.50	35.25	0.50	33.0	21.02	11.02	139.56	1.57	8.0	8.0	1.0	30.82	3307.17	40	1.0	62.9	3347.1	35.5	23.6	10	9.13	8.99	9.34	153.1	1186.1	7840.4	388.8	7043.1	**3136.17**	**2347.69**
35.50	37.00	36.25	1.50	34.5	19.13	9.13	139.56	4.71	23.6	23.6	1.0	287.43	3594.60	10	1.0	47.1	3394.3	37.0	23.6	10	9.13	8.99	9.34	153.1	1186.1	8175.0	406.4	7395.3	**3270.00**	**2465.11**
37.00	37.50	37.25	0.50	35.0	19.13	9.13	139.56	1.57	23.6	23.6	1.0	95.81	3690.41	10	1.0	15.7	3410.0	37.5	23.6	10	9.13	8.99	9.34	153.1	1186.1	8286.5	412.3	7512.7	**3314.61**	**2504.25**
37.50	38.50	38.00	1.00	36.0	19.13	9.13	139.56	3.14	23.6	23.6	1.0	191.62	3882.03	10	1.0	31.4	3441.4	38.5	23.6	10	9.89	8.99	9.34	153.1	1188.9	8512.4	424.1	7747.6	**3404.94**	**2582.52**
38.50	40.00	39.25	1.50	37.5	19.89	9.89	139.56	4.71	23.6	23.6	1.0	287.43	4169.46	10	1.0	47.1	3488.6	40.0	23.6	10	9.89	8.99	9.34	153.1	1188.9	8846.9	441.8	8099.8	**3538.77**	**2699.94**
BORE NO: P12, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	19.31	9.31	25.60	1.57	7.9	7.9	1.0	5.58	5.58	64	1.0	100.6	100.6	3.0	11.6	26	9.31	2.94	1.68	27.9	254.5	360.7	5.9	112.0	**144.27**	**37.35**
3.00	4.00	3.50	1.00	1.5	19.31	9.31	32.59	3.14	11.6	11.6	1.0	21.02	26.60	26	1.0	81.7	182.3	4.0	11.6	26	9.31	2.94	1.68	37.2	276.0	484.9	17.7	226.6	**193.97**	**75.52**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Q_b					
4.00	5.00	4.50	1.00	2.5	19.31	9.31	41.90	3.14	11.6	11.6	1.0	27.03	53.63	26	1.0	81.7	264.0	5.0	7.3	66	9.31	1.98	0.80	46.6	542.2	859.9	29.5	347.1	**343.94**	**115.69**
5.00	6.00	5.50	1.00	3.5	19.31	9.31	51.21	3.14	7.3	7.3	1.0	20.62	74.25	66	1.0	207.4	471.4	6.0	11.6	29	9.20	2.94	1.68	55.9	340.2	885.9	41.2	586.9	**354.35**	**195.64**
6.00	7.00	6.50	1.00	4.5	19.20	9.20	60.46	3.14	11.6	11.6	1.0	39.00	113.25	29	1.0	91.1	562.6	7.0	11.6	29	9.20	2.94	1.68	65.1	361.4	1037.3	53.0	728.8	**414.91**	**242.95**
7.00	8.00	7.50	1.00	5.5	19.20	9.20	69.66	3.14	11.6	11.6	1.0	44.94	158.19	29	1.0	91.1	653.7	8.0	25.9	0	9.20	12.03	12.95	74.3	748.5	1560.4	64.8	876.7	**624.18**	**292.23**
8.00	9.00	8.50	1.00	6.5	19.20	9.20	78.86	3.14	25.9	25.9	1.0	120.35	278.54	0	1.0	0.0	653.7	9.0	25.9	0	9.20	12.03	12.95	83.5	835.5	1767.7	76.6	1008.8	**707.09**	**336.28**
9.00	10.00	9.50	1.00	7.5	19.20	9.20	88.06	3.14	25.9	25.9	1.0	134.39	412.93	0	1.0	0.0	653.7	10.0	25.0	0	9.20	10.00	10.88	92.7	767.4	1834.0	88.4	1155.0	**733.60**	**385.00**
10.00	11.00	10.50	1.00	8.5	19.20	9.20	97.26	3.14	25.0	25.0	1.0	142.54	555.47	0	1.0	0.0	653.7	11.0	24.5	15	10.35	9.64	10.33	101.9	919.6	2128.8	100.1	1309.3	**851.51**	**436.44**
11.00	12.50	11.75	1.50	10.0	20.35	10.35	109.62	4.71	24.5	24.5	1.0	235.52	790.98	15	1.0	70.7	724.4	12.5	8.5	56	10.31	2.20	0.99	117.4	602.9	2118.3	117.8	1633.2	**847.33**	**544.41**
12.50	15.50	14.00	3.00	13.0	20.31	10.31	132.85	9.43	8.5	8.5	1.0	187.20	978.18	56	1.0	528.0	1252.4	15.5	11.5	54	9.03	2.91	1.65	117.4	656.2	2886.8	153.2	2383.8	**1154.72**	**794.59**
15.50	18.50	17.00	3.00	16.0	19.03	9.03	132.85	9.43	11.5	11.5	1.0	254.84	1233.02	54	1.0	509.1	1761.6	18.5	10.8	59	10.57	2.71	1.45	117.4	672.7	3667.3	188.5	3183.1	**1466.93**	**1061.03**
18.50	21.50	20.00	3.00	19.0	20.57	10.57	132.85	9.43	10.8	10.8	1.0	238.94	1471.97	59	1.0	556.3	2317.9	21.5	9.1	61	10.44	2.31	1.08	117.4	648.7	4438.5	223.8	4013.7	**1775.39**	**1337.89**
21.50	24.50	23.00	3.00	22.0	20.44	10.44	132.85	9.43	9.1	9.1	1.0	200.63	1672.60	61	1.0	575.1	2893.0	24.5	9.5	53	10.64	2.38	1.14	117.4	599.1	5164.7	259.2	4824.8	**2065.87**	**1608.26**
24.50	27.50	26.00	3.00	25.0	20.64	10.64	132.85	9.43	9.5	9.5	1.0	209.61	1882.21	53	1.0	499.7	3392.7	27.5	9.5	53	10.64	2.38	1.14	117.4	599.1	5874.0	294.5	5569.4	**2349.60**	**1856.48**
27.50	29.00	28.25	1.50	26.5	20.64	10.64	132.85	4.71	9.5	9.5	1.0	104.81	1987.02	53	1.0	249.9	3642.6	29.0	30.6	0	10.64	24.28	25.48	117.4	2346.0	7975.6	312.2	5941.8	**3190.25**	**1980.59**
29.00	30.00	29.50	1.00	27.5	20.64	10.64	132.85	3.14	30.6	30.6	1.0	254.33	2241.35	0	1.0	0.0	3642.6	30.0	31.0	0	9.63	26.30	27.53	117.4	2529.5	8413.5	324.0	6207.9	**3365.38**	**2069.30**
30.00	30.50	30.25	0.50	28.0	19.63	9.63	132.85	1.57	31.0	31.0	1.1	131.71	2373.06	0	1.0	0.0	3642.6	30.5	31.0	0	10.05	26.30	27.53	117.4	2534.1	8549.7	329.9	6345.5	**3419.88**	**2115.17**
30.50	32.00	31.25	1.50	29.5	20.05	10.05	132.85	4.71	31.0	31.0	1.1	395.13	2768.19	0	1.0	0.0	3642.6	32.0	32.5	0	10.05	33.85	35.22	117.4	3261.3	9672.1	347.5	6758.3	**3868.84**	**2252.77**
32.00	32.50	32.25	0.50	30.0	20.05	10.05	132.85	1.57	32.5	32.5	1.1	149.62	2917.81	0	1.0	0.0	3642.6	32.5	32.5	0	10.05	33.85	35.22	117.4	3261.3	9821.7	353.4	6913.8	**3928.69**	**2304.60**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Q_b	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
32.50	33.50	33.00	1.00	31.0	20.05	10.05	132.85	3.14	32.5	32.5	1.1	299.24	3217.06	0	1.0	0.0	3642.6	33.5	32.1	0	10.05	31.84	33.16	117.4	3067.4	9927.0	365.2	7224.8	**3970.81**	**2408.28**
33.50	35.00	34.25	1.50	32.5	20.05	10.05	132.85	4.71	32.1	32.1	1.1	434.12	3651.18	0	1.0	0.0	3642.6	35.0	32.1	0	10.05	31.84	33.16	117.4	3067.4	10361.2	382.9	7676.6	**4144.46**	**2558.88**
35.00	36.50	35.75	1.50	34.0	20.05	10.05	132.85	4.71	32.1	32.1	1.1	434.12	4085.30	0	1.0	0.0	3642.6	36.5	32.3	0	10.05	32.85	34.19	117.4	3164.4	10892.3	400.6	8128.4	**4356.90**	**2709.48**
36.50	37.50	37.00	1.00	35.0	20.05	10.05	132.85	3.14	32.3	32.3	1.1	294.30	4379.61	0	1.0	0.0	3642.6	37.5	32.3	0	10.05	32.85	34.19	117.4	3164.4	11186.6	412.3	8434.5	**4474.62**	**2811.51**
37.50	40.00	38.75	2.50	37.5	20.05	10.05	132.85	7.86	32.3	32.3	1.1	735.76	5115.37	0	1.0	0.0	3642.6	40.0	32.3	0	10.05	32.85	34.19	117.4	3164.4	11922.3	441.8	9199.7	**4768.93**	**3066.58**
BORE NO: P13, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	19.71	9.71	26.70	1.57	24.3	24.3	1.0	18.95	0	0	1.0	0.0	0	3.0	26.3	5	9.71	12.93	13.88	29.1	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.5	19.71	9.71	33.99	3.14	26.3	26.3	1.0	52.79	0	5	1.0	15.7	0	4.0	26.3	5	9.46	12.93	13.88	38.8	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	5.00	4.50	1.00	2.5	19.46	9.46	43.57	3.14	26.3	26.3	1.0	67.68	0	5	1.0	15.7	0	5.0	24.7	10	9.46	9.78	10.55	48.3	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.5	19.46	9.46	53.03	3.14	24.7	24.7	1.0	76.66	0	10	1.0	31.4	0	6.0	24.7	10	9.46	9.78	10.55	57.8	0	0.0	41.2	41.2	**0.00**	**13.74**
6.00	7.00	6.50	1.00	4.5	19.46	9.46	62.49	3.14	24.7	24.7	1.0	90.33	0	10	1.0	31.4	0	7.0	24.7	10	9.10	9.78	10.55	67.2	0	0.0	53.0	53.0	**0.00**	**17.67**
7.00	8.00	7.50	1.00	5.5	19.10	9.10	71.77	3.14	24.7	24.7	1.0	103.75	0	10	1.0	31.4	0	8.0	24.2	0	9.10	9.42	10.00	76.3	0	0.0	64.8	64.8	**0.00**	**21.60**
8.00	9.00	8.50	1.00	6.5	19.10	9.10	80.87	3.14	24.2	24.2	1.0	114.23	0	0	1.0	0.0	0	9.0	24.2	0	9.10	9.42	10.00	85.4	0	0.0	76.6	76.6	**0.00**	**25.53**
9.00	10.00	9.50	1.00	7.5	19.10	9.10	89.97	3.14	24.2	24.2	1.0	127.08	0	0	1.0	0.0	0	10.0	10.5	48	10.36	2.62	1.36	94.5	539.3	539.3	88.4	88.4	**215.73**	**29.45**
10.00	11.00	10.50	1.00	8.5	20.36	10.36	99.70	3.14	10.5	10.5	1.0	58.07	58.07	48	1.0	150.9	150.9	11.0	10.5	48	10.36	2.62	1.36	104.9	560.6	769.6	100.1	309.1	**307.83**	**103.02**
11.00	12.00	11.50	1.00	9.5	20.36	10.36	110.06	3.14	10.5	10.5	1.0	64.11	122.18	48	1.0	150.9	301.7	12.0	10.5	48	10.36	2.62	1.36	115.2	581.9	1005.8	111.9	535.8	**402.33**	**178.61**
12.00	13.00	12.50	1.00	10.5	20.36	10.36	120.42	3.14	10.5	10.5	1.0	70.14	192.33	48	1.0	150.9	452.6	13.0	28.0	0	9.54	16.76	17.79	125.6	1720.2	2365.1	123.7	768.6	**946.05**	**256.20**
13.00	14.50	13.75	1.50	12.0	19.54	9.54	132.76	4.71	28.0	28.0	1.0	332.77	525.10	0	1.0	0.0	452.6	14.5	28.0	0	9.54	16.76	17.79	139.9	1908.6	2886.3	141.4	1119.0	**1154.52**	**373.01**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Q_b					
14.50	16.00	15.25	1.50	13.5	19.54	9.54	132.76	4.71	28.0	28.0	1.0	332.77	857.86	0	1.0	0.0	452.6	16.0	10.2	49	10.49	2.53	1.28	139.9	629.8	1940.2	159.0	1469.5	**776.07**	**489.83**
16.00	17.50	16.75	1.50	15.0	20.49	10.49	132.76	4.71	10.2	10.2	1.0	112.61	970.47	49	1.0	231.0	683.6	17.5	10.8	49	11.03	2.71	1.45	139.9	650.2	2304.2	176.7	1830.8	**921.68**	**610.25**
17.50	20.50	19.00	3.00	18.0	21.03	11.03	132.76	9.43	10.8	10.8	1.0	238.77	1209.24	49	1.0	462.0	1145.6	20.5	13.5	47	11.03	3.50	2.22	139.9	726.7	3081.5	212.1	2566.9	**1232.62**	**855.62**
20.50	23.50	22.00	3.00	21.0	21.03	11.03	132.76	9.43	13.5	13.5	1.0	300.50	1509.75	47	1.0	443.1	1588.7	23.5	11.5	47	8.68	2.91	1.65	139.9	658.0	3756.4	247.4	3345.9	**1502.58**	**1115.29**
23.50	25.00	24.25	1.50	22.5	18.68	8.68	132.76	4.71	11.5	11.5	1.0	127.33	1637.08	47	1.0	221.6	1810.3	25.0	11.5	47	8.61	2.91	1.65	139.9	657.9	4105.3	265.1	3712.4	**1642.12**	**1237.48**
25.00	26.50	25.75	1.50	24.0	18.61	8.61	132.76	4.71	11.5	11.5	1.0	127.33	1764.41	47	1.0	221.6	2031.9	26.5	11.5	47	8.99	2.91	1.65	139.9	658.2	4454.4	282.7	4079.0	**1781.78**	**1359.67**
26.50	27.50	27.00	1.00	25.0	18.99	8.99	132.76	3.14	11.5	11.5	1.0	84.89	1849.29	47	1.0	147.7	2179.6	27.5	11.5	47	8.99	2.91	1.65	139.9	658.2	4687.0	294.5	4323.4	**1874.82**	**1441.13**
27.50	28.00	27.75	0.50	25.5	18.99	8.99	132.76	1.57	11.5	11.5	1.0	42.44	1891.74	47	1.0	73.9	2253.4	28.0	12.5	49	9.36	3.20	1.94	139.9	705.8	4851.0	300.4	4445.6	**1940.40**	**1481.86**
28.00	29.50	28.75	1.50	27.0	19.36	9.36	132.76	4.71	12.5	12.5	1.0	138.75	2030.48	49	1.0	231.0	2484.4	29.5	12.5	49	9.08	3.20	1.94	139.9	705.6	5220.5	318.1	4833.0	**2088.21**	**1611.00**
29.50	30.00	29.75	0.50	27.5	19.08	9.08	132.76	1.57	12.5	12.5	1.0	46.25	2076.73	49	1.0	77.0	2561.4	30.0	12.5	49	10.98	3.20	1.94	139.9	707.1	5345.2	324.0	4962.1	**2138.09**	**1654.05**
30.00	31.00	30.50	1.00	28.5	20.98	10.98	132.76	3.14	12.5	12.5	1.0	92.50	2169.23	49	1.0	154.0	2715.4	31.0	12.5	49	10.98	3.20	1.94	139.9	707.1	5591.7	335.8	5220.4	**2236.69**	**1740.14**
31.00	32.50	31.75	1.50	30.0	20.98	10.98	132.76	4.71	12.5	12.5	1.0	138.75	2307.98	49	1.0	231.0	2946.4	32.5	28.6	0	10.98	18.11	19.17	139.9	2073.2	7327.6	353.4	5607.8	**2931.04**	**1869.28**
32.50	35.00	33.75	2.50	32.5	20.98	10.98	132.76	7.86	28.6	28.6	1.0	568.70	2876.68	0	1.0	0.0	2946.4	35.0	28.6	0	10.98	18.11	19.17	139.9	2073.2	7896.3	382.9	6206.0	**3158.52**	**2068.66**
35.00	35.50	35.25	0.50	33.0	20.98	10.98	132.76	1.57	28.6	28.6	1.0	113.74	2990.42	0	1.0	0.0	2946.4	35.5	28.5	0	10.98	17.88	18.94	139.9	2047.4	7984.3	388.8	6325.6	**3193.71**	**2108.54**
35.50	37.50	36.50	2.00	35.0	20.98	10.98	132.76	6.29	28.5	28.5	1.0	453.07	3443.49	0	1.0	0.0	2946.4	37.5	28.5	0	8.84	17.88	18.94	139.9	2031.5	8421.4	412.3	6802.3	**3368.57**	**2267.42**
37.50	38.50	38.00	1.00	36.0	18.84	8.84	132.76	3.14	28.5	28.5	1.0	226.54	3670.03	0	1.0	0.0	2946.4	38.5	28.5	0	9.15	17.88	18.94	139.9	2033.8	8650.3	424.1	7040.6	**3460.11**	**2346.86**
38.50	40.00	39.25	1.50	37.5	19.15	9.15	132.76	4.71	28.5	28.5	1.0	339.81	4009.84	0	1.0	0.0	2946.4	40.0	28.5	0	9.15	17.88	18.94	139.9	2033.8	8990.1	441.8	7398.1	**3596.03**	**2466.02**

BORE NO: P17, CUT OFF LENGTH: 2.50 m, Nc= 9

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	N_γ	q	Q_b	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
2.50	3.00	2.75	0.50	0.5	19.85	9.85	27.09	1.57	26.5	26.5	1.0	21.22	0	8	1.0	12.6	0	3.0	24.1	0	9.85	9.35	9.89	29.6	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.5	19.85	9.85	34.48	3.14	24.1	24.1	1.0	48.47	0	0	1.0	0.0	0	4.0	24.1	0	9.38	9.35	9.89	39.4	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	6.00	5.00	2.00	3.5	19.38	9.38	48.78	6.29	24.1	24.1	1.0	137.16	0	0	1.0	0.0	0	6.0	27.0	0	9.38	14.50	15.49	58.2	0	0.0	41.2	41.2	**0.00**	**13.74**
6.00	7.00	6.50	1.00	4.5	19.38	9.38	62.85	3.14	27.0	27.0	1.0	100.65	0	0	1.0	0.0	0	7.0	29.5	0	9.38	20.13	21.25	67.5	0	0.0	53.0	53.0	**0.00**	**17.67**
7.00	8.00	7.50	1.00	5.5	19.38	9.38	72.23	3.14	29.5	29.5	1.0	128.44	0	0	1.0	0.0	0	8.0	29.5	0	9.79	20.13	21.25	76.9	0	0.0	64.8	64.8	**0.00**	**21.60**
8.00	9.00	8.50	1.00	6.5	19.79	9.79	81.82	3.14	29.5	29.5	1.0	145.48	0	0	1.0	0.0	0	9.0	28.3	0	9.79	17.43	18.48	86.7	1258.7	1258.7	76.6	76.6	**503.47**	**25.53**
9.00	10.00	9.50	1.00	7.5	19.79	9.79	91.61	3.14	28.3	28.3	1.0	155.02	155.02	0	1.0	0.0	0.0	10.0	28.3	0	8.54	17.43	18.48	96.5	1383.7	1538.7	88.4	243.4	**615.48**	**81.13**
10.00	12.50	11.25	2.50	10.0	18.54	8.54	107.18	7.86	28.3	28.3	1.0	453.42	608.44	0	1.0	0.0	0.0	12.5	9.3	55	8.54	2.34	1.11	117.9	609.7	1218.1	117.8	726.2	**487.26**	**242.08**
12.50	14.00	13.25	1.50	11.5	18.54	8.54	124.26	4.71	9.3	9.3	1.0	95.92	704.36	55	1.0	259.3	259.3	14.0	24.5	14	8.96	9.64	10.33	130.7	1125.0	2088.7	135.5	1099.1	**835.47**	**366.38**
14.00	15.50	14.75	1.50	13.0	18.96	8.96	137.38	4.71	24.5	24.5	1.0	295.15	999.51	14	1.0	66.0	325.3	15.5	9.5	50	10.22	2.38	1.14	130.7	602.5	1927.3	153.2	1478.0	**770.92**	**492.65**
15.50	18.50	17.00	3.00	16.0	20.22	10.22	137.38	9.43	9.5	9.5	1.0	216.76	1216.27	50	1.0	471.4	796.7	18.5	8.5	64	9.12	2.20	0.99	130.7	682.0	2695.0	188.5	2201.5	**1077.98**	**733.83**
18.50	21.50	20.00	3.00	19.0	19.12	9.12	137.38	9.43	8.5	8.5	1.0	193.58	1409.85	64	1.0	603.4	1400.1	21.5	8.5	64	9.12	2.20	0.99	130.7	682.0	3492.0	223.8	3033.8	**1396.79**	**1011.28**
21.50	23.00	22.25	1.50	20.5	19.12	9.12	137.38	4.71	8.5	8.5	1.0	96.79	1506.65	64	1.0	301.7	1701.9	23.0	8.9	57	10.31	2.27	1.05	130.7	640.6	3849.1	241.5	3450.0	**1539.63**	**1150.00**
23.00	24.50	23.75	1.50	22.0	20.31	10.31	137.38	4.71	8.9	8.9	1.0	101.42	1608.06	57	1.0	268.7	1970.6	24.5	8.9	57	10.31	2.27	1.05	130.7	640.6	4219.2	259.2	3837.8	**1687.68**	**1279.27**
24.50	26.00	25.25	1.50	23.5	20.31	10.31	137.38	4.71	8.9	8.9	1.0	101.42	1709.48	57	1.0	268.7	2239.3	26.0	8.5	55	10.31	2.20	0.99	130.7	618.8	4567.6	276.9	4225.6	**1827.02**	**1408.54**
26.00	27.50	26.75	1.50	25.0	20.31	10.31	137.38	4.71	8.5	8.5	1.0	96.79	1806.28	55	1.0	259.3	2498.6	27.5	8.5	55	10.44	2.20	0.99	130.7	618.8	4923.7	294.5	4599.4	**1969.47**	**1533.12**
27.50	30.00	28.75	2.50	27.5	20.44	10.44	137.38	7.86	8.5	8.5	1.0	161.32	1967.59	55	1.0	432.1	2930.7	30.0	8.3	54	10.44	2.16	0.96	130.7	607.9	5506.3	324.0	5222.3	**2202.50**	**1740.76**
30.00	30.50	30.25	0.50	28.0	20.44	10.44	137.38	1.57	8.3	8.3	1.0	31.49	1999.09	54	1.0	84.9	3015.6	30.5	31.2	0	10.44	27.30	28.55	130.7	2920.2	7934.9	329.9	5344.5	**3173.95**	**1781.51**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Q_b					
30.50	32.00	31.25	1.50	29.5	20.44	10.44	137.38	4.71	31.2	31.2	1.1	415.76	2414.85	0	1.0	0.0	3015.6	32.0	31.2	0	10.44	27.30	28.55	130.7	2920.2	8350.6	347.5	5778.0	**3340.26**	**1925.99**
32.00	32.50	32.25	0.50	30.0	20.44	10.44	137.38	1.57	31.2	31.2	1.1	138.59	2553.44	0	1.0	0.0	3015.6	32.5	30.6	0	8.78	24.28	25.48	130.7	2580.7	8149.7	353.4	5922.4	**3259.88**	**1974.15**
32.50	33.50	33.00	1.00	31.0	18.78	8.78	137.38	3.14	30.6	30.6	1.0	263.01	2816.45	0	1.0	0.0	3015.6	33.5	25.4	10	8.39	10.90	11.80	130.7	1228.7	7060.7	365.2	6197.2	**2824.29**	**2065.74**
33.50	35.00	34.25	1.50	32.5	18.39	8.39	137.38	4.71	25.4	25.4	1.0	307.53	3123.97	10	1.0	47.1	3062.7	35.0	25.4	10	7.89	10.90	11.80	130.7	1226.4	7413.1	382.9	6569.6	**2965.23**	**2189.86**
35.00	36.50	35.75	1.50	34.0	17.89	7.89	137.38	4.71	25.4	25.4	1.0	307.53	3431.50	10	1.0	47.1	3109.9	36.5	30.6	0	7.74	24.28	25.48	130.7	2570.3	9111.6	400.6	6941.9	**3644.66**	**2313.97**
36.50	37.50	37.00	1.00	35.0	17.74	7.74	137.38	3.14	30.6	30.6	1.0	263.01	3694.50	0	1.0	0.0	3109.9	37.5	30.6	0	7.74	24.28	25.48	130.7	2570.3	9374.6	412.3	7216.7	**3749.86**	**2405.57**
37.50	38.00	37.75	0.50	35.5	17.74	7.74	137.38	1.57	30.6	30.6	1.0	131.50	3826.01	0	1.0	0.0	3109.9	38.0	10.0	50	7.58	2.47	1.22	130.7	610.8	7546.6	418.2	7354.1	**3018.66**	**2451.36**
38.00	40.00	39.00	2.00	37.5	17.58	7.58	137.38	6.29	10.0	10.0	1.0	152.26	3978.27	50	1.0	314.3	3424.1	40.0	10.0	50	7.58	2.47	1.22	130.7	610.8	8013.2	441.8	7844.2	**3205.28**	**2614.73**
BORE NO: P18, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	19.10	9.10	25.03	1.57	28.0	28.0	1.0	20.91	0	0	1.0	0.0	0	3.0	28.0	0	9.90	16.76	17.79	27.3	428.6	428.6	5.9	5.9	**171.44**	**1.96**
3.00	5.00	4.00	2.00	2.5	19.90	9.90	37.20	6.29	28.0	28.0	1.0	124.33	124.33	0	1.0	0.0	0.0	5.0	28.0	0	9.90	16.76	17.79	47.1	689.3	813.6	29.5	153.8	**325.44**	**51.26**
5.00	6.00	5.50	1.00	3.5	19.90	9.90	52.05	3.14	28.0	28.0	1.0	86.98	211.31	0	1.0	0.0	0.0	6.0	27.9	0	9.90	16.53	17.56	57.0	808.6	1019.9	41.2	252.5	**407.98**	**84.18**
6.00	8.00	7.00	2.00	5.5	19.90	9.90	66.90	6.29	27.9	27.9	1.0	222.65	433.96	0	1.0	0.0	0.0	8.0	28.3	0	7.90	17.43	18.48	76.8	1109.2	1543.2	64.8	498.8	**617.27**	**166.25**
8.00	9.00	8.50	1.00	6.5	17.90	7.90	80.75	3.14	28.3	28.3	1.0	136.65	570.61	0	1.0	0.0	0.0	9.0	28.3	0	7.90	17.43	18.48	84.7	1217.4	1788.0	76.6	647.2	**715.21**	**215.73**
9.00	11.00	10.00	2.00	8.5	17.90	7.90	92.60	6.29	28.3	28.3	1.0	313.41	884.01	0	1.0	0.0	0.0	11.0	28.6	0	7.90	18.11	19.17	100.5	1489.3	2373.3	100.1	984.2	**949.33**	**328.05**
11.00	12.00	11.50	1.00	9.5	17.90	7.90	104.45	3.14	28.6	28.6	1.0	178.98	1062.99	0	1.0	0.0	0.0	12.0	26.7	0	9.66	13.83	14.80	108.4	1233.9	2296.9	111.9	1174.9	**918.77**	**391.64**
12.00	14.50	13.25	2.50	12.0	19.66	9.66	120.48	7.86	26.7	26.7	1.0	476.08	1539.08	0	1.0	0.0	0.0	14.5	29.1	0	10.00	19.23	20.33	132.6	2082.9	3622.0	141.4	1680.5	**1448.78**	**560.15**
14.50	17.50	16.00	3.00	15.0	20.00	10.00	120.48	9.43	29.1	29.1	1.0	632.24	2171.32	0	1.0	0.0	0.0	17.5	9.5	54	10.60	2.38	1.14	132.6	634.5	2805.8	176.7	2348.0	**1122.32**	**782.68**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Q_b	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
17.50	20.50	19.00	3.00	18.0	20.60	10.60	120.48	9.43	9.5	9.5	1.0	190.09	2361.40	54	1.0	509.1	509.1	20.5	10.0	46	9.92	2.47	1.22	132.6	587.3	3457.8	212.1	3082.6	**1383.13**	**1027.53**
20.50	23.50	22.00	3.00	21.0	19.92	9.92	120.48	9.43	10.0	10.0	1.0	200.29	2561.69	46	1.0	433.7	942.9	23.5	11.5	42	10.80	2.91	1.65	132.6	607.2	4111.7	247.4	3752.0	**1644.69**	**1250.65**
23.50	26.50	25.00	3.00	24.0	20.80	10.80	120.48	9.43	11.5	11.5	1.0	231.10	2792.80	42	1.0	396.0	1338.9	26.5	11.0	44	10.80	2.76	1.51	132.6	605.4	4737.0	282.7	4414.4	**1894.82**	**1471.47**
26.50	27.50	27.00	1.00	25.0	20.80	10.80	120.48	3.14	11.0	11.0	1.0	73.60	2866.40	44	1.0	138.3	1477.1	27.5	11.0	44	10.80	2.76	1.51	132.6	605.4	4948.9	294.5	4638.1	**1979.57**	**1546.02**
27.50	28.00	27.75	0.50	25.5	20.80	10.80	120.48	1.57	11.0	11.0	1.0	36.80	2903.20	44	1.0	69.1	1546.3	28.0	10.0	44	10.90	2.47	1.22	132.6	573.6	5023.1	300.4	4749.9	**2009.24**	**1583.30**
28.00	29.50	28.75	1.50	27.0	20.90	10.90	120.48	4.71	10.0	10.0	1.0	100.15	3003.34	44	1.0	207.4	1753.7	29.5	31.6	0	10.90	29.32	30.60	132.6	3184.6	7941.6	318.1	5075.1	**3176.64**	**1691.71**
29.50	30.00	29.75	0.50	27.5	20.90	10.90	120.48	1.57	31.6	31.6	1.1	125.79	3129.13	0	1.0	0.0	1753.7	30.0	31.6	0	10.90	29.32	30.60	132.6	3184.6	8067.4	324.0	5206.8	**3226.96**	**1735.61**
30.00	31.00	30.50	1.00	28.5	20.90	10.90	120.48	3.14	31.6	31.6	1.1	251.57	3380.70	0	1.0	0.0	1753.7	31.0	31.6	0	10.90	29.32	30.60	132.6	3184.6	8319.0	335.8	5470.2	**3327.59**	**1823.39**
31.00	32.50	31.75	1.50	30.0	20.90	10.90	120.48	4.71	31.6	31.6	1.1	377.36	3758.06	0	1.0	0.0	1753.7	32.5	31.2	0	8.78	27.30	28.55	132.6	2942.1	8453.9	353.4	5865.2	**3381.57**	**1955.07**
32.50	34.00	33.25	1.50	31.5	18.78	8.78	120.48	4.71	31.2	31.2	1.1	364.60	4122.66	0	1.0	0.0	1753.7	34.0	12.3	29	9.22	3.15	1.88	132.6	539.5	6415.9	371.1	6247.5	**2566.34**	**2082.49**
34.00	35.00	34.50	1.00	32.5	19.22	9.22	120.48	3.14	12.3	12.3	1.0	82.56	4205.22	29	1.0	91.1	1844.9	35.0	12.3	29	9.22	3.15	1.88	132.6	539.5	6589.6	382.9	6433.0	**2635.82**	**2144.32**
35.00	35.50	35.25	0.50	33.0	19.22	9.22	120.48	1.57	12.3	12.3	1.0	41.28	4246.50	29	1.0	45.6	1890.4	35.5	15.0	35	8.44	3.94	2.65	132.6	666.6	6803.5	388.8	6525.7	**2721.42**	**2175.23**
35.50	37.00	36.25	1.50	34.5	18.44	8.44	120.48	4.71	15.0	15.0	1.0	152.18	4398.68	35	1.0	165.0	2055.4	37.0	15.5	44	9.25	4.19	2.92	132.6	757.7	7211.8	406.4	6860.6	**2884.73**	**2286.85**
37.00	37.50	37.25	0.50	35.0	19.25	9.25	120.48	1.57	15.5	15.5	1.0	52.50	4451.18	44	1.0	69.1	2124.6	37.5	15.5	44	9.25	4.19	2.92	132.6	757.7	7333.5	412.3	6988.1	**2933.39**	**2329.36**
37.50	38.50	38.00	1.00	36.0	19.25	9.25	120.48	3.14	15.5	15.5	1.0	105.00	4556.19	44	1.0	138.3	2262.9	38.5	15.5	44	9.64	4.19	2.92	132.6	758.2	7577.2	424.1	7243.2	**3030.89**	**2414.39**
38.50	40.00	39.25	1.50	37.5	19.64	9.64	120.48	4.71	15.5	15.5	1.0	157.51	4713.70	44	1.0	207.4	2470.3	40.0	15.5	50	9.64	4.19	2.92	132.6	800.6	7984.6	441.8	7625.8	**3193.83**	**2541.92**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
BORE NO: A1, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	18.84	8.84	24.31	1.89	12.9	12.9	1.0	10.50	0	42	1.0	79.2	0	3.0	18.9	0	8.84	5.82	4.79	26.5	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.50	18.84	8.84	30.94	3.77	18.9	18.9	1.0	39.95	0	0	1.0	0.0	0	4.0	23.6	2	8.84	8.99	9.34	35.4	0	0.0	25.4	25.4	**0.00**	**8.48**
4.00	6.00	5.00	2.00	3.50	18.84	8.84	44.20	7.54	23.6	23.6	1.0	145.66	0	2	1.0	15.1	0	6.0	23.6	2	8.84	8.99	9.34	53.0	0	0.0	59.4	59.4	**0.00**	**19.79**
6.00	7.00	6.50	1.00	4.50	18.84	8.84	57.46	3.77	23.6	23.6	1.0	94.68	0	2	1.0	7.5	0	7.0	28.5	0	8.84	17.88	18.94	61.9	1365.6	1365.6	76.3	76.3	**546.25**	**25.45**
7.00	8.00	7.50	1.00	5.50	18.84	8.84	66.30	3.77	28.5	28.5	1.0	135.76	135.76	0	1.0	0.0	0.00	8.0	19.3	10	10.25	6.03	5.01	70.7	619.0	754.7	93.3	229.1	**301.89**	**76.36**
8.00	9.00	8.50	1.00	6.50	20.25	10.25	75.85	3.77	19.3	19.3	1.0	100.17	235.93	10	1.0	37.7	37.71	9.0	13.5	40	10.25	3.50	2.22	81.0	743.4	1017.1	110.3	383.9	**406.82**	**127.97**
9.00	10.00	9.50	1.00	7.50	20.25	10.25	86.10	3.77	13.5	13.5	1.0	77.95	313.89	40	1.0	150.9	188.57	10.0	10.4	37	11.25	2.59	1.33	91.2	654.0	1156.5	127.2	629.7	**462.59**	**209.90**
10.00	12.50	11.25	2.50	10.00	21.25	11.25	105.28	9.43	10.4	10.4	1.0	182.19	496.08	37	1.0	348.9	537.43	12.5	18.6	11	11.25	5.69	4.62	119.3	915.3	1948.8	169.6	1203.2	**779.51**	**401.05**
12.50	14.00	13.25	1.50	11.50	21.25	11.25	127.78	5.66	18.6	18.6	1.0	243.28	739.35	11	1.0	62.2	599.66	14.0	12.6	45	9.96	3.23	1.96	136.2	969.8	2308.8	195.1	1534.1	**923.53**	**511.37**
14.00	15.50	14.75	1.50	13.00	19.96	9.96	143.69	5.66	12.6	12.6	1.0	181.70	921.05	45	1.0	254.6	854.23	15.5	8.6	45	9.89	2.22	1.00	151.2	844.3	2619.6	220.5	1995.8	**1047.84**	**665.27**
15.50	18.50	17.00	3.00	16.00	19.89	9.89	166.00	11.31	8.6	8.6	1.0	284.04	1205.09	45	1.0	509.1	1363.37	18.5	8.6	45	10.27	2.22	1.00	151.2	844.6	3413.0	271.4	2839.9	**1365.21**	**946.63**
18.50	21.50	20.00	3.00	19.00	20.27	10.27	166.00	11.31	8.6	8.6	1.0	284.04	1489.13	45	1.0	509.1	1872.51	21.5	11.5	52	10.27	2.91	1.65	151.2	1038.9	4400.5	322.3	3684.0	**1760.20**	**1227.99**
21.50	24.50	23.00	3.00	22.00	20.27	10.27	166.00	11.31	11.5	11.5	1.0	382.11	1871.24	52	1.0	588.3	2460.86	24.5	11.5	52	10.95	2.91	1.65	151.2	1039.6	5371.7	373.2	4705.3	**2148.69**	**1568.44**
24.50	27.50	26.00	3.00	25.00	20.95	10.95	166.00	11.31	11.5	11.5	1.0	382.11	2253.34	52	1.0	588.3	3049.20	27.5	12.0	48	10.95	3.06	1.79	151.2	1025.1	6327.6	424.1	5726.7	**2531.06**	**1908.89**
27.50	29.00	28.25	1.50	26.50	20.95	10.95	166.00	5.66	12.0	12.0	1.0	199.60	2452.95	48	1.0	271.5	3320.74	29.0	22.5	0	8.91	8.20	8.14	151.2	1451.6	7225.3	449.6	6223.3	**2890.13**	**2074.42**
29.00	30.00	29.50	1.00	27.50	18.91	8.91	166.00	3.77	22.5	22.5	1.0	259.31	2712.26	0	1.0	0.0	3320.74	30.0	22.5	0	8.91	8.20	8.14	151.2	1451.6	7484.6	466.5	6499.5	**2993.85**	**2166.51**
30.00	30.50	30.25	0.50	28.00	18.91	8.91	166.00	1.89	22.5	22.5	1.0	129.66	2841.92	0	1.0	0.0	3320.74	30.5	12.3	45	8.91	3.15	1.88	151.2	1007.6	7170.2	475.0	6637.7	**2868.09**	**2212.56**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	N_γ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
30.50	32.00	31.25	1.50	29.50	18.91	8.91	166.00	5.66	12.3	12.3	1.0	204.75	3046.66	45	1.0	254.6	3575.31	32.0	27.1	0	8.91	14.73	15.72	151.2	2614.1	9236.1	500.5	7122.4	**3694.44**	**2374.14**
32.00	32.50	32.25	0.50	30.00	18.91	8.91	166.00	1.89	27.1	27.1	1.0	160.18	3206.84	0	1.0	0.0	3575.31	32.5	28.9	0	7.27	18.78	19.87	151.2	3310.3	10092.5	508.9	7291.1	**4037.00**	**2430.37**
32.50	33.50	33.00	1.00	31.00	17.27	7.27	166.00	3.77	28.9	28.9	1.0	345.59	3552.44	0	1.0	0.0	3575.31	33.5	31.5	0	10.00	28.82	30.09	151.2	5132.5	12260.3	525.9	7653.7	**4904.10**	**2551.22**
33.50	35.00	34.25	1.50	32.50	20.00	10.00	166.00	5.66	31.5	31.5	1.1	618.61	4171.05	0	1.0	0.0	3575.31	35.0	32.1	0	9.48	31.84	33.16	151.2	5658.6	13405.0	551.3	8297.7	**5361.99**	**2765.90**
35.00	36.50	35.75	1.50	34.00	19.48	9.48	166.00	5.66	32.1	32.1	1.1	650.92	4821.97	0	1.0	0.0	3575.31	36.5	14.5	40	8.37	3.80	2.51	151.2	1070.6	9467.9	576.8	8974.1	**3787.16**	**2991.36**
36.50	37.50	37.00	1.00	35.00	18.37	8.37	166.00	3.77	14.5	14.5	1.0	161.90	4983.88	40	1.0	150.9	3726.17	37.5	23.1	10	8.37	8.63	8.79	151.2	1628.1	10338.1	593.8	9303.8	**4135.26**	**3101.27**
37.50	40.00	38.75	2.50	37.50	18.37	8.37	166.00	9.43	23.1	23.1	1.0	667.57	5651.45	10	1.0	94.3	3820.46	40.0	23.1	10	8.37	8.63	8.79	151.2	1628.1	11100.0	636.2	10108.1	**4440.00**	**3369.36**
BORE NO: P6, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	20.61	10.61	29.18	1.89	6.4	6.4	1.0	6.17	6.17	44	1.0	83.0	83.0	3.0	22.3	0	10.61	8.06	7.92	31.8	347.1	436.3	8.5	97.6	**174.51**	**32.54**
3.00	4.00	3.50	1.00	1.5	20.61	10.61	37.14	3.77	22.3	22.3	1.0	57.44	63.61	0	1.0	0.0	83.0	4.0	29.2	0	10.61	19.46	20.56	42.4	1082.4	1229.0	25.4	172.0	**491.59**	**57.34**
4.00	5.00	4.50	1.00	2.5	20.61	10.61	47.75	3.77	29.2	29.2	1.0	100.64	164.25	0	1.0	0.0	83.0	5.0	28.6	0	9.57	18.11	19.17	53.1	1211.4	1458.6	42.4	289.6	**583.44**	**96.54**
5.00	6.00	5.50	1.00	3.5	19.57	9.57	57.84	3.77	28.6	28.6	1.0	118.92	283.17	0	1.0	0.0	83.0	6.0	30.4	0	10.19	23.27	24.45	62.6	1818.1	2184.3	59.4	425.5	**873.71**	**141.84**
6.00	8.00	7.00	2.00	5.5	20.19	10.19	72.81	7.54	30.4	30.4	1.0	328.66	611.83	0	1.0	0.0	83.0	8.0	30.1	0	10.40	21.76	22.91	83.0	2205.5	2900.3	93.3	788.1	**1160.13**	**262.70**
8.00	9.00	8.50	1.00	6.5	20.40	10.40	88.20	3.77	30.1	30.1	1.0	193.79	805.61	0	1.0	0.0	83.0	9.0	31.6	0	10.86	29.32	30.60	93.4	3323.9	4212.5	110.3	998.9	**1685.01**	**332.95**
9.00	11.00	10.00	2.00	8.5	20.86	10.86	104.26	7.54	31.6	31.6	1.1	522.51	1328.13	0	1.0	0.0	83.0	11.0	12.4	45	10.86	3.17	1.91	115.1	885.8	2296.9	144.2	1555.3	**918.76**	**518.43**
11.00	12.00	11.50	1.00	9.5	20.86	10.86	120.55	3.77	12.4	12.4	1.0	99.96	1428.09	45	1.0	169.7	252.7	12.0	12.4	41	10.86	3.17	1.91	126.0	884.1	2564.9	161.2	1841.9	**1025.94**	**613.98**
12.00	14.50	13.25	2.50	12.0	20.86	10.86	139.56	9.43	12.4	12.4	1.0	289.30	1717.39	41	1.0	386.6	639.3	14.5	12.4	41	10.86	3.17	1.91	153.1	981.6	3338.2	203.6	2560.2	**1335.30**	**853.41**
14.50	17.50	16.00	3.00	15.0	20.86	10.86	169.42	11.31	12.4	12.4	1.0	421.45	2138.84	41	1.0	463.9	1103.1	17.5	11.0	48	8.14	2.76	1.51	185.7	1077.9	4319.8	254.5	3496.4	**1727.94**	**1165.48**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
17.50	20.50	19.00	3.00	18.0	18.14	8.14	169.42	11.31	11.0	11.0	1.0	372.60	2511.44	48	1.0	543.1	1646.2	20.5	11.5	40	8.14	2.91	1.65	185.7	1028.1	5185.7	305.4	4463.0	**2074.30**	**1487.68**
20.50	23.50	22.00	3.00	21.0	18.14	8.14	169.42	11.31	11.5	11.5	1.0	389.99	2901.43	40	1.0	452.6	2098.8	23.5	8.5	52	11.08	2.20	0.99	185.7	999.2	5999.4	356.3	5356.5	**2399.77**	**1785.49**
23.50	26.50	25.00	3.00	24.0	21.08	11.08	169.42	11.31	8.5	8.5	1.0	286.48	3187.91	52	1.0	588.3	2687.1	26.5	8.5	48	11.08	2.20	0.99	185.7	958.5	6833.5	407.2	6282.2	**2733.41**	**2094.07**
26.50	27.50	27.00	1.00	25.0	21.08	11.08	169.42	3.77	8.5	8.5	1.0	95.49	3283.40	48	1.0	181.0	2868.2	27.5	8.5	48	11.08	2.20	0.99	185.7	958.5	7110.0	424.1	6575.7	**2844.02**	**2191.89**
27.50	28.00	27.75	0.50	25.5	21.08	11.08	169.42	1.89	8.5	8.5	1.0	47.75	3331.14	48	1.0	90.5	2958.7	28.0	11.8	48	9.89	3.00	1.73	185.7	1130.6	7420.4	432.6	6722.4	**2968.18**	**2240.81**
28.00	29.50	28.75	1.50	27.0	19.89	9.89	169.42	5.66	11.8	11.8	1.0	200.23	3531.37	48	1.0	271.5	3230.2	29.5	11.8	48	9.89	3.00	1.73	185.7	1130.6	7892.2	458.0	7219.6	**3156.88**	**2406.55**
29.50	30.00	29.75	0.50	27.5	19.89	9.89	169.42	1.89	11.8	11.8	1.0	66.74	3598.11	48	1.0	90.5	3320.7	30.0	11.8	48	9.89	3.00	1.73	185.7	1130.6	8049.5	466.5	7385.4	**3219.79**	**2461.79**
30.00	31.00	30.50	1.00	28.5	19.89	9.89	169.42	3.77	11.8	11.8	1.0	133.48	3731.60	48	1.0	181.0	3501.8	31.0	24.7	11	10.91	9.78	10.55	185.7	2245.9	9479.3	483.5	7716.9	**3791.73**	**2572.29**
31.00	32.50	31.75	1.50	30.0	20.91	10.91	169.42	5.66	24.7	24.7	1.0	440.83	4172.43	11	1.0	62.2	3564.0	32.5	8.3	40	10.91	2.16	0.96	185.7	869.1	8605.5	508.9	8245.4	**3442.21**	**2748.46**
32.50	35.00	33.75	2.50	32.5	20.91	10.91	169.42	9.43	8.3	8.3	1.0	233.03	4405.46	40	1.0	377.1	3941.1	35.0	8.0	40	11.02	2.11	0.91	185.7	857.5	9204.1	551.3	8898.0	**3681.64**	**2965.98**
35.00	35.50	35.25	0.50	33.0	21.02	11.02	169.42	1.89	8.0	8.0	1.0	44.90	4450.36	40	1.0	75.4	4016.6	35.5	23.6	10	9.13	8.99	9.34	185.7	2049.1	10516.0	559.8	9026.8	**4206.42**	**3008.92**
35.50	37.00	36.25	1.50	34.5	19.13	9.13	169.42	5.66	23.6	23.6	1.0	418.73	4869.09	10	1.0	56.6	4073.1	37.0	23.6	10	9.13	8.99	9.34	185.7	2049.1	10991.3	585.3	9527.5	**4396.54**	**3175.84**
37.00	37.50	37.25	0.50	35.0	19.13	9.13	169.42	1.89	23.6	23.6	1.0	139.58	5008.67	10	1.0	18.9	4092.0	37.5	23.6	10	9.13	8.99	9.34	185.7	2049.1	11149.8	593.8	9694.4	**4459.91**	**3231.48**
37.50	38.50	38.00	1.00	36.0	19.13	9.13	169.42	3.77	23.6	23.6	1.0	279.15	5287.82	10	1.0	37.7	4129.7	38.5	23.6	10	9.89	8.99	9.34	185.7	2053.9	11471.5	610.7	10028.3	**4588.59**	**3342.75**
38.50	40.00	39.25	1.50	37.5	19.89	9.89	169.42	5.66	23.6	23.6	1.0	418.73	5706.55	10	1.0	56.6	4186.3	40.0	23.6	10	9.89	8.99	9.34	185.7	2053.9	11946.8	636.2	10529.0	**4778.71**	**3509.67**
BORE NO: P12, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	19.31	9.31	25.60	1.89	7.9	7.9	1.0	6.70	6.70	64	1.0	120.7	120.7	3.0	11.6	26	9.31	2.94	1.68	27.9	368.3	495.7	8.5	135.9	**198.26**	**45.29**
3.00	4.00	3.50	1.00	1.5	19.31	9.31	32.59	3.77	11.6	11.6	1.0	25.23	31.93	26	1.0	98.1	218.7	4.0	11.6	26	9.31	2.94	1.68	37.2	399.2	649.9	25.4	276.1	**259.97**	**92.04**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
4.00	5.00	4.50	1.00	2.5	19.31	9.31	41.90	3.77	11.6	11.6	1.0	32.43	64.36	26	1.0	98.1	316.8	5.0	7.3	66	9.31	1.98	0.80	46.6	781.6	1162.8	42.4	423.6	**465.12**	**141.19**
5.00	6.00	5.50	1.00	3.5	19.31	9.31	51.21	3.77	7.3	7.3	1.0	24.74	89.10	66	1.0	248.9	565.7	6.0	11.6	29	9.20	2.94	1.68	55.9	491.6	1146.4	59.4	714.2	**458.57**	**238.06**
6.00	7.00	6.50	1.00	4.5	19.20	9.20	60.46	3.77	11.6	11.6	1.0	46.81	135.90	29	1.0	109.4	675.1	7.0	11.6	29	9.20	2.94	1.68	65.1	522.2	1333.2	76.3	887.3	**533.29**	**295.78**
7.00	8.00	7.50	1.00	5.5	19.20	9.20	69.66	3.77	11.6	11.6	1.0	53.93	189.83	29	1.0	109.4	784.5	8.0	25.9	0	9.20	12.03	12.95	74.3	1091.4	2065.7	93.3	1067.6	**826.27**	**355.86**
8.00	9.00	8.50	1.00	6.5	19.20	9.20	78.86	3.77	25.9	25.9	1.0	144.42	334.25	0	1.0	0.0	784.5	9.0	25.9	0	9.20	12.03	12.95	83.5	1216.6	2335.3	110.3	1229.0	**934.11**	**409.66**
9.00	10.00	9.50	1.00	7.5	19.20	9.20	88.06	3.77	25.9	25.9	1.0	161.26	495.51	0	1.0	0.0	784.5	10.0	25.0	0	9.20	10.00	10.88	92.7	1116.3	2396.3	127.2	1407.2	**958.52**	**469.07**
10.00	11.00	10.50	1.00	8.5	19.20	9.20	97.26	3.77	25.0	25.0	1.0	171.05	666.56	0	1.0	0.0	784.5	11.0	24.5	15	10.35	9.64	10.33	101.9	1336.3	2787.3	144.2	1595.2	**1114.93**	**531.74**
11.00	12.50	11.75	1.50	10.0	20.35	10.35	109.62	5.66	24.5	24.5	1.0	282.62	949.18	15	1.0	84.9	869.3	12.5	8.5	56	10.31	2.20	0.99	117.4	869.4	2687.8	169.6	1988.1	**1075.14**	**662.71**
12.50	15.50	14.00	3.00	13.0	20.31	10.31	132.85	11.31	8.5	8.5	1.0	224.64	1173.82	56	1.0	633.6	1502.9	15.5	11.5	54	9.03	2.91	1.65	148.3	1048.5	3725.2	220.5	2897.3	**1490.08**	**965.76**
15.50	18.50	17.00	3.00	16.0	19.03	9.03	161.86	11.31	11.5	11.5	1.0	372.59	1546.41	54	1.0	611.0	2113.9	18.5	10.8	59	10.57	2.71	1.45	148.3	1065.1	4725.4	271.4	3931.7	**1890.17**	**1310.58**
18.50	21.50	20.00	3.00	19.0	20.57	10.57	161.86	11.31	10.8	10.8	1.0	349.34	1895.75	59	1.0	667.5	2781.4	21.5	9.1	61	10.44	2.31	1.08	148.3	1016.1	5693.3	322.3	4999.5	**2277.32**	**1666.50**
21.50	24.50	23.00	3.00	22.0	20.44	10.44	161.86	11.31	9.1	9.1	1.0	293.33	2189.08	61	1.0	690.2	3471.6	24.5	9.5	53	10.64	2.38	1.14	148.3	947.3	6608.0	373.2	6033.9	**2643.21**	**2011.30**
24.50	27.50	26.00	3.00	25.0	20.64	10.64	161.86	11.31	9.5	9.5	1.0	306.46	2495.54	53	1.0	599.7	4071.3	27.5	9.5	53	10.64	2.38	1.14	148.3	947.3	7514.1	424.1	6990.9	**3005.65**	**2330.31**
27.50	29.00	28.25	1.50	26.5	20.64	10.64	161.86	5.66	9.5	9.5	1.0	153.23	2648.77	53	1.0	299.8	4371.1	29.0	30.6	0	10.64	24.28	25.48	148.3	4258.7	11278.6	449.6	7469.4	**4511.43**	**2489.81**
29.00	30.00	29.50	1.00	27.5	20.64	10.64	161.86	3.77	30.6	30.6	1.0	371.85	3020.62	0	1.0	0.0	4371.1	30.0	31.0	0	9.63	26.30	27.53	148.3	4592.8	11984.5	466.5	7858.2	**4793.80**	**2619.41**
30.00	30.50	30.25	0.50	28.0	19.63	9.63	161.86	1.89	31.0	31.0	1.1	192.57	3213.18	0	1.0	0.0	4371.1	30.5	31.0	0	10.05	26.30	27.53	148.3	4600.6	12184.9	475.0	8059.3	**4873.96**	**2686.43**
30.50	32.00	31.25	1.50	29.5	20.05	10.05	161.86	5.66	31.0	31.0	1.1	577.70	3790.88	0	1.0	0.0	4371.1	32.0	32.5	0	10.05	33.85	35.22	148.3	5921.1	14083.0	500.5	8662.4	**5633.21**	**2887.47**
32.00	32.50	32.25	0.50	30.0	20.05	10.05	161.86	1.89	32.5	32.5	1.1	218.75	4009.63	0	1.0	0.0	4371.1	32.5	32.5	0	10.05	33.85	35.22	148.3	5921.1	14301.8	508.9	8889.7	**5720.72**	**2963.22**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	N_γ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
32.50	33.50	33.00	1.00	31.0	20.05	10.05	161.86	3.77	32.5	32.5	1.1	437.51	4447.14	0	1.0	0.0	4371.1	33.5	32.1	0	10.05	31.84	33.16	148.3	5569.0	14387.2	525.9	9344.1	**5754.87**	**3114.71**
33.50	35.00	34.25	1.50	32.5	20.05	10.05	161.86	5.66	32.1	32.1	1.1	634.71	5081.85	0	1.0	0.0	4371.1	35.0	32.1	0	10.05	31.84	33.16	148.3	5569.0	15021.9	551.3	10004.3	**6008.76**	**3334.76**
35.00	36.50	35.75	1.50	34.0	20.05	10.05	161.86	5.66	32.1	32.1	1.1	634.71	5716.56	0	1.0	0.0	4371.1	36.5	32.3	0	10.05	32.85	34.19	148.3	5745.0	15832.7	576.8	10664.4	**6333.06**	**3554.81**
36.50	37.50	37.00	1.00	35.0	20.05	10.05	161.86	3.77	32.3	32.3	1.1	430.29	6146.84	0	1.0	0.0	4371.1	37.5	32.3	0	10.05	32.85	34.19	148.3	5745.0	16262.9	593.8	11111.7	**6505.18**	**3703.90**
37.50	40.00	38.75	2.50	37.5	20.05	10.05	161.86	9.43	32.3	32.3	1.1	1075.71	7222.56	0	1.0	0.0	4371.1	40.0	32.3	0	10.05	32.85	34.19	148.3	5745.0	17338.7	636.2	12229.8	**6935.46**	**4076.60**
BORE NO: P13, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	19.71	9.71	26.70	1.89	24.3	24.3	1.0	22.74	0	0	1.0	0.0	0	3.0	26.3	5	9.71	12.93	13.88	29.1	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.5	19.71	9.71	33.99	3.77	26.3	26.3	1.0	63.35	0	5	1.0	18.9	0	4.0	26.3	5	9.46	12.93	13.88	38.8	0	0.0	25.4	25.4	**0.00**	**8.48**
4.00	5.00	4.50	1.00	2.5	19.46	9.46	43.57	3.77	26.3	26.3	1.0	81.21	0	5	1.0	18.9	0	5.0	24.7	10	9.46	9.78	10.55	48.3	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.5	19.46	9.46	53.03	3.77	24.7	24.7	1.0	91.99	0	10	1.0	37.7	0	6.0	24.7	10	9.46	9.78	10.55	57.8	0	0.0	59.4	59.4	**0.00**	**19.79**
6.00	7.00	6.50	1.00	4.5	19.46	9.46	62.49	3.77	24.7	24.7	1.0	108.40	0	10	1.0	37.7	0	7.0	24.7	10	9.10	9.78	10.55	67.2	0	0.0	76.3	76.3	**0.00**	**25.45**
7.00	8.00	7.50	1.00	5.5	19.10	9.10	71.77	3.77	24.7	24.7	1.0	124.50	0	10	1.0	37.7	0	8.0	24.2	0	9.10	9.42	10.00	76.3	0	0.0	93.3	93.3	**0.00**	**31.10**
8.00	9.00	8.50	1.00	6.5	19.10	9.10	80.87	3.77	24.2	24.2	1.0	137.07	0	0	1.0	0.0	0	9.0	24.2	0	9.10	9.42	10.00	85.4	0	0.0	110.3	110.3	**0.00**	**36.76**
9.00	10.00	9.50	1.00	7.5	19.10	9.10	89.97	3.77	24.2	24.2	1.0	152.49	0	0	1.0	0.0	0	10.0	10.5	48	10.36	2.62	1.36	94.5	778.2	778.2	127.2	127.2	**311.29**	**42.41**
10.00	11.00	10.50	1.00	8.5	20.36	10.36	99.70	3.77	10.5	10.5	1.0	69.69	69.69	48	1.0	181.0	181.0	11.0	10.5	48	10.36	2.62	1.36	104.9	808.9	1059.6	144.2	394.9	**423.85**	**131.64**
11.00	12.00	11.50	1.00	9.5	20.36	10.36	110.06	3.77	10.5	10.5	1.0	76.93	146.62	48	1.0	181.0	362.1	12.0	10.5	48	10.36	2.62	1.36	115.2	839.6	1348.3	161.2	669.8	**539.30**	**223.28**
12.00	13.00	12.50	1.00	10.5	20.36	10.36	120.42	3.77	10.5	10.5	1.0	84.17	230.79	48	1.0	181.0	543.1	13.0	28.0	0	9.54	16.76	17.79	125.6	2496.3	3270.2	178.1	952.0	**1308.09**	**317.34**
13.00	14.50	13.75	1.50	12.0	19.54	9.54	132.76	5.66	28.0	28.0	1.0	399.32	630.11	0	1.0	0.0	543.1	14.5	28.0	0	9.54	16.76	17.79	139.9	2767.6	3940.8	203.6	1376.8	**1576.33**	**458.93**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
14.50	16.00	15.25	1.50	13.5	19.54	9.54	147.07	5.66	28.0	28.0	1.0	442.37	1072.48	0	1.0	0.0	543.1	16.0	10.2	49	10.49	2.53	1.28	154.2	949.3	2564.9	229.0	1844.6	**1025.95**	**614.86**
16.00	17.50	16.75	1.50	15.0	20.49	10.49	162.09	5.66	10.2	10.2	1.0	164.99	1237.47	49	1.0	277.2	820.3	17.5	10.8	49	11.03	2.71	1.45	170.0	1030.0	3087.7	254.5	2312.2	**1235.10**	**770.74**
17.50	20.50	19.00	3.00	18.0	21.03	11.03	162.09	11.31	10.8	10.8	1.0	349.84	1587.30	49	1.0	554.4	1374.7	20.5	13.5	47	11.03	3.50	2.22	170.0	1168.2	4130.2	305.4	3267.4	**1652.09**	**1089.12**
20.50	23.50	22.00	3.00	21.0	21.03	11.03	162.09	11.31	13.5	13.5	1.0	440.28	2027.58	47	1.0	531.8	1906.5	23.5	11.5	47	8.68	2.91	1.65	170.0	1048.1	4982.1	356.3	4290.3	**1992.85**	**1430.10**
23.50	25.00	24.25	1.50	22.5	18.68	8.68	162.09	5.66	11.5	11.5	1.0	186.56	2214.14	47	1.0	265.9	2172.3	25.0	11.5	47	8.61	2.91	1.65	170.0	1048.0	5434.5	381.7	4768.2	**2173.79**	**1589.40**
25.00	26.50	25.75	1.50	24.0	18.61	8.61	162.09	5.66	11.5	11.5	1.0	186.56	2400.69	47	1.0	265.9	2438.2	26.5	11.5	47	8.99	2.91	1.65	170.0	1048.4	5887.3	407.2	5246.1	**2354.94**	**1748.69**
26.50	27.50	27.00	1.00	25.0	18.99	8.99	162.09	3.77	11.5	11.5	1.0	124.37	2525.07	47	1.0	177.3	2615.5	27.5	11.5	47	8.99	2.91	1.65	170.0	1048.4	6189.0	424.1	5564.7	**2475.59**	**1854.89**
27.50	28.00	27.75	0.50	25.5	18.99	8.99	162.09	1.89	11.5	11.5	1.0	62.19	2587.25	47	1.0	88.6	2704.1	28.0	12.5	49	9.36	3.20	1.94	170.0	1127.4	6418.7	432.6	5724.0	**2567.49**	**1907.99**
28.00	29.50	28.75	1.50	27.0	19.36	9.36	162.09	5.66	12.5	12.5	1.0	203.28	2790.53	49	1.0	277.2	2981.3	29.5	12.5	49	9.08	3.20	1.94	170.0	1127.0	6898.8	458.0	6229.9	**2759.54**	**2076.63**
29.50	30.00	29.75	0.50	27.5	19.08	9.08	162.09	1.89	12.5	12.5	1.0	67.76	2858.30	49	1.0	92.4	3073.7	30.0	12.5	49	10.98	3.20	1.94	170.0	1129.5	7061.5	466.5	6398.5	**2824.60**	**2132.85**
30.00	31.00	30.50	1.00	28.5	20.98	10.98	162.09	3.77	12.5	12.5	1.0	135.52	2993.82	49	1.0	184.8	3258.5	31.0	12.5	49	10.98	3.20	1.94	170.0	1129.5	7381.8	483.5	6735.8	**2952.73**	**2245.27**
31.00	32.50	31.75	1.50	30.0	20.98	10.98	162.09	5.66	12.5	12.5	1.0	203.28	3197.10	49	1.0	277.2	3535.7	32.5	28.6	0	10.98	18.11	19.17	170.0	3624.7	10357.5	508.9	7241.8	**4143.02**	**2413.92**
32.50	35.00	33.75	2.50	32.5	20.98	10.98	162.09	9.43	28.6	28.6	1.0	833.23	4030.33	0	1.0	0.0	3535.7	35.0	28.6	0	10.98	18.11	19.17	170.0	3624.7	11190.8	551.3	8117.4	**4476.31**	**2705.80**
35.00	35.50	35.25	0.50	33.0	20.98	10.98	162.09	1.89	28.6	28.6	1.0	166.65	4196.98	0	1.0	0.0	3535.7	35.5	28.5	0	10.98	17.88	18.94	170.0	3579.7	11312.4	559.8	8292.5	**4524.96**	**2764.17**
35.50	37.50	36.50	2.00	35.0	20.98	10.98	162.09	7.54	28.5	28.5	1.0	663.82	4860.80	0	1.0	0.0	3535.7	37.5	28.5	0	8.84	17.88	18.94	170.0	3552.2	11948.7	593.8	8990.3	**4779.48**	**2996.76**
37.50	38.50	38.00	1.00	36.0	18.84	8.84	162.09	3.77	28.5	28.5	1.0	331.91	5192.71	0	1.0	0.0	3535.7	38.5	28.5	0	9.15	17.88	18.94	170.0	3556.2	12284.6	610.7	9339.1	**4913.84**	**3113.05**
38.50	40.00	39.25	1.50	37.5	19.15	9.15	162.09	5.66	28.5	28.5	1.0	497.86	5690.57	0	1.0	0.0	3535.7	40.0	28.5	0	9.15	17.88	18.94	170.0	3556.2	12782.5	636.2	9862.5	**5112.98**	**3287.49**
BORE NO: P17, CUT OFF LENGTH: 2.50 m, Nc= 9																														

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	N_γ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
2.50	3.00	2.75	0.50	0.5	19.85	9.85	27.09	1.89	26.5	26.5	1.0	25.47	0	8	1.0	15.1	0	3.0	24.1	0	9.85	9.35	9.89	29.6	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.5	19.85	9.85	34.48	3.77	24.1	24.1	1.0	58.16	0	0	1.0	0.0	0	4.0	24.1	0	9.38	9.35	9.89	39.4	0	0.0	25.4	25.4	**0.00**	**8.48**
4.00	6.00	5.00	2.00	3.5	19.38	9.38	48.78	7.54	24.1	24.1	1.0	164.59	0	0	1.0	0.0	0	6.0	27.0	0	9.38	14.50	15.49	58.2	0	0.0	59.4	59.4	**0.00**	**19.79**
6.00	7.00	6.50	1.00	4.5	19.38	9.38	62.85	3.77	27.0	27.0	1.0	120.78	0	0	1.0	0.0	0	7.0	29.5	0	9.38	20.13	21.25	67.5	0	0.0	76.3	76.3	**0.00**	**25.45**
7.00	8.00	7.50	1.00	5.5	19.38	9.38	72.23	3.77	29.5	29.5	1.0	154.12	0	0	1.0	0.0	0	8.0	29.5	0	9.79	20.13	21.25	76.9	0	0.0	93.3	93.3	**0.00**	**31.10**
8.00	9.00	8.50	1.00	6.5	19.79	9.79	81.82	3.77	29.5	29.5	1.0	174.57	0	0	1.0	0.0	0	9.0	28.3	0	9.79	17.43	18.48	86.7	1833.0	1833.0	110.3	110.3	**733.18**	**36.76**
9.00	10.00	9.50	1.00	7.5	19.79	9.79	91.61	3.77	28.3	28.3	1.0	186.02	186.02	0	1.0	0.0	0.0	10.0	28.3	0	8.54	17.43	18.48	96.5	2010.4	2196.4	127.2	313.3	**878.55**	**104.42**
10.00	12.50	11.25	2.50	10.0	18.54	8.54	107.18	9.43	28.3	28.3	1.0	544.10	730.12	0	1.0	0.0	0.0	12.5	9.3	55	8.54	2.34	1.11	117.9	879.1	1609.2	169.6	899.8	**643.67**	**299.92**
12.50	14.00	13.25	1.50	11.5	18.54	8.54	124.26	5.66	9.3	9.3	1.0	115.11	845.23	55	1.0	311.1	311.1	14.0	24.5	14	8.96	9.64	10.33	130.7	1630.5	2786.9	195.1	1351.5	**1114.75**	**450.49**
14.00	15.50	14.75	1.50	13.0	18.96	8.96	137.38	5.66	24.5	24.5	1.0	354.18	1199.41	14	1.0	79.2	390.3	15.5	9.5	50	10.22	2.38	1.14	144.1	905.1	2494.9	220.5	1810.3	**997.94**	**603.43**
15.50	18.50	17.00	3.00	16.0	20.22	10.22	159.43	11.31	9.5	9.5	1.0	301.86	1501.27	50	1.0	565.7	956.1	18.5	8.5	64	9.12	2.20	0.99	144.1	1016.5	3473.8	271.4	2728.8	**1389.54**	**909.59**
18.50	21.50	20.00	3.00	19.0	19.12	9.12	159.43	11.31	8.5	8.5	1.0	269.59	1770.86	64	1.0	724.1	1680.2	21.5	8.5	64	9.12	2.20	0.99	144.1	1016.5	4467.5	322.3	3773.4	**1787.02**	**1257.79**
21.50	23.00	22.25	1.50	20.5	19.12	9.12	159.43	5.66	8.5	8.5	1.0	134.79	1905.65	64	1.0	362.1	2042.2	23.0	8.9	57	10.31	2.27	1.05	144.1	958.2	4906.1	347.8	4295.7	**1962.43**	**1431.88**
23.00	24.50	23.75	1.50	22.0	20.31	10.31	159.43	5.66	8.9	8.9	1.0	141.24	2046.89	57	1.0	322.5	2364.7	24.5	8.9	57	10.31	2.27	1.05	144.1	958.2	5369.8	373.2	4784.8	**2147.91**	**1594.93**
24.50	26.00	25.25	1.50	23.5	20.31	10.31	159.43	5.66	8.9	8.9	1.0	141.24	2188.12	57	1.0	322.5	2687.1	26.0	8.5	55	10.31	2.20	0.99	144.1	925.7	5800.9	398.7	5273.9	**2320.37**	**1757.98**
26.00	27.50	26.75	1.50	25.0	20.31	10.31	159.43	5.66	8.5	8.5	1.0	134.79	2322.92	55	1.0	311.1	2998.3	27.5	8.5	55	10.44	2.20	0.99	144.1	925.8	6247.0	424.1	5745.3	**2498.78**	**1915.11**
27.50	30.00	28.75	2.50	27.5	20.44	10.44	159.43	9.43	8.5	8.5	1.0	224.65	2547.57	55	1.0	518.6	3516.9	30.0	8.3	54	10.44	2.16	0.96	144.1	909.5	6973.9	466.5	6531.0	**2789.56**	**2176.98**
30.00	30.50	30.25	0.50	28.0	20.44	10.44	159.43	1.89	8.3	8.3	1.0	43.86	2591.43	54	1.0	101.8	3618.7	30.5	31.2	0	10.44	27.30	28.55	144.1	4654.0	10864.2	475.0	6685.1	**4345.66**	**2228.37**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
30.50	32.00	31.25	1.50	29.5	20.44	10.44	159.43	5.66	31.2	31.2	1.1	578.99	3170.42	0	1.0	0.0	3618.7	32.0	31.2	0	10.44	27.30	28.55	144.1	4654.0	11443.1	500.5	7289.6	**4577.26**	**2429.86**
32.00	32.50	32.25	0.50	30.0	20.44	10.44	159.43	1.89	31.2	31.2	1.1	193.00	3363.42	0	1.0	0.0	3618.7	32.5	30.6	0	8.78	24.28	25.48	144.1	4110.8	11092.9	508.9	7491.0	**4437.14**	**2497.02**
32.50	33.50	33.00	1.00	31.0	18.78	8.78	159.43	3.77	30.6	30.6	1.0	366.26	3729.69	0	1.0	0.0	3618.7	33.5	25.4	10	8.39	10.90	11.80	144.1	1946.3	9294.7	525.9	7874.3	**3717.87**	**2624.76**
33.50	35.00	34.25	1.50	32.5	18.39	8.39	159.43	5.66	25.4	25.4	1.0	428.26	4157.95	10	1.0	56.6	3675.3	35.0	25.4	10	7.89	10.90	11.80	144.1	1942.3	9775.5	551.3	8384.6	**3910.20**	**2794.85**
35.00	36.50	35.75	1.50	34.0	17.89	7.89	159.43	5.66	25.4	25.4	1.0	428.26	4586.21	10	1.0	56.6	3731.8	36.5	30.6	0	7.74	24.28	25.48	144.1	4092.8	12410.8	576.8	8894.8	**4964.32**	**2964.94**
36.50	37.50	37.00	1.00	35.0	17.74	7.74	159.43	3.77	30.6	30.6	1.0	366.26	4952.47	0	1.0	0.0	3731.8	37.5	30.6	0	7.74	24.28	25.48	144.1	4092.8	12777.1	593.8	9278.1	**5110.83**	**3092.69**
37.50	38.00	37.75	0.50	35.5	17.74	7.74	159.43	1.89	30.6	30.6	1.0	183.13	5135.60	0	1.0	0.0	3731.8	38.0	10.0	50	7.58	2.47	1.22	144.1	918.1	9785.6	602.2	9469.7	**3914.22**	**3156.56**
38.00	40.00	39.00	2.00	37.5	17.58	7.58	159.43	7.54	10.0	10.0	1.0	212.04	5347.65	50	1.0	377.1	4109.0	40.0	10.0	50	7.58	2.47	1.22	144.1	918.1	10374.7	636.2	10092.8	**4149.90**	**3364.26**
BORE NO: P18, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	19.10	9.10	25.03	1.89	28.0	28.0	1.0	25.09	0	0	1.0	0.0	0	3.0	28.0	0	9.90	16.76	17.79	27.3	637.1	637.1	8.5	8.5	**254.85**	**2.83**
3.00	5.00	4.00	2.00	2.5	19.90	9.90	37.20	7.54	28.0	28.0	1.0	149.19	149.19	0	1.0	0.0	0.0	5.0	28.0	0	9.90	16.76	17.79	47.1	1012.5	1161.7	42.4	191.6	**464.67**	**63.87**
5.00	6.00	5.50	1.00	3.5	19.90	9.90	52.05	3.77	28.0	28.0	1.0	104.38	253.57	0	1.0	0.0	0.0	6.0	27.9	0	9.90	16.53	17.56	57.0	1184.1	1437.7	59.4	312.9	**575.07**	**104.32**
6.00	8.00	7.00	2.00	5.5	19.90	9.90	66.90	7.54	27.9	27.9	1.0	267.18	520.75	0	1.0	0.0	0.0	8.0	28.3	0	7.90	17.43	18.48	76.8	1613.8	2134.5	93.3	614.1	**853.82**	**204.69**
8.00	9.00	8.50	1.00	6.5	17.90	7.90	80.75	3.77	28.3	28.3	1.0	163.98	684.73	0	1.0	0.0	0.0	9.0	28.3	0	7.90	17.43	18.48	84.7	1769.6	2454.3	110.3	795.0	**981.73**	**265.00**
9.00	11.00	10.00	2.00	8.5	17.90	7.90	92.60	7.54	28.3	28.3	1.0	376.09	1060.82	0	1.0	0.0	0.0	11.0	28.6	0	7.90	18.11	19.17	100.5	2161.7	3222.6	144.2	1205.0	**1289.02**	**401.67**
11.00	12.00	11.50	1.00	9.5	17.90	7.90	104.45	3.77	28.6	28.6	1.0	214.78	1275.59	0	1.0	0.0	0.0	12.0	26.7	0	9.66	13.83	14.80	108.4	1793.0	3068.6	161.2	1436.8	**1227.45**	**478.92**
12.00	14.50	13.25	2.50	12.0	19.66	9.66	120.48	9.43	26.7	26.7	1.0	571.30	1846.89	0	1.0	0.0	0.0	14.5	29.1	0	10.00	19.23	20.33	132.6	3022.3	4869.2	203.6	2050.5	**1947.70**	**683.49**
14.50	17.50	16.00	3.00	15.0	20.00	10.00	147.55	11.31	29.1	29.1	1.0	929.19	2776.08	0	1.0	0.0	0.0	17.5	9.5	54	10.60	2.38	1.14	162.6	995.8	3771.9	254.5	3030.6	**1508.76**	**1010.18**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
17.50	20.50	19.00	3.00	18.0	20.60	10.60	147.55	11.31	9.5	9.5	1.0	279.37	3055.45	54	1.0	611.0	611.0	20.5	10.0	46	9.92	2.47	1.22	162.6	930.9	4597.3	305.4	3971.8	**1838.93**	**1323.93**
20.50	23.50	22.00	3.00	21.0	19.92	9.92	147.55	11.31	10.0	10.0	1.0	294.36	3349.81	46	1.0	520.5	1131.4	23.5	11.5	42	10.80	2.91	1.65	162.6	975.1	5456.4	356.3	4837.5	**2182.55**	**1612.50**
23.50	26.50	25.00	3.00	24.0	20.80	10.80	147.55	11.31	11.5	11.5	1.0	339.65	3689.46	42	1.0	475.2	1606.6	26.5	11.0	44	10.80	2.76	1.51	162.6	967.4	6263.5	407.2	5703.2	**2505.41**	**1901.08**
26.50	27.50	27.00	1.00	25.0	20.80	10.80	147.55	3.77	11.0	11.0	1.0	108.17	3797.63	44	1.0	165.9	1772.6	27.5	11.0	44	10.80	2.76	1.51	162.6	967.4	6537.6	424.1	5994.3	**2615.05**	**1998.11**
27.50	28.00	27.75	0.50	25.5	20.80	10.80	147.55	1.89	11.0	11.0	1.0	54.08	3851.71	44	1.0	83.0	1855.5	28.0	10.0	44	10.90	2.47	1.22	162.6	911.3	6618.6	432.6	6139.9	**2647.44**	**2046.62**
28.00	29.50	28.75	1.50	27.0	20.90	10.90	147.55	5.66	10.0	10.0	1.0	147.18	3998.90	44	1.0	248.9	2104.5	29.5	31.6	0	10.90	29.32	30.60	162.6	5618.7	11722.0	458.0	6561.4	**4688.81**	**2187.13**
29.50	30.00	29.75	0.50	27.5	20.90	10.90	147.55	1.89	31.6	31.6	1.1	184.87	4183.76	0	1.0	0.0	2104.5	30.0	31.6	0	10.90	29.32	30.60	162.6	5618.7	11906.9	466.5	6754.7	**4762.76**	**2251.58**
30.00	31.00	30.50	1.00	28.5	20.90	10.90	147.55	3.77	31.6	31.6	1.1	369.73	4553.49	0	1.0	0.0	2104.5	31.0	31.6	0	10.90	29.32	30.60	162.6	5618.7	12276.6	483.5	7141.4	**4910.65**	**2380.48**
31.00	32.50	31.75	1.50	30.0	20.90	10.90	147.55	5.66	31.6	31.6	1.1	554.60	5108.09	0	1.0	0.0	2104.5	32.5	31.2	0	8.78	27.30	28.55	162.6	5191.8	12404.4	508.9	7721.5	**4961.76**	**2573.83**
32.50	34.00	33.25	1.50	31.5	18.78	8.78	147.55	5.66	31.2	31.2	1.1	535.85	5643.94	0	1.0	0.0	2104.5	34.0	12.3	29	9.22	3.15	1.88	162.6	885.6	8634.0	534.4	8282.8	**3453.59**	**2760.93**
34.00	35.00	34.50	1.00	32.5	19.22	9.22	147.55	3.77	12.3	12.3	1.0	121.33	5765.28	29	1.0	109.4	2213.8	35.0	12.3	29	9.22	3.15	1.88	162.6	885.6	8864.7	551.3	8530.5	**3545.87**	**2843.48**
35.00	35.50	35.25	0.50	33.0	19.22	9.22	147.55	1.89	12.3	12.3	1.0	60.67	5825.94	29	1.0	54.7	2268.5	35.5	15.0	35	8.44	3.94	2.65	162.6	1096.2	9190.7	559.8	8654.3	**3676.26**	**2884.76**
35.50	37.00	36.25	1.50	34.5	18.44	8.44	147.55	5.66	15.0	15.0	1.0	223.66	6049.60	35	1.0	198.0	2466.5	37.0	15.5	44	9.25	4.19	2.92	162.6	1236.3	9752.4	585.3	9101.4	**3900.95**	**3033.80**
37.00	37.50	37.25	0.50	35.0	19.25	9.25	147.55	1.89	15.5	15.5	1.0	77.16	6126.76	44	1.0	83.0	2549.5	37.5	15.5	44	9.25	4.19	2.92	162.6	1236.3	9912.5	593.8	9270.0	**3965.01**	**3090.00**
37.50	38.50	38.00	1.00	36.0	19.25	9.25	147.55	3.77	15.5	15.5	1.0	154.32	6281.09	44	1.0	165.9	2715.4	38.5	15.5	44	9.64	4.19	2.92	162.6	1237.0	10233.6	610.7	9607.2	**4093.42**	**3202.41**
38.50	40.00	39.25	1.50	37.5	19.64	9.64	147.55	5.66	15.5	15.5	1.0	231.49	6512.57	44	1.0	248.9	2964.3	40.0	15.5	50	9.64	4.19	2.92	162.6	1298.1	10775.1	636.2	10113.1	**4310.02**	**3371.03**

APPENDIX-H

TABLE 3: COMPUTATION OF LATERAL PILE LOAD CAPACITY (Dia. 1000 mm)

Bore No.	Dia. of pile (m)	Cut-off length (m)	Scour depth (m)	Concrete Grade	Young's Modulus (kN/m^2)	Moment of Inertia (m^4)	Average SPT	Modulus of sub grade (k_1)	Stiffness Factor (T)	Cantilever length	L_1/T	L_f/T	Permissible deflection (m)	Depth of Fixity (m)	Allowable Load capacity of pile(kN)
A1	1.00	2.50	0.00	35	29580399	0.0491	14	1976	3.74	4.50	1.20	2.05	0.005	7.67	48
P6	1.00	2.50	0.00	35	29580399	0.0491	16	2264	3.64	0.00	0.00	2.23	0.005	8.12	163
P12	1.00	2.50	0.00	35	29580399	0.0491	10	1400	4.01	0.00	0.00	2.23	0.005	8.94	122
P13	1.00	2.50	0.00	35	29580399	0.0491	29	4136	3.23	7.50	2.32	1.92	0.005	6.21	34
P17	1.00	2.50	0.00	35	29580399	0.0491	25	3560	3.33	6.50	1.95	1.94	0.005	6.45	40
P18	1.00	2.50	0.00	35	29580399	0.0491	15	2120	3.69	0.50	0.14	2.21	0.005	8.16	134

APPENDIX-H

TABLE 4: COMPUTATION OF LATERAL PILE LOAD CAPACITY (Dia. 1200 mm)

Bore No.	Dia. of pile (m)	Cut-off length (m)	Scour depth (m)	Concrete Grade	Young's Modulus (kN/m^2)	Moment of Inertia (m^4)	Average SPT	Modulus of sub grade (k_1)	Stiffness Factor (T)	Cantilever length	L_1/T	L_f/T	Permissible deflection (m)	Depth of Fixity (m)	Allowable Load capacity of pile(kN)
A1	1.20	2.50	0.00	35	29580399	0.1018	15	2120	4.27	4.50	1.05	2.07	0.005	8.85	76
P6	1.20	2.50	0.00	35	29580399	0.1018	17	2408	4.16	0.00	0.00	2.23	0.005	9.28	226
P12	1.20	2.50	0.00	35	29580399	0.1018	12	1688	4.47	0.00	0.00	2.23	0.005	9.97	182
P13	1.20	2.50	0.00	35	29580399	0.1018	29	4136	3.74	7.50	2.01	1.93	0.005	7.21	57
P17	1.20	2.50	0.00	35	29580399	0.1018	25	3560	3.85	6.50	1.69	1.98	0.005	7.61	64
P18	1.20	2.50	0.00	35	29580399	0.1018	16	2264	4.21	0.50	0.12	2.21	0.005	9.32	191

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
A1	0.50	ML	61	4	9.40	5.00	4.40	1.00	0.332	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.510	Liquefiable
	1.00	CL	57	4	18.80	10.00	8.80	0.99	0.331	1.70	6.80	5.00	1.20	13.16	0.14	1.00	-	-	Non-liquefiable
	3.00	ML	51	6	56.40	30.00	26.40	0.98	0.326	1.70	10.20	5.00	1.20	17.24	0.18	1.00	0.219	0.672	Liquefiable
	4.00	SM	37	11	75.20	40.00	35.20	0.97	0.323	1.69	18.54	5.00	1.20	27.25	0.35	1.00	0.412	1.275	Non-liquefiable
	6.00	SM	29	12	112.80	60.00	52.80	0.95	0.318	1.38	16.51	4.64	1.15	23.57	0.27	1.00	0.317	0.998	Liquefiable
	7.00	SM	29	13	131.60	70.00	61.60	0.95	0.315	1.27	16.56	4.64	1.15	23.62	0.27	1.00	0.318	1.009	Non-liquefiable
	8.00	ML	53	13	162.40	80.00	82.40	0.94	0.289	1.10	14.32	5.00	1.20	22.19	0.24	1.00	0.292	1.011	Non-liquefiable
	9.00	CL	64	14	182.70	90.00	92.70	0.93	0.286	1.04	14.54	5.00	1.20	22.45	0.25	1.00	-	-	Non-liquefiable
	10.00	CL	57	10	203.00	100.00	103.00	0.91	0.279	0.99	9.85	5.00	1.20	16.82	0.18	1.00	-	-	Non-liquefiable
	12.50	CL-ML	61	21	266.25	125.00	141.25	0.84	0.247	0.84	17.67	5.00	1.20	26.20	0.32	1.00	-	-	Non-liquefiable
	14.00	CL	61	21	280.00	140.00	140.00	0.80	0.250	0.85	17.75	5.00	1.20	26.30	0.32	1.00	-	-	Non-liquefiable
	15.50	CL	61	19	310.00	155.00	155.00	0.76	0.237	0.80	15.26	5.00	1.20	23.31	0.26	0.88	-	-	Non-liquefiable
	18.50	CL	74	35	368.15	185.00	183.15	0.68	0.213	0.74	25.86	5.00	1.20	36.03	0.52	0.82	-	-	Non-liquefiable
	21.50	CL	73	39	436.45	215.00	221.45	0.60	0.184	0.67	26.21	5.00	1.20	36.45	0.52	0.77	-	-	Non-liquefiable
	24.50	CL	73	30	497.35	245.00	252.35	0.56	0.172	0.63	18.89	5.00	1.20	27.66	0.36	0.73	-	-	Non-liquefiable
	27.50	CL	76	32	574.75	275.00	299.75	0.56	0.167	0.58	18.48	5.00	1.20	27.18	0.34	0.72	-	-	Non-liquefiable
	29.00	CL-ML	55	32	548.10	290.00	258.10	0.56	0.185	0.62	19.92	5.00	1.20	28.90	0.41	0.80	-	-	Non-liquefiable
	30.50	CL	65	35	576.45	305.00	271.45	0.56	0.185	0.61	21.24	5.00	1.20	30.49	0.51	0.79	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	32.00	SM	47	100	604.80	320.00	284.80	0.56	0.185	0.59	59.26	5.00	1.20	76.11	0.52	0.78	0.484	2.608	Non-liquefiable
	33.50	SM	38	80	633.15	335.00	298.15	0.56	0.185	0.58	46.33	5.00	1.20	60.60	0.52	0.78	0.484	2.608	Non-liquefiable
	35.00	SM	38	79	661.50	350.00	311.50	0.56	0.185	0.57	44.76	5.00	1.20	58.71	0.52	0.77	0.478	2.575	Non-liquefiable
	36.50	CL	71	44	689.85	365.00	324.85	0.56	0.185	0.55	24.41	5.00	1.20	34.29	0.52	0.76	-	-	Non-liquefiable
	40.00	CL-ML	66	48	756.00	400.00	356.00	0.56	0.185	0.53	25.44	5.00	1.20	35.53	0.52	0.75	-	-	Non-liquefiable
P6	0.50	SM	37	7	10.30	5.00	5.30	1.00	0.302	1.70	11.90	5.00	1.20	19.28	0.21	1.00	0.246	0.816	Liquefiable
	1.00	CL	70	7	20.60	10.00	10.60	0.99	0.301	1.70	11.90	5.00	1.20	19.28	0.21	1.00	-	-	Non-liquefiable
	2.00	CL	80	7	41.20	20.00	21.20	0.98	0.299	1.70	11.90	5.00	1.20	19.28	0.21	1.00	-	-	Non-liquefiable
	3.00	ML	62	10	61.80	30.00	31.80	0.98	0.296	1.70	17.00	5.00	1.20	25.40	0.30	1.00	0.358	1.208	Non-liquefiable
	4.00	SM	31	10	82.40	40.00	42.40	0.97	0.294	1.54	15.36	4.77	1.16	22.62	0.25	1.00	0.300	1.019	Non-liquefiable
	5.00	SM	30	21	103.00	50.00	53.00	0.96	0.292	1.37	28.85	4.71	1.15	38.00	0.52	1.00	0.620	2.127	Non-liquefiable
	6.00	SM	30	18	123.60	60.00	63.60	0.95	0.289	1.25	22.57	4.71	1.15	30.76	0.52	1.00	0.620	2.144	Non-liquefiable
	8.00	SM	32	29	164.80	80.00	84.80	0.94	0.285	1.09	31.49	4.83	1.17	41.71	0.52	1.00	0.620	2.179	Non-liquefiable
	9.00	SM	33	30	185.40	90.00	95.40	0.93	0.282	1.02	30.71	4.88	1.18	41.11	0.52	1.00	0.620	2.197	Non-liquefiable
	11.00	CL	84	24	226.60	110.00	116.60	0.88	0.267	0.93	22.23	5.00	1.20	31.67	0.52	1.00	-	-	Non-liquefiable
	12.00	CL	84	22	247.20	120.00	127.20	0.85	0.259	0.89	19.51	5.00	1.20	28.41	0.38	1.00	-	-	Non-liquefiable
	14.50	CL	85	32	303.05	145.00	158.05	0.79	0.235	0.80	25.45	5.00	1.20	35.54	0.52	1.00	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	17.50	CL	87	25	365.75	175.00	190.75	0.71	0.211	0.72	18.10	5.00	1.20	26.72	0.33	0.80	-	-	Non-liquefiable
	20.50	CL	68	62	428.45	205.00	223.45	0.63	0.187	0.67	41.48	5.00	1.20	54.77	0.52	0.74	-	-	Non-liquefiable
	23.50	CL	82	61	425.35	235.00	190.35	0.56	0.195	0.72	44.21	5.00	1.20	58.06	0.52	0.91	-	-	Non-liquefiable
	26.50	CL	83	45	559.15	265.00	294.15	0.56	0.166	0.58	26.24	5.00	1.20	36.49	0.52	0.93	-	-	Non-liquefiable
	28.00	MI	96	45	557.20	280.00	277.20	0.56	0.176	0.60	27.03	5.00	1.20	37.43	0.52	0.91	-	-	Non-liquefiable
	29.50	MI	96	37	587.05	295.00	292.05	0.56	0.176	0.59	21.65	5.00	1.20	30.98	0.52	0.91	-	-	Non-liquefiable
	31.00	CL-ML	62	37	647.90	310.00	337.90	0.56	0.167	0.54	20.13	5.00	1.20	29.15	0.42	0.70	-	-	Non-liquefiable
	32.50	MI	96	41	679.25	325.00	354.25	0.56	0.167	0.53	21.78	5.00	1.20	31.14	0.52	0.69	-	-	Non-liquefiable
	35.50	CL-ML	64	45	741.95	355.00	386.95	0.56	0.167	0.51	22.88	5.00	1.20	32.45	0.52	0.67	-	-	Non-liquefiable
	37.00	ML	52	45	773.30	370.00	403.30	0.56	0.167	0.50	22.41	5.00	1.20	31.89	0.52	0.66	0.409	2.444	Non-liquefiable
	38.50	ML	52	59	804.65	385.00	419.65	0.56	0.167	0.49	28.80	5.00	1.20	39.56	0.52	0.65	0.403	2.407	Non-liquefiable
	40.00	ML	52	70	836.00	400.00	436.00	0.56	0.167	0.48	33.52	5.00	1.20	45.23	0.52	0.64	0.397	2.370	Non-liquefiable
P12	0.50	ML	54	4	9.65	5.00	4.65	1.00	0.323	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.525	Liquefiable
	1.00	CL-ML	58	4	19.30	10.00	9.30	0.99	0.321	1.70	6.80	5.00	1.20	13.16	0.14	1.00	-	-	Non-liquefiable
	2.00	MI	90	4	38.60	20.00	18.60	0.98	0.319	1.70	6.80	5.00	1.20	13.16	0.14	1.00	-	-	Non-liquefiable
	3.00	CL	71	5	57.90	30.00	27.90	0.98	0.316	1.70	8.50	5.00	1.20	15.20	0.16	1.00	-	-	Non-liquefiable
	4.00	CL	71	7	77.20	40.00	37.20	0.97	0.314	1.64	11.48	5.00	1.20	18.77	0.20	1.00	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	5.00	MI	96	7	96.50	50.00	46.50	0.96	0.311	1.47	10.27	5.00	1.20	17.32	0.18	1.00	-	-	Non-liquefiable
	6.00	ML	69	15	115.80	60.00	55.80	0.95	0.309	1.34	20.08	5.00	1.20	29.10	0.41	1.00	0.495	1.602	Non-liquefiable
	7.00	ML	69	18	135.10	70.00	65.10	0.95	0.306	1.24	22.31	5.00	1.20	31.77	0.52	1.00	0.620	2.024	Non-liquefiable
	8.00	SM	29	18	154.40	80.00	74.40	0.94	0.304	1.16	20.87	4.64	1.15	28.56	0.39	1.00	0.466	1.533	Non-liquefiable
	9.00	SM	29	19	172.80	90.00	82.80	0.93	0.303	1.10	20.88	4.64	1.15	28.57	0.39	1.00	0.467	1.539	Non-liquefiable
	10.00	SM	29	21	192.00	100.00	92.00	0.91	0.295	1.04	21.89	4.64	1.15	29.73	0.45	1.00	0.537	1.817	Non-liquefiable
	11.00	CL-ML	77	21	211.20	110.00	101.20	0.88	0.287	0.99	20.88	5.00	1.20	30.05	0.47	1.00	-	-	Non-liquefiable
	12.50	CL	85	19	253.75	125.00	128.75	0.84	0.258	0.88	16.74	5.00	1.20	25.09	0.29	1.00	-	-	Non-liquefiable
	15.50	CL	83	22	314.65	155.00	159.65	0.76	0.234	0.79	17.41	5.00	1.20	25.89	0.31	0.87	-	-	Non-liquefiable
	18.50	CL	66	32	375.55	185.00	190.55	0.68	0.209	0.72	23.18	5.00	1.20	32.82	0.52	0.82	-	-	Non-liquefiable
	21.50	CL	72	41	408.50	215.00	193.50	0.60	0.198	0.72	29.47	5.00	1.20	40.37	0.52	0.83	-	-	Non-liquefiable
	24.50	CL	73	44	504.70	245.00	259.70	0.56	0.170	0.62	27.30	5.00	1.20	37.76	0.52	0.71	-	-	Non-liquefiable
	27.50	CL	80	49	561.00	275.00	286.00	0.56	0.171	0.59	28.97	5.00	1.20	39.77	0.52	0.69	-	-	Non-liquefiable
	29.00	SM	44	60	597.40	290.00	307.40	0.56	0.170	0.57	34.22	5.00	1.20	46.07	0.52	0.67	0.416	2.448	Non-liquefiable
	30.50	SM	44	66	628.30	305.00	323.30	0.56	0.170	0.56	36.71	5.00	1.20	49.05	0.52	0.66	0.409	2.412	Non-liquefiable
	32.00	SM	36	79	659.20	320.00	339.20	0.56	0.170	0.54	42.89	5.00	1.20	56.47	0.52	0.64	0.397	2.338	Non-liquefiable
	33.50	SM	38	74	690.10	335.00	355.10	0.56	0.170	0.53	39.27	5.00	1.20	52.12	0.52	0.63	0.391	2.302	Non-liquefiable
	36.50	SM	37	77	751.90	365.00	386.90	0.56	0.170	0.51	39.15	5.00	1.20	51.98	0.52	0.61	0.378	2.229	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	40.00	SM	40	85	804.00	400.00	404.00	0.56	0.174	0.50	42.29	5.00	1.20	55.75	0.52	0.65	0.403	2.319	Non-liquefiable
P13	0.50	SM	44	4	9.85	5.00	4.85	1.00	0.316	1.700	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.54	Liquefiable
	1.00	CL	76	4	19.70	10.00	9.70	0.99	0.314	1.700	6.80	5.00	1.20	13.16	0.14	1.00	-	-	Non-liquefiable
	2.00	SM	43	4	39.40	20.00	19.40	0.98	0.312	1.700	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.54	Liquefiable
	3.00	CL	74	5	59.10	30.00	29.10	0.98	0.310	1.700	8.50	5.00	1.20	15.20	0.16	1.00	-	-	Non-liquefiable
	4.00	ML	53	5	78.80	40.00	38.80	0.97	0.307	1.605	8.03	5.00	1.20	14.63	0.16	1.00	0.187	0.61	Liquefiable
	5.00	ML	53	4	98.30	50.00	48.30	0.96	0.305	1.439	5.76	5.00	1.20	11.91	0.13	1.00	0.155	0.51	Liquefiable
	6.00	CL-ML	81	6	117.80	60.00	57.80	0.95	0.303	1.315	7.89	5.00	1.20	14.47	0.15	1.00	-	-	Non-liquefiable
	7.00	ML	65	6	137.30	70.00	67.30	0.95	0.301	1.219	7.31	5.00	1.20	13.78	0.15	1.00	0.177	0.59	Liquefiable
	8.00	SM	47	8	156.40	80.00	76.40	0.94	0.300	1.144	9.15	5.00	1.20	15.98	0.17	1.00	0.203	0.68	Liquefiable
	9.00	SM	47	12	175.50	90.00	85.50	0.93	0.298	1.081	12.98	5.00	1.20	20.57	0.22	1.00	0.266	0.89	Liquefiable
	10.00	CL	84	12	194.60	100.00	94.60	0.91	0.291	1.028	12.34	5.00	1.20	19.81	0.21	1.00	-	-	Non-liquefiable
	11.00	CL	84	31	215.00	110.00	105.00	0.88	0.281	0.976	30.25	5.00	1.20	41.30	0.52	1.00	-	-	Non-liquefiable
	12.00	CL	84	34	235.40	120.00	115.40	0.85	0.272	0.931	31.65	5.00	1.20	42.98	0.52	1.00	-	-	Non-liquefiable
	13.00	SM	39	34	255.80	130.00	125.80	0.83	0.262	0.892	30.31	5.00	1.20	41.38	0.52	1.00	0.620	2.36	Non-liquefiable
	14.50	SM	39	36	285.05	145.00	140.05	0.79	0.250	0.845	30.42	5.00	1.20	41.50	0.52	1.00	0.620	2.48	Non-liquefiable
	16.00	CL	89	36	314.30	160.00	154.30	0.75	0.237	0.805	28.98	5.00	1.20	39.78	0.52	0.84	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	17.50	CL	89	29	345.05	175.00	170.05	0.71	0.224	0.767	22.24	5.00	1.20	31.69	0.52	0.81	-	-	Non-liquefiable
	20.50	CL	73	42	406.55	205.00	201.55	0.63	0.197	0.704	29.58	5.00	1.20	40.50	0.52	0.77	-	-	Non-liquefiable
	23.50	CL	77	59	469.55	235.00	234.55	0.56	0.175	0.653	38.52	5.00	1.20	51.23	0.52	0.73	-	-	Non-liquefiable
	25.00	CL	77	62	501.05	250.00	251.05	0.56	0.174	0.631	39.13	5.00	1.20	51.96	0.52	0.71	-	-	Non-liquefiable
	26.50	CL	77	75	532.55	265.00	267.55	0.56	0.174	0.611	45.85	5.00	1.20	60.02	0.52	0.69	-	-	Non-liquefiable
	28.00	CL	71	71	564.05	280.00	284.05	0.56	0.173	0.593	42.13	5.00	1.20	55.55	0.52	0.68	-	-	Non-liquefiable
	29.50	CL	71	59	595.55	295.00	300.55	0.56	0.173	0.577	34.03	5.00	1.20	45.84	0.52	0.66	-	-	Non-liquefiable
	31.00	CL	77	55	627.05	310.00	317.05	0.56	0.173	0.562	30.89	5.00	1.20	42.07	0.52	0.65	-	-	Non-liquefiable
	32.50	SM	39	58	658.55	325.00	333.55	0.56	0.172	0.548	31.76	5.00	1.20	43.11	0.52	0.64	0.394	2.29	Non-liquefiable
	35.50	SM	39	53	721.55	355.00	366.55	0.56	0.172	0.522	27.68	5.00	1.20	38.22	0.52	0.60	0.371	2.16	Non-liquefiable
	38.50	SM	43	57	784.55	385.00	399.55	0.56	0.172	0.500	28.52	5.00	1.20	39.22	0.52	0.58	0.359	2.09	Non-liquefiable
	40.00	SM	43	59	816.05	400.00	416.05	0.56	0.171	0.490	28.93	5.00	1.20	39.71	0.52	0.57	0.353	2.06	Non-liquefiable
P17	0.50	CL-ML	51	3	9.90	5.00	4.90	1.00	0.314	1.70	5.10	5.00	1.20	11.12	0.12	1.00	-	-	Non-liquefiable
	1.00	CL-ML	51	3	19.80	10.00	9.80	0.99	0.313	1.70	5.10	5.00	1.20	11.12	0.12	1.00	-	-	Non-liquefiable
	2.00	SM-SC	49	3	39.60	20.00	19.60	0.98	0.310	1.70	5.10	5.00	1.20	11.12	0.12	1.00	0.147	0.473	Liquefiable
	3.00	SM	42	4	59.40	30.00	29.40	0.98	0.308	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.550	Liquefiable
	4.00	SM	42	6	79.20	40.00	39.20	0.97	0.306	1.60	9.58	5.00	1.20	16.50	0.18	1.00	0.209	0.685	Liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	6.00	SM	25	9	118.80	60.00	58.80	0.95	0.301	1.30	11.74	4.29	1.12	17.38	0.18	1.00	0.221	0.733	Liquefiable
	7.00	SM	25	10	135.80	70.00	65.80	0.95	0.305	1.23	12.33	4.29	1.12	18.03	0.19	1.00	0.229	0.752	Liquefiable
	8.00	SP-ML	9	10	155.20	80.00	75.20	0.94	0.302	1.15	11.53	0.56	1.02	12.28	0.13	1.00	0.160	0.528	Liquefiable
	9.00	SP-ML	9	25	178.20	90.00	88.20	0.93	0.293	1.06	26.62	0.56	1.02	27.63	0.36	1.00	0.426	1.451	Non-liquefiable
	10.00	SM	26	34	198.00	100.00	98.00	0.91	0.286	1.01	34.35	4.39	1.12	42.94	0.52	1.00	0.620	2.170	Non-liquefiable
	12.50	CL	86	27	247.50	125.00	122.50	0.84	0.265	0.90	24.39	5.00	1.20	34.27	0.52	1.00	-	-	Non-liquefiable
	14.00	CL-ML	69	27	259.00	140.00	119.00	0.80	0.272	0.92	24.75	5.00	1.20	34.70	0.52	1.00	-	-	Non-liquefiable
	15.50	CL	88	30	294.50	155.00	139.50	0.76	0.250	0.85	25.40	5.00	1.20	35.48	0.52	0.91	-	-	Non-liquefiable
	18.50	CI	82	38	351.50	185.00	166.50	0.68	0.224	0.77	29.45	5.00	1.20	40.34	0.52	0.88	-	-	Non-liquefiable
	21.50	CI	88	65	434.30	215.00	219.30	0.60	0.185	0.68	43.89	5.00	1.20	57.67	0.52	0.80	-	-	Non-liquefiable
	23.00	CL	85	65	439.30	230.00	209.30	0.56	0.183	0.69	44.93	5.00	1.20	58.92	0.52	0.83	-	-	Non-liquefiable
	24.50	CL	85	70	497.35	245.00	252.35	0.56	0.172	0.63	44.07	5.00	1.20	57.88	0.52	0.70	-	-	Non-liquefiable
	26.00	CL	89	52	527.80	260.00	267.80	0.56	0.172	0.61	31.78	5.00	1.20	43.13	0.52	0.68	-	-	Non-liquefiable
	27.50	CL	88	41	558.25	275.00	283.25	0.56	0.172	0.59	24.36	5.00	1.20	34.23	0.52	0.67	-	-	Non-liquefiable
	30.50	SM	42	56	619.15	305.00	314.15	0.56	0.172	0.56	31.60	5.00	1.20	42.91	0.52	0.64	0.397	2.306	Non-liquefiable
	32.00	SM	42	65	652.80	320.00	332.80	0.56	0.171	0.55	35.63	5.00	1.20	47.76	0.52	0.60	0.372	2.172	Non-liquefiable
	33.50	ML	51	61	683.40	335.00	348.40	0.56	0.171	0.54	32.68	5.00	1.20	44.22	0.52	0.58	0.360	2.100	Non-liquefiable
	35.00	ML	51	68	714.00	350.00	364.00	0.56	0.171	0.52	35.64	5.00	1.20	47.77	0.52	0.57	0.354	2.063	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	36.50	SM	46	83	744.60	365.00	379.60	0.56	0.171	0.51	42.60	5.00	1.20	56.12	0.52	0.56	0.347	2.027	Non-liquefiable
	38.00	CL	80	55	775.20	380.00	395.20	0.56	0.171	0.50	27.67	5.00	1.20	38.20	0.52	0.55	-	-	Non-liquefiable
	40.00	CL	77	63	816.00	400.00	416.00	0.56	0.171	0.49	30.89	5.00	1.20	42.07	0.52	0.54	-	-	Non-liquefiable
P18	0.50	SM	43	9	9.55	5.00	4.55	1.00	0.326	1.70	15.30	5.00	1.20	23.36	0.26	1.00	0.313	0.961	Liquefiable
	2.00	SM-SC	36	9	38.20	20.00	18.20	0.98	0.322	1.70	15.30	5.00	1.20	23.36	0.26	1.00	0.313	0.972	Liquefiable
	3.00	SM	32	10	57.30	30.00	27.30	0.98	0.320	1.70	17.00	4.83	1.17	24.74	0.29	1.00	0.342	1.069	Non-liquefiable
	5.00	SM	30	15	95.50	50.00	45.50	0.96	0.315	1.48	22.24	4.71	1.15	30.38	0.50	1.00	0.592	1.880	Non-liquefiable
	6.00	SM	30	19	119.40	60.00	59.40	0.95	0.299	1.30	24.65	4.71	1.15	33.16	0.52	1.00	0.620	2.073	Non-liquefiable
	8.00	SM	33	17	159.20	80.00	79.20	0.94	0.294	1.12	19.10	4.88	1.18	27.41	0.35	1.00	0.418	1.420	Non-liquefiable
	9.00	SM	33	21	179.10	90.00	89.10	0.93	0.292	1.06	22.25	4.88	1.18	31.12	0.52	1.00	0.620	2.124	Non-liquefiable
	11.00	SM	28	24	218.90	110.00	108.90	0.88	0.276	0.96	23.00	4.56	1.14	30.74	0.52	1.00	0.620	2.247	Non-liquefiable
	12.00	SM	34	28	214.80	120.00	94.80	0.85	0.302	1.03	28.76	4.93	1.19	39.10	0.52	1.00	0.620	2.056	Non-liquefiable
	14.50	SM	42	17	259.55	145.00	114.55	0.79	0.278	0.93	15.88	5.00	1.20	24.06	0.27	1.00	0.327	1.177	Non-liquefiable
	17.50	CL	92	20	344.75	175.00	169.75	0.71	0.224	0.77	15.35	5.00	1.20	23.42	0.26	0.86	-	-	Non-liquefiable
	20.50	CL	88	33	410.00	205.00	205.00	0.63	0.196	0.70	23.05	5.00	1.20	32.66	0.52	0.78	-	-	Non-liquefiable
	23.50	CL	85	36	484.10	235.00	249.10	0.56	0.170	0.63	22.81	5.00	1.20	32.37	0.52	0.77	-	-	Non-liquefiable
	26.50	MI	87	34	527.35	265.00	262.35	0.56	0.176	0.62	20.99	5.00	1.20	30.19	0.48	0.79	-	-	Non-liquefiable

APPENDIX-H

TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	28.00	CL-CI	80	34	582.40	280.00	302.40	0.56	0.168	0.58	19.55	5.00	1.20	28.46	0.39	0.74	-	-	Non-liquefiable
	29.50	SM	41	83	616.55	295.00	321.55	0.56	0.167	0.56	46.29	5.00	1.20	60.54	0.52	0.73	0.453	2.703	Non-liquefiable
	31.00	SM	41	100	647.90	310.00	337.90	0.56	0.167	0.54	54.40	5.00	1.20	70.28	0.52	0.72	0.447	2.666	Non-liquefiable
	32.50	SM-SC	43	77	679.25	325.00	354.25	0.56	0.167	0.53	40.91	5.00	1.20	54.09	0.52	0.71	0.440	2.629	Non-liquefiable
	34.00	CL-ML	80	86	710.60	340.00	370.60	0.56	0.167	0.52	44.67	5.00	1.20	58.61	0.52	0.70	-	-	Non-liquefiable
	35.50	CL-ML	80	66	741.95	355.00	386.95	0.56	0.167	0.51	33.55	5.00	1.20	45.26	0.52	0.69	-	-	Non-liquefiable
	37.00	CL	69	68	773.30	370.00	403.30	0.56	0.167	0.50	33.86	5.00	1.20	45.63	0.52	0.68	-	-	Non-liquefiable
	38.50	CL	69	67	804.65	385.00	419.65	0.56	0.167	0.49	32.71	5.00	1.20	44.25	0.52	0.67	-	-	Non-liquefiable
	40.00	CL	85	74	836.00	400.00	436.00	0.56	0.167	0.48	35.44	5.00	1.20	47.53	0.52	0.66	-	-	Non-liquefiable

APPENDIX-I
SITE PHOTOGRAPHS

SPT at depth 24.50 m

SPT sample at depth 36.50 m

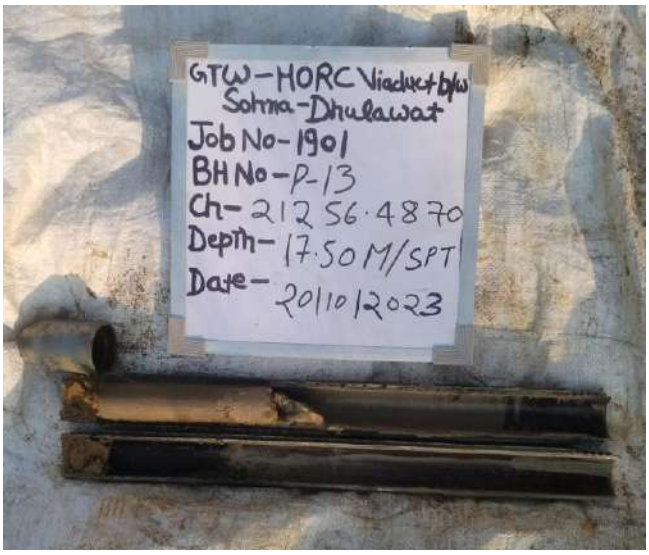
SPT sample at depth 11.00 m

UDS at depth 25.00 m

APPENDIX-I
SITE PHOTOGRAPHS

SPT sample at depth 12.50 m

SPT at depth 27.50 m



SPT sample at depth 17.50 m

SPT at depth 31.00 m

APPENDIX-I
SITE PHOTOGRAPHS

SPT at depth 10.00 m

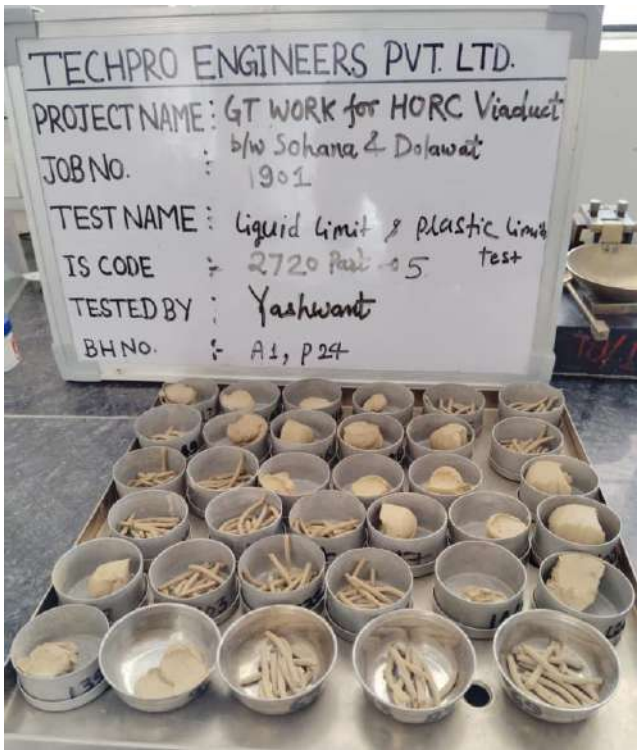
SPT sample at depth 12.50 m

SPT at depth 9.00 m

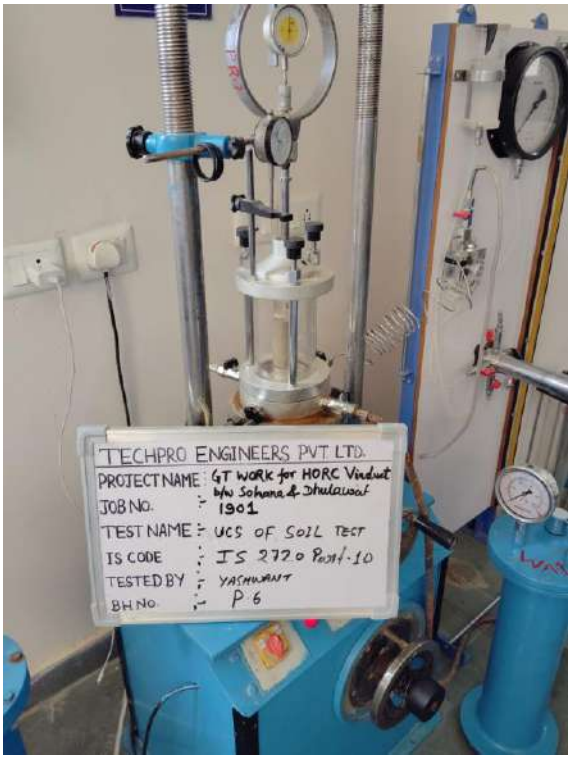
SPT sample at depth 29.50 m

APPENDIX-J
LABORATORY PHOTOGRAPHS

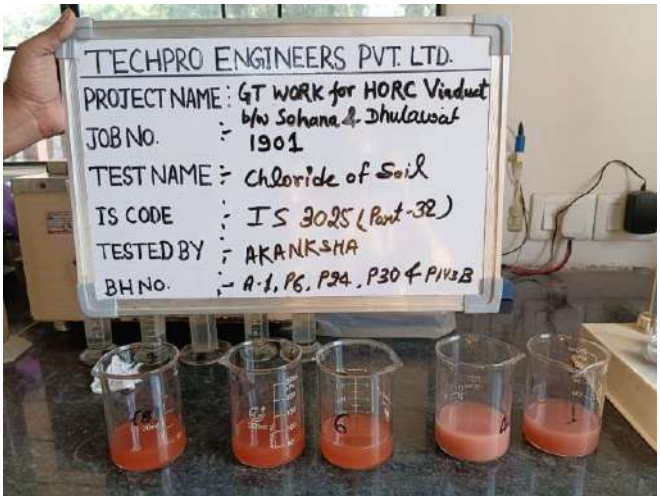
Water content test



Atterbergs' limit test



UCS of soil



Chemical test of soil

APPENDIX-J
LABORATORY PHOTOGRAPHS

Atterbergs' limit test

Triaxial test

Direct shear test

APPENDIX-K
CHART 1: FIELD BORE LOG CHARTS (A1)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GT Work For HORC Viaduct Idw Sohana & Dhulawat station					**Project Code:**	1901
Coordinate:	N: 3118903.449		E: 702633.931		**Location/ Chainage:**	20915.8870	
Method of Drilling:	Percussion			**Drilling Equipment:**	Power winch	**Bore No.:**	A1
Casing Lowered (M):	24M	**Bentonite Used:**	No	**Standard Sampler:**	yes	**Barrel Type:**	NA
Ground Elevation:	RL = 191.636		**Date: From** 20-9-23	**to** 23-9-23		**Water Table (M):**	0.50M

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
20/9/23	0.0	0.50	0.50	D	SX	Collected				—	—	—	—	—	—	Cohesive Soil
"	1.00	1.45	0.45	DP	—	1	1	3	4	—	—	—	—	—	—	"
"	2.00	2.45	0.45	U	—	Slipped				—	—	—	—	—	—	Cohesive Soil DS Collected
"	3.00	3.45	0.45	DP	—	2	3	3	6	—	—	—	—	—		Low Braunish Cohesive soil
"	4.00	4.45	0.45	DP	—	3	5	6	11	—	—	—	—	—		Non cohesive Soil
"	5.00	5.45	0.45	U	—	Received				—	—	—	—	—		"
21/9/23	6.00	6.45	0.45	DP	—	5	6	6	12	—	—	—	—	—	—	"
"	7.00	7.45	0.45	DP	—	4	6	7	13	—	—	—	—	—	—	"
"	8.00	8.45	0.45	U	—	Received				—	—	—	—	—	—	"
"	9.00	9.45	0.45	DP	—	5	6	8	14	—	—	—	—	—	—	"
"	10.00	10.45	0.45	DP	—	4	5	5	10	—	—	—	—	—	—	Cohesive Soil with Gravel
"	11.00	11.45	0.45	U	—	Received				—	—	—	—	—		"
"	12.50	12.95	0.45	DP	—	6	10	11	21	—	—	—	—	—	—	"
"	14.00	14.45	0.45	U	—	Received				—	—	—	—	—	—	"
"	15.50	15.95	0.45	DP	—	4	7	12	19	—	—	—	—	—	—	"
"	17.00	17.45	0.45	U	—	Received				—	—	—	—	—	—	"
"	18.50	18.95	0.45	DP	—	8	15	20	35	—	—	—	—	—	—	"
22/9/23	20.00	20.45	0.45	U	—	Received				—	—	—	—	—	—	"
"	21.50	21.95	0.45	DP	—	8	17	22	39	—	—	—	—	—	—	"
"	23.00	23.45	0.45	U	—	Slipped				—	—	—	—	—	—	" DS Collected
"	24.50	24.95	0.45	DP	—	11	13	17	30	—	—	—	—	—	—	"
"	26.00	26.45	0.45	U	—	Received				—	—	—	—	—	—	"
"	27.50	27.95	0.45	DP	—	10	14	18	32	—	—	—	—	—	—	"
"	29.00	29.45	0.45	U	—	Received				—	—	—	—	—	—	"

Supervisor

Techpro Engineers Pvt. Ltd. Kanpur

E-in-C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 2: FIELD BORE LOG CHARTS (A1)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GT Work For HORC Viaduct Idw Sohana & Dhulawat station			Project Code:	1901
Coordinate:	N: 3118903.449	E: 702633.931		Location/ Chainage:	20915.8870
Method of Drilling:	Percussion		Drilling Equipment:	Power winch	Bore No.: A1
Casing Lowered (M):	24 M	Bentonite Used: NO	Standard Sampler:	Yes	Barrel Type: NA
Ground Elevation:	RL-191.636	Date: From 20-9-23 to 23-9-23			Water Table (M): 0.50M

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
22/9/23	30.50	30.95	0.45	DP	SX	11	15	20	35	—	—	—	—	—	—	Cohesive Soil with Gravel
11	32.00	32.28	0.28	DP	—	35	65	-	R	—	—	—	—	—	—	Non Cohesive
11	33.50	33.95	0.45	DP	—	15	35	45	80	—	—	—	—	—	—	11
11	35.00	35.45	0.45	DP	—	10	37	42	79	—	—	—	—	—	—	Cohesive Soil with Gravel
23/9/23	36.50	36.95	0.45	DP	—	8	17	27	44	—	—	—	—	—	—	11
11	38.00	38.45	0.45	U	—	Slipped				—	—	—	—	—	—	11 / DS Collected
11	40.00	40.45	0.45	DP	—	9	18	30	48	—	—	—	—	—	—	11

C.P. Kashyap
Supervisor

E-in-C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 3: FIELD BORE LOG CHARTS (P6)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name: GT- for HORC viaduct between Sohona & Dhulawat stations						**Project Code:**	1901
Coordinate:	N: 3118922.47		E: 702477.831		**Location/ Chainage:**	21073.0870	
Method of Drilling:	Percussion			**Drilling Equipment**	Power winch	**Bore No.:**	P6
Casing Lowered (M):	18.00	**Bentonite Used:**	Yes	**Standard Sampler :**	Yes	**Barrel Type :**	N/A
Ground Elevation:	RL-192.181	**Date: From**	21/9/23	**to**	23/9/23	**Water Table (M):**	1.20M

Day / Date	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
21/9/23	0.0	0.50	0.50	DS	SX	Received			—							Yellwoish NON
11	1.00	1.45	0.45	U	11	Received			—							cohessive soil
11	2.00	2.45	0.45	DP	11	2	3	4	7							Brownish NON cohessive
11	3.00	3.45	0.45	DP	11	2	4	6	10							Soil
11	4.00	4.45	0.45	U	11	SLIPPed										11
11	5.00	5.45	0.45	DP	11	4	9	12	21							11
11	6.00	6.45	0.45	DP	11	5	7	11	18							11
11	7.00	7.45	0.45	U	11	SLIPPed	–									11
11	8.00	8.45	0.45	DP	11	7	12	17	29							11
11	9.00	9.45	0.45	DP	11	9	12	18	30							11
11	10.00	10.45	0.45	U	11	SLIPPed	–									11
11	11.00	11.45	0.45	DP	11	8	10	14	24							Yellwoish soil
11	12.00	12.45	0.45	DP	11	6	10	12	22							cohessive soil with
11	13.00	13.45	0.45	U	11	Received	–									Gravel soil
4	14.50	14.95	0.45	DP	11	7	14	18	32							11
22/9/23	16.00	16.45	0.45	U	11	SLIPPed	–									11
11	17.50	17.95	0.45	DP	11	6	10	15	25							11
11	19.00	19.45	0.45	U	11	SLIPPed	–									11
11	20.50	20.95	0.45	DP	11	8	22	40	62							11
11	22.00	22.45	0.45	U	11	Received	–									11
11	23.50	23.95	0.45	DP	11	9	23	38	61							11
11	25.00	25.45	0.45	U	11	Received	–									11
11	26.50	26.95	0.45	DP	11	10	19	26	45							11
11	28.00	28.45	0.45	U	11	Received	–									11

Supervisor

E-in-C SE

Abbreviation Used: U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 4: FIELD BORE LOG CHARTS (P6)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date:	28.12.2021

Project Name:	GT: for HORC viaduct between Sohana & Dhulawat stations			Project Code:	1901
Coordinate:	N: 3118922.47	E: 7024771.831		Location/ Chainage:	21073.0870
Method of Drilling:	Percussion		Drilling Equipment:	Power winch	Bore No.: P6
Casing Lowered (M):	18.00	Bentonite Used: Yes	Standard Sampler:	Yes	Barrel Type: N/A
Ground Elevation:	RL- 192.101	Date: From 21/9/23 to 23/9/23			Water Table (M): 1.20

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
21/9/23	29.50	29.95	0.45	DP	SX	10	17	20	37							cohesive soil
"	31.00	31.45	0.45	U	"	Recovid	—									"
"	32.50	32.95	0.45	DP	"	11	19	22	41							"
"	34.00	34.45	0.45	U	"	Slipped	—									Non cohesive soil
"	35.50	35.95	0.45	DP	"	16	19	26	45							"
"	37.00	37.45	0.45	U	"	Slipped	—									"
"	38.50	38.95	0.45	DP	"	19	26	33	59							"
"	40.00	40.45	0.45	DP	"	22	30	40	70							"

Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 5: FIELD BORE LOG CHARTS (P12)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date:	28.12.2021

Project Name:	GT work for HORC viaduct B/w Sohana & Dhulawat stations			Project Code:	1901
Coordinate:	N: 3118341.487	E: 702321.763		Location/ Chainage:	21230-2870
Method of Drilling:	Percussion	Drilling Equipment:	Autotrip/ Power Winch	Bore No.:	P-12
Casing Lowered (M):	21.m	Bentonite Used: No	Standard Sampler: YES	Barrel Type:	N/A
Ground Elevation:	R.L-191.831	Date: From 15/10/2021 to 18/10/2023		Water Table (M):	150.m

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
15/10/23	0.0	0.50	0.50	D	SX	Collect				–	–	–	–	–	–	Non cohesive soil
"	1.00	1.45	0.45	DP	–	1	2	2	4	–	–	–	–	–	–	– do –
"	2.00	2.45	0.45	U	–	Received				–	–	–	–	–	–	Non cohesive soil with grae
"	3.00	3.45	0.45	DP	–	2	2	3	5	–	–	–	–	–	–	Non cohesive soil
"	4.00	4.45	0.45	DP	–	2	3	4	7	–	–	–	–	–	–	– do –
"	5.00	5.45	0.45	U	–	Slipped				–	–	–	–	–	–	– do – DS collect
"	6.00	6.45	0.45	DP	–	4	7	8	15	–	–	–	–	–	–	Non cohesive soil
"	7.00	7.45	0.45	DP	–	3	8	10	18	–	–	–	–	–	–	– do –
16/10/23	8.00	8.45	0.45	U	–	Slipped				–	–	–	–	–	–	– do – DS collect
"	9.00	9.45	0.45	DP	–	4	8	11	19	–	–	–	–	–	–	Non cohesive soil
"	10.00	10.45	0.45	DP	–	5	9	12	21	–	–	–	–	–	–	– do –
"	11.00	11.45	0.45	U	–	Received				–	–	–	–	–	–	cohesive soil
"	12.50	12.95	0.45	DP	–	4	8	11	19	–	–	–	–	–	–	– do –
"	14.00	14.45	0.45	U	–	Received				–	–	–	–	–	–	– do –
"	15.50	15.95	0.45	DP	–	6	10	12	22	–	–	–	–	–	–	– do –
"	17.00	17.45	0.45	U	–	Received				–	–	–	–	–	–	cohesive soil with gravels
"	18.50	18.95	0.45	DP	–	7	13	19	32	–	–	–	–	–	–	– do –
"	20.00	20.45	0.45	U	–	Received				–	–	–	–	–	–	– do –
"	21.50	21.95	0.45	DP	–	9	17	24	41	–	–	–	–	–	–	– do –
"	23.00	23.45	0.45	U	–	Received				–	–	–	–	–	–	cohesive soil
"	24.50	24.95	0.45	DP	–	8	19	25	44	–	–	–	–	–	–	– do –
"	26.00	26.45	0.45	U	–	Received				–	–	–	–	–	–	– do –
"	27.50	27.95	0.45	DP	–	11	22	27	49	–	–	–	–	–	–	– do –
17/10/23	29.00	29.45	0.45	DP	–	17	28	32	60	–	–	–	–	–	–	Non cohesive soil

Supervisor

Techpro Engineers Pvt. Ltd.

E - In - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 6: FIELD BORE LOG CHARTS (P12)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	Network for HORC Viaduct B/W Sohana & Dhulawat stations			Project Code:	1901
Coordinate:	N: 3118941.487	E: 702321.763		Location/ Chainage:	71230-2870
Method of Drilling:	Percussion		Drilling Equipment:	Auto Trip/ Rope Winch	Bore No.: P-12
Casing Lowered (M):	21.0 m	Bentonite Used: No	Standard Sampler:	Yes	Barrel Type: N/A
Ground Elevation:	R.L - 191.831	Date: From 15/10/2023 to 18/10/2023			Water Table (M): 150.m

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R(%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
13/10/23	31.50	31.95	0.45	DP	SX	18	30	36	66	—	—	—	—	—	—	Non cohesive soil
11	32.00	32.45	0.45	DP	—	19	35	44	79	—	—	—	—	—	—	— do —
4	33.50	33.95	0.45	DP	—	17	33	41	64	—	—	—	—	—	—	— do —
11	35.00	35.45	0.45	U	—	Slipped				—	—	—	—	—	—	— do Toscollect
11	36.50	36.95	0.45	DP	—	19	34	43	77	—	—	—	—	—	—	Non cohesive soil
14/10/23	38.00	38.45	0.45	U	—	Slipped				—	—	—	—	—	—	— do Toscollected
11	40.00	40.45	0.45	DP	—	21	37	48	85	—	—	—	—	—	—	Non cohesive Soil

Supervisor

Techpro Engineers Pvt. Ltd. Rohtak

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 7: FIELD BORE LOG CHARTS (P13)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GT work for HORC Viaduct B/w Sohna & Dhulawat station			Project Code:	1901
Coordinate:	N: 3118949.656	E: 702295.755		Location/ Chainage:	21256-48 70
Method of Drilling:	Percussion	Drilling Equipment:	Power winch	Bore No.:	P-13
Casing Lowered (M):	22.00 Bentonite Used: NO	Standard Sampler :	YES	Barrel Type :	N/A
Ground Elevation:	R.L-191.69	Date: From 19/10/2023 to 22/10/2023		Water Table (M):	1.50 m

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
19/10/23	0.00	0.50	0.50	D	SX	collect				—	—	—	—	—	—	Non cohesive soil
11	1.00	1.45	0.45	U	—	Received				—	—	—	—	—	—	— do —
11	2.00	2.45	0.45	DP	—	1	2	2	4	—	—	—	—	—	—	— do —
11	3.00	3.45	0.45	DP	—	2	2	3	5	—	—	—	—	—	—	Non cohesive soil with gravels
11	4.00	4.45	0.45	U	—	Received				—	—	—	—	—	—	Non cohesive soil
11	5.00	5.45	0.45	DP	—	1	2	2	4	—	—	—	—	—	—	— do —
11	6.00	6.45	0.45	DP	—	2	3	3	6	—	—	—	—	—	—	— do —
11	7.00	7.45	0.45	U	—	Slipped				—	—	—	—	—	—	— do — as called
11	8.00	8.45	0.45	DP	—	2	3	5	8	—	—	—	—	—	—	Non cohesive soil
20/10/23	9.00	9.45	0.45	DP	—	4	5	7	12	—	—	—	—	—	—	— do —
11	10.00	10.45	0.45	U	—	Received				—	—	—	—	—	—	cohesive soil
11	11.00	11.45	0.45	DP	—	9	14	17	31	—	—	—	—	—	—	— do —
11	12.00	12.45	0.45	DP	—	8	15	19	34	—	—	—	—	—	—	— do —
11	13.00	13.45	0.45	U	—	Received				—	—	—	—	—	—	— do —
11	14.50	14.95	0.45	DP	—	9	16	26	36	—	—	—	—	—	—	Non cohesive soil
11	16.00	16.45	0.45	U	—	Received				—	—	—	—	—	—	cohesive soil with gravels
11	17.50	17.95	0.45	DP	—	8	13	16	29	—	—	—	—	—	—	— do —
11	19.00	19.45	0.45	U	—	Received				—	—	—	—	—	—	— do —
11	20.50	20.95	0.45	DP	—	11	20	22	42	—	—	—	—	—	—	cohesive soil
21/10/23	22.00	22.45	0.45	U	—	Slipped				—	—	—	—	—	—	Cohesive soil with gravels
11	23.50	23.95	0.45	DP	—	13	26	33	59	—	—	—	—	—	—	— do —
11	25.00	25.45	0.45	DP	—	15	27	35	62	—	—	—	—	—	—	cohesive soil with gravels
11	26.50	26.95	0.45	DP	—	17	29	41	75	—	—	—	—	—	—	— do —
11	28.00	28.45	0.45	DP	—	14	32	39	71	—	—	—	—	—	—	— do —

Techpro Engineers

Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 8: FIELD BORE LOG CHARTS (P13)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GT work for HORC viaduct B/w Sohna & Dhulawat station			Project Code:	1901
Coordinate:	N: 3118944.656	E: 702295.755		Location/ Chainage:	21256.4870
Method of Drilling:	Percussion	Drilling Equipment:	Powerwinch	Bore No.:	P-13
Casing Lowered (M):	22.m	Bentonite Used:	No	Standard Sampler:	YES	Barrel Type:	N/A
Ground Elevation:	R-L-191.69	Date: From 19/10/2023 to 22/10/2023		Water Table (M):	1.50 m

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
22/10/23	29.50	29.95	0.45	DP	SX	11	28	31	59	—	—	—	—	—	—	cohesive soil with gravels
"	31.00	31.45	0.45	DP	—	10	25	30	55	—	—	—	—	—	—	— do —
"	32.50	32.95	0.45	DP	—	10	27	31	58	—	—	—	—	—	—	Non cohesive soil
"	34.00	34.45	0.45	U	—	Silpped				—	—	—	—	—	—	Non cohesive soil / DS
"	35.50	35.95	0.45	DP	—	8	24	29	53	—	—	—	—	—	—	Non cohesive soil
"	37.00	37.45	0.45	U	—	Silpped				—	—	—	—	—	—	Non cohesive soil / DS
"	38.50	38.95	0.45	DP	—	10	26	31	57	—	—	—	—	—	—	Non cohesive soil
"	40.00	40.45	0.45	DP	—	11	27	32	59	—	—	—	—	—	—	— do —

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E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 9: FIELD BORE LOG CHARTS (P17)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GT For HORC Viaduct between Sohana Dhulawat Sec					**Project Code:**	1901
Coordinate:	N: 3118957.327	E: 702191.763			**Location/ Chainage:**	21361.287	
Method of Drilling:	Percussion		**Drilling Equipment:**	Auto Rig Powerwinch	**Bore No.:**	P-17	
Casing Lowered (M):	15	**Bentonite Used:** NA	**Standard Sampler:**	Yes.	**Barrel Type:**	NA	
Ground Elevation:	R.L-191.107	**Date: From** 18/10/23 **to** 21/10/23			**Water Table (M):**	1.20	

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
18/10/23	0.00	0.50	0.50	D	SX	collected				—	—	—	—	—	—	Non cohesive soil
"	1.00	1.45	0.45	DP	"	1	1	2	3	—	—	—	—	—	—	do
"	2.00	2.45	0.45	U	"	Received				—	—	—	—	—	—	do
"	3.00	3.45	0.45	DP	"	1	2	2	4	—	—	—	—	—	—	do
"	4.00	4.45	0.45	DP	"	2	3	3	6	—	—	—	—	—	—	do
"	5.00	5.45	0.45	W/O	"	Slipped				—	—	—	—	—	—	Gray Non cohesive soil
"	6.00	6.45	0.45	DP	"	3	4	5	9	—	—	—	—	—	—	do
19/10/23	7.00	7.45	0.45	DP	"	3	4	6	10	—	—	—	—	—	—	do
"	8.00	8.45	0.45	W/O	"	Slipped				—	—	—	—	—	—	do
"	9.00	9.45	0.45	DP	"	5	10	15	25	—	—	—	—	—	—	Gray Non cohesive soil
"	10.00	10.45	0.45	DP	"	8	12	22	34	—	—	—	—	—	—	do
"	11.00	11.45	0.45	U	"	Received				—	—	—	—	—	—	do
"	12.50	12.95	0.45	DP	"	6	11	16	27	—	—	—	—	—	—	cohesive soil
"	14.00	14.45	0.45	U	"	Received				—	—	—	—	—	—	do
"	15.50	15.95	0.45	DP	"	7	13	17	30	—	—	—	—	—	—	do
"	17.00	17.45	0.45	U	"	Received				—	—	—	—	—	—	cohesive soil
"	18.50	18.95	0.45	DP	"	15	18	20	38	—	—	—	—	—	—	do
"	20.00	20.45	0.45	U	"	Received				—	—	—	—	—	—	do
"	21.50	21.95	0.45	DP	"	16	30	35	65	—	—	—	—	—	—	cohesive soil
"	23.00	23.45	0.45	U	"	Received				—	—	—	—	—	—	"
20/10/23	24.50	24.95	0.45	DP	"	17	32	38	70	—	—	—	—	—	—	cohesive soil
"	26.00	26.45	0.45	U	"	15	25	27	52	—	—	—	—	—	—	cohesive soil with Gravel
"	27.50	27.95	0.45	DP	"	7	15	26	41	—	—	—	—	—	—	cohesive soil.
"	29.00	29.45	0.45	U	"	Received				—	—	—	—	—	—	do

Supervisor

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E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 10: FIELD BORE LOG CHARTS (P17)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GT. FOR HORC Viaduct between Sohana Dhulawat st			Project Code:	1901
Coordinate:	N: 3118957.327	E: 702191.763		Location/ Chainage:	21367.2870
Method of Drilling:	Percussion	Drilling Equipment:	4WDTWP/ Down the hole	Bore No.:	P-17
Casing Lowered (M):	15.0	Bentonite Used: NA	Standard Sampler:	Yes	Barrel Type:	NA
Ground Elevation:	R.L-191.107	Date: From 18/10/23 to 21/10/23			Water Table (M):	1.20

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
20/10/23	30.00	30.45	0.45	DP	SX	16	22	34	56	-	-	-	-	-	-	Non cohesive soil
11	32.00	32.45	0.45	DP	11	20	27	38	65	-	-	-	-	-	-	do
11	33.50	33.95	0.45	DP	11	14	26	35	61	-	-	-	-	-	-	Non cohesive soil
11	35.00	35.45	0.45	DP	11	17	32	36	68	-	-	-	-	-	-	do
11	36.50	36.50	0.45	DP	11	19	38	45	83	-	-	-	-	-	-	do
21/10/23	38.00	38.45	0.45	DP	11	10	25	30	55	-	-	-	-	-	-	- do -
	40.00	40.45	0.45	DP	11	18	27	36	63	-	-	-	-	-	-	- do -

Supervisor

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Value (N) > 100), Sampler means SPT sampler

E - in - C

APPENDIX-K
CHART 11: FIELD BORE LOG CHARTS (P18)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GT. For HORC Viaduct between Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 3118960.484	E: 702165.761	Location/ Chainage:	21387.4870	
Method of Drilling:	Percussion	Drilling Equipment:	Auto Typ. Power Winch	Bore No.:	P-18
Casing Lowered (M):	27.00 Bentonite Used: NA	Standard Sampler:	Yes	Barrel Type:	NA
Ground Elevation:	R.L-191.128	Date: From 15/10/23 to 18/10/23		Water Table (M):	1.20 m

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
15/10/23	0.00	0.50	0.45	D	SX	collected				—	—	—	—	—	—	Non cohesive soil
"	1.00	1.45	0.45	"	"	Received				—	—	—	—	—	—	do
"	2.00	2.45	0.45	DP	"	3	4	5	9	—	—	—	—	—	—	do
"	3.00	3.45	0.45	DP	"	4	5	5	10	—	—	—	—	—	—	do
"	4.00	4.45	0.45	"	"	Received				—	—	—	—	—	—	do
"	5.00	5.45	0.45	DP	"	5	7	8	15	—	—	—	—	—	—	Non cohesive soil
"	6.00	6.45	0.45	DP	"	6	9	10	19	—	—	—	—	—	—	do
"	7.00	7.45	0.45	U/S	"	slipped				—	—	—	—	—	—	do
"	8.00	8.45	0.45	DP	"	4	6	11	17	—	—	—	—	—	—	do
"	9.00	9.45	0.45	DP	"	5	8	13	21	—	—	—	—	—	—	do
"	10.00	10.45	0.45	U	"	Received				—	—	—	—	—	—	do
16/10/23	11.00	11.45	0.45	DP	"	5	9	15	24	—	—	—	—	—	—	Non cohesive soil
"	12.00	12.45	0.45	DP	"	6	11	17	28	—	—	—	—	—	—	do
"	13.00	13.45	0.45	"	"	Received				—	—	—	—	—	—	do
"	14.50	14.95	0.45	DP	"	4	7	10	17	—	—	—	—	—	—	do
"	16.00	16.45	0.45	"	"	Received				—	—	—	—	—	—	do
"	17.50	17.95	0.45	DP	"	5	8	12	20	—	—	—	—	—	—	cohesive soil
"	19.00	19.45	0.45	"	"	Received				—	—	—	—	—	—	do
"	20.50	20.95	0.45	DP	"	9	15	18	33	—	—	—	—	—	—	do
"	22.00	22.45	0.45	"	"	Received				—	—	—	—	—	—	do
"	23.50	23.95	0.45	DP	"	8	17	19	36	—	—	—	—	—	—	cohesive soil
"	25.00	25.45	0.45	"	"	Received				—	—	—	—	—	—	do
"	26.50	26.95	0.45	DP	"	8	15	19	34	—	—	—	—	—	—	do
"	28.00	28.45	0.45	"	"	Received				—	—	—	—	—	—	do

Supervisor

Techpro Engineers Pvt. Ltd. Jaipur

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 12: FIELD BORE LOG CHARTS (P18)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GT For HORC Viaduct between Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 3118960.484	E: 702165.761		Location/ Chainage:	21387.4870
Method of Drilling:	Percussion	Drilling Equipment:	Auto Trip/ Pneumatic	Bore No.:	P-18
Casing Lowered (M):	27.00 Bentonite Used: NA	Standard Sampler:	Yes	Barrel Type:	NIA
Ground Elevation:	R.L-191.128	Date: From 15/10/23 to 18/10/23		Water Table (M):	1.20 m

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
17/10/23	29.40	29.45	0.45	DP	SX	19	38	45	83	—	—	—	—	—	—	Non Cohesive soil
"	31.00	31.45	0.45	DP	"	22	48	52	100	—	—	—	—	—	—	Do
"	32.50	32.95	0.45	DP	"	17	35	42	77	—	—	—	—	—	—	Do
"	34.00	34.45	0.45	DP	"	19	39	47	86	—	—	—	—	—	—	Non cohesive soil with Gravel
"	35.50	35.95	0.45	DP	"	16	31	35	66	—	—	—	—	—	—	Cohesive soil
18/10/23	37.00	37.45	0.45	DP	"	14	28	40	68	—	—	—	—	—	—	None cohesive soil.
"	38.50	38.95	0.45	DP	"	15	32	35	67	—	—	—	—	—	—	Cohesive soil.
"	40.00	40.45	0.45	DP	"	14	33	41	74	—	—	—	—	—	—	Do

Supervisor

Techpro Engineers Pvt. Ltd. Kanpur

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

End of Report

Report No: 1901-HORC-II

Report No.: 1901-HORC-II

Date: Oct 16th; 2023

GEOTECHNICAL INVESTIGATION REPORT

ULR No.: TC916923000000032P
REVISION-R1

AT THE SITE FOR

HORC VIADUCT BETWEEN SOHANA & DHULAWAT STATIONS OF HARYANA ORBITAL RAIL CORRIDOR (HORC) PROJECT, HARYANA

FROM BOREHOLES P21 TO P40

CLIENT

HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LTD.

Plot No. 143, 5th floor RailTel tower, Sector-44,
Gurugram, Haryana 122003

GENERAL CONSULTANTS

RITES-SMEC JV

Gurugram, Haryana

GEOTECHNICAL CONSULTANTS

TECHPRO ENGINEERS PVT. LTD.

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e-mail: info@techproindia.com

TC-9169

REVISION NOTES

REVISION NO.	DATE	DESCRIPTION
R1	13.12.2023	• Lithological profile added in Appendix-C.

REPORT FORMAT

Report No.	Bore included	Total Number of Bores
1901-HORC-I	A1 to P20	21
1901-HORC-II	P21 to P40	20
1901-HORC-III	P41 to P60	20
1901-HORC-IV	P61 to P80	20
1901-HORC-V	P81 to P100	20
1901-HORC-VI	P101 to P113	13
1901-HORC-VII	P114A to P133A	20
1901-HORC-VIII	P134A to A2A	16
1901-HORC-IX	P114B to P133B	20
1901-HORC-X	P134B to A2B	16

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Issue Date: 23/12/2022 **Valid Until:** 22/12/2024

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Name of Legal Identity : Techpro Engineers Private Limited

Signed for and on behalf of NABL

N. Venkateswaran
Chief Executive Officer

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Oct 16th; 2023

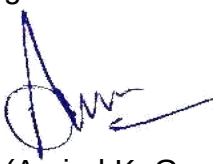
ACKNOWLEDGEMENTS

We are pleased to submit the part-2 of the report of Geotechnical investigation, conducted for the boreholes P21 to P40 for the design of foundations for HORC Viaduct between Sohana & Dhulawat stations of Haryana Orbital Rail Corridor (HORC) project in the state of Haryana, India.

We hereby, convey our sincere thanks to Mr. Neeraj Bhandari (CPM/South) and Mr. Raju Solanki (DGM/C/South), HRIDCL for trust and support during the investigation. We also acknowledge our thanks to Mr. Uma Maheshwara Rao B, DGM/C/West, HRIDCL for awarding the said work to us. We are also grateful Mr. Ravindra Dutta Upadhyay (Geotech Expert), Mr. PS Gautam & Mr. Jitender Parashar, Site Engineer from the RITES- SMEC JV and Mohd. Ishak (Executive/Civil) from HRIDCL, for their help rendered during and prior to the investigation work.

We are also thankful to our staff members for conducting field and laboratory test, preparing sketches, and typing the report.

for Techpro Engineers Pvt. Ltd.



(Arvind K. Garg)
B.Tech. (Civil), M.Tech.
Principal Consultant &
Managing Director

1. INTRODUCTION:

Haryana Rail Infrastructure Development Corporation Ltd. (HRIDC) and Ministry of Railways, Govt. of India has come together to form a new company namely Haryana Orbital Rail Corporation Limited (HORCL), to design and construction of new BG line from Palwal to Sonipat named Haryana Orbital Rail Corridor (HORC), in the state of Haryana, India. In this connection, a Geotechnical investigation has been planned for the design of foundations of Viaduct between Sohana & Dhulawat stations of Haryana Orbital Rail Corridor (HORC) Project in the state of Haryana. The work of conducting the detailed Geotechnical Investigation has been awarded to us by HRIDC, through work order No. HRIDC/HORC/GTI/211/2023-2024/Vol-0 dated 02-09-2023, which includes investigation in field, laboratory testing of disturbed and undisturbed samples, collected from the field, and submission of the geotechnical **investigation** test report.

A geotechnical investigation was carried out, with the locations, planned by the client. Purpose of the investigation is to determine the nature and properties of soil and rock strata across the bore holes and representing them through log sections showing the levels, nature, and properties of various strata up to a sufficient depth below the founding level, proneness of site to artesian conditions, seismic disturbance and other engineering properties of soil and rock strata.

This part -2 of the report includes the detailed methodology of investigation, collection of samples, field and laboratory test result including their interpretation/ analysis, recommendations on the properties of soils and rock required for design of foundation and suggesting suitable type and depth of foundation with allowable bearing capacity for safe and strong foundations for the Bore Hole numbers P21 to P40.

2. SCOPE OF WORK:

For the design of foundation of viaduct, it is required to determine the allowable bearing capacity together with necessary engineering characteristics of underlying soil & rock strata. In general, the geotechnical investigation has been planned as per IS:1892-2021 and further extended to IS: 1904, IS:2911 (part-1/Sec 2) & IRC 78:2014 for planning the laboratory testing and computing the allowable bearing capacity, hence the scope of work is as follows:

2.1. Mobilisation of all tools & plants along with accessories, materials, labours etc. at site of work for drilling and testing work, including setting up boring and shifting to different bore holes point etc.

2.2. Exploratory drilling of 150 mm diameter bore holes through soil deposits and 75 mm in rock within the proposed alignment upto the required depth.

2.3. Collection of disturbed soil samples at an interval of 3.00 meter in all the bore holes.

2.4. Collection of undisturbed soil samples at every 3.00 m interval or at change of stratum from all the boreholes.

2.5. To conduct Standard Penetration Test (SPT) at an interval of 3.00 m or noticeable change of stratum in soil deposits in all bore holes.

2.6. Collection of rock core samples and preserving them in core boxes.

2.7. To collect ground water sample on completion of bore holes.

2.8. To record the ground water table in all the bore holes.

2.9. Transporting all the disturbed, undisturbed soil and rock core samples collected during the field investigation to our NABL accredited Geotech Engineering laboratory at Kanpur.

2.10. To conduct the laboratory tests on all the soil and rock core samples collected during field investigation for determination of their engineering characteristics.

2.11. To compile of field and laboratory test results, working out the allowable bearing capacity and preparing the report including detailed recommendations and necessary precautions.

3. GEOLOGICAL INFORMATION OF THE REGION:

3.1. Geography:

The project location is in the bordering area of Gurugram and Nuh (recent old name-Mewat), districts in the Indian state of Haryana. The stretch of the alignment of the proposed corridor starts from southmost part of Gurugram in the town of Sohna and ends at Dhulawat, which is a village lying at the north of Nuh district.

Haryana is a state located in the northern part of India. Gurugram is among one

of the districts in Haryana which is also the part of National Capital Region (30km south of New Delhi). It lies at an elevation of 217 m above msl. Sohna is a small town located 25km in the south of Gurugram. Sohna is well known for its hot water springs and famous Shiva temple. Sohna is located in between 28°15' N latitude and 77°40' E longitude at the elevation of 212.14m above msl. Mewat district is located at 28 °12′ N latitude, 77 °3′ E longitude, at the south of Gurugram at an elevation of 199 m above msl. The location is bordered by Rewari district on west and Faridabad & Palwal district on the east.

3.2. Geology:

The Gurugram district is having of almost flat topography, however, in the north-eastern part small isolated hillocks of Precambrian rocks are exposed. Small hill ranges which are part of the Aravali and Mangar Bani ranges exists in the district. The major part of district is underlain by Quaternary alluvium consisting of sand, clay and silt. The alluvial plain is formed by the Sahibi river which is a tributary of River Yamuna. Soils of the Gurgaon district is classified as tropical and brown soils, existing in the north western extreme, northern and north eastern parts of the district and water logged and salt affected soils in the southern parts of the district. The soils are medium textured loamy sand is the average texture in Gurgaon and Sohna blocks.

3.3. Rainfall and Climate:

The area has hot semi-arid type of climate characterising extreme dryness of the air except in the monsoon season. Intense hot summer and cold winters. The total annual rainfall in the region is about 596 mm, of which 75 to 80% is because of the south-west monsoon.

3.4. Seismicity:

The site under consideration exists in the district of Gurugram and Mewat which lies in the Seismic Zone IV (high damage risk zone), as per the current seismic zonation map of India (IS 1893-2016): RA 2021 and have a zone factor of 0.24 for design basis earthquake. The region is surrounded by many in-homogeneities in the form of faults and ridges like Sohna Fault, Moradabad Fault, Delhi-Moradabad Fault, Delhi-Haridwar ridge, junction of Aravalli and Alluvium near Delhi. The Sohna fault line lies between the Delhi ridge and Sohna town and falls between the Arjangarh and

Manesar outcrops. All the developed area in Gurugram comes within 200 km of the fault line. The Sohna fault line is located at the junction between the hard rock terrain of the Aravalli hills and the sandy formation of the Yamuna River and is currently inactive from several years and is capable of a disastrous earthquake.

The project location has been marked in Fig.1 Seismic zone map of India.

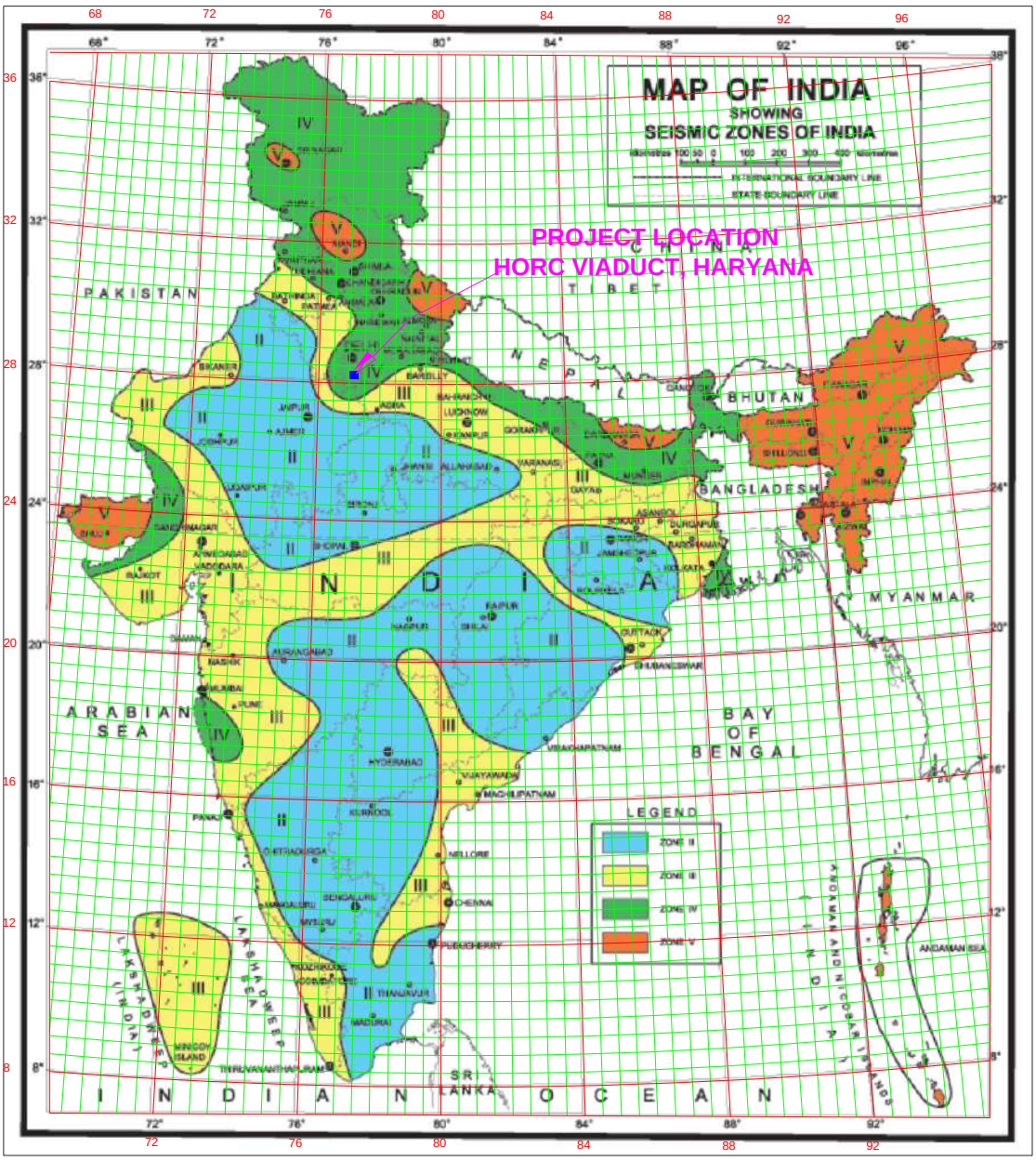


Fig.1: Seismic Zone Map of India

4. FIELD INVESTIGATION:

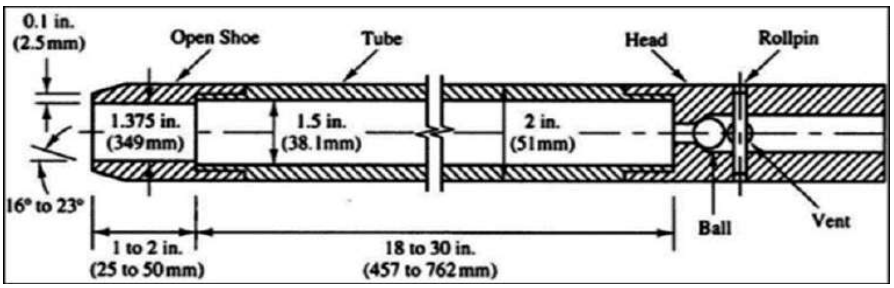
The field investigation work at this site was carried out from Sep 24th; 2023 to Sep 27th; 2023, Oct 15th; 2023 to Oct 22nd; 2023 & Nov 06th; 2023 to Nov 09th;

2023. The following investigation work was carried out:

4.1. **Eight number** of **boreholes** (marked as P24, P30, P32, P33, P34, P36, P39 & P40) of diameter 150 mm in soil were made within the proposed alignment for conducting Standard Penetration Test and collection of disturbed and undisturbed soil samples. The boreholes were progressed using power operated winch and hydraulic rig machine under **percussion** and **rotary** method of drilling respectively. Casing was used to keep the borehole stable, and Bentonite was also used as drilling mud to help prevent wall collapse of boreholes at deeper depth. The records of achieved depth of bore holes have been given in Para No. 6, the details of drilled bores along with depth of casing used have been reported in Appendix B. Locations of boreholes have been reported in "TEST LOCATION PLAN" in Appendix A.

4.2. **Standard Penetration Tests** were conducted at 1.00 to 2.00 metre interval upto the depth of 12.00 meter and 3.00 metre interval, beyond 12.00 metre depth, as per the procedure in IS: 2131-1981-(RA: 2021) in all the bore holes. The **standard SPT sampler** (without liner and with no space for liner) and **auto-trip and rope-pulley driven hammer** of standard weight of 63.50 kg have been used to perform the test.

For conducting the test, the bottom of the borehole was properly cleaned, and split spoon sampler was properly seated in position in the borehole. The split spoon sampler resting on the bottom of borehole was allowed to sink under its own weight; then the sampler was allowed to penetrate 15 cm with the blows of the hammer 63.50 kg weight falling free through 75cm, thereafter the split spoon sampler was further driven by another 15 cm. For the 3rd and final drive, the sampler was further allowed to penetrate 15 cm. The number of blows required to get each 15 cm of penetration, was recorded. The first 15 cm of drive is seating drive.



Structure of SPT Sampler

The total blows of penetration for the second and third 15 cm of penetration is

termed the penetration resistance N. The N' values are indicative of the compactness/ relative density of cohesion less soils and consistency of cohesive soils.

In case the blows count of SPT in soil (including the number of blows of seating) exceeds 100, the corresponding penetration was recorded and this particular test at that depth stopped. If the total penetration is more than the seating penetration of 15 cm, then breakup of blow counts for 15 cm seating penetration and for remaining portion of penetration is also given.

SPT 'N' values are correlated with non-cohesive stratum as per BS: 5930 (1999) – for sandy strata and with consistency of cohesive stratum.

Correlation For Clay/Plastic Silt		**Correlation For Sand/Non-Plastic Silt**	
Consistency of clays	**Penetration Value**	**Relative Density of sand**	**Penetration Value**
Very Soft	0 to 2 Blows	Very loose	0 to 4 Blows
Soft	3 to 4 Blows	Loose	5 to 10 Blows
Medium Stiff	5 to 8 Blows	Medium	11 to 30 Blows
Stiff	9 to 16 Blows	Dense	31 to 80 Blows
Very Stiff	17 to 32 Blows	Very Dense	Above 50
Hard	Above 32		

In this method, the sampler acts as a probe and the driving energy is supplied by the fall of the drop weight. The values of 'N' depend on the compactness or relative density of the material. In hard formations, the testing is discontinued if 'N' value is found to be more than 100. It is termed as 'Refusal'. Refusal is also recorded when SPT blow count records 50 or more for any of the single drive of 15 cm.

'N' value depends upon degree of saturation and over burden pressure of the formation. Silty fine sand and fine sand below the water table develop pore water pressure depending on the in-situ void ratio which in turn affects the effective stress. This change in effective stress influences the 'N' value considerably.

Depth of overburden affects the SPT values in none to low cohesive soils and hence need correction. The SPT value after the overburden correction, N' is as follows:

$$N' = 0.77x \log (2000/q) \times N$$

Where, q= Overburden Pressure (kN/m^2) and N = observed SPT value

N' is corrected further for dilatancy in case of saturated fine sands and silts for the values of N' greater than 15.

Modified value after dilatancy correction N" = 15+ (N'-15)/2

Soil samples obtained from split spoon sampler were collected in the polythene bags of suitable size. These samples were property sealed, labelled, and carefully transported to the laboratory for testing. The results have been reported in Table 1 to 8 of Appendix B under the title "SUMMARY OF TEST RESULTS".

4.3. **Disturbed soil samples** were collected at 0.50 metre, then at 1.00 to 2.00 metre interval upto the depth of 12.00 meter and 3.00 metre interval, beyond 12.00 metre depth and at significant change of stratum. Soil from cutting edge of SPT samplers and retained in split spoon, used for Standard Penetration Tests was taken as disturbed samples. These samples were placed without delay in adequately sealed polythene bags. Where the collection of disturbed soil samples could not be collected from SPT samples, Shelby tubes were driven and retained soil samples were obtained. The laboratory tests were conducted on the collected soil samples and reported in Table 1 to 8 of Appendix-B under the title "SUMMARY OF TEST RESULTS".

4.4. **Undisturbed soil samples** were collected in accordance with IS: 2132-1986-(RA: 2021) at an interval of 3.00 metre or at change of stratum, starting from the depth of 1.00 or 2.00 m, by using 100 mm dia. and 450 mm long MS tubes provided with sampler head with ball check arrangement. However, the some of the samples could not be extracted due to the partial penetration or slippage during the evacuation.

Moreover, collection of Undisturbed samples in very hard cohesive soils/ dense granular soils/gravels/ cobbles/ pebbles/ boulders, refusal strata is practically not possible and such collected samples will not truly represent the undisturbed conditions.

Immediately after taking undisturbed sample in the tube, the adopter head was removed along with the disturbed material. The visible ends of the samples shall then be trimmed off any wet disturbed soil. The ends will then be coated alternately with four layers of molten wax. More molten wax will then be added to give a total thickness

of not less than 25 mm. The laboratory test results have been reported in Table 1 to 8 of Appendix-B.

4.5. The **ground water table** in the borehole was allowed to stabilize and measured after 8, 16, 24 and 48 hours after completion of the bore hole. It was ensured that last two reading were identical. The records of ground water table have been given in Para No.6.

4.6. **Ground water samples** were collected from borehole as per IS: 6935-1973-(RA:2019) for chemical analysis to determine aggressiveness in relation to attack on concrete / reinforcement including determination of pH value.

5. LABORATORY TESTS:

The following laboratory tests were conducted to determine the engineering characteristics of sub-soils:

5.1. **Field moisture contents** were determined by oven drying method as per IS: 2720 (part II)-1973-(RA: 2020). The results have been reported in Table 1 to 8: "SUMMARY OF TEST RESULTS" of Appendix B.

5.2. **Bulk density** of soil strata was obtained using Shelby tubes in accordance with IS 2720 (part XXIX)-1975-(RA: 2020). The results have been reported in Table 1 to 8: "SUMMARY OF TEST RESULTS" of Appendix B.

5.3. **Mechanical sieve analysis** test was performed in accordance with IS: 2720 (Part IV) – 1985-(RA: 2020), for the purpose of identification by grain size analysis, on coarse part of the soil samples and the results have been reported in Table 1 to 8: "SUMMARY OF TEST RESULTS" of Appendix B.

5.4. **Particle size analysis** test by **Hydrometer method** were performed in accordance with IS: 2720 (Part IV) -1985-(RA: 2020) on the part of soil samples obtained after the sieve analysis. The results have been reported in Table 1 to 8: "SUMMARY OF TEST RESULTS" of Appendix B.

5.5. **Atterbergs' limits tests** were performed in accordance with IS: 2720 (part V)-1985-(RA: 2020) and results have been reported in Table 1 to 8: "SUMMARY OF TEST RESULTS" of Appendix B.

5.6. **Specific gravity tests** were performed in accordance with IS 2720 (part III-sec. 1) -1980-(RA: 2021) and the results have been reported in Table 1 to 8: "SUMMARY OF TEST RESULTS" of Appendix B.

5.7. **Consolidation tests** were performed on cohesive soil samples in accordance with IS: 2720 (part XV)-1965-(RA: 2021). The results have been reported in Table 1 to 8: "SUMMARY OF TEST RESULTS" of Appendix B.

5.8. **Direct shear tests** were performed as per IS: 2720 (part XIII)-1986-(RA: 2021), on the undisturbed soil samples obtained during the field investigation. The results and the density of samples have been reported in Table 1 to 8: "SUMMARY OF TEST RESULTS" of Appendix B.

5.9. **Tri-axial Compression Test** under Unconsolidated Un-drained (UU) condition as per IS: 2720 (Part-XI)-1993-(RA: 2021) were performed on the selected undisturbed soil samples, obtained during the field investigation. The results have been reported in Table 1 to 8: "SUMMARY OF TEST RESULTS" of Appendix B.

5.10. **Unconfined Compressive strength tests** were performed in accordance with IS 2720 (Part-X) -1991-(RA:2020) on selected undisturbed soil samples and the results have been reported in Table 11 of Appendix B.

5.11. **Shrinkage Limit tests** were performed in accordance with IS 2720 (part-VI) -1972-(RA: 2021) and the results have been reported in Table 1 to 8: "SUMMARY OF TEST RESULTS" of Appendix B.

5.12. **Free Swell Index** were performed in accordance with IS 2720 (part-XL) -1977-(RA: 2021) and the results have been reported in Table 1 to 8: "SUMMARY OF TEST RESULTS" of Appendix B.

5.13. **Chemical analysis on soil samples** was performed in accordance with IS: 2720 (Part-XXVI)-1987-(RA: 2021) for pH value, IS: 2720 (Part-XXVII)-1977-(RA: 2020) for Sulphate & BS:1377-3-2018 for chlorides and results have been reported in Table 9 "CHEMICAL TEST ON SOIL SAMPLES" of Appendix B.

5.14. **Chemical analysis on Ground Water sample** was performed in accordance with IS: 3025 (Part-XI)-2022 for pH value, IS: 3025 (Part-XXIV: Sec-1)-2022 for Sulphate & IS: 3025-(Part-XXXII)-1988-(RA: 2019) for chlorides and results have been reported in

Table 10 “CHEMICAL TEST ON GROUND WATER SAMPLES” of Appendix B.

6. GROUND WATER TABLE:

The water table at this site was encountered during the drilling operation up to the depth of investigation.

Borehole No.	Chainage	Global Co-ordinates (UTM format)		Reduced level (m)	Depth of Borehole (m)	Water table (m)
		Easting	Northing			
P24	21544.687	702009.821	3118982.298	192.043	40.00	1.40
P30	21701.887	701856.668	3119020.255	191.396	40.00	1.50
P32	21754.287	701806.797	3119037.179	191.328	40.00	1.30
P33	21780.487	701782.232	3119046.389	191.287	40.00	1.35
P34	21806.687	701757.766	3119056.154	191.452	40.00	1.40
P36	21859.087	701709.564	3119077.181	191.271	40.00	1.30
P39	21937.687	701638.957	3119112.511	191.204	40.00	1.30
P40	21963.887	701615.905	3119125.287	191.009	40.00	1.40

7. DESCRIPTION OF STRATA:

The classification of soil stratum has been done with the help of soil characteristics obtained in laboratory tests as per IS 1498-1970-(RA:2021). The classification of rock masses has been done based on RMR as per IS: 4464-1985, IS: 13365-1. The detailed nature of the strata has been reported in Table 1 to 8: “SUMMARY OF TEST RESULTS” of Appendix-B and represented through Lithological plots in Appendix-C.

The strata exhibited in the boreholes, is predominantly comprising of inorganic silty clays of low plasticity and inorganic silts of non to low plastic category. Silty sands were encountered at variable depth and thickness. Inorganic silts and silty clays of intermediate plasticity were also encountered at some depth and thickness in some of the bores.

8. SAFE BEARING CAPACITY COMPUTATIONS:

For the construction of viaducts, deep foundation **(Bored Cast-In-Situ RCC piles)** have been considered for computation of

load bearing capacity of the underlying soil strata. The computation of load bearing capacity of bored cast-in-situ RCC piles have been done as per IS 2911 (part-1, section-2)-2010-(RA: 2020) with due consideration of effects of liquefaction.

8.1. Design Parameters:

Factor of safety in compression	=	2.50
Factor of safety in tension	=	3.00
Depth of critical water table	=	0.00 m
Diameter of pile	=	1.00 & 1.20 m
Cut off length	=	2.50 m
Type of pile head consider	=	Fixed

8.2. Computation of friction along pile stem:

$$Q_{uf} = \sum K_i . P_{di} . \tan\delta_i . A_{si}$$

where,

Q_{uf} = Ultimate shaft friction (kN/m^2)

K_i = Coefficient of earth pressure at mid-depth of ith layer

P_{di} = Effective overburden pressure at mid-depth of ith layer (kN/m^2)

A_{si} = Surface area of pile stem in i^{th} layer (m^2)

δ_i = Angle of wall friction between pile and soil of ith layer (= ϕ) (degree)

ϕ_i = Angle of internal friction of soil in i^{th} layer (degree)

$\sum$ = Sum of all layers up to i^{th} layer

8.3. Computation of Cohesion along the stem of pile:

$$Q_{uc} = \sum \alpha_i . c_i . A_{si}$$

Where,

c_i = Cohesion in i^{th} layer

A_{si} = Surface area of pile stem in i^{th} layer (m^2)

α_i = Adhesion factor for i^{th} layer of soil depending of consistency of soils

$\sum$ = Sum of cohesion of all layers considered

8.4. Computation of end bearing resistance:

$$Q_{ub} = A_p (c.Nc + q.Nq + 0.5.\ \gamma.B.N\gamma)$$

Where,

A_p = Area of the pile toe (m^2)

c = cohesion of soils at pile toe (kN/m^2)

γ = Effective Unit weight of soils at pile toe (kN/m^3)

B = Diameter of pile (m)

q = Effective overburden pressure at pile toe (kN/m^2)

N_c = Bearing Capacity Factor (Recommended equal to 9)

$Nq, N\gamma$ = Bearing Capacity Factor

8.5. Lateral load capacity of piles in soils:

$$Q_u = 12.E.I.\delta/(L_1+L_f)^3$$

where,

Q_u = Ultimate lateral load capacity of pile (kN)

δ = Permissible deflection (m) = 1% of diameter of pile

E = Young Modulus of pile material (kN/m^2)

I = Moment of Inertia of the pile cross section (m^4)

L_1 = Cantilever Length of pile (m)

L_f = Length of fixity (m)

Detailed calculations of pile load carrying capacity in compression & uplift in soil have been reported in **Table-1 to 2** of **APPENDIX-H.**

Pile lateral Load capacity has been given in **Table-3 to 4** of **APPENDIX-H**.

9. LIQUEFACTION ANALYSIS:

Liquefaction is the sudden loss of shear strength of the loose fine sands due to earthquake-induced vibration under saturated conditions. Liquefaction generally takes place in loose fine sands (fines < 10 %, D_{60}= 0.20 mm to 1.0 mm and C_u between 2 to 5) with N value less than 15. In case of soil strata having N>15, liquefaction of soil will not take place normally.

The present site falls in **seismic zone – IV.** Considering the history of past earthquakes and available seismic data, an earthquake of **magnitude 7.0** having peak ground acceleration $\mathbf{a_{max}}$**= 0.24 g** is considered in the present analysis.

Preliminary assessment of liquefaction potential of foundation strata is made by simplified approach proposed by IS: 1893 (part-1)-2016-(RA: 2021) from the data obtained in Standard Penetration Test.

In this method, cyclic shear stress likely to be induced in the foundation strata by Design Basis Earthquake is first evaluated. Next threshold cyclic shear stress, which is good enough to cause liquefaction, is determined from SPT data and the empirical relations. Finally, comparison of these two stresses is used in the estimation of liquefaction susceptibility of the foundation strata.

Cyclic Stress Ratio (CSR):

The equivalent average of shear stress likely to be induced in the foundation material due to an earthquake is calculated by using the equations.

Cyclic Resistance Ratio (CRR):

It expresses capacity of soil to resist liquefaction. CRR is determined using correlation between corrected blow count $(N_1)_{60}$ and CRR for earthquake of magnitude 7.5. $(N_1)_{60}$ is the SPT blow count corrected to an effective overburden pressure of 100 kPa and to hammer energy efficiency of 60 %.

Following variable have been adopted in calculation of N_{60} (SPT value for 60% efficiency)

Energy correction to SPT values:

C_{60} = 1.00 (energy efficiency factor)

Design Earthquake Base:

Earthquake zone	= IV
Magnitude of earthquake	= 7
Seismic Zone factor	= 0.24

Status of Liquefaction:

The value of CSR and CRR are computed at different depth and then the ratio of CRR to CSR to get the factor of safety towards the susceptibility of the

stratum towards liquefaction potential.

If factor of safety:

< 1.00 : Stratum is to be considered as liquefiable.

> 1.20 : Non-Liquefiable

The detailed calculations of liquefaction have been reported in **Table-5** of **APPENDIX-H.**

10. RECOMMENDATIONS:

Keeping in mind, the field test results, laboratory test results and IS codes of practice the following recommendations are hereby made:

10.1. **Bored Cast-In-Situ RCC Piles** of diameter 1000 and 1200 mm have been adopted for SBC computations of foundation for Viaduct.

10.2. **Cut off length** of piles have been considered as 2.50 m from the existing ground level for the purpose of computation of SBC.

10.3. **Pile length** recommended in the table below, shall be measured **after the cut-off depth.**

10.4. **Allowable load carrying capacity** of pile corresponding to the length and diameter of pile shall be read from the tables below:

10.4.1. For Pile diameter = 1000 mm

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
P24	25.00	2350	1750	55
	27.50	2600	2050	
	30.00	2900	2300	
	32.50	3600	2500	
	35.00	4350	2750	
P30	25.00	1700	1350	30
	27.50	1950	1500	
	30.00	2150	1700	

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
	32.50	2350	1900	
	35.00	2600	2050	
P32	25.00	2150	1700	40
	27.50	2400	1900	
	30.00	2600	2100	
	32.50	2850	2300	
	35.00	3100	2500	
P33	25.00	2300	1750	65
	27.50	2600	2000	
	30.00	2850	2250	
	32.50	3100	2500	
	35.00	3350	2700	
P34	25.00	2200	1700	105
	27.50	2450	1950	
	30.00	2800	2200	
	32.50	2950	2400	
	35.00	3150	2600	
P36	25.00	2450	1900	140
	27.50	2750	2150	
	30.00	3150	2350	
	32.50	3300	2600	
	35.00	3650	2850	
P39	25.00	2050	1600	35
	27.50	2200	1750	
	30.00	2750	1950	
	32.50	2650	2100	
	35.00	2900	2300	
P40	25.00	2000	1550	30
	27.50	2350	1750	
	30.00	3000	2000	

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
	32.50	3050	2200	
	35.00	2950	2350	

** Indicates Grade of Concrete*

10.4.2. For Pile diameter = 1200 mm

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
P24	25.00	3100	2250	85
	27.50	3450	2600	
	30.00	3800	2900	
	32.50	4950	3200	
	35.00	6250	3550	
P30	25.00	2300	1750	45
	27.50	2600	1950	
	30.00	2850	2250	
	32.50	3150	2500	
	35.00	3450	2700	
P32	25.00	2800	2150	65
	27.50	3100	2400	
	30.00	3350	2650	
	32.50	3700	2900	
	35.00	4000	3200	
P33	25.00	2950	2200	100
	27.50	3350	2500	
	30.00	3700	2850	
	32.50	4000	3150	
	35.00	4250	3400	
P34	25.00	2850	2150	150
	27.50	3150	2450	

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
	30.00	3700	2800	
	32.50	3850	3100	
	35.00	4150	3350	
P36	25.00	3150	2400	190
	27.50	3550	2700	
	30.00	4100	3000	
	32.50	4300	3300	
	35.00	4750	3650	
P39	25.00	2650	2050	55
	27.50	2850	2250	
	30.00	3800	2500	
	32.50	3500	2800	
	35.00	3850	3050	
P40	25.00	2600	2000	50
	27.50	3100	2250	
	30.00	4250	2600	
	32.50	4300	2900	
	35.00	3950	3150	

***** *Indicates Grade of Concrete*

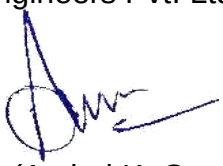
10.5. Liquefaction Potential: All the bore holes have been analysed for Liquefaction potential as per IS: 1893 (part-1)-2016-(RA: 2021) with Seismic Zone IV, earthquake intensity of 7.0 on Richter scale and critical ground water table at existing ground level. Out of which several boreholes show the potential at various depths mentioned in the table below:

Bore No.	Liquefiable depth zone (meter)
P24	Top 1.00 & 6.00 to 7.00
P30	Top to 10.00
P32	Top 1.00 & 2.00 to 8.00

Bore No.	Liquefiable depth zone (meter)
P33	Top 6.00
P34	Top 4.00
P36	1.00 to 3.00
P39	Top 9.00
P40	Top 1.00, 5.00 to 6.00 & 8.00 to 9.00

10.6. Type of cement to be used: Harmful chemical contents in the soil samples are within the permissible limit. So, Ordinary Portland Cement or Portland Pozzolana Cement may be used for all civil constructions.

for Techpro Engineers Pvt. Ltd.



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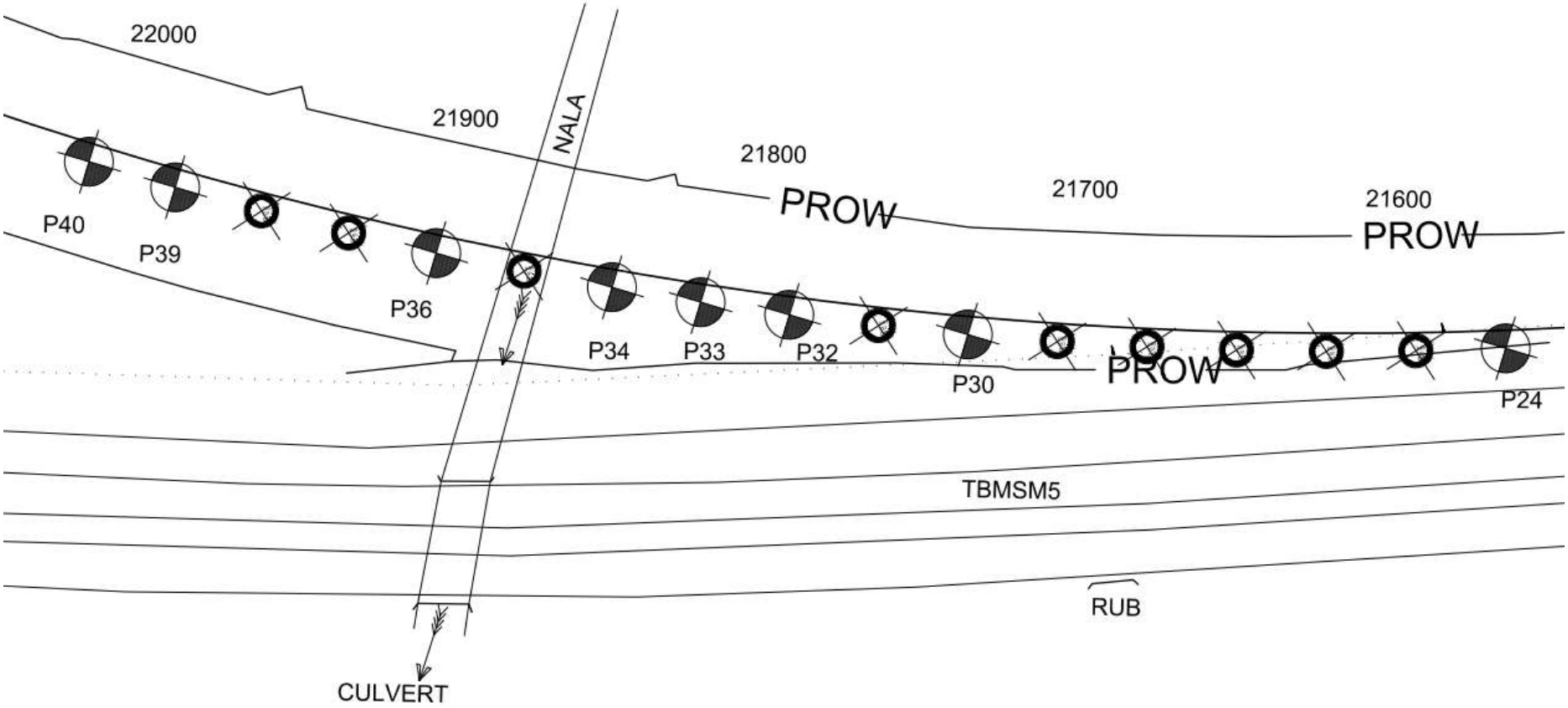
APPENDIX-A
TEST LOCATION PLAN



APPENDIX "B"
TABLE 1: SUMMARY OF TEST RESULTS

Bore No: P24	**Ground Elevation: RL 192.043 m**	**Method of drilling: Percussion**	**Depth of Water: 1.40 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 24/09/2023**	**SPT Sampler: Standard**
Location / Chainage: 21544.687	**Casing Lowered: 19.00 m**	**Ending Date: 27/09/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	ML	0	0	2	34	64	0	10.85	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	1.00	D	2	1	2	2	4	6.10	CL-ML	3	2	1	22	65	7	21.40	-	-	26.0	20.0	6.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	2.00	U	3	-	-	-	-	-	CL	10	1	4	33	44	8	20.41	2.10	1.74	29.0	19.0	10.0	2.68	UU	51.0	7.5	-	0.540	-	8	19	-	Inorganic clays of low plasticity											
	3.00	D	4	5	6	8	14	16.29	SM	4	1	3	66	26	0	22.82	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	4.00	D	5	6	8	10	18	18.17	-	-	-	-	-	-	-	22.09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	5.00	D	6	-	-	-	-	-	-	-	-	-	-	-	-	23.44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Silty Sands											
	6.00	D	7	3	5	7	12	13.15	SM	2	1	4	70	23	0	21.57	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	7.00	D	8	4	7	12	19	17.55	-	-	-	-	-	-	-	26.40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	8.00	U	9	-	-	-	-	-	SP-ML	0	0	0	90	10	0	24.78	1.90	1.52	Non-Plastic			2.65	DST	2.0	28.0	-	0.743	-	-	-	-	Poorly Graded Sands with inorganic Silts of low plasticity											
	9.00	D	10	5	9	14	23	18.93	-	-	-	-	-	-	-	26.10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	10.00	D	11	6	10	16	26	20.06	SM	0	0	0	87	13	0	23.88	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	11.00	U	12	-	-	-	-	-	-	-	-	-	-	-	-	26.75	1.91	1.51	-	-	-	-	-	-	-	-	-	-	-	-	-	Silty Sands											
	12.50	D	13	6	11	17	28	20.15	-	-	-	-	-	-	-	28.45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	14.00	U	14	-	-	-	-	-	CL-ML	1	1	2	21	68	7	19.75	2.10	1.75	24.0	18.0	6.0	-	DST	14.0	26.5	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	15.50	D	15	4	8	10	18	14.94	ML	2	2	2	28	61	5	21.10	-	-	23.0	19.0	4.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	17.00	U	16	-	-	-	-	-	CL	4	1	4	30	48	13	21.94	2.09	1.71	27.5	18.0	9.5	2.67	UU	45.0	14.6	-	0.561	-	8	19	-	Inorganic clays of low plasticity											

APPENDIX "B"
TABLE 1: SUMMARY OF TEST RESULTS

Bore No: P24	Ground Elevation: RL 192.043 m	Method of drilling: Percussion	Depth of Water: 1.40 m
Diameter of Bore Hole: 150 mm	Bore Retained using: Casing	Starting Date: 24/09/2023	SPT Sampler: Standard
Location / Chainage: 21544.687	Casing Lowered: 19.00 m	Ending Date: 27/09/2023	Hammer type: Auto-trip

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	18.50	D	17	5	10	12	22	22.00	-	-	-	-	-	-	-	16.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	20.00	U	18	-	-	-	-	-	CL	6	4	3	30	46	11	18.52	2.09	1.76	26.0	18.0	8.0	-	-	-	-	-	-	-	-	-	-												
	21.50	D	19	8	15	20	35	35.00	-	-	-	-	-	-	-	14.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	23.00	U	20	-	-	-	-	-	CL	9	1	2	9	70	9	19.01	2.02	1.70	30.0	21.0	9.0	2.67	UU	44.0	11.1	0.140	0.571	-	8	17	-												
	24.50	D	21	9	16	16	32	32.00	-	-	-	-	-	-	-	16.14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	26.00	U	22	-	-	-	-	-	CI	7	2	1	11	64	15	21.12	2.03	1.68	36.0	20.5	15.5	2.68	-	-	-	-	0.595	-	8	17	-	Inorganic clays of Intermediate plasticity											
	27.50	D	23	10	18	20	38	38.00	-	-	-	-	-	-	-	21.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	29.00	U	24	-	-	-	-	-	CL	3	2	5	21	57	12	18.13	1.91	1.62	31.0	18.5	12.5	-	UU	54.0	13.3	-	-	-	17	14	-	Inorganic clays of low plasticity											
	30.50	D	25	10	15	18	33	33.00	-	-	-	-	-	-	-	19.83	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	32.00	D	26	-	-	-	-	-	CL	7	2	2	15	63	11	17.31	-	-	30.0	18.0	12.0	-	-	-	-	-	-	-	-	-	-												
	33.50	D	27	11	18	21	39	39.00	-	-	-	-	-	-	-	18.29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	35.00	D	28	-	-	-	-	-	SM	0	0	1	62	37	0	18.94	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	36.50	D	29	12	14	22	36	17.54	SM	0	0	1	83	16	0	23.66	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	38.00	D	30	-	-	-	-	-	-	-	-	-	-	-	-	25.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	40.00	D	31	17	24	45	69	25.84	-	-	-	-	-	-	-	17.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 2: SUMMARY OF TEST RESULTS

Bore No: P30	**Ground Elevation: RL 191.396 m**	**Method of drilling: Percussion**	**Depth of Water: 1.50 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 25/09/2023**	**SPT Sampler: Standard**
Location / Chainage: 21701.887	**Casing Lowered: 25.00 m**	**Ending Date: 27/09/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen												
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	0.50	D	1	-	-	-	-	-	SM	0	0	0	68	32	0	17.34	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	1.00	U	2	-	-	-	-	-	SM	0	0	0	70	30	0	21.46	1.80	1.48	Non-Plastic			-	DST	12.0	27.2	-	-	-	-	-	-											
	2.00	D	3	2	2	3	5	6.97	-	-	-	-	-	-	-	24.70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	3.00	D	4	3	4	5	9	11.86	-	-	-	-	-	-	-	25.56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	4.00	U	5	-	-	-	-	-	SM	0	1	0	86	13	0	27.71	1.92	1.50	Non-Plastic			-	DST	9.0	28.3	-	-	-	-	-	-											
	5.00	D	6	4	5	6	11	13.07	-	-	-	-	-	-	-	28.32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	6.00	D	7	3	5	7	12	13.66	SM	0	1	1	85	13	0	25.04	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-											
	7.00	D	8	-	-	-	-	-	-	-	-	-	-	-	-	27.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	8.00	D	9	4	6	8	14	14.74	-	-	-	-	-	-	-	27.15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	9.00	D	10	5	7	9	16	15.60	SM	0	1	2	82	15	0	28.54	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-											
	10.00	U	11	-	-	-	-	-	CL	8	4	7	15	54	12	20.27	2.10	1.75	29.5	20.0	9.5	2.67	UU	40.0	10.6	-	0.526	-	0	18	-	Inorganic clays of low plasticity										
	11.00	D	12	4	7	8	15	15.00	-	-	-	-	-	-	-	21.92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	12.00	D	13	4	8	9	17	17.00	-	-	-	-	-	-	-	18.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	13.00	U	14	-	-	-	-	-	CL	1	4	1	18	67	9	20.36	2.15	1.79	27.0	19.0	8.0	-	-	-	-	0.146	-	-	8	15	-											
	14.50	D	15	4	9	12	21	21.00	-	-	-	-	-	-	-	18.77	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	16.00	U	16	-	-	-	-	-	CL	3	2	3	16	64	12	19.34	2.14	1.79	29.0	18.0	11.0	-	UU	45.0	11.2	-	-	-	-	-	-											
	17.50	D	17	6	9	13	22	22.00	-	-	-	-	-	-	-	18.65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											

APPENDIX "B"
TABLE 2: SUMMARY OF TEST RESULTS

Bore No: P30	**Ground Elevation: RL 191.396 m**	**Method of drilling: Percussion**	**Depth of Water: 1.50 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 25/09/2023**	**SPT Sampler: Standard**
Location / Chainage: 21701.887	**Casing Lowered: 25.00 m**	**Ending Date: 27/09/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen													
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	19.00	U	18	-	-	-	-	-	SM-SC	2	1	3	45	44	5	17.47	2.07	1.76	25.5	20.0	5.5	2.66	DST	10.0	24.3	-	0.511	-	-	16	-	Silty Sands with clay binder										
	20.50	D	19	7	11	15	26	26.00	CL	0	1	2	28	61	8	16.98	-	-	26.0	18.0	8.0	-	-	-	-	-	-	-	-	-	-											
	22.00	D	20	-	-	-	-	-	-	-	-	-	-	-	-	19.86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	23.50	D	21	6	10	13	23	23.00	-	-	-	-	-	-	-	18.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	25.00	U	22	-	-	-	-	-	CL	1	1	3	13	68	14	26.47	2.18	1.72	34.0	21.5	12.5	2.67	UU	41.0	8.6	-	0.552	-	0	17	-	Inorganic clays of low plasticity										
	26.50	D	23	5	9	13	22	22.00	-	-	-	-	-	-	-	23.86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	28.00	D	24	-	-	-	-	-	CL	2	1	4	15	66	12	20.72	-	-	31.0	20.5	10.5	-	-	-	-	-	-	-	-	-	-											
	29.50	D	25	6	11	15	26	26.00	-	-	-	-	-	-	-	16.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	31.00	U	26	-	-	-	-	-	CL-ML	5	2	2	34	52	5	28.46	1.93	1.50	25.0	19.0	6.0	-	DST	5.0	27.8	-	-	-	8	-	-	Inorganic Silty Clays of low plasticity										
	32.50	D	27	8	14	18	32	32.00	CL	0	0	1	16	71	12	15.94	-	-	31.0	19.0	12.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	34.00	D	28	-	-	-	-	-	-	-	-	-	-	-	-	16.84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	35.50	D	29	9	18	22	40	18.63	CL-ML	4	1	1	18	71	5	20.07	-	-	24.0	19.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	37.00	D	30	-	-	-	-	-	CL	0	1	1	12	72	14	21.46	-	-	32.0	18.0	14.0	-	-	-	-	-	-	-	-	-	-											
	38.50	D	31	10	20	30	50	50.00	CL	5	4	3	20	56	12	24.79	-	-	28.5	19.5	9.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	40.00	D	32	11	23	36	59	59.00	-	-	-	-	-	-	-	14.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 3: SUMMARY OF TEST RESULTS

Bore No : P32	**Ground Elevation : RL 191.328 m**	**Method of drilling :Rotary**	**Depth of Water : 1.30 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 06/11/2023**	**SPT Sampler: Standard**
Location / Chainage : 21754.287	**Casing Lowered : 0.00 m**	**Ending Date : 09/11/2023**	**Hammer type: Rope-pulley**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	SM	0	0	1	55	44	0	5.80	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	1.00	U	2	-	-	-	-	-	CL-ML	2	1	1	38	51	7	10.99	1.97	1.78	26.0	20.5	5.5	2.66	DST	5.0	25.2	-	0.499	-	-	-	-	Inorganic Silty Clays of low plasticity											
	2.00	D	3	1	2	2	4	5.51	SM	0	0	0	76	24	0	25.30	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	3.00	D	4	2	2	3	5	6.46	-	-	-	-	-	-	-	23.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	4.00	D	5	-	-	-	-	-	SM	4	0	0	65	31	0	20.42	1.94	1.61	Non-Plastic			2.62	DST	0.0	28.2	-	0.627	-	-	-	-												
	5.00	D	6	3	3	4	7	8.17	SM-SC	3	3	4	42	43	5	15.91	-	-	25.0	21.0	4.0	-	-	-	-	-	-	-	-	-	-	Silty Sands with clay binder											
	6.00	D	7	3	4	5	9	10.08	SM	0	0	1	77	22	0	23.35	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	7.00	D	8	-	-	-	-	-	-	-	-	-	-	-	-	21.25	1.96	1.62	-	-	-	-	RDST	0.0	28.5	-	-	-	-	-	-												
	8.00	D	9	4	6	7	13	13.50	CL-ML	2	1	1	24	66	6	17.61	-	-	27.0	21.5	5.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	9.00	D	10	5	8	9	17	16.04	-	-	-	-	-	-	-	16.90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	10.00	U	11	-	-	-	-	-	CL	4	2	2	11	70	11	18.31	2.04	1.72	28.0	19.0	9.0	2.68	UU	54.0	11.6	0.141	0.555	-	8	16	-	Inorganic clays of low plasticity											
	11.00	D	12	5	8	10	18	18.00	-	-	-	-	-	-	-	19.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	12.00	D	13	6	10	12	22	22.00	-	-	-	-	-	-	-	19.78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	13.00	D	15	-	-	-	-	-	SM	0	0	0	56	44	0	18.51	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	14.50	D	16	8	14	22	36	22.86	-	-	-	-	-	-	-	16.62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	16.00	U	17	-	-	-	-	-	CL	3	2	2	18	65	10	21.54	2.02	1.66	28.0	20.5	7.5	2.68	UU	51.0	10.4	-	0.614	-	10	18	-	Inorganic clays of low plasticity											
	17.50	D	18	5	9	10	19	19.00	-	-	-	-	-	-	-	18.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

APPENDIX "B"
TABLE 3: SUMMARY OF TEST RESULTS

Bore No : P32	**Ground Elevation : RL 191.328 m**	**Method of drilling :Rotary**	**Depth of Water : 1.30 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 06/11/2023**	**SPT Sampler: Standard**
Location / Chainage : 21754.287	**Casing Lowered : 0.00 m**	**Ending Date : 09/11/2023**	**Hammer type: Rope-pulley**

FIELD TEST RESULT										LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen												
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL												
	19.00	U	19	-	-	-	-	-	CL-ML	4	1	0	28	60	7	21.18	2.00	1.65	26.0	20.0	6.0	2.66	DST	12.0	24.0	-	0.612	-	-	-	-	Inorganic Silty Clays of low plasticity												
	20.50	D	20	11	18	20	38	38.00	CL	0	1	0	12	76	11	18.63	-	-	29.0	21.0	8.0	-	-	-	-	-	-	-	-	-	-													
	22.00	U	21	-	-	-	-	-	CL	2	1	2	8	74	13	18.70	2.04	1.72	33.0	20.0	13.0	2.68	UU	62.0	9.3	-	0.558	-	-	-	-													
	23.50	D	22	27	35	40	75	75.00	-	-	-	-	-	-	-	19.43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-													
	25.00	D	23	17	28	35	63	63.00	-	-	-	-	-	-	-	17.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity												
	26.50	D	24	21	32	39	71	71.00	CL	2	1	1	6	78	12	16.16	-	-	30.0	19.5	10.5	-	-	-	-	-	-	-	-	-	-													
	28.00	D	25	19	35	40	75	75.00	CL	4	0	1	6	76	13	18.11	-	-	32.0	21.5	10.5	2.68	-	-	-	-	-	-	-	-	-													
	29.50	D	26	14	25	37	62	62.00	-	-	-	-	-	-	-	17.83	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-													
	31.00	D	27	20	42	60	R	-	CL-ML	0	0	1	10	81	8	23.33	-	-	27.0	20.5	6.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity												
	32.50	D	28	21	45	50	95	95.00	CL	4	1	1	8	76	10	15.86	-	-	28.0	20.5	7.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity												
	34.00	D	29	32	48	55	R	-	ML	0	0	1	22	72	5	19.58	-	-	27.0	22.0	5.0	2.66	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity												
	35.50	D	30	22	40	47	87	87.00	CL	1	1	0	5	80	13	17.41	-	-	31.0	21.0	10.0	-	-	-	-	-	-	-	-	-	-													
	37.00	D	31	25	43	48	91	91.00	-	-	-	-	-	-	-	19.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity												
	38.50	D	32	27	38	45	83	83.00	CL	1	1	2	10	75	11	17.66	-	-	30.0	20.5	9.5	-	-	-	-	-	-	-	-	-	-													
	40.00	D	33	14	19	37	56	56.00	-	-	-	-	-	-	-	20.57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-													

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 4: SUMMARY OF TEST RESULTS

Bore No : P33	**Ground Elevation : RL 191.287m**	**Method of drilling :Rotary**	**Depth of Water : 1.35 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 06/11/2023**	**SPT Sampler: Standard**
Location / Chainage : 21780.487	**Casing Lowered : 0.00 m**	**Ending Date : 08/11/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.00	D	1	-	-	-	-	-	CL-ML	0	0	1	46	47	6	11.63	-	-	26.0	20.5	5.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	1.00	U	2	-	-	-	-	-	CL-ML	0	0	0	44	49	7	13.09	1.98	1.75	27.0	21.0	6.0	2.66	DST	8.0	25.5	-	0.520	-	-	-	-												
	2.00	D	3	2	2	3	5	6.86	SM	0	0	1	55	44	0	19.27	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	3.00	D	4	2	3	4	7	9.00	-	-	-	-	-	-	-	21.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	4.00	U	5	-	-	-	-	-	SM	0	0	1	62	37	0	19.07	1.95	1.64	Non-Plastic			2.61	DST	0.0	28.6	-	0.591	-	-	-	-												
	5.00	D	6	3	4	6	10	11.62	-	-	-	-	-	-	-	26.78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	6.00	D	7	4	5	7	12	13.37	-	-	-	-	-	-	-	27.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	7.00	U	8	-	-	-	-	-	SM	0	0	0	70	30	0	24.71	1.95	1.56	Non-Plastic			2.61	DST	0.0	29.3	-	0.673	-	-	-	-												
	8.00	D	9	5	6	8	14	14.50	-	-	-	-	-	-	-	25.45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	9.00	D	10	4	9	11	20	20.00	CL	3	2	1	7	79	8	17.42	-	-	28.0	20.5	7.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	10.00	U	11	-	-	-	-	-	CL	4	1	1	9	74	11	13.73	2.02	1.78	29.0	21.0	8.0	2.67	UU	56.0	12.2	0.148	0.500	-	6	17	-												
	11.00	D	12	11	14	16	30	21.60	SM-SC	1	1	0	52	42	4	16.18	-	-	24.0	19.0	5.0	-	-	-	-	-	-	-	-	-	-	Silty Sands with clay binder											
	12.00	D	13	9	12	17	29	20.73	SM	0	0	1	55	44	0	16.46	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	13.00	U	14	-	-	-	-	-	CL	3	2	1	8	74	12	22.84	2.04	1.66	30.0	21.0	9.0	2.68	UU	59.0	8.6	-	0.614	-	-	-	-	Inorganic clays of low plasticity											
	14.50	D	15	11	15	17	32	32.00	-	-	-	-	-	-	-	21.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	16.00	U	16	-	-	-	-	-	CL	3	2	0	7	75	13	18.44	2.06	1.74	30.0	19.0	11.0	2.68	UU	62.0	10.3	-	0.540	-	10	16	-												
	17.50	D	17	13	17	22	39	39.00	-	-	-	-	-	-	-	19.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

APPENDIX "B"
TABLE 4: SUMMARY OF TEST RESULTS

Bore No : P33	**Ground Elevation : RL 191.287m**	**Method of drilling :Rotary**	**Depth of Water : 1.35 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 06/11/2023**	**SPT Sampler: Standard**
Location / Chainage : 21780.487	**Casing Lowered : 0.00 m**	**Ending Date : 08/11/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	19.00	U	18	-	-	-	-	-	CL	0	0	1	6	79	14	16.01	2.04	1.76	33.0	21.0	12.0	2.69	UU	65.0	11.6	-	0.528	-	-	-	-	Inorganic clays of low plasticity											
	20.50	D	19	15	19	23	42	42.00	-	-	-	-	-	-	-	14.28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	22.00	U	20	-	-	-	-	-	CL-ML	2	0	1	44	49	4	19.10	1.97	1.65	24.0	19.5	4.5	2.66	DST	8.0	25.2	-	0.612	-	-	-	-	Inorganic Silty Clays of low plasticity											
	23.50	D	21	32	43	45	88	88.00	CL	3	2	2	9	73	11	19.26	-	-	29.0	20.5	8.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	25.00	D	22	12	35	40	75	75.00	-	-	-	-	-	-	-	16.98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	26.50	D	23	25	38	42	80	80.00	-	-	-	-	-	-	-	17.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	28.00	D	24	27	42	45	87	87.00	CL-CI	4	2	0	6	74	14	21.63	-	-	35.0	21.5	13.5	-	-	-	-	-	-	-	-	-	-	Inorganic Clays of low to Intermediate plasticity											
	29.50	D	25	32	45	56	R	-	-	-	-	-	-	-	-	17.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	31.00	D	26	24	32	50	82	82.00	-	-	-	-	-	-	-	18.59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	32.50	D	27	23	35	55	90	90.00	CL	4	2	1	16	66	11	18.51	-	-	31.0	21.5	9.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	34.00	D	28	25	38	60	98	98.00	-	-	-	-	-	-	-	18.44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	35.50	D	29	21	35	37	72	72.00	CL	4	1	0	12	75	8	16.53	-	-	29.0	21.5	7.5	-	-	-	-	-	-	-	-	-	-												
	37.00	D	30	26	38	50	88	88.00	CL	2	1	1	6	77	13	19.23	-	-	32.0	20.0	12.0	-	-	-	-	-	-	-	-	-	-												
	38.50	D	31	30	42	58	R	-	-	-	-	-	-	-	-	12.97	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	40.00	D	32	29	43	53	96	96.00	CL	1	1	2	12	74	10	21.70	-	-	30.0	20.5	9.5	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 5: SUMMARY OF TEST RESULTS

Bore No : P34	**Ground Elevation : RL 191.452 m**	**Method of drilling :Rotary**	**Depth of Water : 1.40 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 06/11/2023**	**SPT Sampler: Standard**
Location / Chainage : 21806.687	**Casing Lowered : 0.00 m**	**Ending Date : 08/11/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion C (kN/m2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	SM	0	0	1	52	47	0	23.24	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	1.00	D	2	1	1	2	3	4.64	SM-SC	1	0	1	48	45	5	16.32	-	-	25.0	20.5	4.5	-	-	-	-	-	-	-	-	-	-	Silty Sands with clay binder											
	2.00	U	3	-	-	-	-	-	-	-	-	-	-	-	-	15.88	1.96	1.69	-	-	-	2.66	DST	6.0	26.7	-	0.574	-	-	-	-												
	3.00	D	4	2	2	4	6	7.72	ML	3	1	1	44	51	0	20.01	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	4.00	D	5	3	6	8	14	16.03	SM	0	0	0	70	30	0	25.69	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	5.00	U	6	-	-	-	-	-	SM	6	2	3	65	24	0	21.35	1.93	1.59	Non-Plastic			2.61	RDST	0.0	30.8	-	0.642	-	-	-	-												
	6.00	D	7	3	7	11	18	17.55	SM	0	2	3	75	20	0	23.73	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	7.00	D	8	5	11	12	23	19.87	SM	0	0	0	55	45	0	19.54	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	8.00	U	9	-	-	-	-	-	ML	0	0	1	48	51	0	17.54	1.97	1.68	Non-Plastic			2.65	DST	7.0	25.8	-	0.577	-	-	-	-	Inorganic Silts of low plasticity											
	9.00	D	10	4	7	8	15	15.02	SM	2	0	0	54	44	0	18.10	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	10.00	D	11	6	8	12	20	17.22	-	-	-	-	-	-	-	18.81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	11.00	U	12	-	-	-	-	-	SM	0	0	1	53	46	0	17.43	1.95	1.66	Non-Plastic			2.65	DST	9.0	26.2	-	0.596	-	-	-	-												
	12.50	D	13	5	9	10	19	19.00	CL	0	0	1	5	81	13	20.88	-	-	32.0	21.5	10.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	14.00	U	14	-	-	-	-	-	CL	1	1	0	6	81	11	22.21	2.04	1.67	30.0	20.5	9.5	2.67	UU	55.0	9.5	-	0.599	-	0	17	-												
	15.50	D	15	4	5	7	12	12.00	-	-	-	-	-	-	-	21.30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	17.00	D	16	-	-	-	-	-	-	-	-	-	-	-	-	19.41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	18.50	D	17	6	8	13	21	21.00	CL	0	1	1	7	79	12	19.07	-	-	32.0	21.5	10.5	-	-	-	-	-	-	-	-	-	-												

APPENDIX "B"
TABLE 5: SUMMARY OF TEST RESULTS

Bore No : P34	Ground Elevation : RL 191.452 m	Method of drilling :Rotary	Depth of Water : 1.40 m
Diameter of Bore Hole : 150 mm	Bore Retained using : Casing	Starting Date : 06/11/2023	SPT Sampler: Standard
Location / Chainage : 21806.687	Casing Lowered : 0.00 m	Ending Date : 08/11/2023	Hammer type: Auto-trip

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion C (kN/m2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	20.00	U	18	-	-	-	-	-	CL	7	2	3	8	69	11	17.16	2.06	1.76	30.0	20.5	9.5	2.67	UU	58.0	11.5	-	0.517	-	8	17	-	Inorganic clays of low plasticity											
	21.50	D	19	8	16	14	30	30.00	-	-	-	-	-	-	-	19.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	23.00	U	20	-	-	-	-	-	CL	2	0	1	5	79	13	21.33	2.01	1.66	32.0	21.0	11.0	2.68	UU	62.0	8.2	-	0.614	-	-	-	-												
	24.50	D	21	11	17	21	38	38.00	-	-	-	-	-	-	-	16.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	26.00	D	22	-	-	-	-	-	-	-	-	-	-	-	-	19.43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	27.50	D	23	14	22	25	47	47.00	CL	1	1	0	6	80	12	20.51	-	-	30.0	20.5	9.5	-	-	-	-	-	-	-	-	-	-												
	29.00	D	24	-	-	-	-	-	-	-	-	-	-	-	-	18.99	2.06	1.73	-	-	-	2.67	RUU	59.0	9.1	-	0.543	-	-	-	-												
	30.50	D	25	17	32	39	71	29.18	SM	0	0	0	64	36	0	16.69	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	32.00	D	26	18	34	41	75	29.80	CL-ML	3	0	2	34	56	5	18.52	-	-	25.0	20.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	33.50	D	27	15	30	38	68	27.25	-	-	-	-	-	-	-	21.39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	35.00	D	28	11	20	35	55	23.12	CL-ML	1	0	1	22	70	6	19.59	-	-	27.0	21.5	5.5	-	-	-	-	-	-	-	-	-	-												
	36.50	D	29	13	24	28	52	21.95	-	-	-	-	-	-	-	19.82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	38.00	D	30	16	29	36	65	65.00	CL	2	1	1	12	75	9	19.04	-	-	28.0	20.5	7.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	40.00	D	31	15	22	31	53	53.00	-	-	-	-	-	-	-	23.44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, '-' indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 6: SUMMARY OF TEST RESULTS

Bore No: P36	**Ground Elevation: RL 191.271 m**	**Method of drilling: Percussion**	**Depth of Water: 1.30 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 15/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 21859.087	**Casing Lowered: 22.00 m**	**Ending Date: 17/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen												
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	0.50	D	1	-	-	-	-	-	CL-ML	0	0	1	42	51	6	12.41	-	-	26.5	21.5	5.0	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	1.00	U	2	-	-	-	-	-	SM	1	0	0	58	41	0	17.43	2.04	1.74	Non-Plastic			2.65	DST	0.0	25.9	-	-	-	-	-	-	Silty Sands										
	2.00	D	3	2	3	3	6	8.18	SM-SC	1	1	2	46	43	7	19.33	-	-	27.0	21.5	5.5	-	-	-	-	-	-	-	-	-	-	Silty Sands with clay binder										
	3.00	D	4	3	5	5	10	12.74	SM	2	1	0	57	40	0	22.55	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	4.00	U	5	-	-	-	-	-	SM	3	0	0	59	38	0	27.83	2.07	1.62	Non-Plastic			2.62	DST	0.0	29.5	-	0.617	-	-	-	-											
	5.00	D	6	4	7	9	16	16.64	SM	0	0	0	76	24	0	26.28	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-											
	6.00	D	7	3	9	13	22	19.51	-	-	-	-	-	-	-	25.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	7.00	U	8	-	-	-	-	-	-	-	-	-	-	-	-	24.15	2.05	1.65	-	-	-	-	-	-	-	-	-	-	-	-	-											
	8.00	D	9	3	6	11	17	16.09	CL-ML	1	1	0	18	74	6	17.92	-	-	26.0	20.0	6.0	2.63	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	9.00	D	10	5	11	11	22	18.24	-	-	-	-	-	-	-	19.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	10.00	U	11	-	-	-	-	-	CL	3	3	3	14	66	11	19.59	2.05	1.71	31.0	21.5	9.5	2.67	UU	49.0	9.5	0.162	0.557	-	-	-	-	Inorganic clays of low plasticity										
	11.00	D	12	6	12	17	29	20.80	CL-ML	3	2	2	7	79	7	17.25	-	-	27.0	21.0	6.0	-	-	-	-	-	-	-	0	18	-	Inorganic Silty Clays of low plasticity										
	12.00	D	13	7	11	15	26	19.08	-	-	-	-	-	-	-	19.80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	13.00	U	14	-	-	-	-	-	SM	0	0	0	55	45	0	19.70	2.00	1.67	Non-Plastic			-	DST	4.0	26.1	-	-	-	-	-	-	Silty Sands										
	14.50	D	15	5	12	15	27	18.78	-	-	-	-	-	-	-	19.98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	16.00	U	16	-	-	-	-	-	CL	1	1	1	23	63	11	20.97	2.06	1.70	29.5	19.5	10.0	2.67	UU	54.0	9.0	-	0.571	-	8	15	-	Inorganic clays of low plasticity										
	17.50	D	17	6	9	14	23	23.00	CL	1	1	1	18	67	12	16.48	-	-	31.0	18.5	12.5	-	-	-	-	-	-	-	-	-	-											

APPENDIX "B"
TABLE 6: SUMMARY OF TEST RESULTS

Bore No: P36	**Ground Elevation: RL 191.271 m**	**Method of drilling: Percussion**	**Depth of Water: 1.30 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 15/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 21859.087	**Casing Lowered: 22.00 m**	**Ending Date: 17/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	19.00	U	18	-	-	-	-	-	-	-	-	-	-	-	-	17.68	2.08	1.77	-	-	-	2.68	UU	60.0	10.0	-	0.514	-	-	-	-	Inorganic clays of low plasticity										
	20.50	D	19	7	9	17	26	26.00	-	-	-	-	-	-	-	17.92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	22.00	U	20	-	-	-	-	-	CL	0	0	0	14	72	14	18.22	2.07	1.75	32.0	19.0	13.0	2.68	UU	64.0	9.5	-	0.531	-	15	15	-											
	23.50	D	21	6	12	17	29	29.00	CL	5	4	4	11	64	12	17.97	-	-	30.0	18.5	11.5	-	-	-	-	-	-	-	-	-	-											
	25.00	D	22	-	-	-	-	-	CL	3	1	3	14	71	8	21.35	-	-	27.5	20.0	7.5	-	-	-	-	-	-	-	-	-	-											
	26.50	D	23	11	17	28	45	45.00	-	-	-	-	-	-	-	19.89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	28.00	U	24	-	-	-	-	-	MI	1	1	0	14	68	16	19.30	2.05	1.72	36.0	25.0	11.0	2.69	UU	68.0	11.5	-	0.564	-	20	20	-	Inorganic Silts of Intermediate plasticity										
	29.50	D	25	11	19	26	45	45.00	-	-	-	-	-	-	-	19.95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	31.00	D	26	-	-	-	-	-	CL-ML	2	1	2	18	68	9	19.18	-	-	27.5	21.5	6.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	32.50	D	27	17	26	30	56	23.79	ML	0	1	1	42	56	0	19.86	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity										
	34.00	D	28	16	29	33	62	25.14	CL-ML	0	0	1	28	65	6	18.90	-	-	25.5	21.0	4.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	35.50	D	29	18	20	29	49	49.00	CL	2	1	2	22	64	9	20.07	-	-	28.5	20.5	8.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	37.00	D	30	-	-	-	-	-	-	-	-	-	-	-	-	18.24	2.05	1.73	-	-	-	2.67	RDST	16.0	20.2	-	0.543	-	-	-	-											
	38.50	D	31	16	22	26	48	20.18	CL-ML	0	1	1	32	60	6	17.08	-	-	26.5	21.5	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	40.00	D	32	17	24	30	54	21.43	-	-	-	-	-	-	-	17.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 7: SUMMARY OF TEST RESULTS

Bore No: P39	**Ground Elevation: RL 191.204 m**	**Method of drilling: Percussion**	**Depth of Water: 1.30 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 17/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 21937.687	**Casing Lowered: 22.00 m**	**Ending Date: 19/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m²)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm²)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	SM	0	0	0	56	44	0	10.61	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	1.00	D	2	-	-	-	-	-	ML	0	0	0	46	49	5	22.14	-	-	26.5	22.0	4.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	2.00	D	3	2	3	4	7	9.79	SM-SC	4	2	2	46	39	7	20.85	-	-	27.5	21.5	6.0	-	-	-	-	-	-	-	-	-	-	Silty Sands with clay binder											
	3.00	D	4	2	3	3	6	7.88	SM	7	3	4	44	42	0	20.69	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	4.00	U	5	-	-	-	-	-	-	-	-	-	-	-	-	18.45	1.90	1.60	-	-	-	2.63	DST	7.0	24.5	-	0.644	-	-	-	-												
	5.00	D	6	3	3	4	7	8.32	ML	0	0	0	36	64	0	18.50	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	6.00	D	7	3	3	5	8	9.11	ML	0	0	1	39	60	0	19.18	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	7.00	D	8	-	-	-	-	-	-	-	-	-	-	-	-	19.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	8.00	D	9	3	4	5	9	9.58	ML	0	0	0	44	56	0	18.34	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	9.00	D	10	3	4	6	10	10.26	CL-ML	1	1	1	24	68	5	18.71	-	-	26.0	20.0	6.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	10.00	U	11	-	-	-	-	-	CL	7	6	5	14	60	8	16.15	2.02	1.74	29.0	21.0	8.0	2.67	UU	51.0	9.5	0.131	0.535	-	8	17	-	Inorganic clays of low plasticity											
	11.00	D	12	5	9	14	23	23.00	-	-	-	-	-	-	-	20.14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	12.00	D	13	6	12	13	25	25.00	-	-	-	-	-	-	-	20.61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	13.00	U	14	-	-	-	-	-	CL	2	1	1	11	72	13	19.90	2.05	1.71	32.0	21.0	11.0	2.67	UU	56.0	8.2	-	0.562	-	-	-	-												
	14.50	D	15	4	7	11	18	15.30	CL-ML	0	1	1	32	61	5	21.24	-	-	26.0	21.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	16.00	U	16	-	-	-	-	-	CL	9	5	5	9	61	11	20.78	2.05	1.70	30.0	20.0	10.0	2.67	UU	53.0	11.5	-	0.573	-	-	-	-	Inorganic clays of low plasticity											
	17.50	D	17	4	6	9	15	15.00	CL	1	1	1	14	71	12	20.51	-	-	31.0	19.5	11.5	-	-	-	-	-	-	-	-	-	-												

APPENDIX "B"
TABLE 7: SUMMARY OF TEST RESULTS

Bore No: P39	**Ground Elevation: RL 191.204 m**	**Method of drilling: Percussion**	**Depth of Water: 1.30 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 17/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 21937.687	**Casing Lowered: 22.00 m**	**Ending Date: 19/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	19.00	U	18	-	-	-	-	-	CL	5	4	3	16	60	12	17.30	1.99	1.70	31.0	22.0	9.0	2.67	UU	58.0	10.5	-	0.574	-	-	-	-	Inorganic clays of low plasticity											
	20.50	D	19	5	7	12	19	19.00	CL	9	3	3	17	58	10	19.43	-	-	29.0	19.5	9.5	-	-	-	-	-	-	-	0	19	-												
	22.00	U	20	-	-	-	-	-	CI	4	3	4	9	64	16	18.23	2.03	1.72	37.0	23.0	14.0	2.68	UU	62.0	9.7	-	0.561	-	-	-	-	Inorganic clays of Intermediate plasticity											
	23.50	D	21	6	15	27	42	42.00	-	-	-	-	-	-	-	20.29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	25.00	U	22	-	-	-	-	-	CL	1	1	1	17	71	9	22.72	2.06	1.68	28.0	21.0	7.0	2.67	UU	46.0	10.4	-	0.591	-	-	-	-	Inorganic clays of low plasticity											
	26.50	D	23	11	22	29	51	24.46	-	-	-	-	-	-	-	20.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	28.00	D	24	-	-	-	-	-	-	-	-	-	-	-	-	20.86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	29.50	D	25	12	24	30	54	24.61	CL-ML	0	0	2	28	63	7	18.31	-	-	27.0	21.0	6.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	31.00	D	26	16	19	27	46	46.00	CL	1	1	1	12	76	9	19.96	-	-	28.0	19.5	8.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	32.50	D	27	14	20	29	49	22.32	SM	0	0	1	52	47	0	18.43	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	34.00	D	28	-	-	-	-	-	CL	2	1	2	18	69	8	17.57	-	-	27.5	20.5	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	35.50	D	29	17	24	26	50	21.86	ML	2	2	3	28	61	4	13.25	-	-	24.0	20.0	4.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	37.00	D	30	-	-	-	-	-	CL	2	1	1	12	73	11	16.66	2.04	1.75	29.0	19.0	10.0	2.67	RUU	54.0	9.6	-	0.526	-	-	-	-	Inorganic clays of low plasticity											
	38.50	D	31	16	22	30	52	52.00	-	-	-	-	-	-	-	11.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	40.00	D	32	18	24	38	62	62.00	-	-	-	-	-	-	-	20.57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 8: SUMMARY OF TEST RESULTS

Bore No: P40	**Ground Elevation: RL 191.009 m**	**Method of drilling: Percussion**	**Depth of Water: 1.40 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 20/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 21963.887	**Casing Lowered: 21.00 m**	**Ending Date: 22/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen												
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	0.50	D	1	-	-	-	-	-	SM	0	0	0	62	38	0	10.72	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	1.00	U	2	-	-	-	-	-	CL	2	1	1	44	44	8	22.17	2.01	1.65	27.5	20.5	7.0	2.66	DST	8.0	26.0	-	0.617	-	-	-	-	Inorganic clays of low plasticity										
	2.00	D	3	1	2	2	4	4.00	CL	0	0	0	24	63	13	24.75	-	-	33.0	23.0	10.0	-	-	-	-	-	-	-	-	-											
	3.00	D	4	2	2	3	5	5.00	-	-	-	-	-	-	-	23.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	4.00	D	5	-	-	-	-	-	CL-ML	0	0	1	35	59	5	20.50	-	-	26.0	21.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	5.00	D	6	2	3	4	7	8.08	SM	0	0	1	58	41	0	26.44	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	6.00	D	7	3	6	6	12	13.28	SM	0	0	1	68	31	0	28.88	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-											
	7.00	U	8	-	-	-	-	-	SM	0	0	1	52	47	0	19.76	1.96	1.64	Non-Plastic			2.63	DST	5.0	27.5	-	0.604	-	-	-	-											
	8.00	D	9	2	3	6	9	9.25	SM	0	0	1	62	37	0	27.91	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-											
	9.00	D	10	3	3	5	8	8.00	CL	0	0	1	12	76	11	21.38	-	-	30.0	20.0	10.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	10.00	U	11	-	-	-	-	-	CL	3	1	2	12	70	12	19.66	2.04	1.70	33.0	22.0	11.0	2.67	UU	56.0	10.5	0.162	0.567	-	-	16	13.80											
	11.00	D	12	5	10	13	23	23.00	-	-	-	-	-	-	-	20.29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	12.00	D	13	5	7	9	16	16.00	-	-	-	-	-	-	-	21.29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	13.00	U	14	-	-	-	-	-	CL	3	1	2	9	72	13	21.68	2.05	1.68	32.0	20.0	12.0	2.67	UU	58.0	9.6	-	0.586	-	-	17	16.60											
	14.50	D	15	2	6	8	14	11.84	CL-ML	0	1	1	18	71	9	20.81	-	-	28.0	21.5	6.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	16.00	U	16	-	-	-	-	-	CL	2	1	2	17	66	12	19.59	2.01	1.68	30.0	18.5	11.5	2.68	UU	60.0	8.3	-	0.595	-	-	-	-	Inorganic clays of low plasticity										
	17.50	D	17	5	10	12	22	22.00	-	-	-	-	-	-	-	19.83	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											

APPENDIX "B"
TABLE 8: SUMMARY OF TEST RESULTS

Bore No: P40	**Ground Elevation: RL 191.009 m**	**Method of drilling: Percussion**	**Depth of Water: 1.40 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 20/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 21963.887	**Casing Lowered: 21.00 m**	**Ending Date: 22/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																															
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen										
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	19.00	U	18	-	-	-	-	-	CL	2	1	3	26	58	10	19.69	2.03	1.70	29.0	20.0	9.0	2.67	UU	52.0	10.2	-	0.573	-	-	-	-	Inorganic clays of low plasticity										
	20.50	D	19	8	10	14	24	16.35	CL-ML	0	0	1	36	58	5	17.83	-	-	24.0	19.0	5.0	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	22.00	D	20	-	-	-	-	-	-	-	-	-	-	-	-	21.94	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	23.50	D	21	5	11	15	26	26.00	CL	4	2	3	14	64	13	20.84	-	-	33.0	21.0	12.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	25.00	D	22	-	-	-	-	-	CL	0	1	3	28	60	8	20.40	-	-	28.5	21.0	7.5	-	-	-	-	-	-	-	-	-	-										
	26.50	D	23	12	19	30	49	49.00	CL	0	1	1	14	76	8	19.50	-	-	29.0	20.5	8.5	-	-	-	-	-	-	-	-	-	-										
	28.00	D	24	-	-	-	-	-	-	-	-	-	-	-	-	22.63	2.08	1.70	-	-	-	2.67	RUU	49.0	8.7	-	0.571	-	-	-	-										
	29.50	D	25	7	13	19	32	32.00	CI	5	2	1	11	66	15	19.31	-	-	42.0	24.0	18.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of Intermediate plasticity										
	31.00	D	26	-	-	-	-	-	SM	0	0	0	54	46	0	19.95	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	32.50	D	27	18	20	30	50	22.22	-	-	-	-	-	-	-	18.91	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	34.00	D	28	-	-	-	-	-	CL-ML	0	0	1	41	53	5	19.82	2.00	1.67	26.0	21.5	4.5	2.66	RDST	7.0	26.3	-	0.593	-	-	-	-	Inorganic Silty Clays of low plasticity										
	35.50	D	29	17	22	27	49	21.24	-	-	-	-	-	-	-	25.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	37.00	D	30	-	-	-	-	-	MI	2	1	1	11	71	14	22.39	-	-	38.0	27.0	11.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of Intermediate plasticity										
	38.50	D	31	18	24	29	53	21.72	CL-ML	4	2	2	34	53	5	20.66	-	-	27.0	21.5	5.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	40.00	D	32	20	28	33	61	23.52	-	-	-	-	-	-	-	20.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX-B
TABLE 9: CHEMICAL TEST ON SOIL SAMPLES

BH No.	DEPTH (m)	SULPHATE CONTENT AS SO_3 (%)	CHLORIDE CONTENT (%)	pH VALUE
P24	2.00	0.034	0.030	8.42
P30	4.00	0.069	0.069	8.97

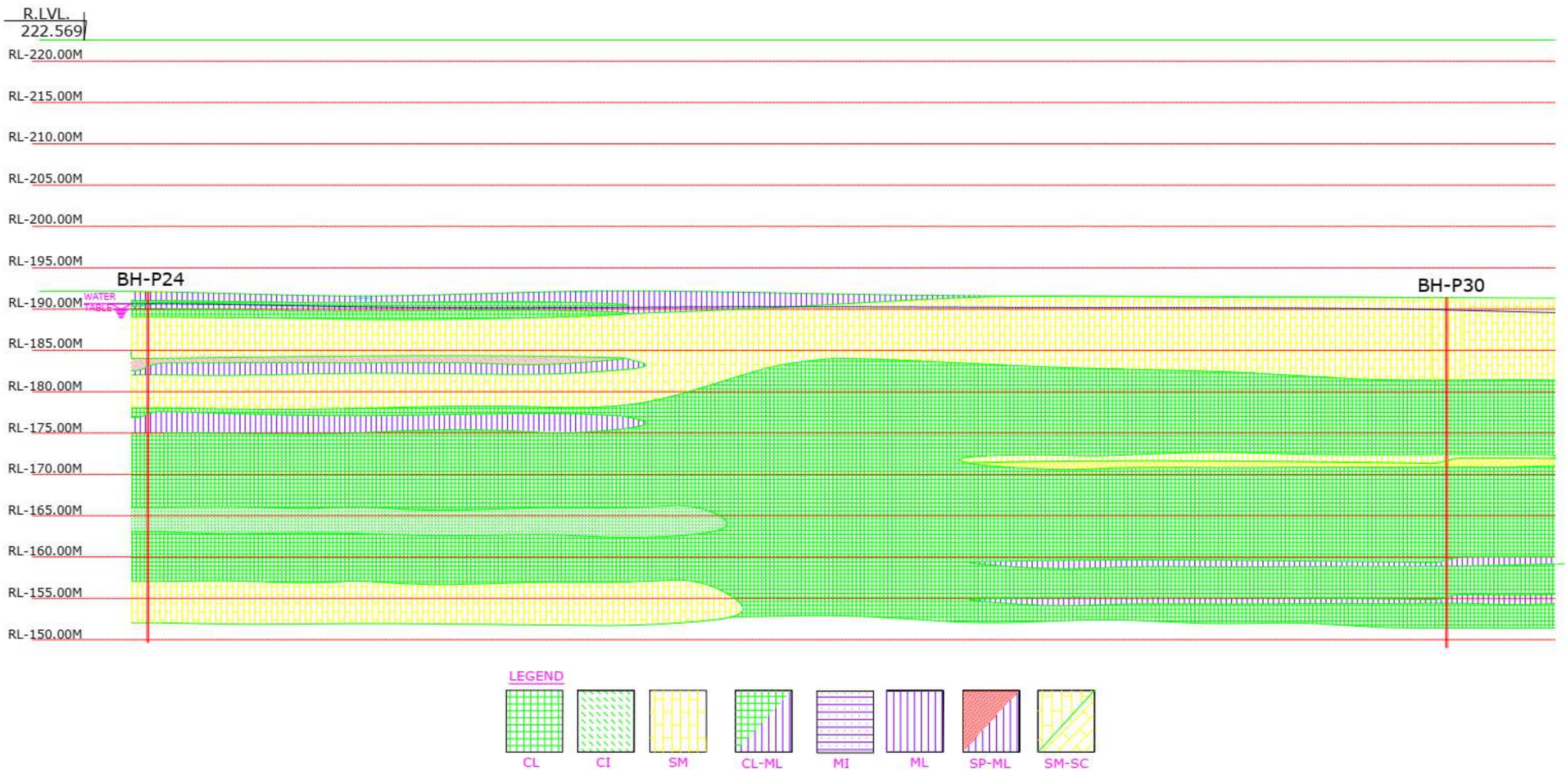
APPENDIX-B
TABLE 10: CHEMICAL TEST ON GROUND WATER SAMPLES

BH No.	SULPHATE CONTENT AS SO_3 (mg/l)	CHLORIDE CONTENT (mg/l)	pH VALUE
P24	61.725	447.861	7.22
P30	57.610	417.870	7.00

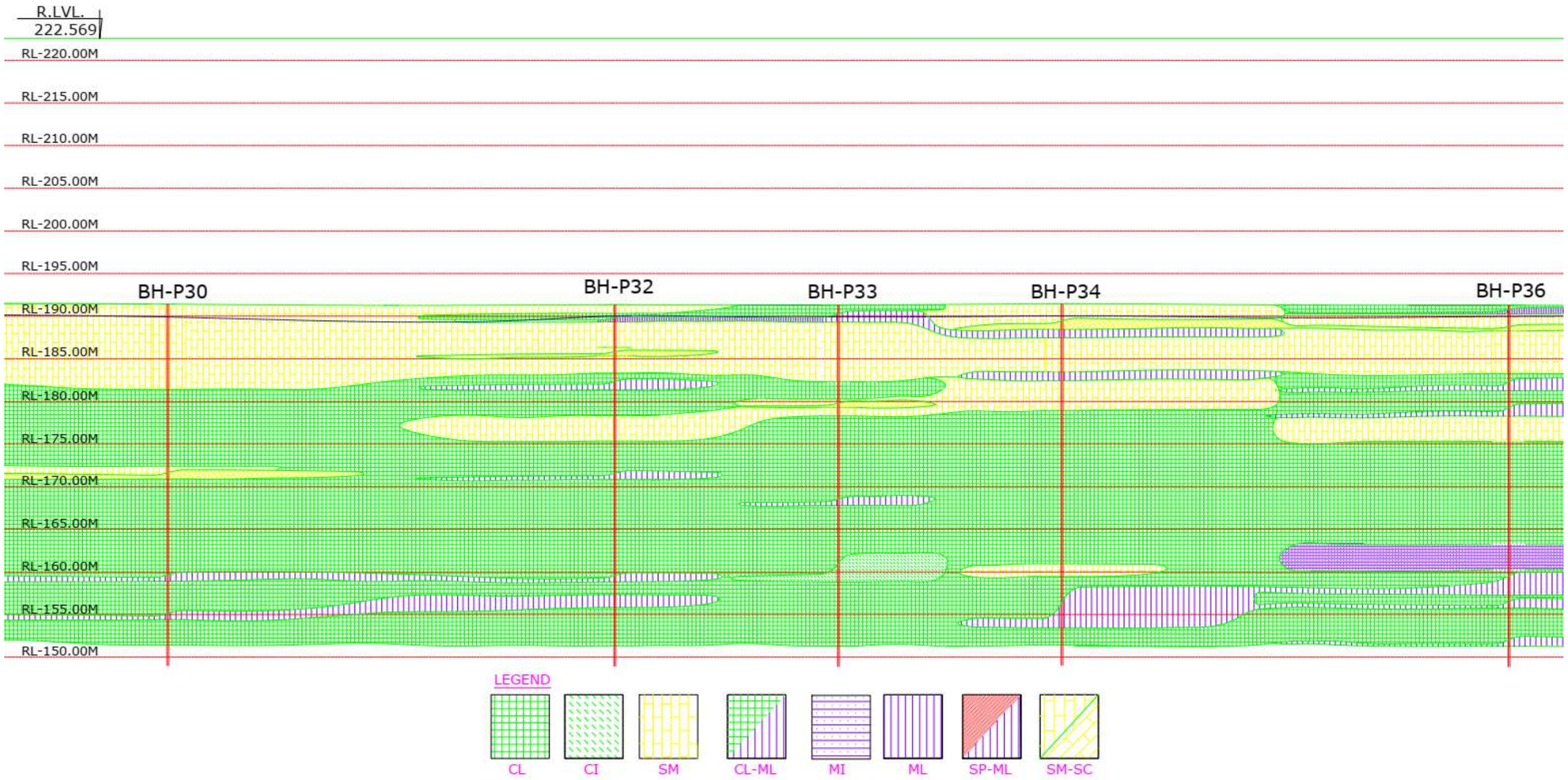
APPENDIX-B
TABLE 11: UCS TEST ON SOIL SAMPLES

BH No.	DEPTH (m)	UCS (kg/cm²)
P24	2.00	0.75
	23.00	0.47
	29.00	0.37
P30	10.00	0.32
	25.00	0.71
	31.00	0.20
P32	10.00	0.63
	16.00	0.60
	22.00	0.71
P33	10.00	0.62
	13.00	0.66
	16.00	0.72
	19.00	0.75
P34	14.00	0.66
	20.00	0.70
	23.00	0.75
P36	10.00	0.73
	16.00	0.76
	19.00	0.81
	22.00	0.84
	28.00	0.89
P39	10.00	0.78
	13.00	0.76
	16.00	0.79
	19.00	0.81
	22.00	0.96
	25.00	0.68
P40	10.00	0.78
	13.00	0.83
	16.00	0.95
	19.00	0.71

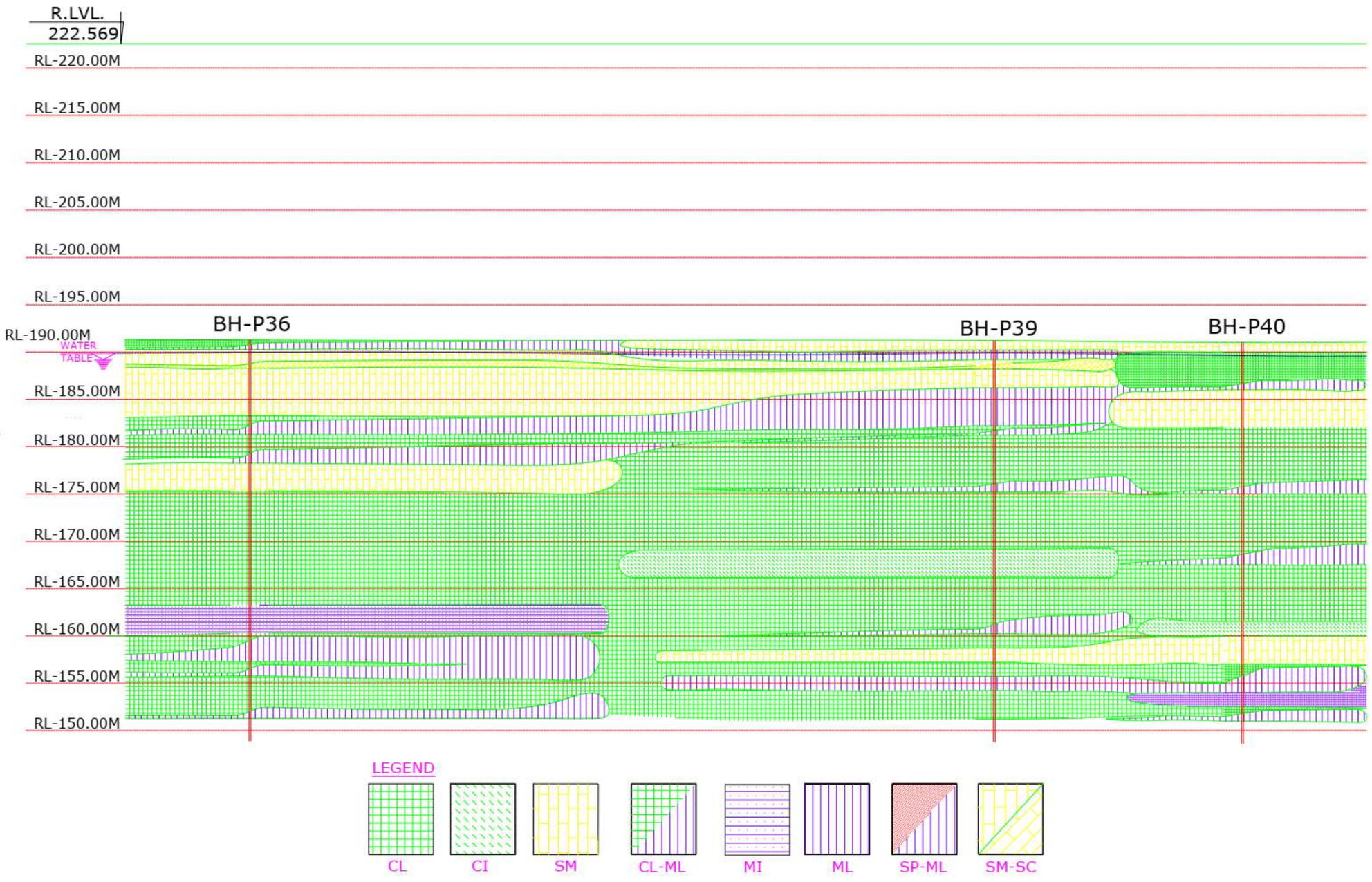
APPENDIX-C
PLOT 1: LITHOLOGICAL PROFILE-1



APPENDIX-C
PLOT 2: LITHOLOGICAL PROFILE-2



APPENDIX-C
PLOT 3: LITHOLOGICAL PROFILE-3



APPENDIX-C
PLOT 4: LITHOLOGICAL PLOTS

BH-P24-21544.6870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Inorganic Silts of low plasticity	ML		0.50	D		-	-
Inorganic Silty Clays of low plasticity	CL-ML		1.00	D	4	-	-
Inorganic clays of low plasticity	CL		2.00	U		-	-
			3.00	D	14	-	-
			4.00	D	18	-	-
Silty Sands	SM		5.00	D		-	-
			6.00	D	12	-	-
			7.00	D	19	-	-
			8.00	U		-	-
Poorly Graded Sands with inorganic Silts of low plasticity	SP-ML		9.00	D	23	-	-
			10.00	D	26	-	-
			11.00	U		-	-
Silty Sands	SM		12.50	D	28	-	-
			14.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML		15.50	D	18	-	-
Inorganic Silts of low plasticity	ML		17.00	U		-	-
Inorganic clays of low plasticity	CL		18.50	D	22	-	-
			20.00	U		-	-

BH-P24-21544.6870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			20.00	U		-	-
			21.50	D	35	-	-
Inorganic clays of low plasticity	CL		23.00	U		-	-
			24.50	D	32	-	-
			26.00	U		-	-
Inorganic clays of Intermediate plasticity	CI		27.50	D	38	-	-
			29.00	U		-	-
			30.50	D	33	-	-
Inorganic clays of low plasticity	CL		32.00	D		-	-
			33.50	D	39	-	-
			35.00	D		-	-
			36.50	D	36	-	-
Silty Sands	SM		38.00	D		-	-
			40.00	D	69	-	-

APPENDIX-C
PLOT 5: LITHOLOGICAL PLOTS

BH-P30-21701.8870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			0.50	D		-	-
			1.00	U		-	-
			2.00	D	5	-	-
			3.00	D	9	-	-
			4.00	U		-	-
Silty Sands	SM		5.00	D	11	-	-
			6.00	D	12	-	-
			7.00	D		-	-
			8.00	D	14	-	-
			9.00	D	16	-	-
			10.00	U		-	-
			11.00	D	15	-	-
			12.00	D	17	-	-
			13.00	U		-	-
Inorganic clays of low plasticity	CL		14.50	D	21	-	-
			16.00	U		-	-
			17.50	D	22	-	-
Silty Sands with clay binder	SM-SC		19.00	U		-	-
			20.00	D	26	-	-

BH-P30-21701.8870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Silty Sands with clay binder	SM-SC		20.50	D	26	-	-
			22.00	D		-	-
			23.50	D	23	-	-
Inorganic clays of low plasticity	CL		25.00	U		-	-
			26.50	D	22	-	-
			28.00	D		-	-
			29.50	D	26	-	-
Inorganic Silty Clays of low plasticity	CL-ML		31.00	U		-	-
			32.50	D	32	-	-
Inorganic clays of low plasticity	CL		34.00	D		-	-
Inorganic Silty Clays of low plasticity	CL-ML		35.50	D	40	-	-
			37.00	D		-	-
Inorganic clays of low plasticity	CL		38.50	D	50	-	-
			40.00	D	59	-	-

APPENDIX-C
PLOT 6: LITHOLOGICAL PLOTS

BH-P32-21754.2870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Silty Sands	SM		0.50	D		-	-
		WATER LVL	1.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML						
			2.00	D	4	-	-
Silty Sands	SM		3.00	D	5	-	-
			4.00	D		-	-
Silty Sands with clay binder	SM-SC		5.00	D	7	-	-
			6.00	D	9	-	-
Silty Sands	SM		7.00	D		-	-
			8.00	D	13	-	-
Inorganic Silty Clays of low plasticity	CL-ML		9.00	D	17	-	-
			10.00	U		-	-
Inorganic clays of low plasticity	CL		11.00	D	18	-	-
			12.00	D	22	-	-
			13.00	D		-	-
Silty Sands	SM		14.50	D	36	-	-
			16.00	U		-	-
Inorganic clays of low plasticity	CL		17.50	D	19	-	-
			19.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML		20.00	D	38	-	-

BH-P32-21754.2870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Inorganic Silty Clays of low plasticity	CL-ML		20.50	D	38	-	-
			22.00	U		-	-
			23.50	D	75	-	-
			25.00	D	63	-	-
Inorganic clays of low plasticity	CL		26.50	D	71	-	-
			28.00	D	75	-	-
			29.50	D	62	-	-
			31.00	D	102	-	-
Inorganic Silty Clays of low plasticity	CL-ML		32.50	D	95	-	-
Inorganic clays of low plasticity	CL		34.00	D	103	-	-
Inorganic Silts of low plasticity	ML		35.50	D	87	-	-
			37.00	D	91	-	-
Inorganic clays of low plasticity	CL		38.50	D	83	-	-
			40.00	D	56	-	-

APPENDIX-C
PLOT 7: LITHOLOGICAL PLOTS

BH-P33-21780.4870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			0.00	D		-	-
Inorganic Silty Clays of low plasticity	CL-ML		1.00	U		-	-
			2.00	D	5	-	-
			3.00	D	7	-	-
			4.00	U		-	-
Silty Sands	SM		5.00	D	10	-	-
			6.00	D	12	-	-
			7.00	U		-	-
			8.00	D	14	-	-
			9.00	D	20	-	-
Inorganic clays of low plasticity	CL		10.00	U		-	-
Silty Sands with clay binder	SM-SC		11.00	D	30	-	-
Silty Sands	SM		12.00	D	29	-	-
			13.00	U		-	-
			14.50	D	32	-	-
Inorganic clays of low plasticity	CL		16.00	U		-	-
			17.50	D	39	-	-
			19.00	U		-	-
			20.00	D	42	-	-

BH-P33-21780.4870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Inorganic clays of low plasticity	CL		20.50	D	42	-	-
			22.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML		23.50	D	88	-	-
			25.00	D	75	-	-
Inorganic clays of low plasticity	CL		26.50	D	80	-	-
			28.00	D	87	-	-
			29.50	D	101	-	-
Inorganic Clays of low to Intermediate plasticity	CL-CI		31.00	D	82	-	-
			32.50	D	90	-	-
			34.00	D	98	-	-
			35.50	D	72	-	-
Inorganic clays of low plasticity	CL		37.00	D	88	-	-
			38.50	D	100	-	-
			40.00	D	96	-	-

APPENDIX-C
PLOT 8: LITHOLOGICAL PLOTS

BH-P34-21806.6870

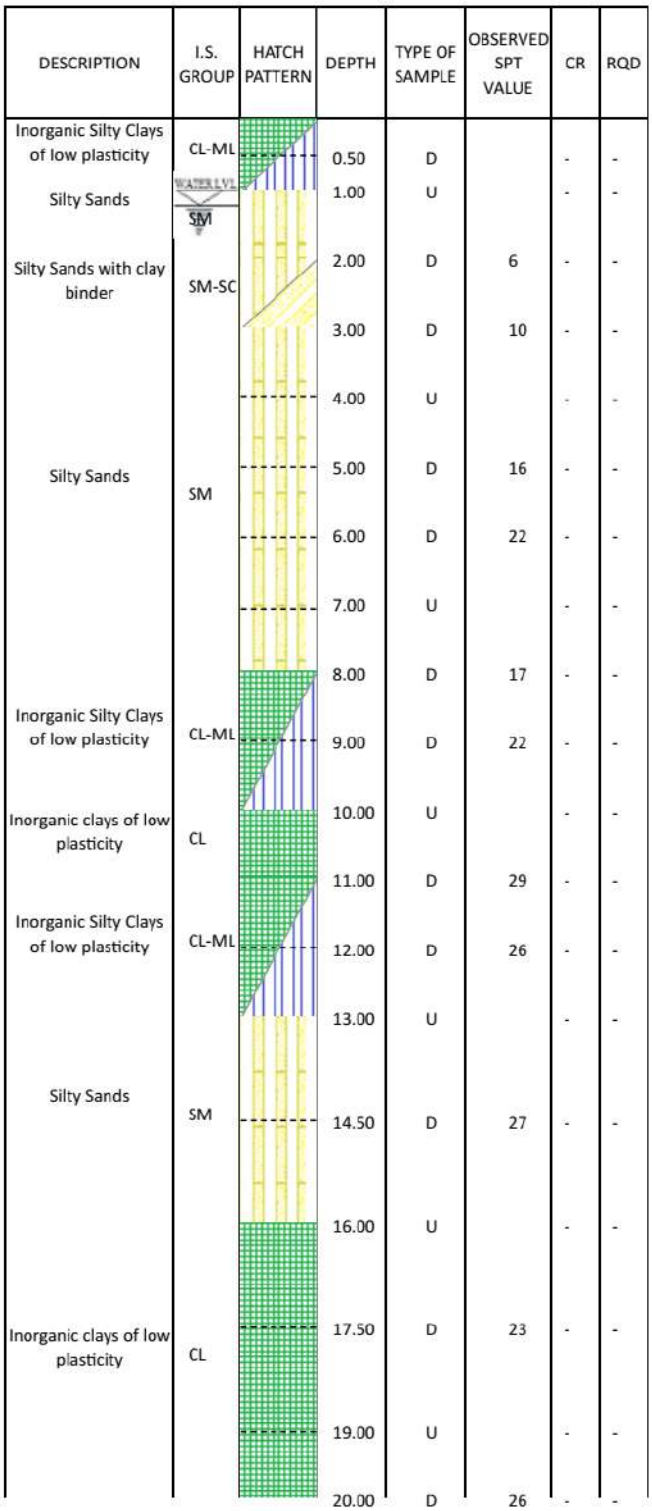
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Silty Sands	SM		0.50	D		-	-
			1.00	D	3	-	-
Silty Sands with clay binder	SM-SC		2.00	U		-	-
Inorganic Silts of low plasticity	ML		3.00	D	6	-	-
			4.00	D	14	-	-
			5.00	U		-	-
Silty Sands	SM		6.00	D	18	-	-
			7.00	D	23	-	-
Inorganic Silts of low plasticity	ML		8.00	U		-	-
			9.00	D	15	-	-
			10.00	D	20	-	-
Silty Sands	SM		11.00	U		-	-
			12.50	D	19	-	-
			14.00	U		-	-
			15.50	D	12	-	-
Inorganic clays of low plasticity	CL		17.00	D		-	-
			18.50	D	21	-	-
			20.00	U		-	-

BH-P34-21806.6870

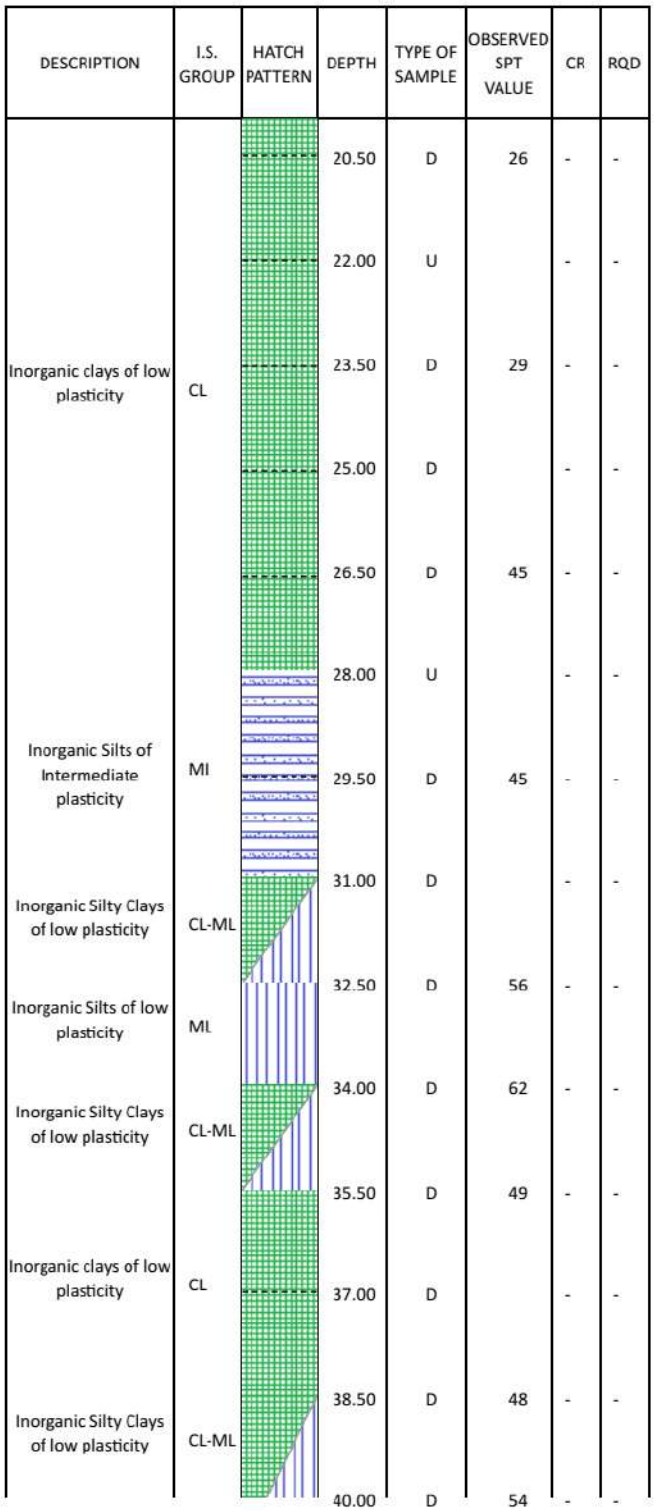
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			20.00	U		-	-
			21.50	D	30	-	-
			23.00	U		-	-
			24.50	D	38	-	-
Inorganic clays of low plasticity	CL		26.00	D		-	-
			27.50	D	47	-	-
			29.00	D		-	-
			30.50	D	71	-	-
Silty Sands	SM		32.00	D	75	-	-
			33.50	D	68	-	-
Inorganic Silty Clays of low plasticity	CL-ML		35.00	D	55	-	-
			36.50	D	52	-	-
			38.00	D	65	-	-
Inorganic clays of low plasticity	CL		40.00	D	53	-	-

APPENDIX-C
PLOT 9: LITHOLOGICAL PLOTS

BH-P36-21859.0870



BH-P36-21859.0870



APPENDIX-C
PLOT 10: LITHOLOGICAL PLOTS

BH-P39-21937.6870

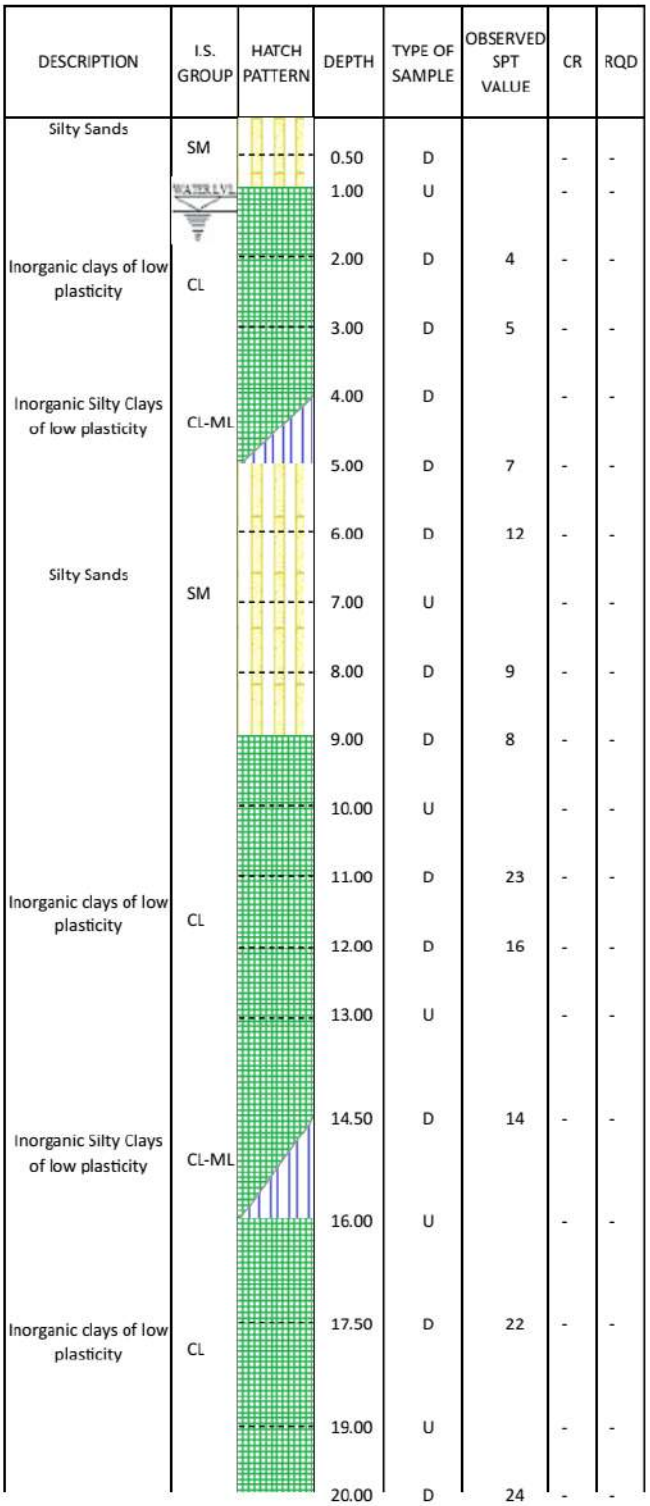
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Silty Sands	SM		0.50	D		-	-
			1.00	D		-	-
Inorganic Silts of low plasticity	ML						
Silty Sands with clay binder	SM-SC		2.00	D	7	-	-
			3.00	D	6	-	-
Silty Sands	SM		4.00	U		-	-
			5.00	D	7	-	-
			6.00	D	8	-	-
Inorganic Silts of low plasticity	ML		7.00	D		-	-
			8.00	D	9	-	-
Inorganic Silty Clays of low plasticity	CL-ML		9.00	D	10	-	-
			10.00	U		-	-
			11.00	D	23	-	-
Inorganic clays of low plasticity	CL		12.00	D	25	-	-
			13.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML		14.50	D	18	-	-
			16.00	U		-	-
Inorganic clays of low plasticity	CL		17.50	D	15	-	-
			19.00	U		-	-
			20.00	D	19	-	-

BH-P39-21937.6870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Inorganic clays of low plasticity	CL		20.50	D	19	-	-
			22.00	U		-	-
Inorganic clays of Intermediate plasticity	CI		23.50	D	42	-	-
			25.00	U		-	-
			26.50	D	51	-	-
Inorganic clays of low plasticity	CL		28.00	D		-	-
Inorganic Silty Clays of low plasticity	CL-ML		29.50	D	54	-	-
			31.00	D	46	-	-
Inorganic clays of low plasticity	CL		32.50	D	49	-	-
Silty Sands	SM		34.00	D		-	-
Inorganic clays of low plasticity	CL		35.50	D	50	-	-
Inorganic Silts of low plasticity	ML		37.00	D		-	-
Inorganic clays of low plasticity	CL		38.50	D	52	-	-
			40.00	D	62	-	-

APPENDIX-C
PLOT 11: LITHOLOGICAL PLOTS

BH-P40-21963.8870



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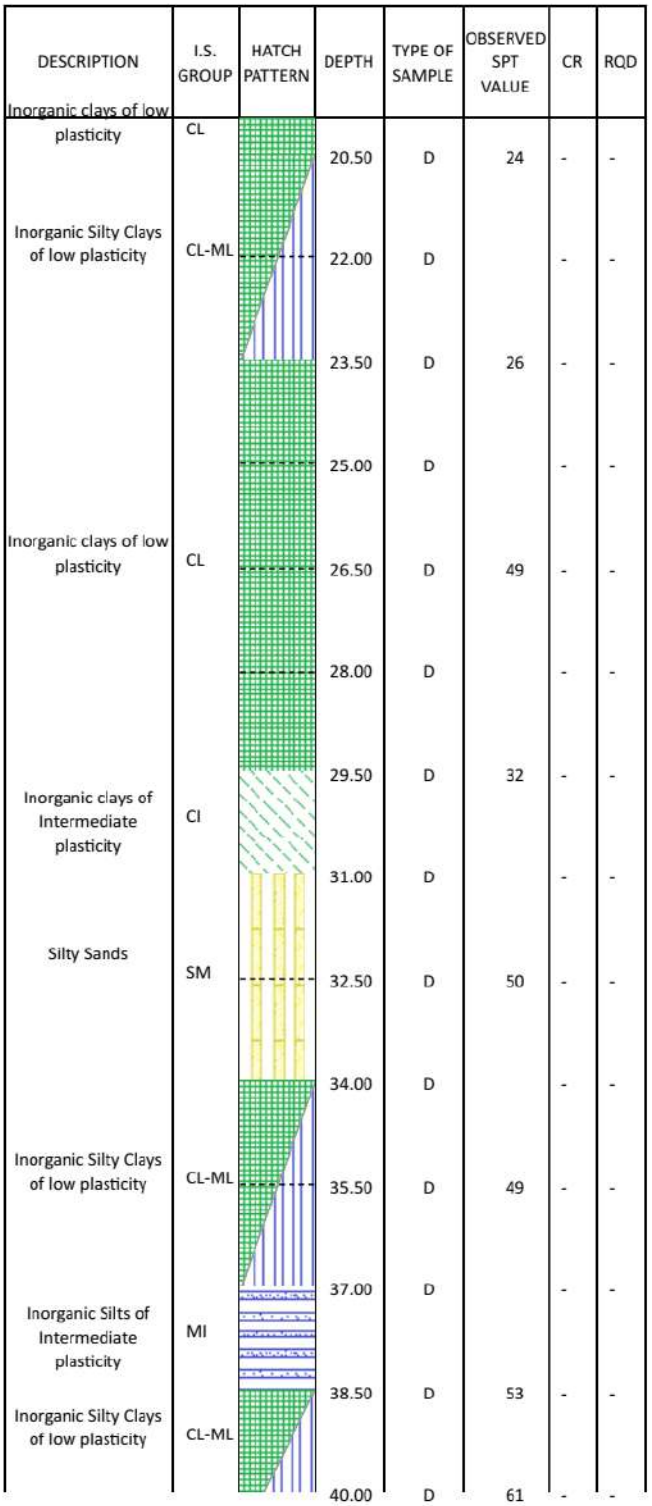
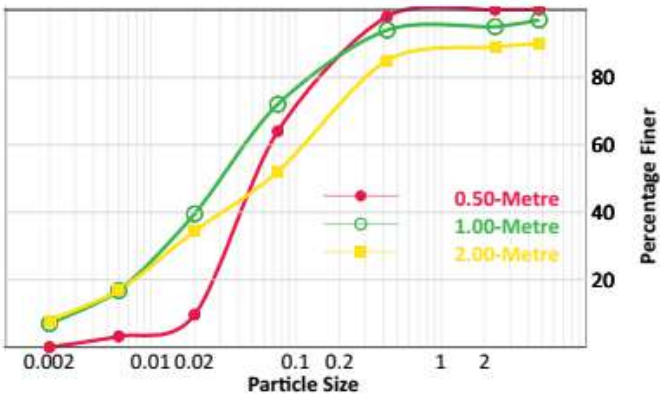


APPENDIX-D
PLOT 1: GRAIN SIZE DISTRIBUTION PLOTS

BH- P24-CH.21544.6870



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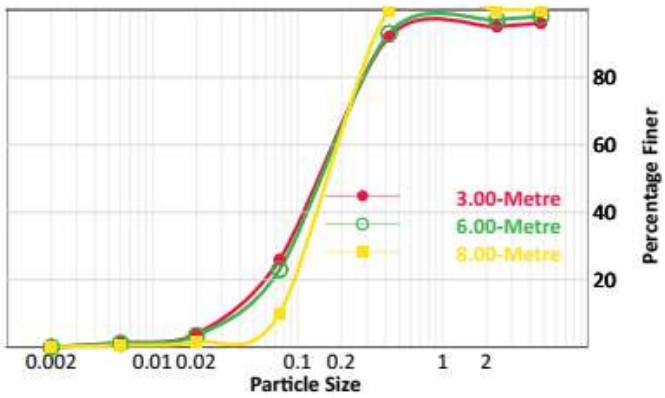

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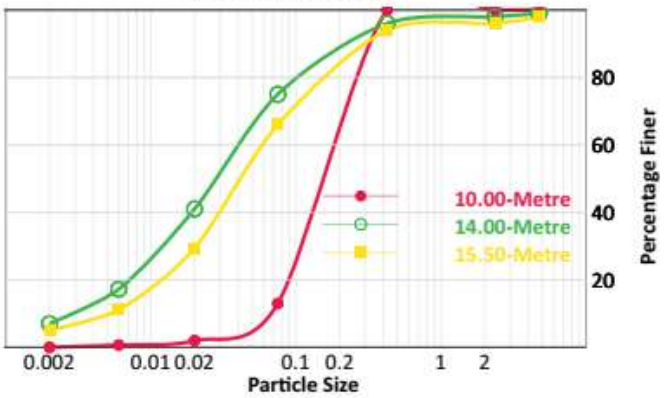

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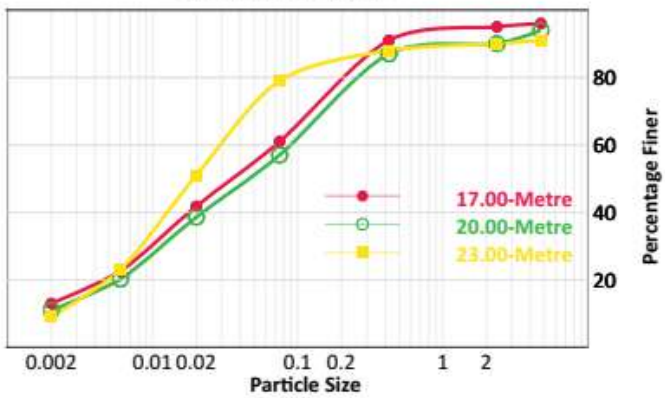

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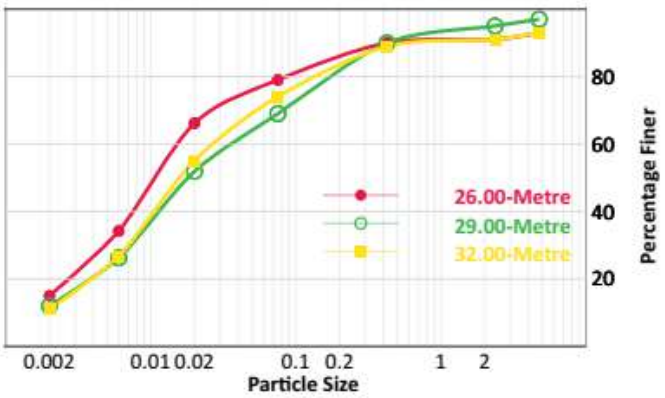

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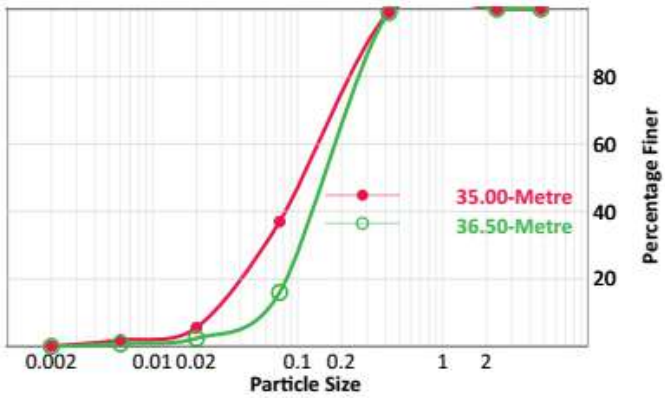
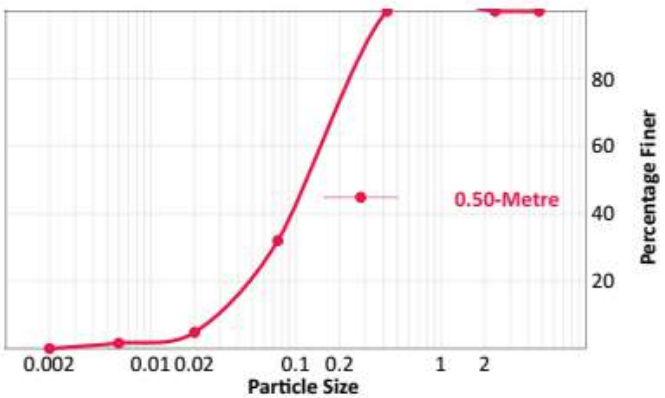
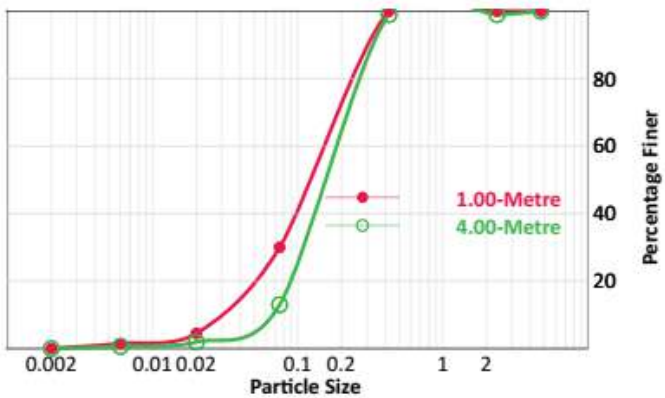


BH- P30-CH.21701.8870

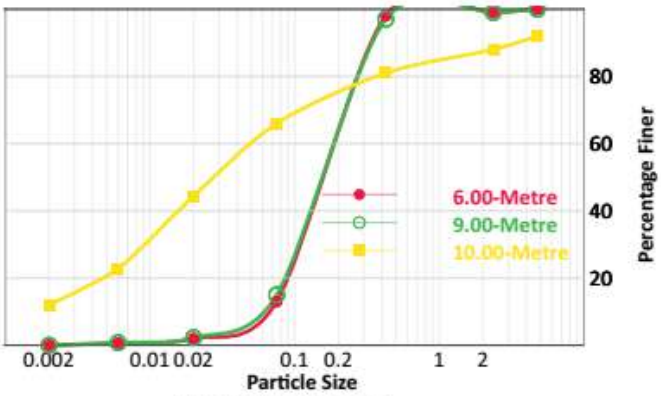


BH- P30-CH.21701.8870

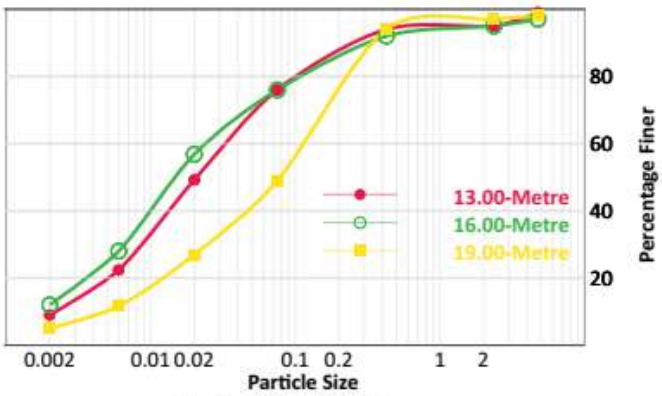


APPENDIX-D
PLOT 2: GRAIN SIZE DISTRIBUTION PLOTS

BH- P30-CH.21701.8870



BH- P30-CH.21701.8870



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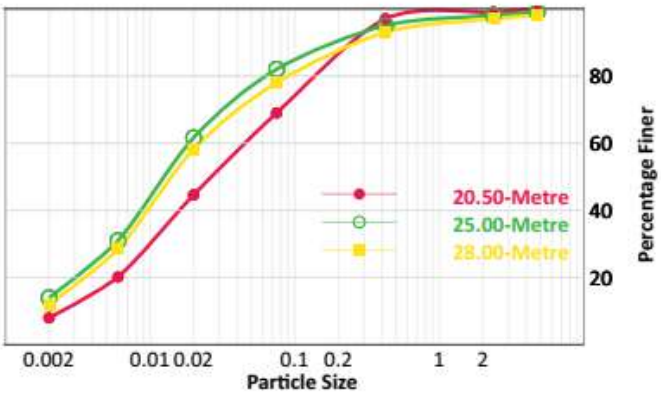
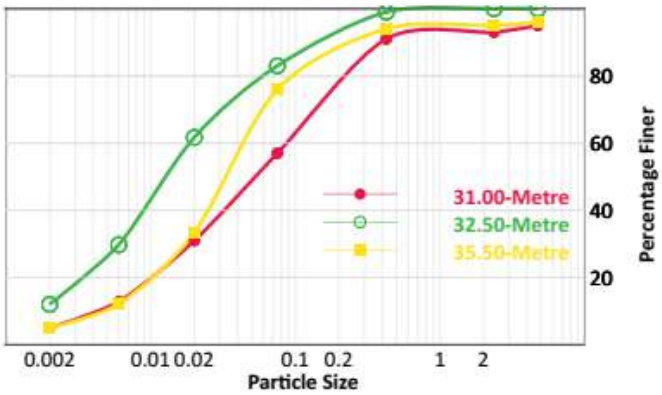
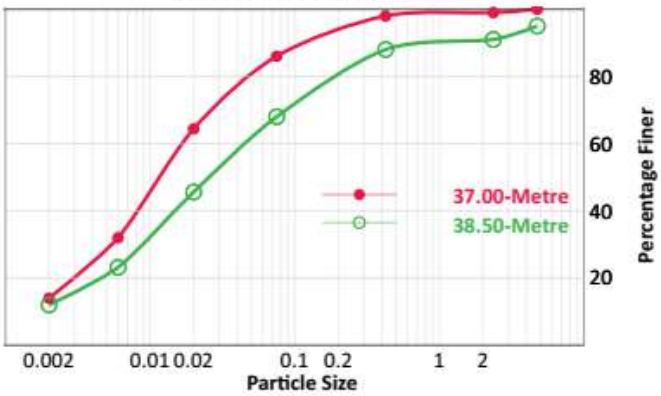


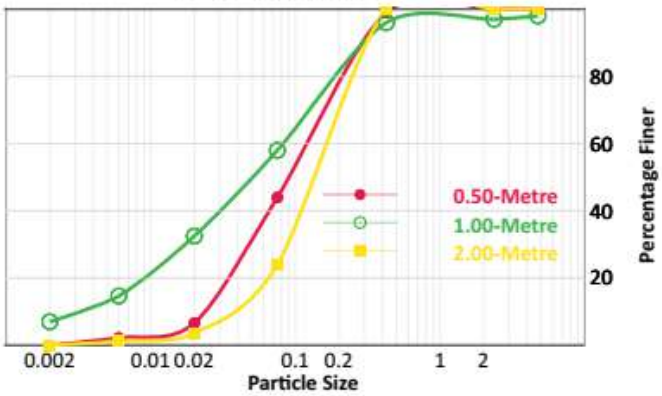
BH- P30-CH.21701.8870



BH- P30-CH.21701.8870



BH- P32-CH.21754.2870



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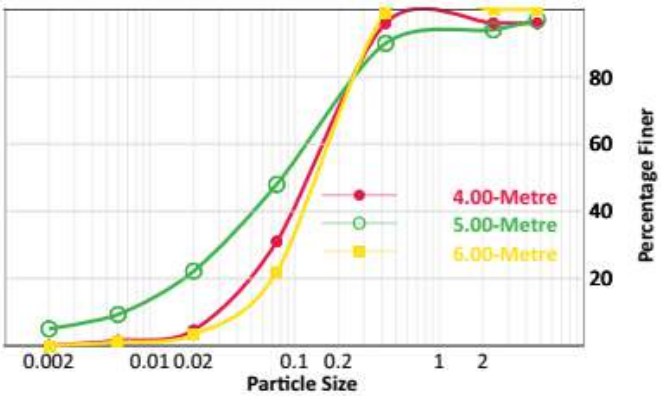
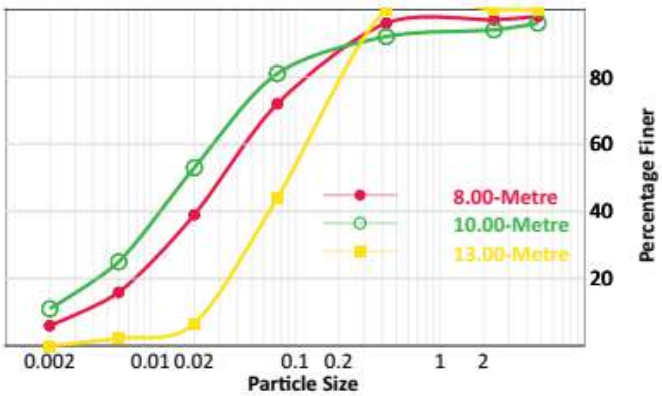
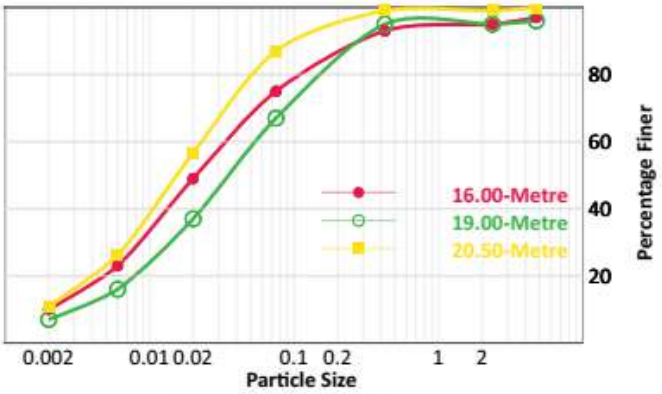


BH- P32-CH.21754.2870

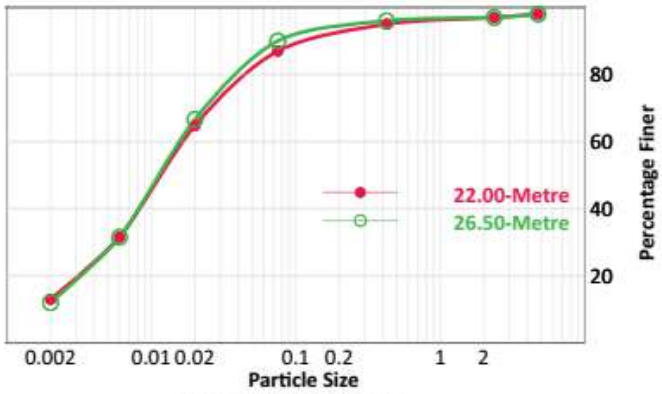


APPENDIX-D
PLOT 3: GRAIN SIZE DISTRIBUTION PLOTS

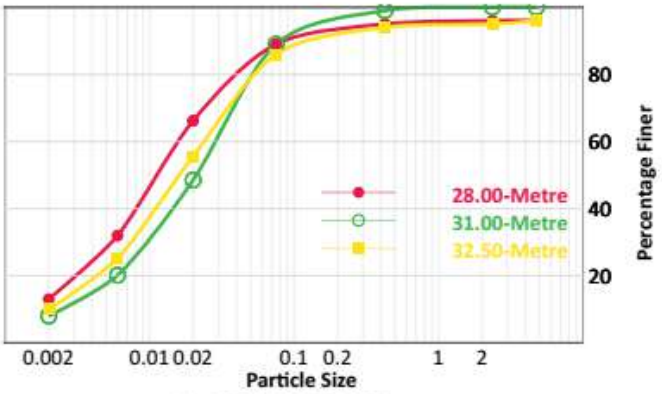
BH- P32-CH.21754.2870



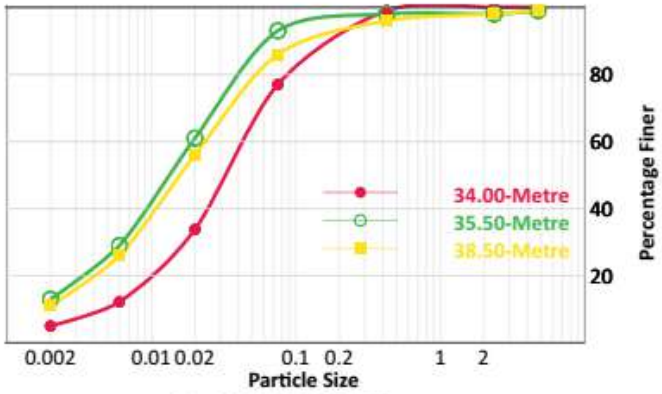
BH- P32-CH.21754.2870



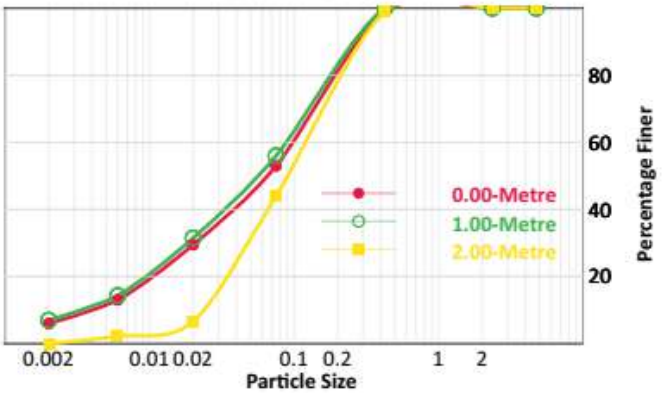
BH- P32-CH.21754.2870



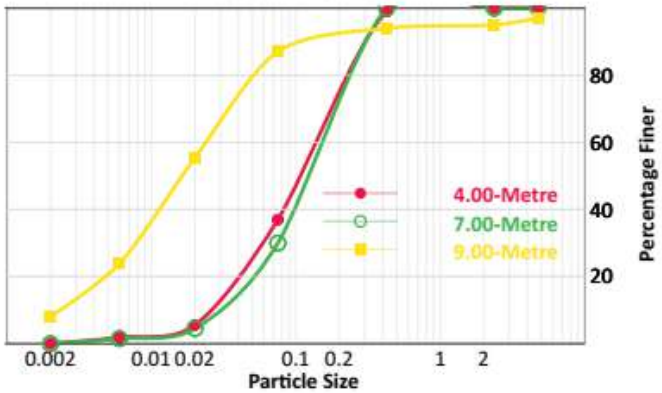
BH- P32-CH.21754.2870



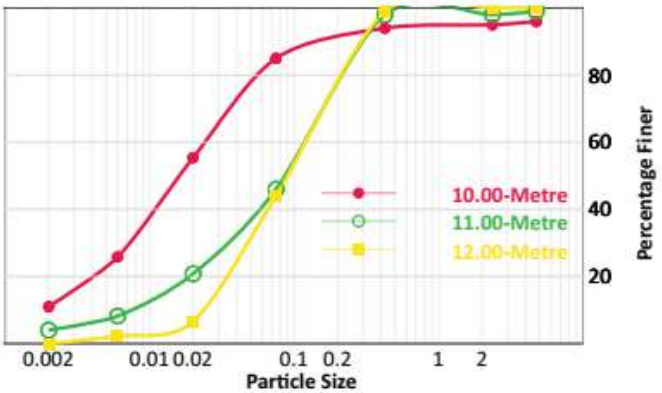
BH- P33-CH.21780.4870



BH- P33-CH.21780.4870



BH- P33-CH.21780.4870



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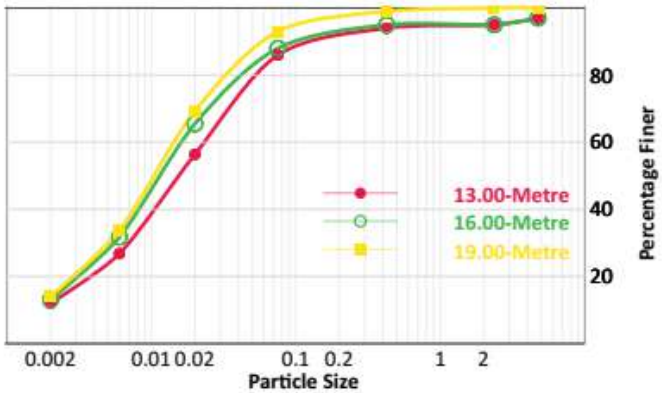
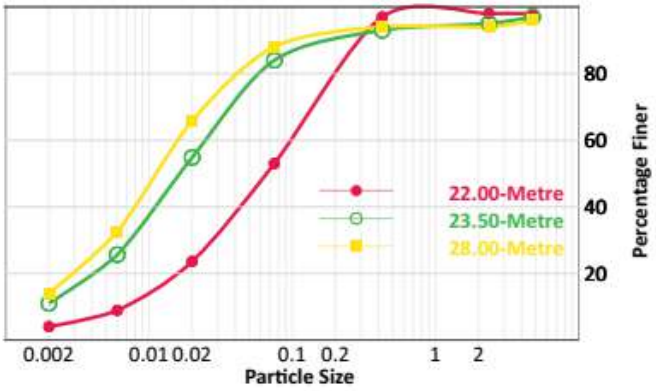
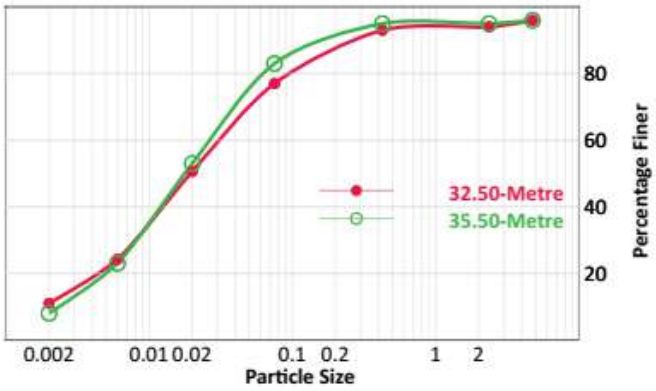


APPENDIX-D
PLOT 4: GRAIN SIZE DISTRIBUTION PLOTS

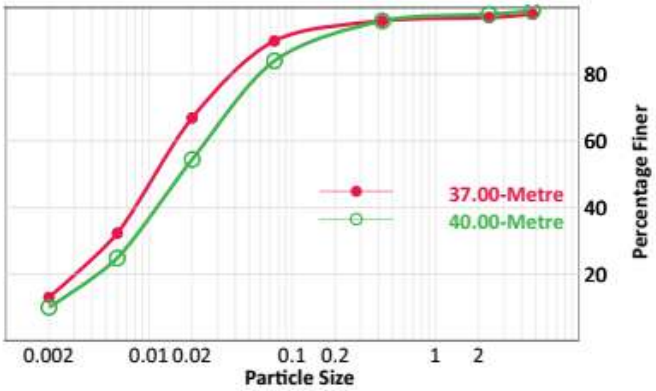
BH- P33-CH.21780.4870



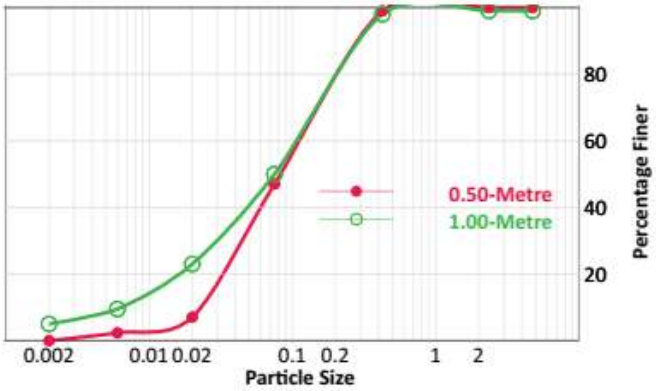
BH- P33-CH.21780.4870



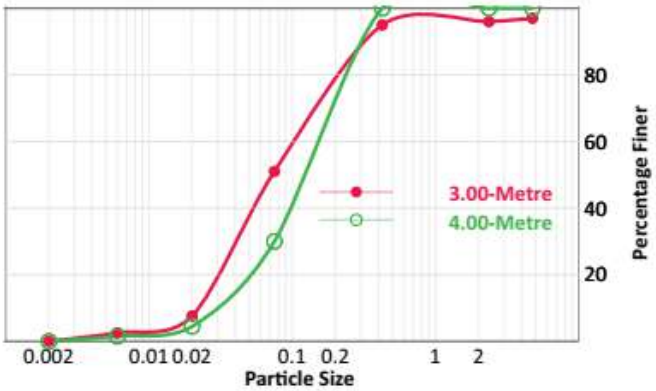
BH- P33-CH.21780.4870



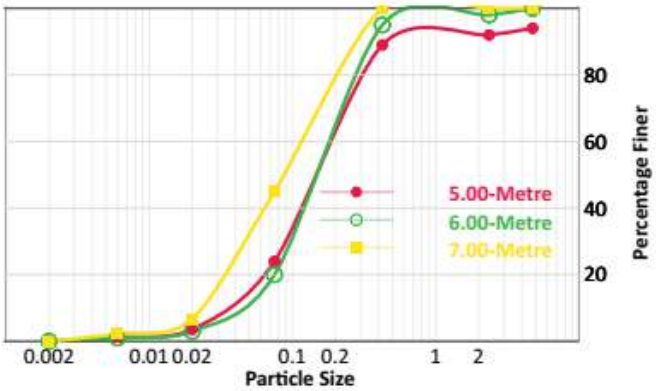
BH- P34-CH.21806.6870



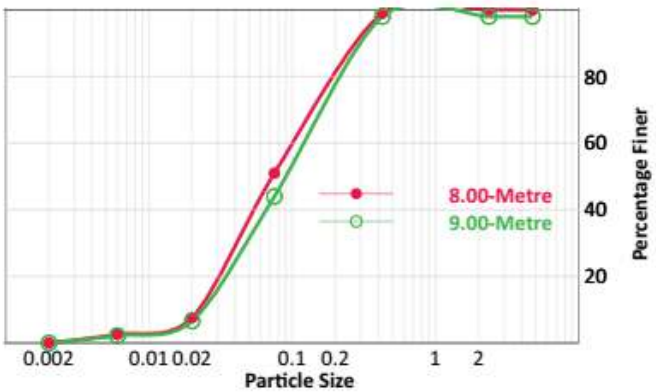
BH- P34-CH.21806.6870



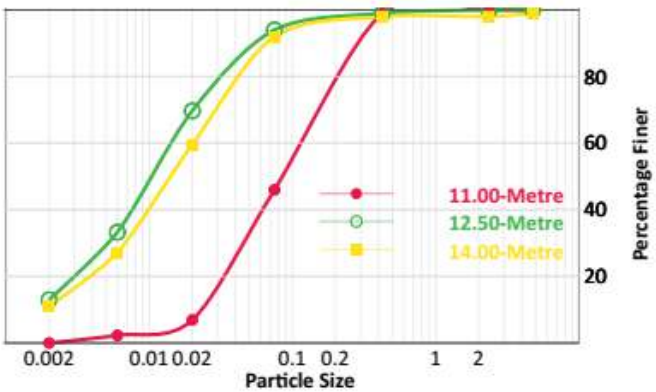
BH- P34-CH.21806.6870



BH- P34-CH.21806.6870

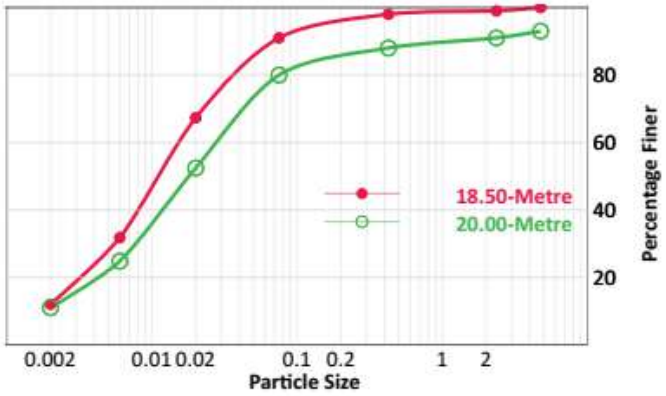


BH- P34-CH.21806.6870

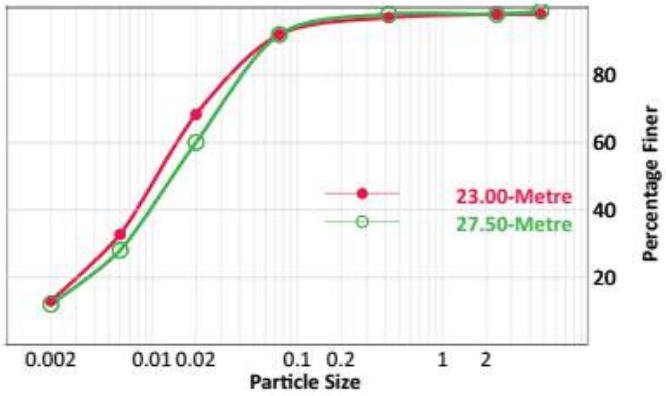


APPENDIX-D
PLOT 5: GRAIN SIZE DISTRIBUTION PLOTS

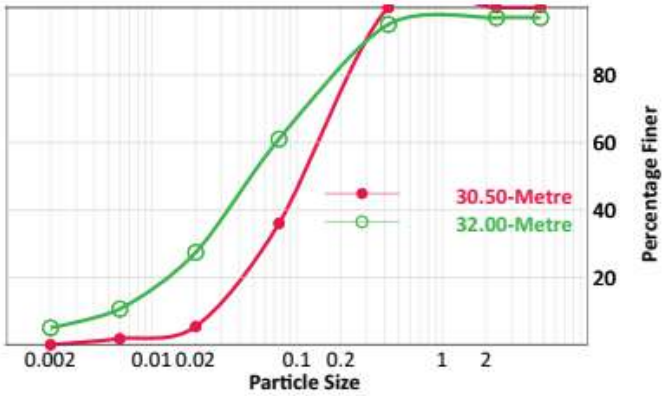
BH- P34-CH.21806.6870



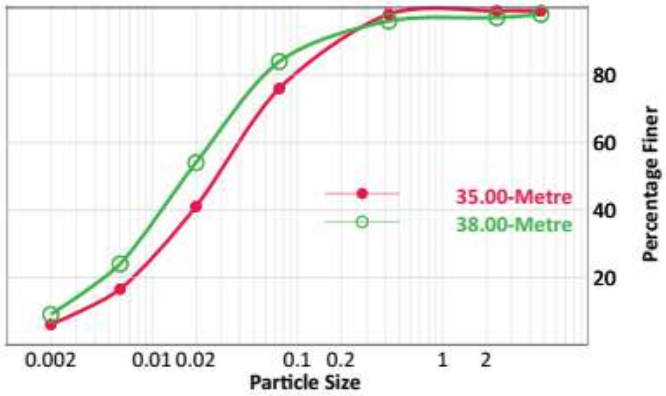
BH- P34-CH.21806.6870



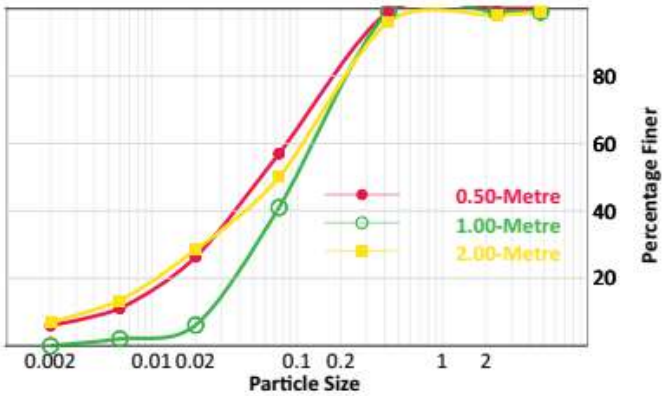
BH- P34-CH.21806.6870



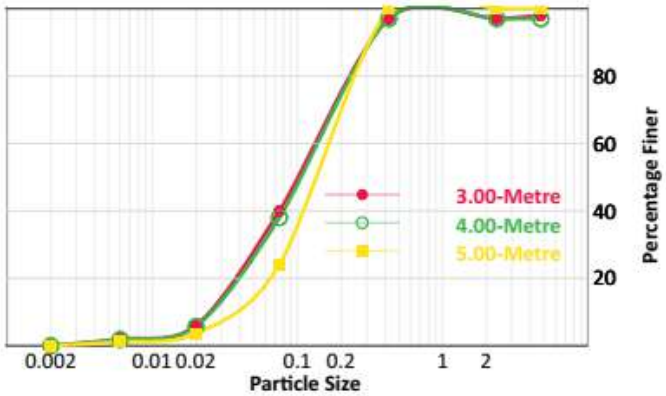
BH- P34-CH.21806.6870



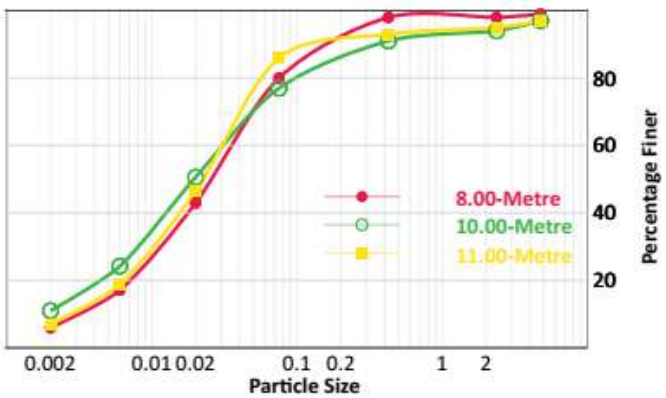
BH- P36-CH.21859.0870



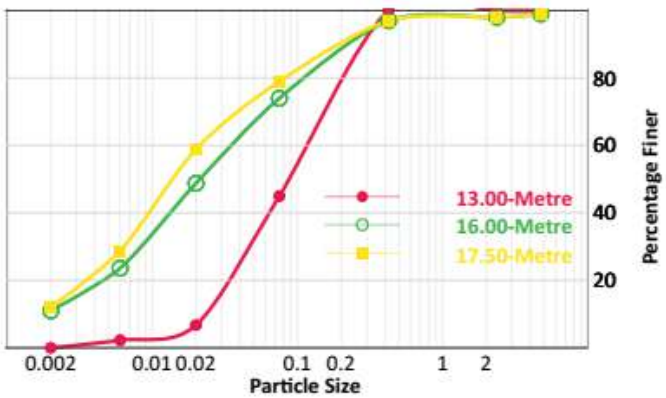
BH- P36-CH.21859.0870



BH- P36-CH.21859.0870

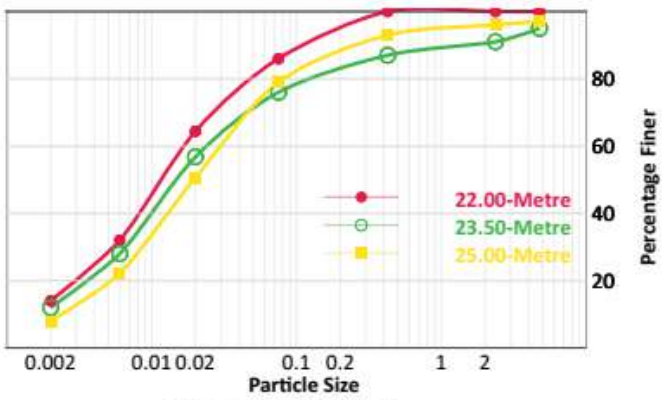


BH- P36-CH.21859.0870

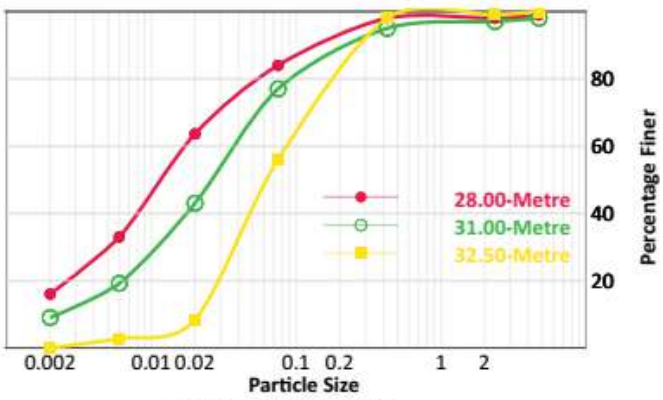


APPENDIX-D
PLOT 6: GRAIN SIZE DISTRIBUTION PLOTS

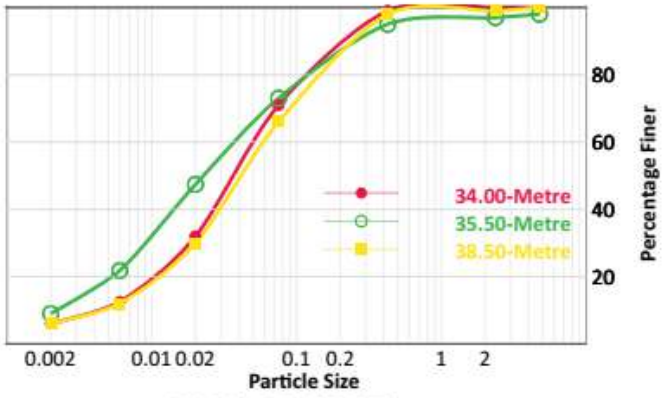
BH- P36-CH.21859.0870



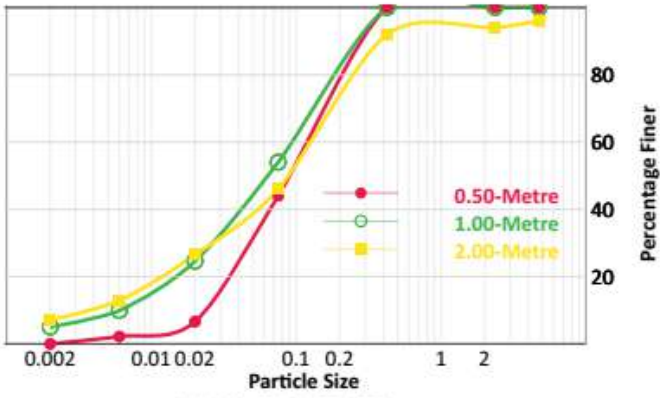
BH- P36-CH.21859.0870



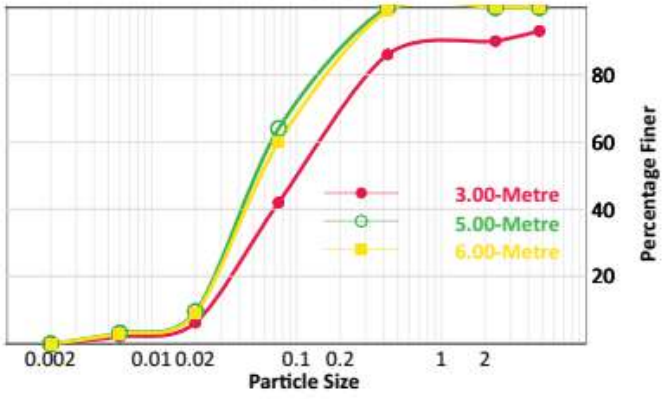
BH- P36-CH.21859.0870



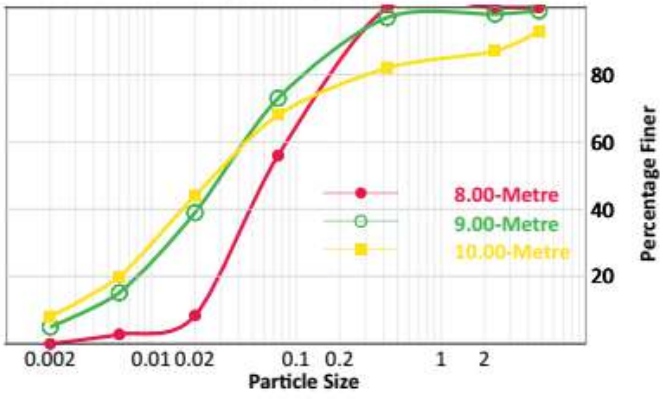
BH- P39-CH.21937.6870



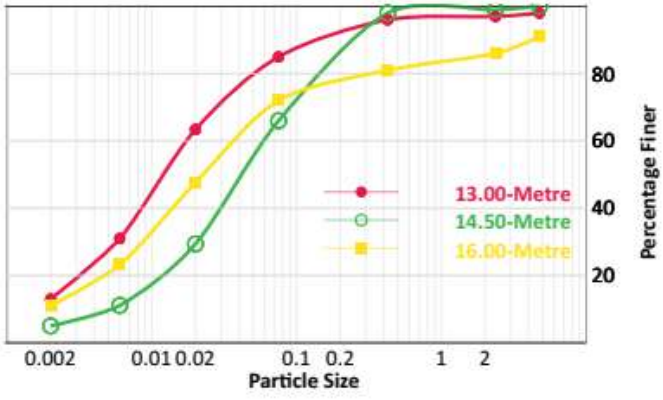
BH- P39-CH.21937.6870



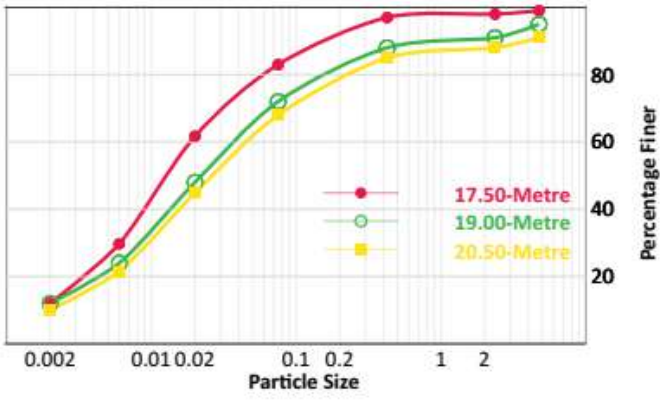
BH- P39-CH.21937.6870



BH- P39-CH.21937.6870

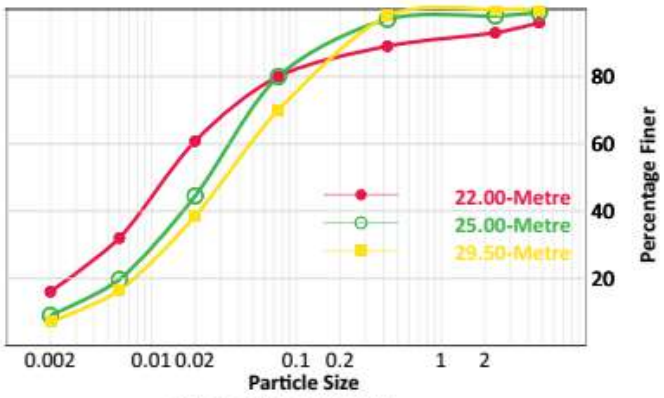


BH- P39-CH.21937.6870

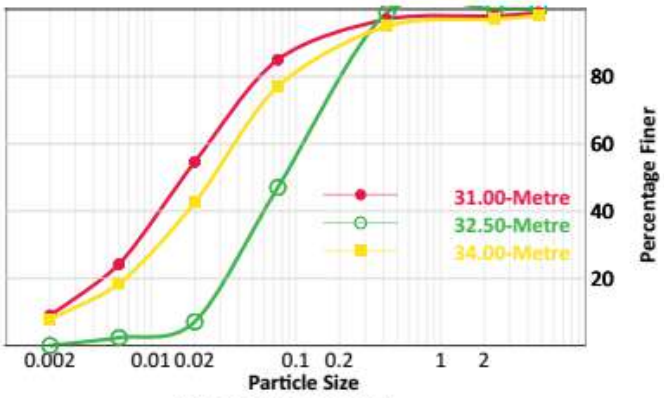


APPENDIX-D
PLOT 7: GRAIN SIZE DISTRIBUTION PLOTS

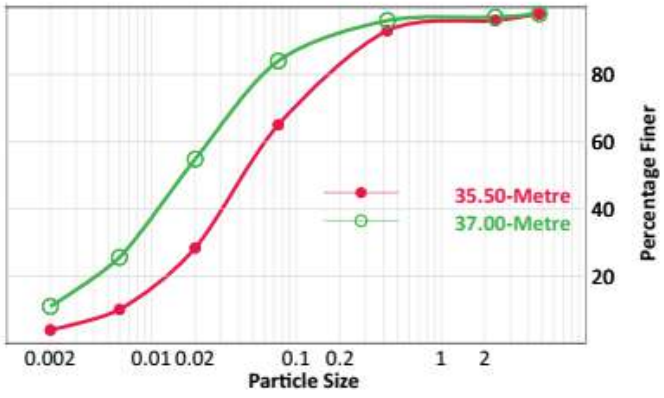
BH- P39-CH.21937.6870



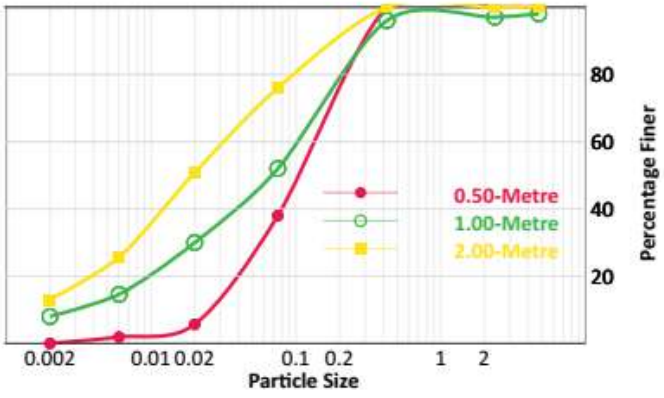
BH- P39-CH.21937.6870



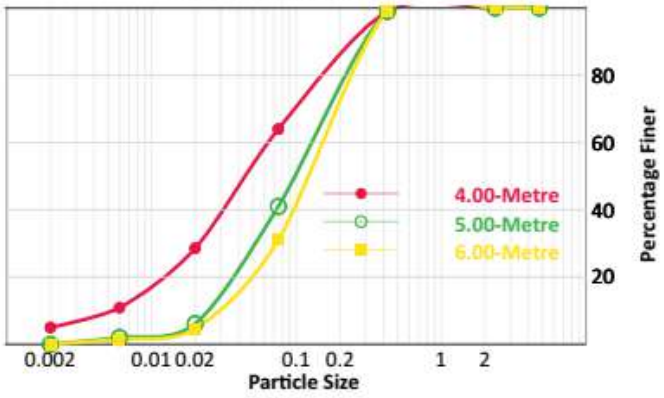
BH- P39-CH.21937.6870



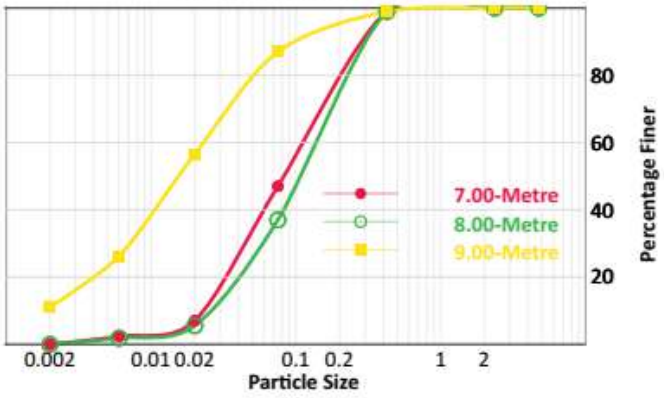
BH- P40-CH.21963.8870



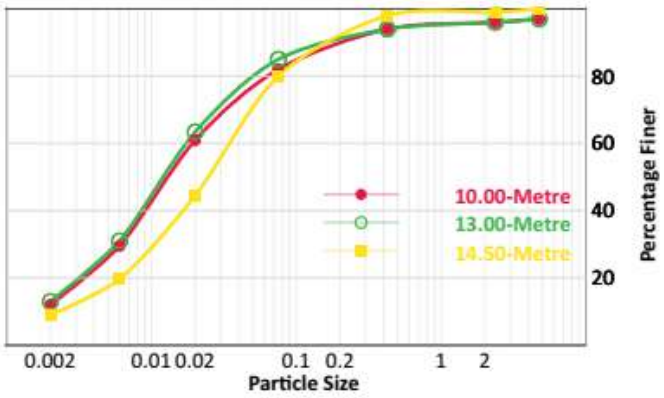
BH- P40-CH.21963.8870



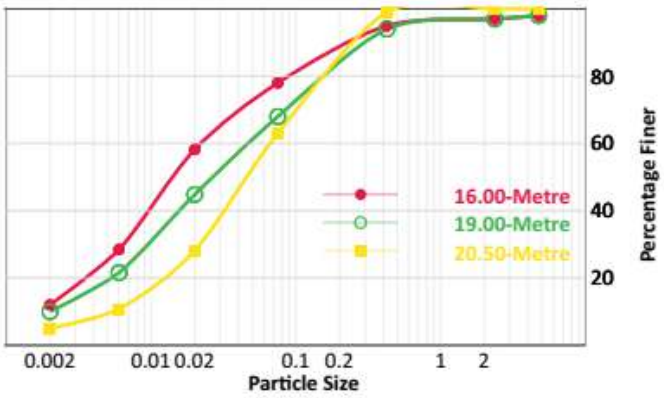
BH- P40-CH.21963.8870



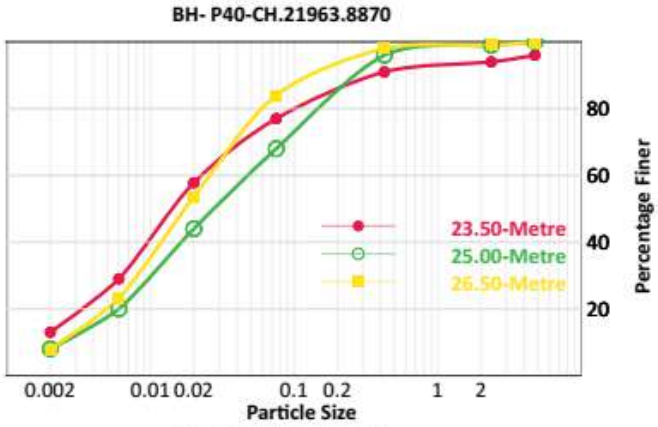
BH- P40-CH.21963.8870

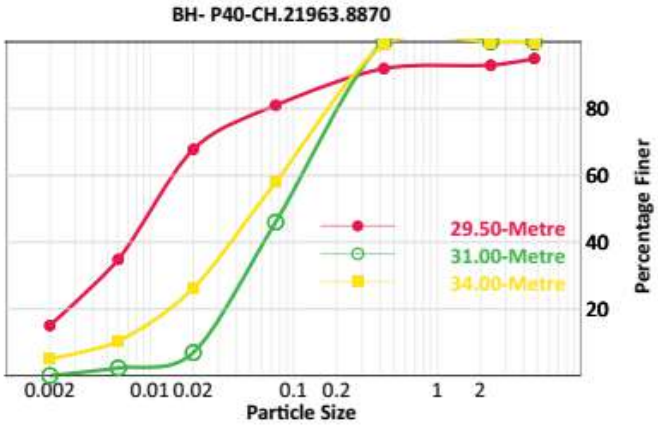


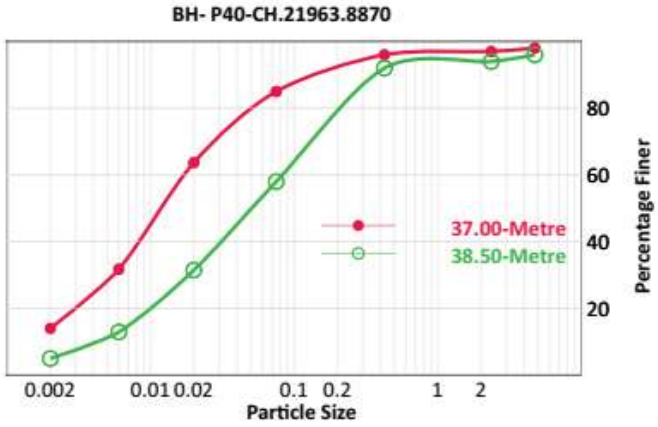
BH- P40-CH.21963.8870



APPENDIX-D
PLOT 8: GRAIN SIZE DISTRIBUTION PLOTS

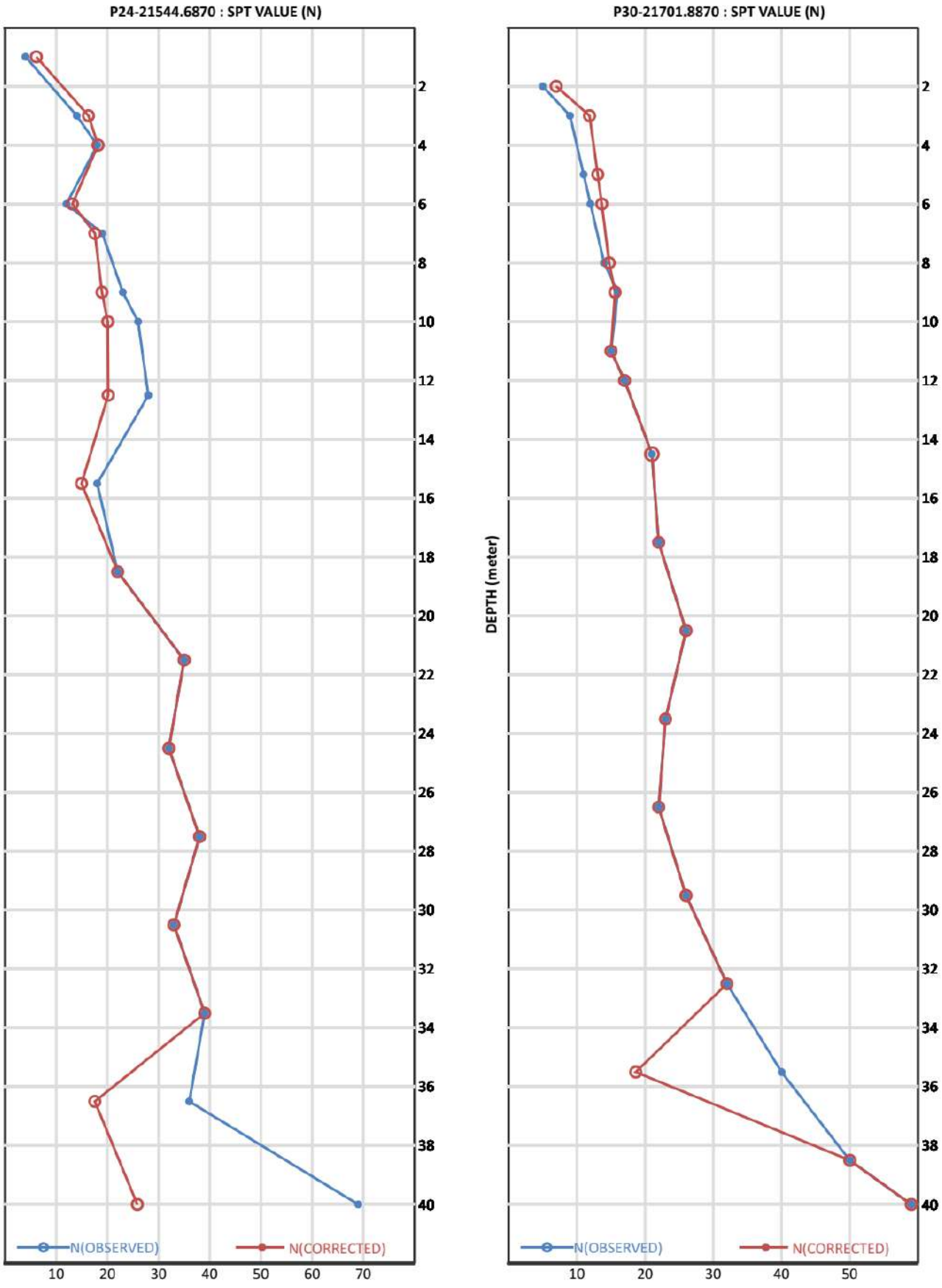




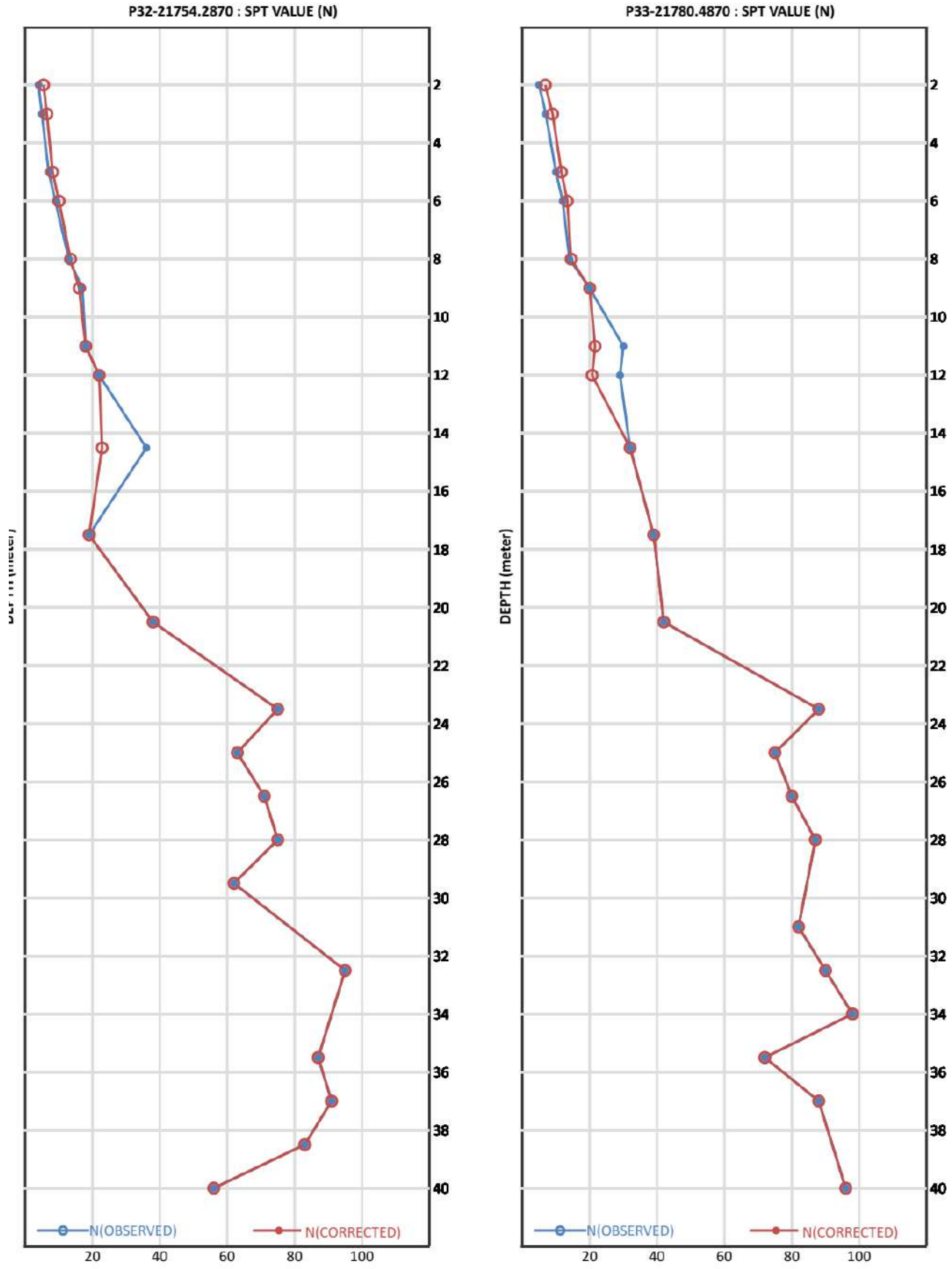


APPENDIX-E

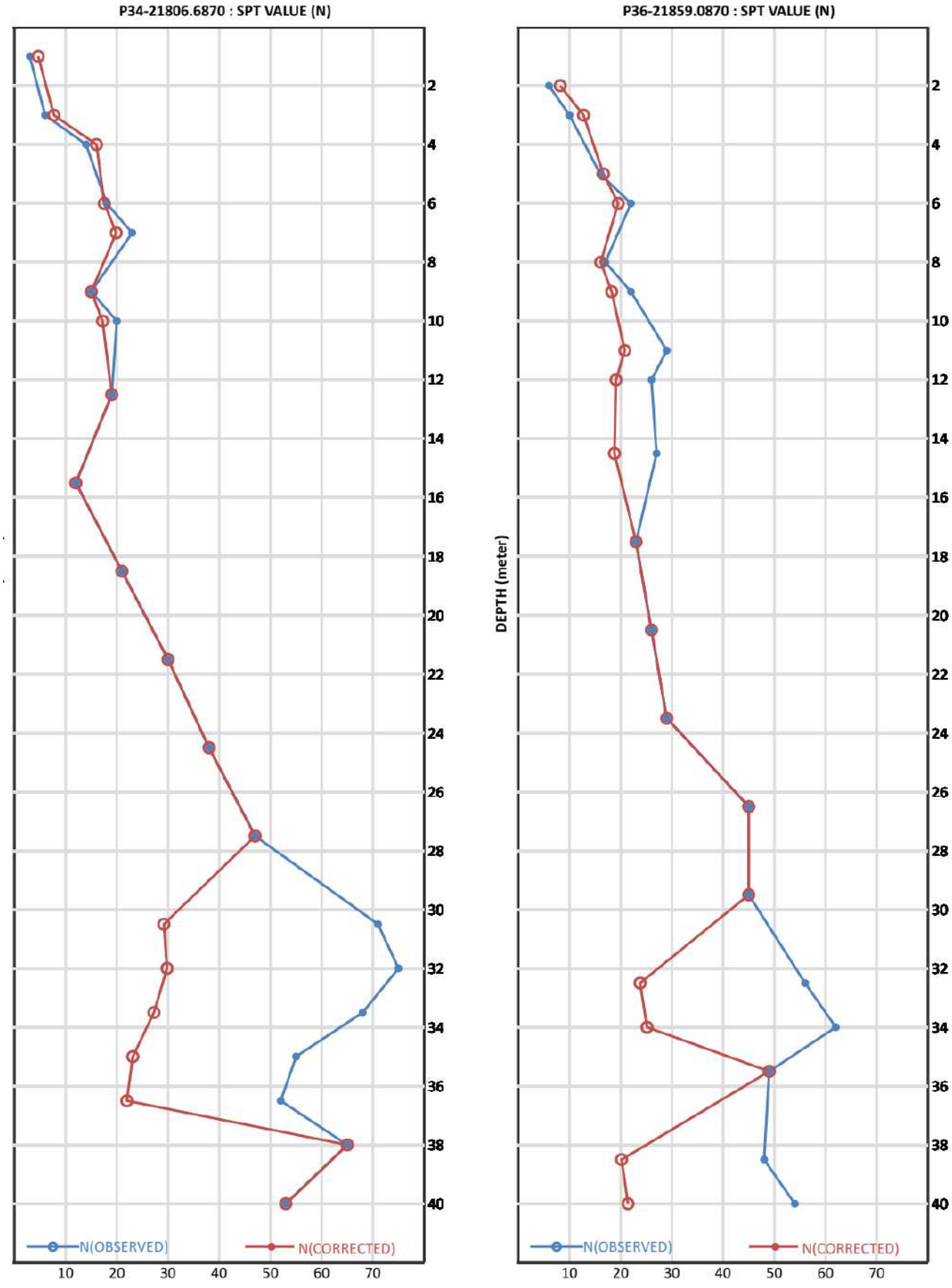
PLOT 1: RECORDED SPT Vs CORRECTED SPT



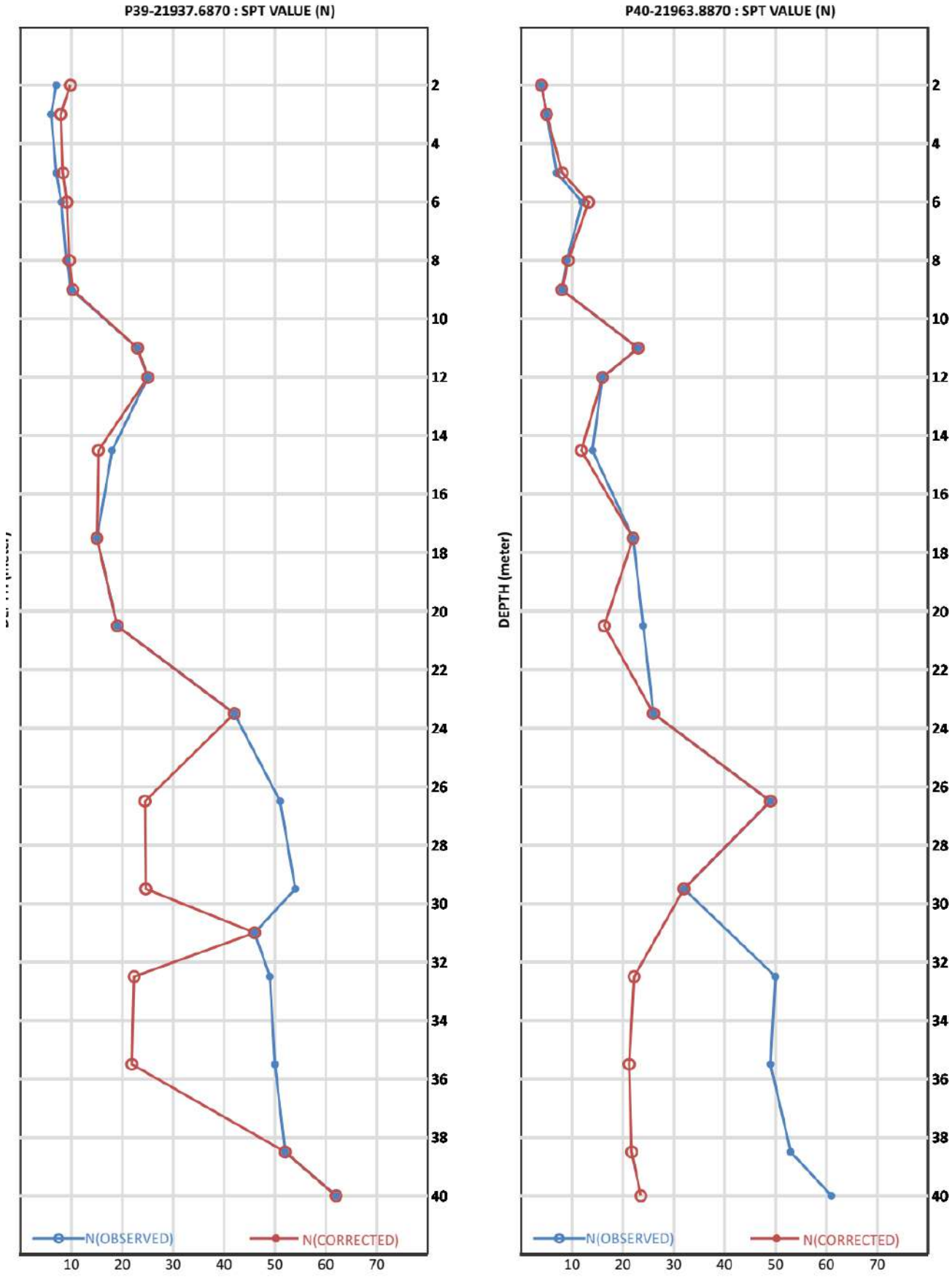
APPENDIX-E
PLOT 2: RECORDED SPT Vs CORRECTED SPT



APPENDIX-E
PLOT 3: RECORDED SPT Vs CORRECTED SPT

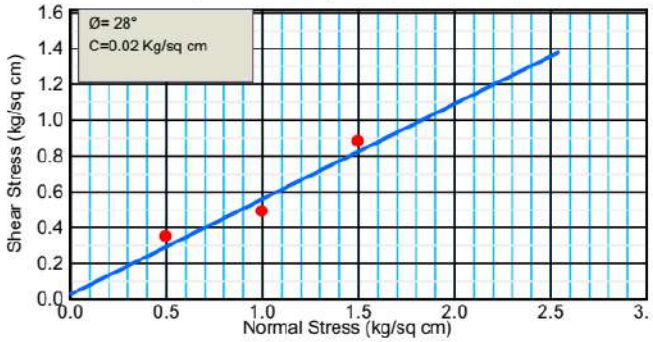


APPENDIX-E
PLOT 4: RECORDED SPT Vs CORRECTED SPT

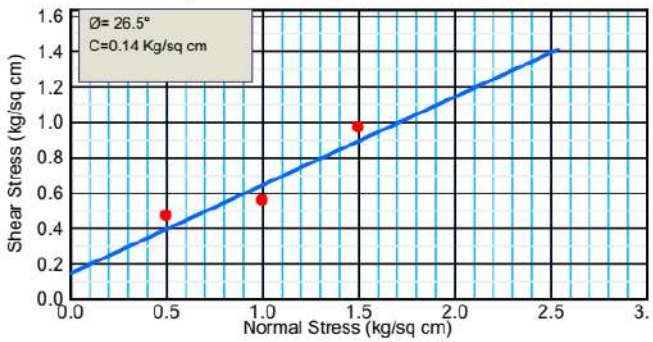


APPENDIX-F
GRAPH 1: DST GRAPH

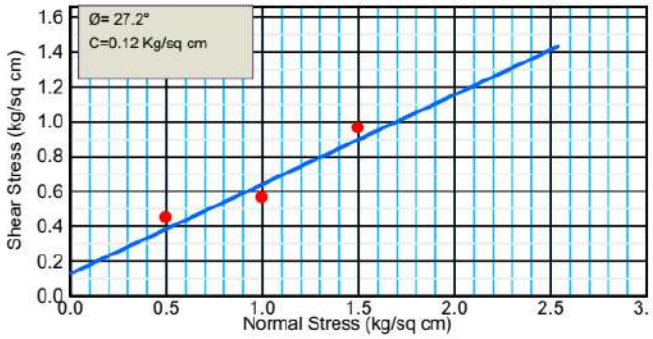
1901-HRIDC-II-21544.6870
BH-P24, DEPTH=6.00M, DIRECT SHEAR TEST



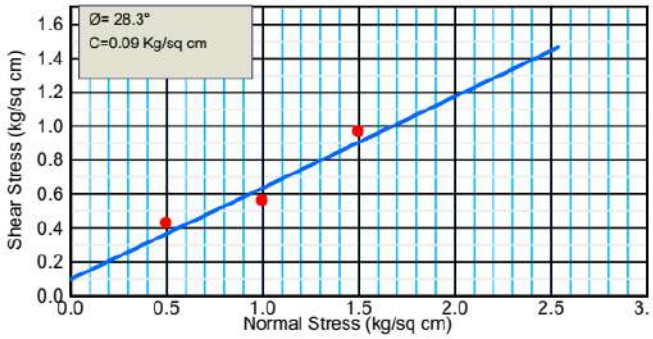
1901-HRIDC-II-21544.6870
BH-P24, DEPTH=14.00M, DIRECT SHEAR TEST



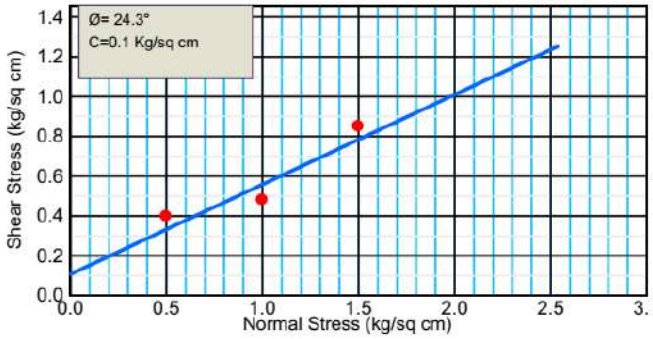
1901-HRIDC-II-21701.8870
BH-P30, DEPTH=1.00M, DIRECT SHEAR TEST



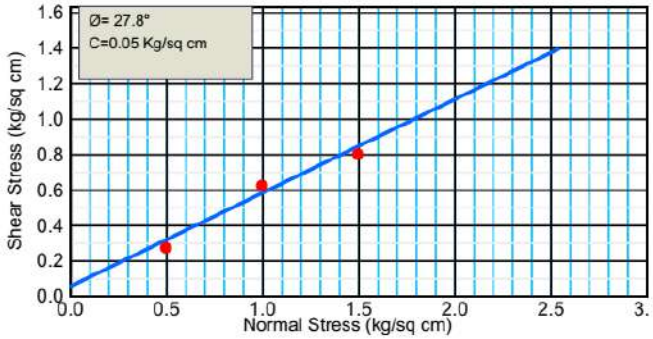
1901-HRIDC-II-21701.8870
BH-P30, DEPTH=4.00M, DIRECT SHEAR TEST



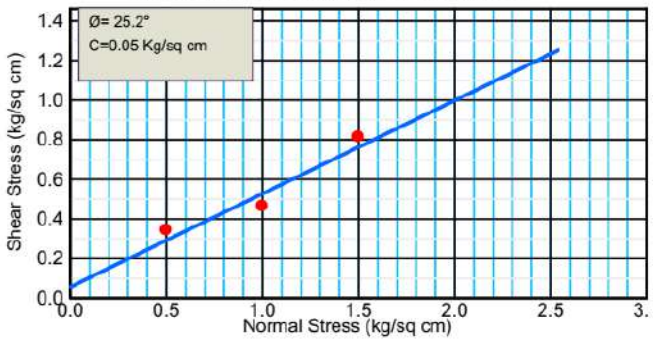
1901-HRIDC-II-21701.8870
BH-P30, DEPTH=19.00M, DIRECT SHEAR TEST



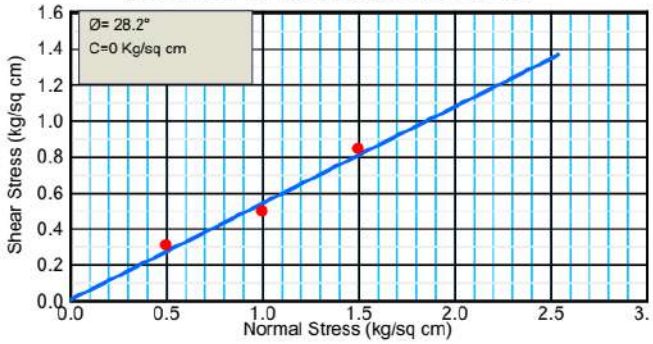
1901-HRIDC-II-21701.8870
BH-P30, DEPTH=31.00M, DIRECT SHEAR TEST



1901-HRIDC-II-21754.2870
BH-P32, DEPTH=1.00M, DIRECT SHEAR TEST

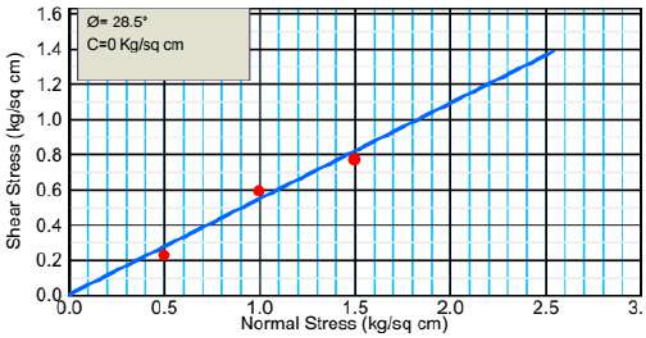


1901-HRIDC-II-21754.2870
BH-P32, DEPTH=4.00M, DIRECT SHEAR TEST

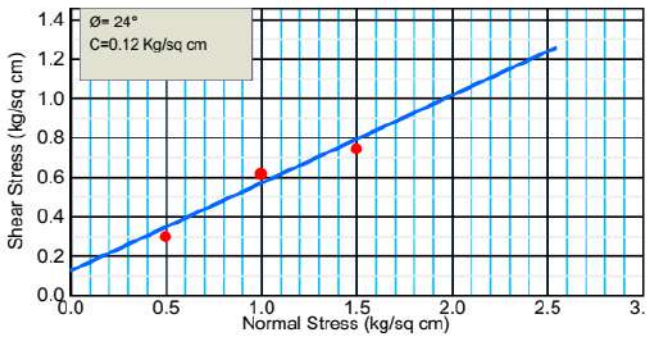


APPENDIX-F
GRAPH 2: DST GRAPH

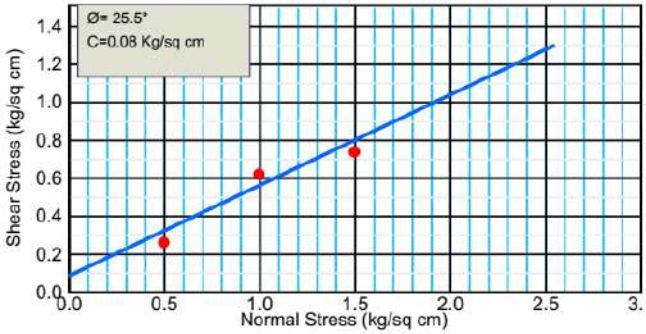
1901-HRIDC-II-21754.2870
BH-P32, DEPTH=7.00M, DIRECT SHEAR TEST



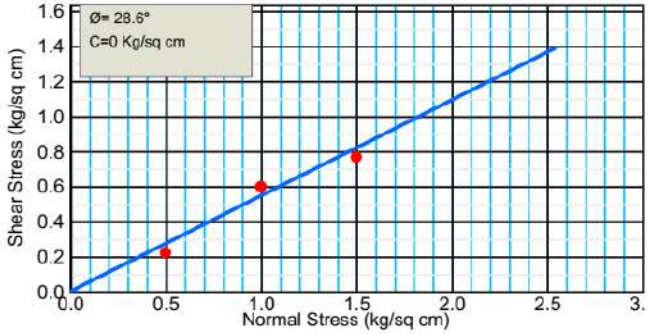
1901-HRIDC-II-21754.2870
BH-P32, DEPTH=19.00M, DIRECT SHEAR TEST



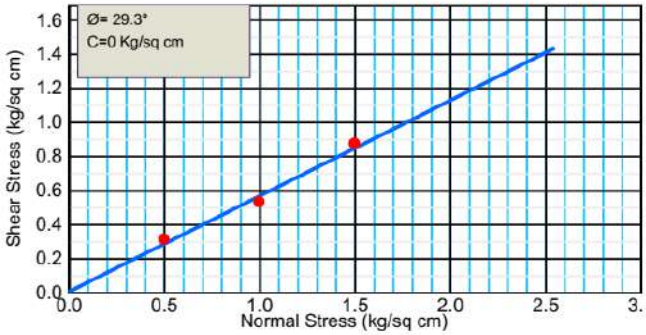
1901-HRIDC-II-21780.4870
BH-P33, DEPTH=1.00M, DIRECT SHEAR TEST



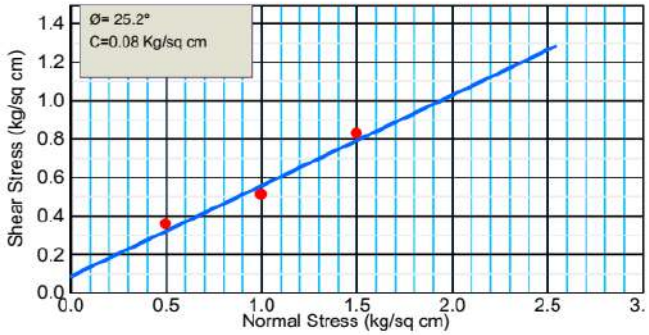
1901-HRIDC-II-21780.4870
BH-P33, DEPTH=4.00M, DIRECT SHEAR TEST



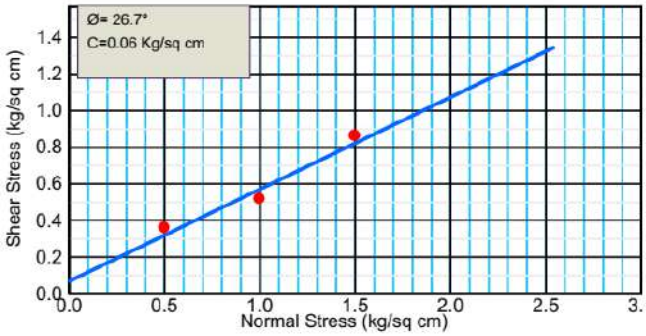
1901-HRIDC-II-21780.4870
BH-P33, DEPTH=7.00M, DIRECT SHEAR TEST



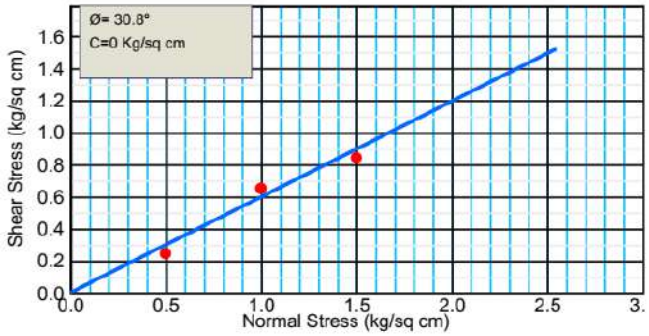
1901-HRIDC-II-21780.4870
BH-P33, DEPTH=22.00M, DIRECT SHEAR TEST



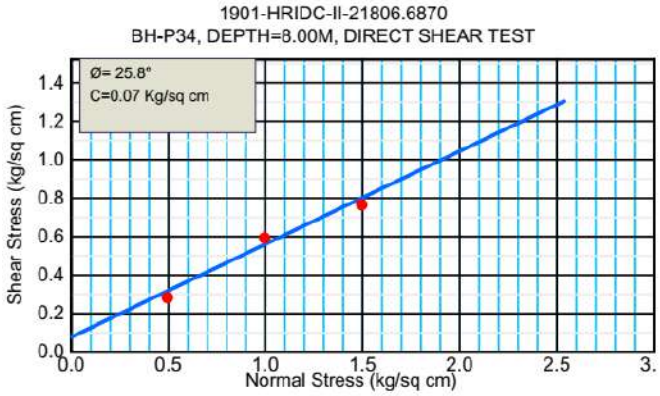
1901-HRIDC-II-21806.6870
BH-P34, DEPTH=2.00M, DIRECT SHEAR TEST

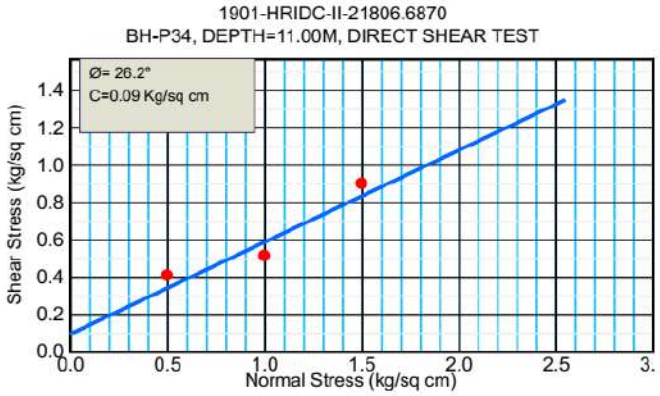


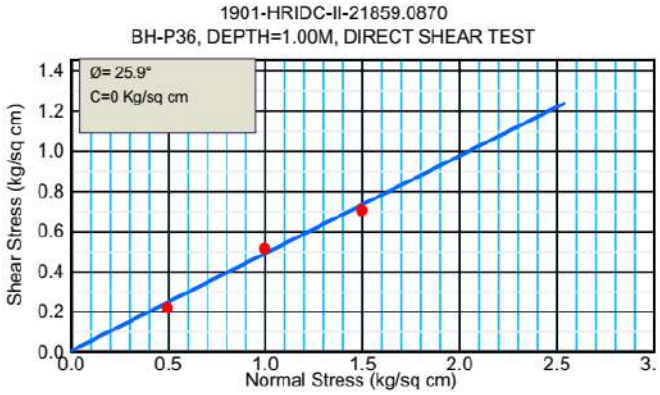
1901-HRIDC-II-21806.6870
BH-P34, DEPTH=5.00M, DIRECT SHEAR TEST

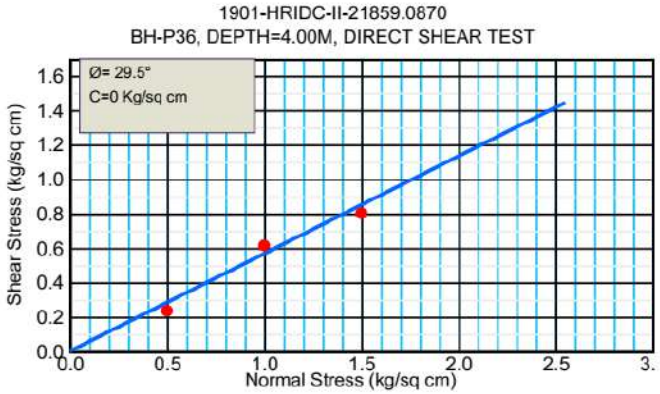


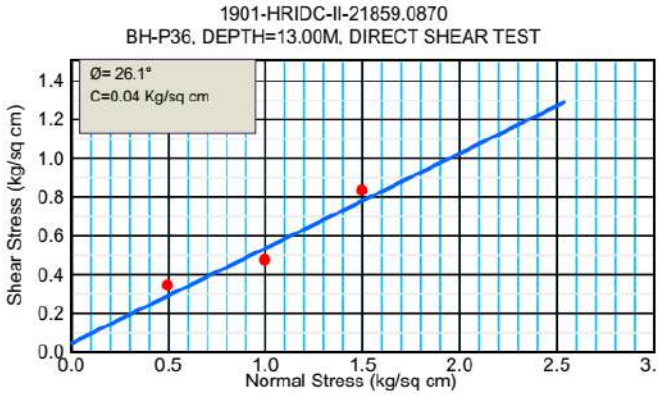
APPENDIX-F
GRAPH 3: DST GRAPH

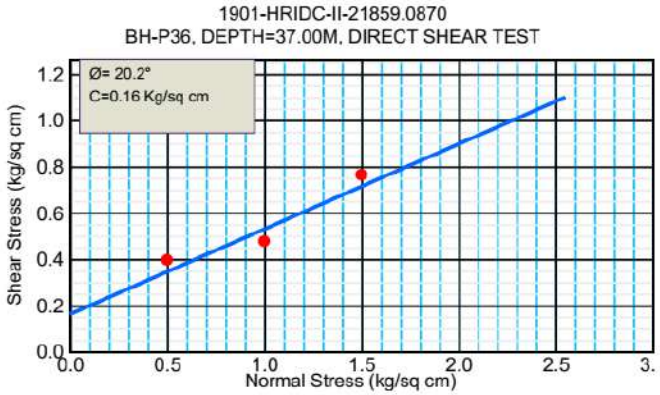




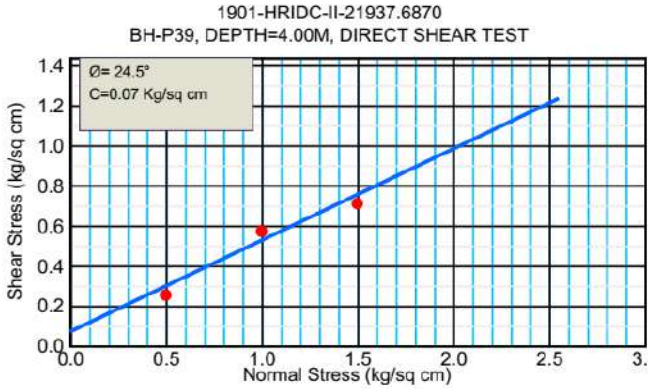


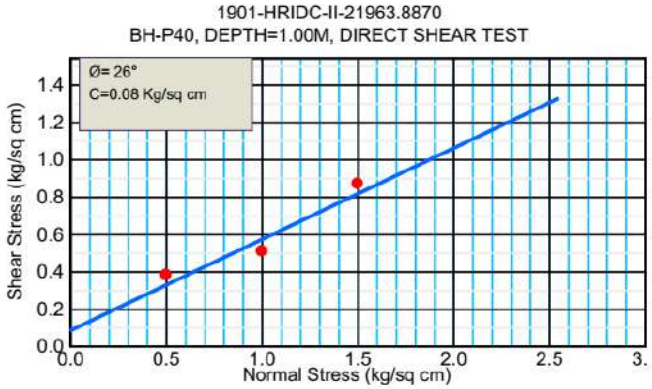


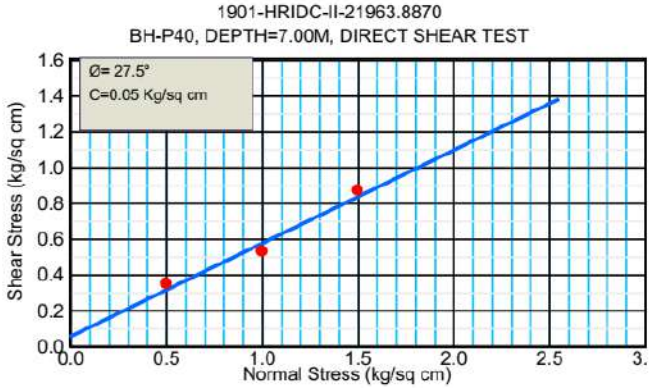


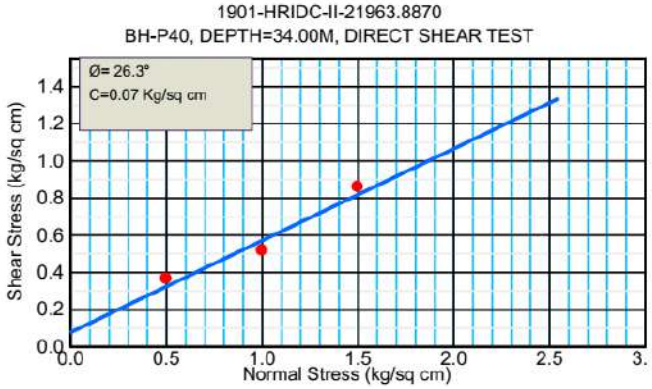


APPENDIX-F
GRAPH 4: DST GRAPH



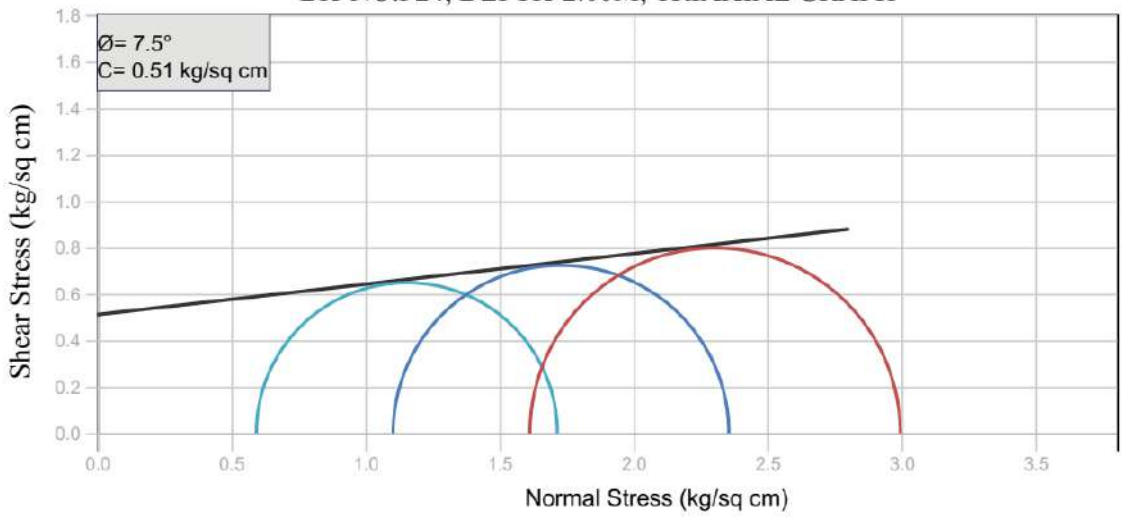






APPENDIX-G
GRAPH 1: UU GRAPH

1901-HRIDC-II-21544.6870
BH-NO.P24, DEPTH-2.00M, TRIAXIAL GRAPH



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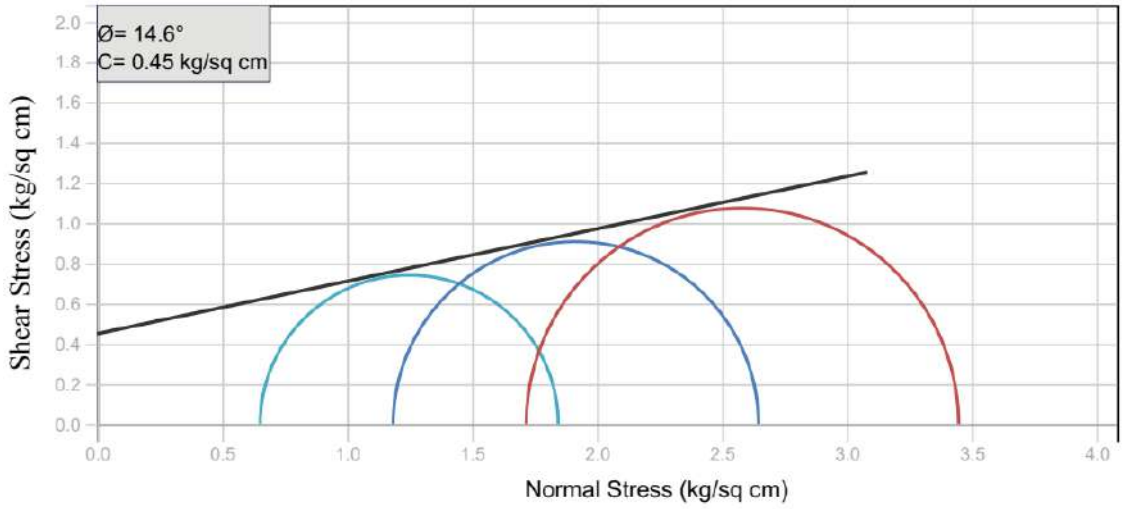
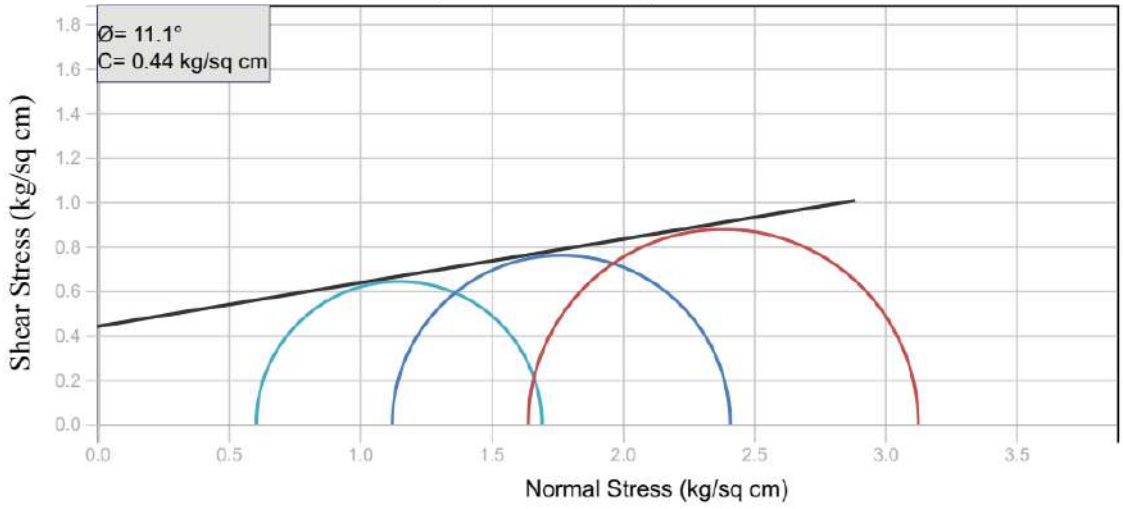
BH-NO.P24, DEPTH-17.00M, TRIAXIAL GRAPH

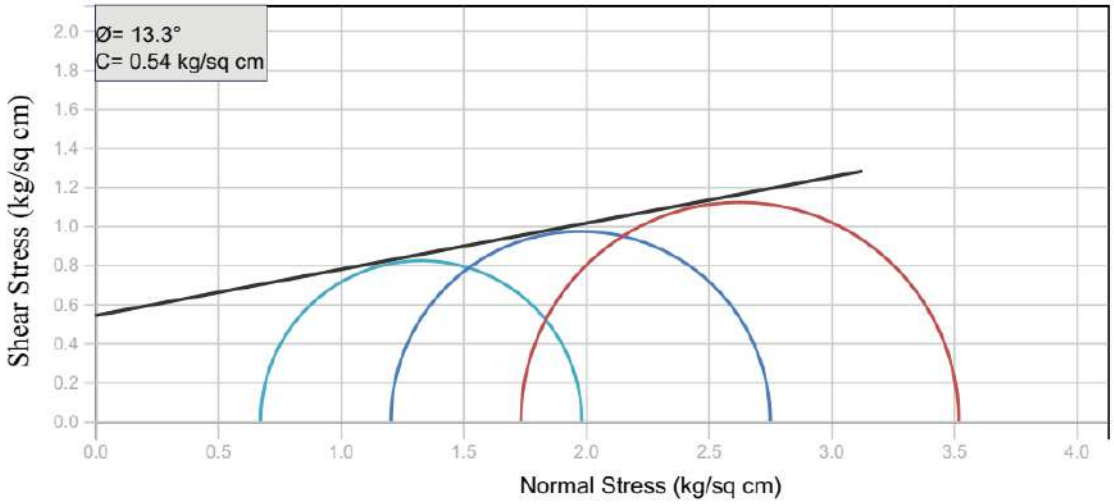


1901-HRIDC-II-21544.6870
BH-NO.P24, DEPTH-23.00M, TRIAXIAL GRAPH

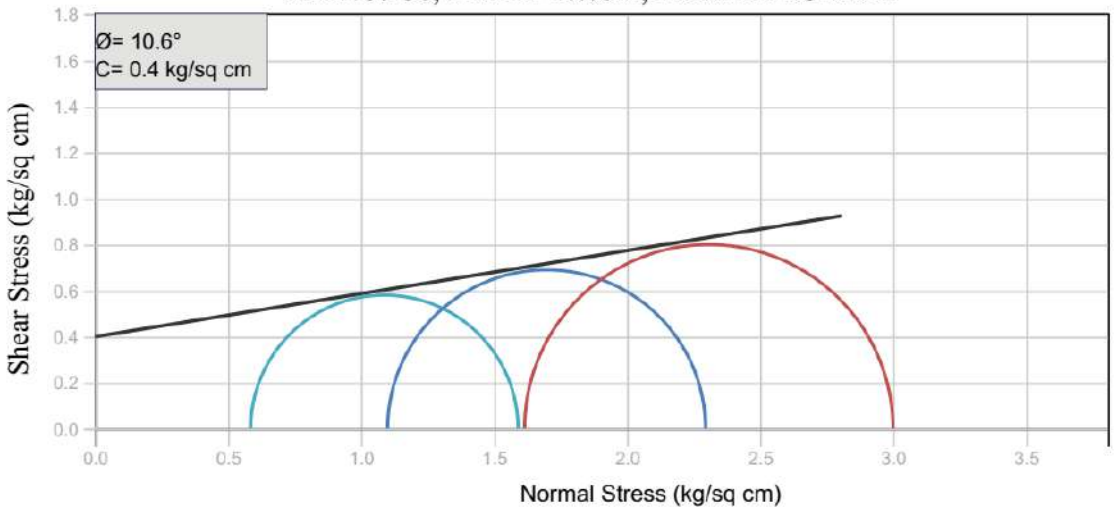


APPENDIX-G
GRAPH 2: UU GRAPH

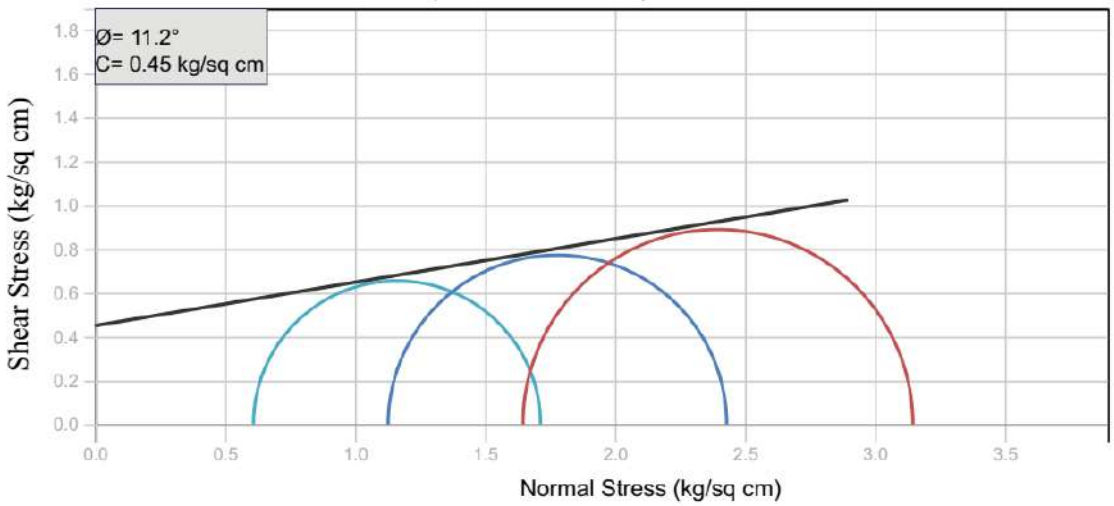
1901-HRIDC-II-21544.6870
BH-NO.P24, DEPTH-29.00M, TRIAXIAL GRAPH



1901-HRIDC-II-21701.8870
BH-NO.P30, DEPTH-10.00M, TRIAXIAL GRAPH

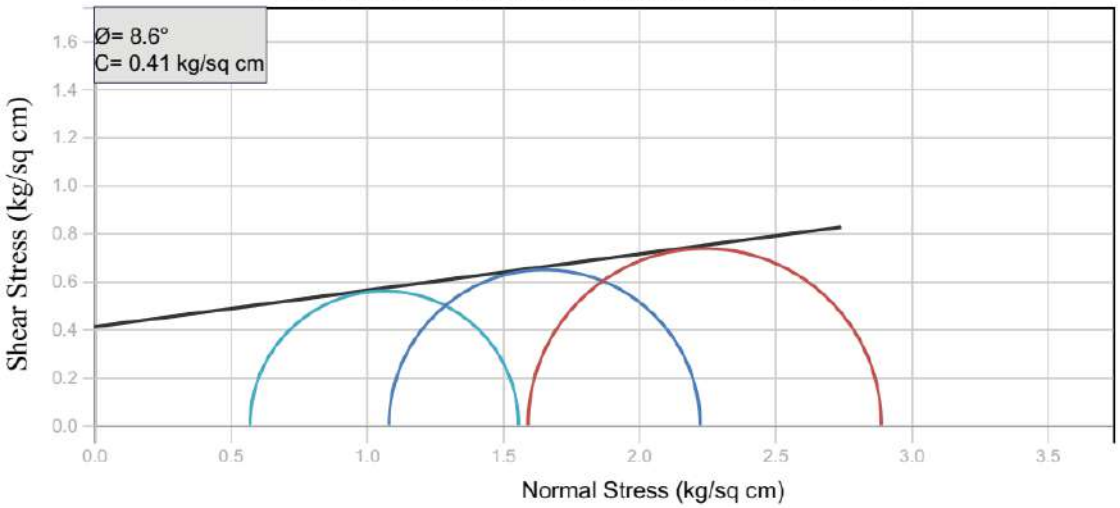


1901-HRIDC-II-21701.8870
BH-NO.P30, DEPTH-16.00M, TRIAXIAL GRAPH

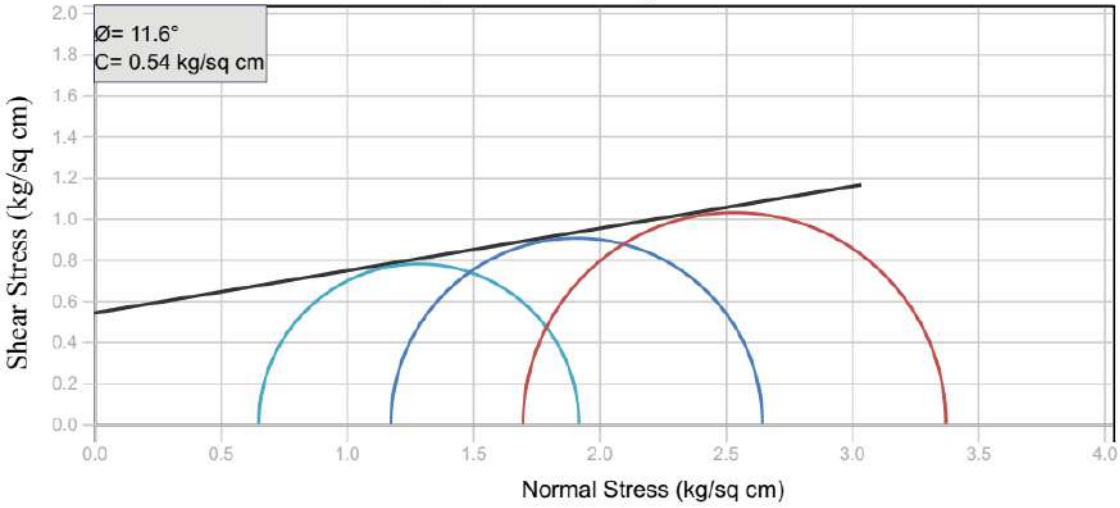


APPENDIX-G
GRAPH 3: UU GRAPH

1901-HRIDC-II-21701.8870
BH-NO.P30, DEPTH-25.00M, TRIAXIAL GRAPH



1901-HRIDC-II-21754.2870
BH-NO.P32, DEPTH-10.00M, TRIAXIAL GRAPH



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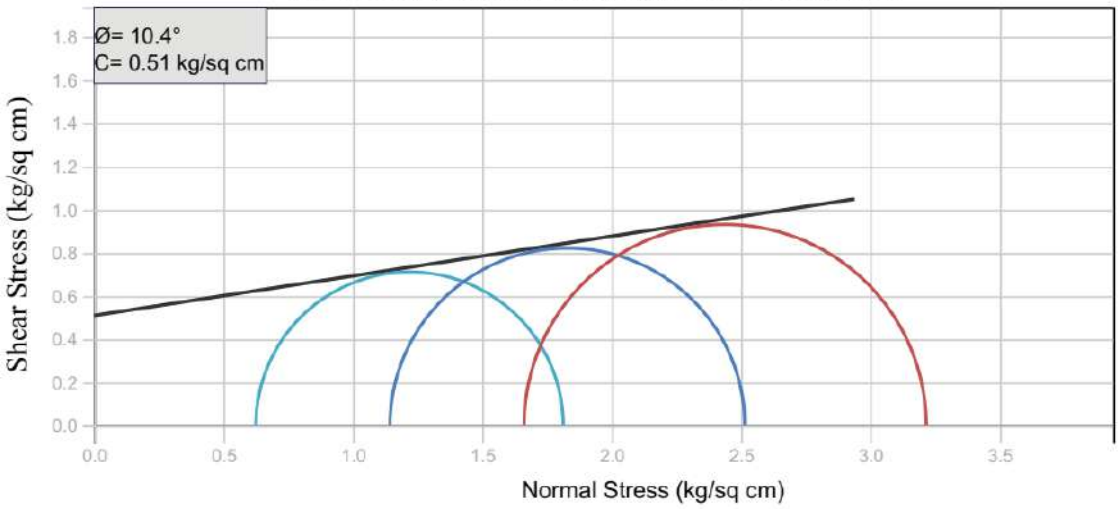
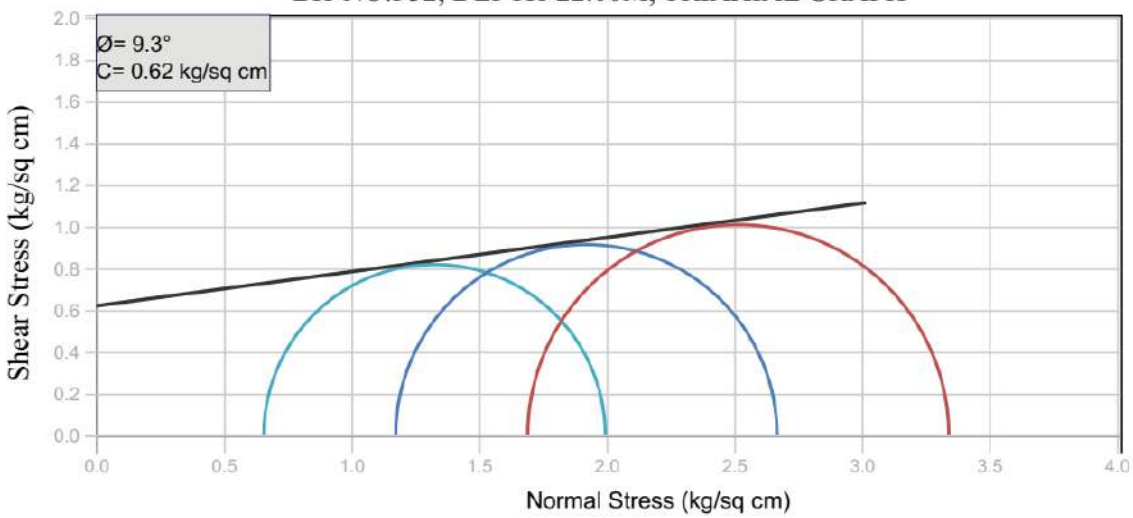
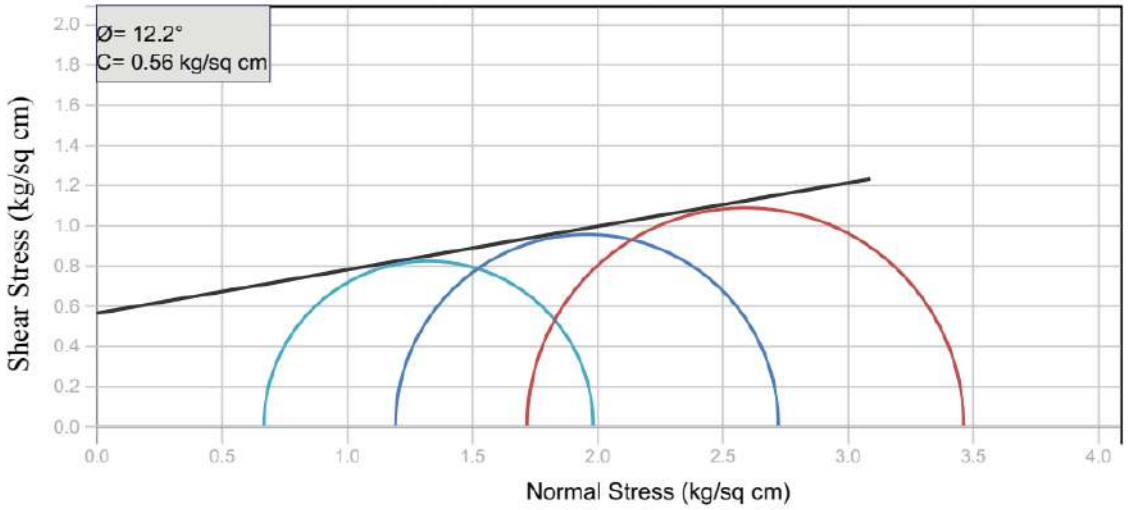


APPENDIX-G
GRAPH 4: UU GRAPH

1901-HRIDC-II-21754.2870
BH-NO.P32, DEPTH-22.00M, TRIAXIAL GRAPH



1901-HRIDC-II-21780.4870
BH-NO.P33, DEPTH-10.00M, TRIAXIAL GRAPH



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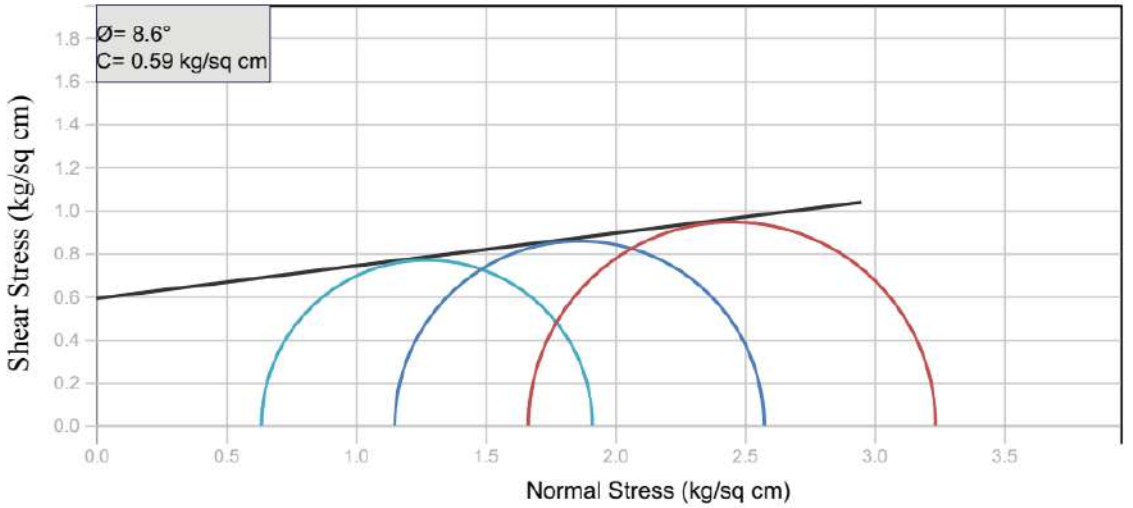
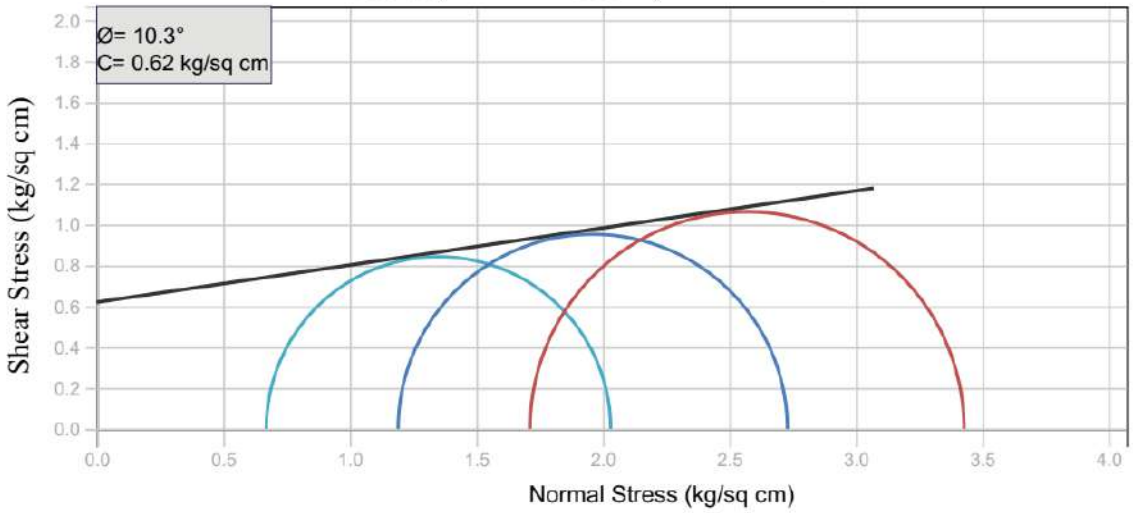
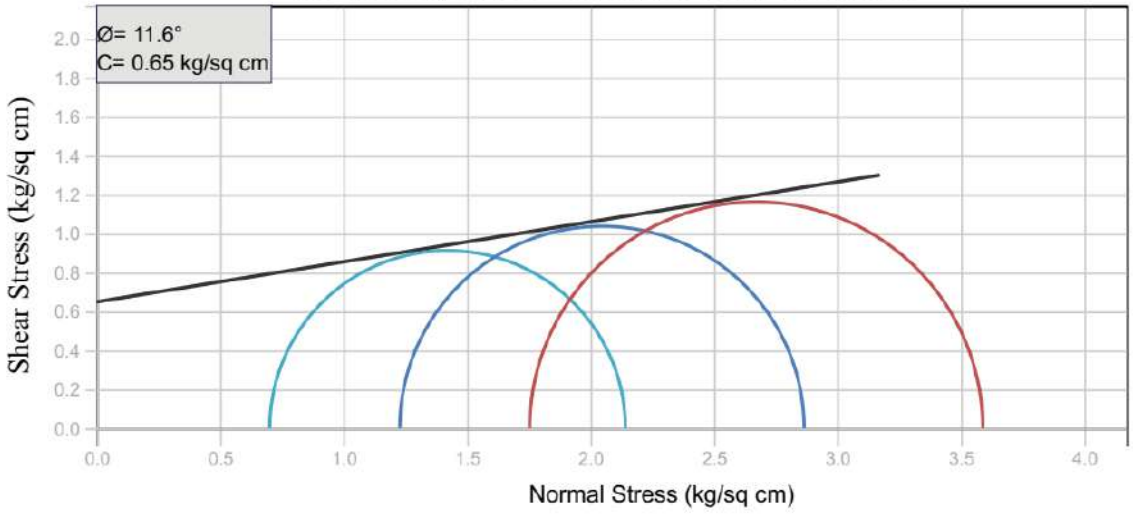


APPENDIX-G
GRAPH 5: UU GRAPH

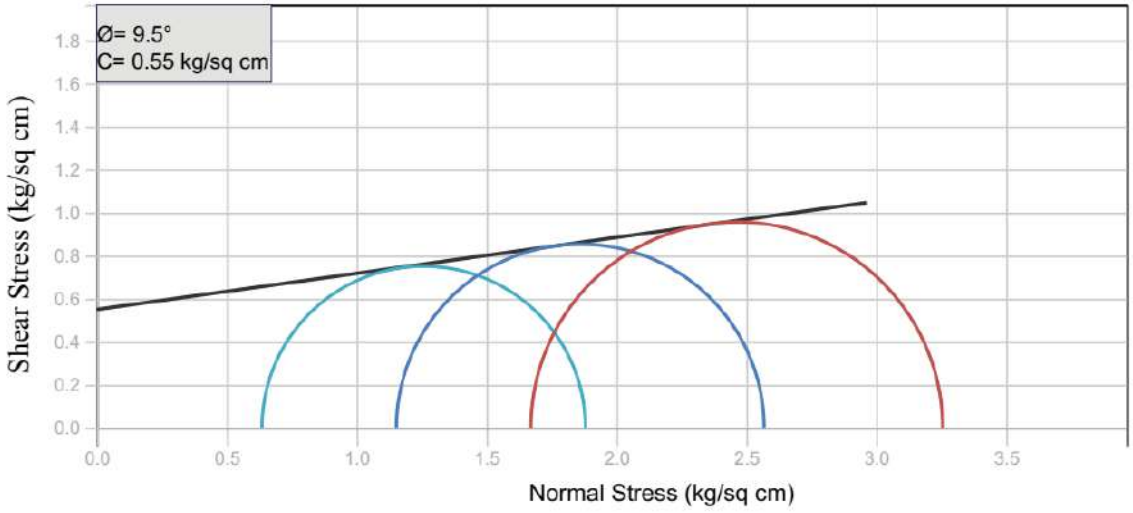
1901-HRIDC-II-21780.4870
BH-NO.P33, DEPTH-16.00M, TRIAXIAL GRAPH



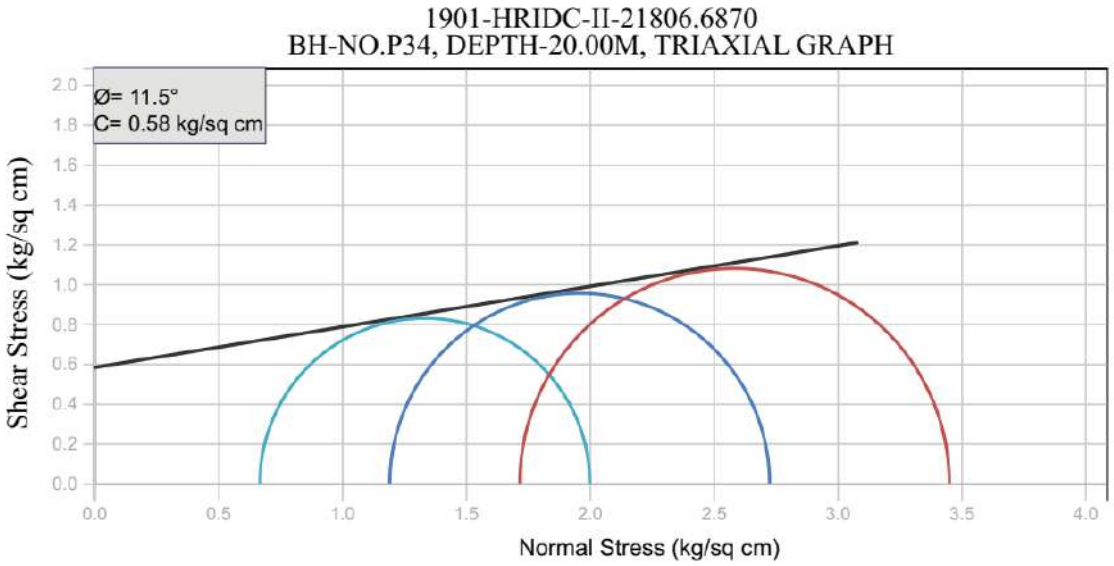
1901-HRIDC-II-21780.4870
BH-NO.P33, DEPTH-19.00M, TRIAXIAL GRAPH

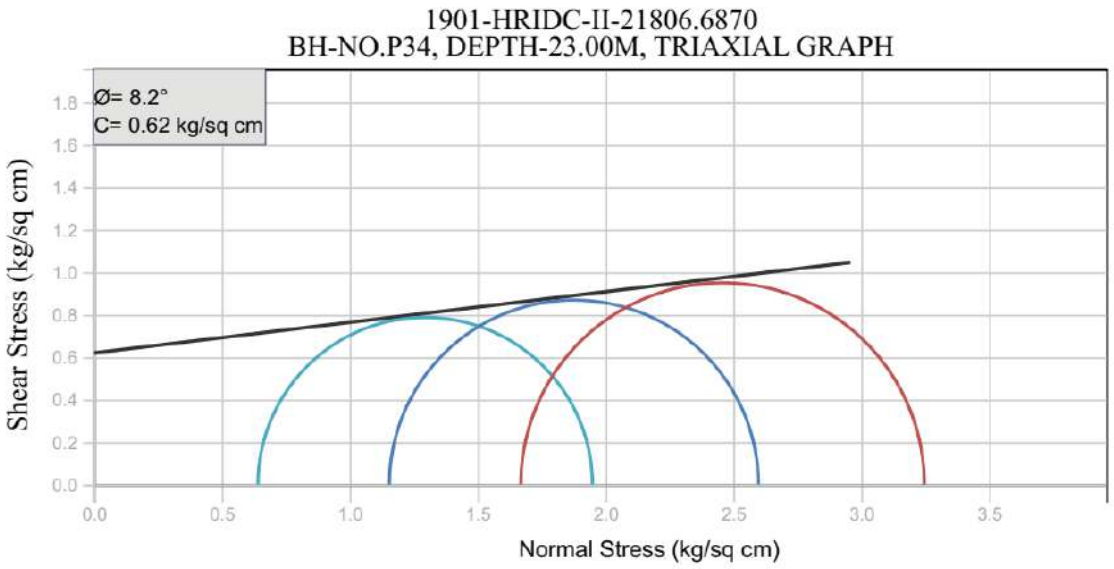


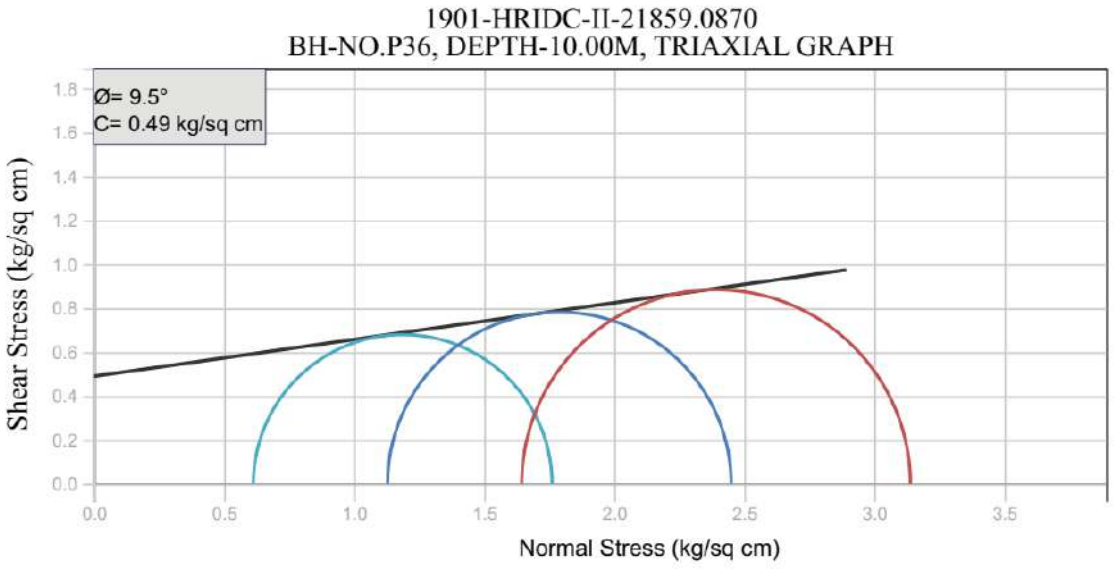
1901-HRIDC-II-21806.6870
BH-NO.P34, DEPTH-14.00M, TRIAXIAL GRAPH



APPENDIX-G
GRAPH 6: UU GRAPH

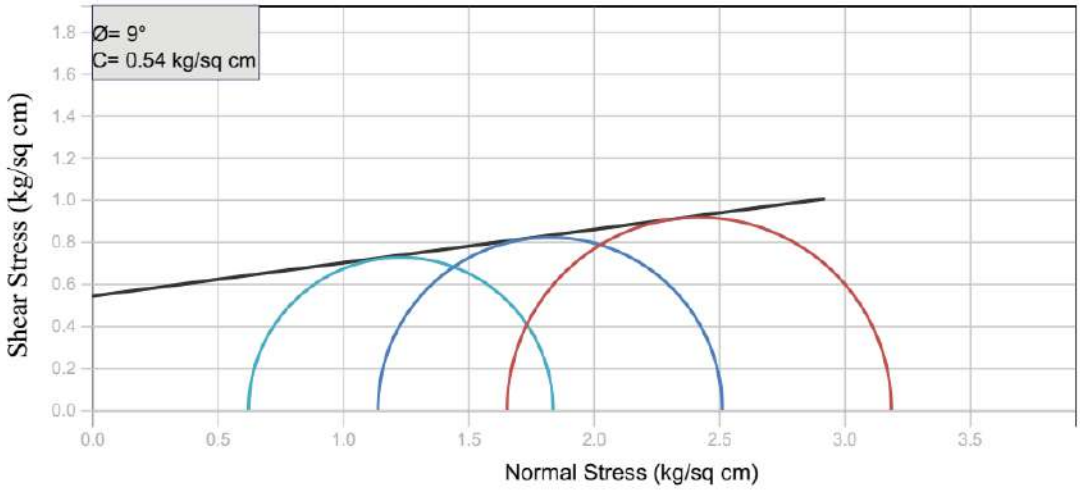




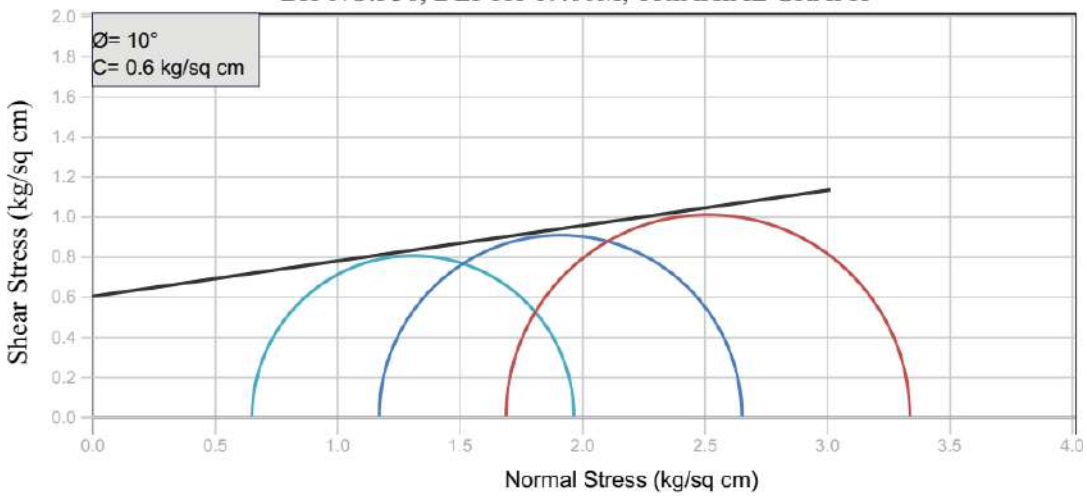


APPENDIX-G
GRAPH 7: UU GRAPH

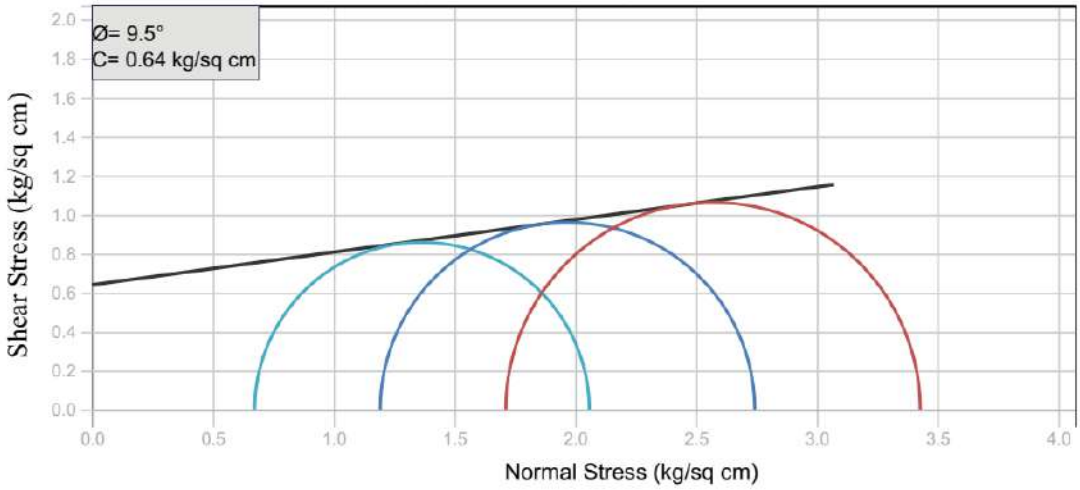
1901-HRIDC-II-21859.0870
BH-NO.P36, DEPTH-16.00M, TRIAXIAL GRAPH



1901-HRIDC-II-21859.0870
BH-NO.P36, DEPTH-19.00M, TRIAXIAL GRAPH

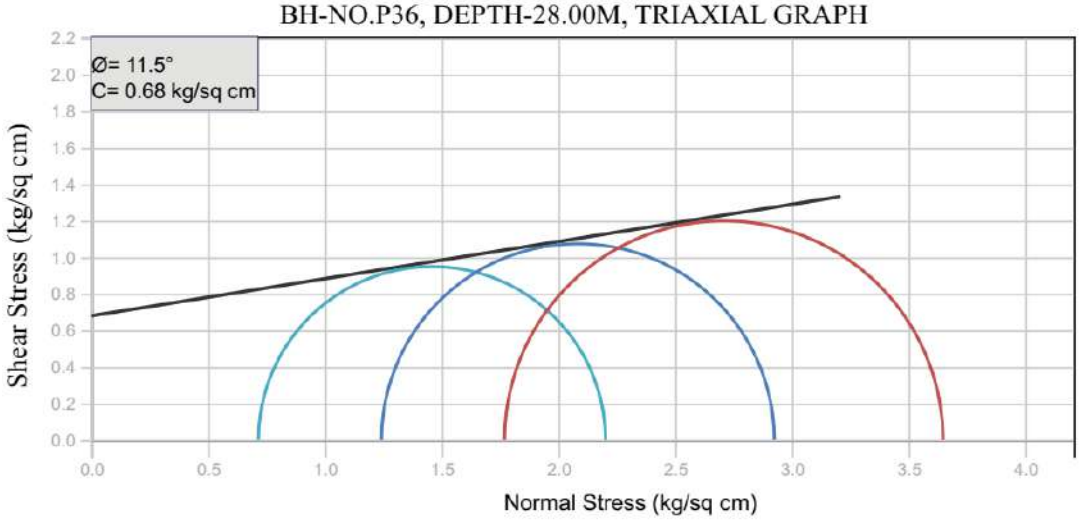


1901-HRIDC-II-21859.0870
BH-NO.P36, DEPTH-22.00M, TRIAXIAL GRAPH

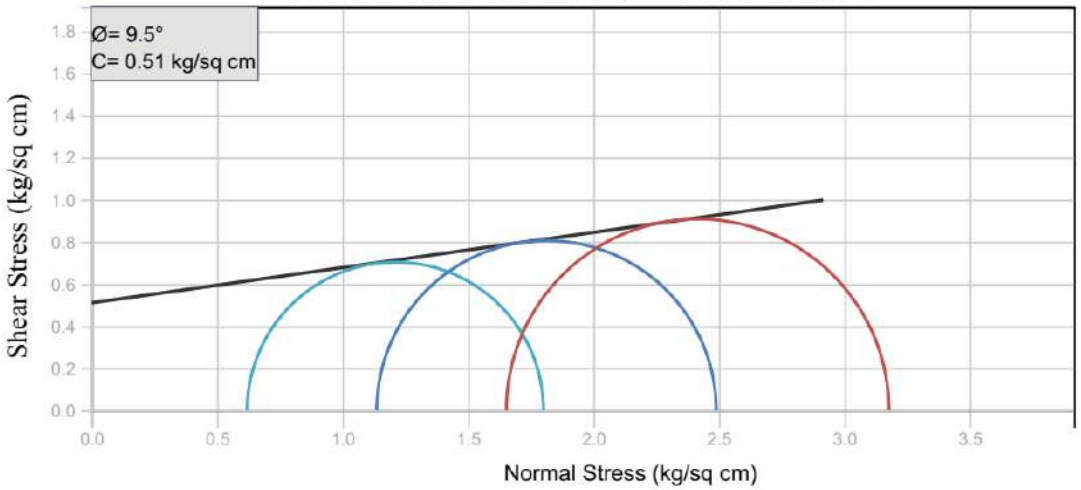


APPENDIX-G
GRAPH 8: UU GRAPH

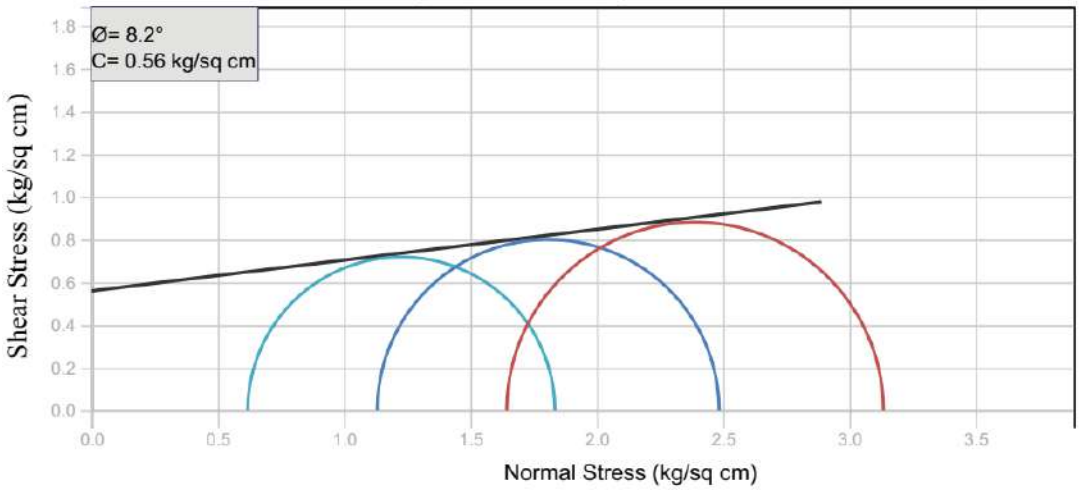
1901-HRIDC-II-21859.0870
BH-NO.P36, DEPTH-28.00M, TRIAXIAL GRAPH



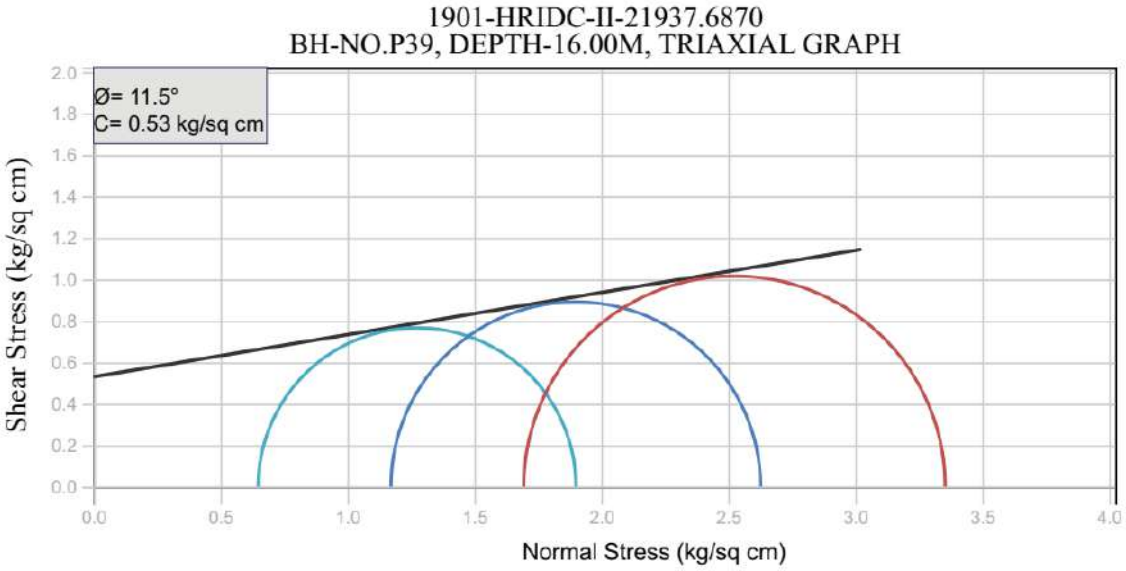
1901-HRIDC-II-21937.6870
BH-NO.P39, DEPTH-10.00M, TRIAXIAL GRAPH

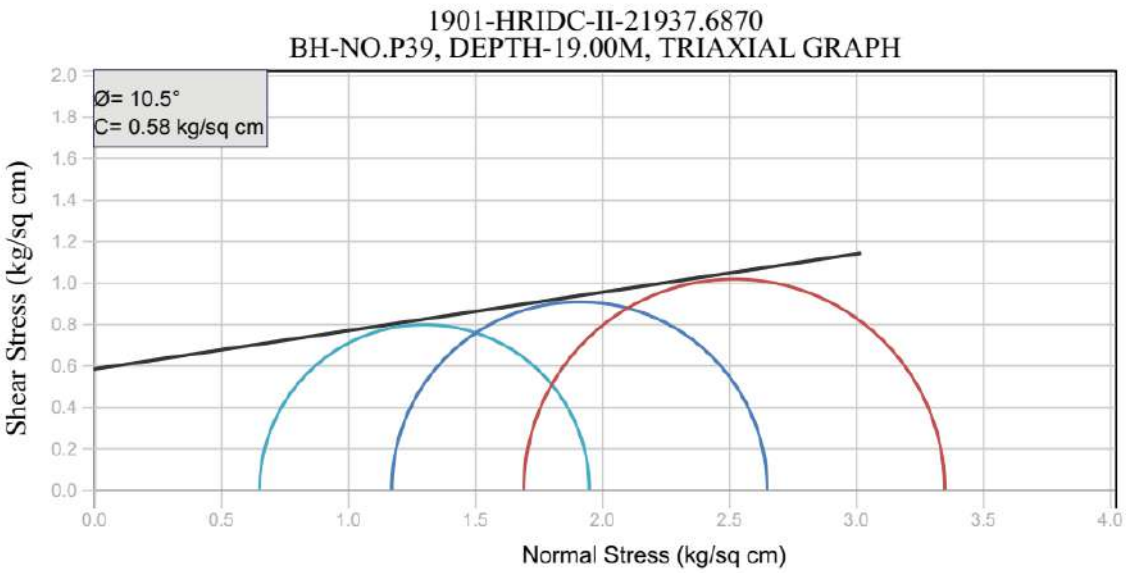


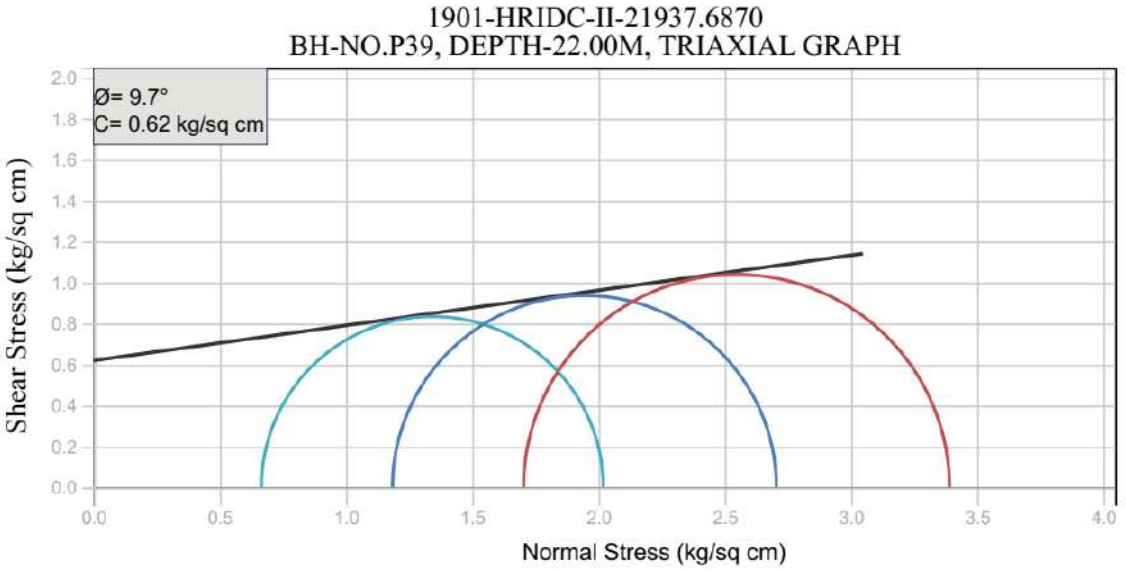
1901-HRIDC-II-21937.6870
BH-NO.P39, DEPTH-13.00M, TRIAXIAL GRAPH



APPENDIX-G
GRAPH 9: UU GRAPH

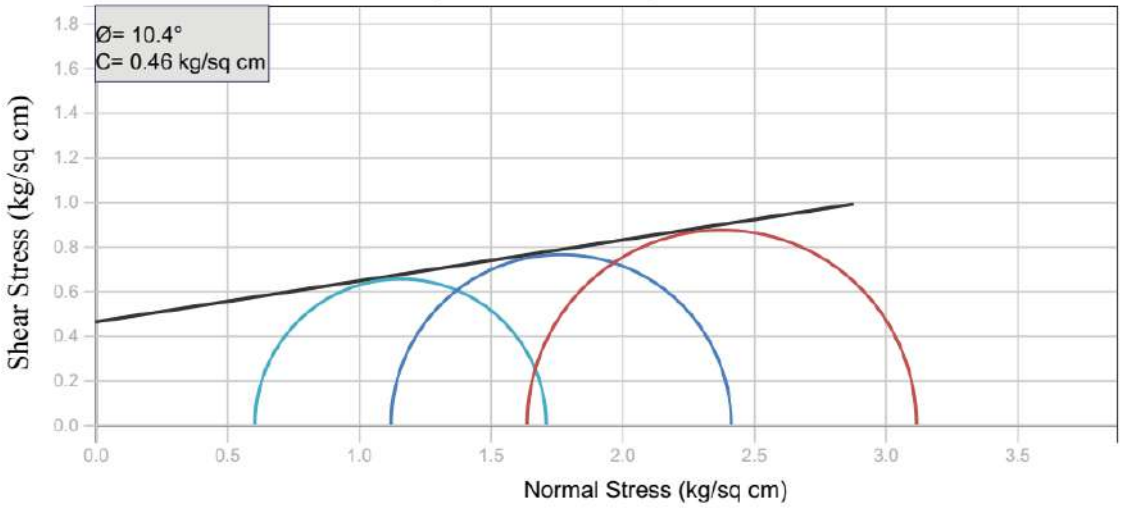




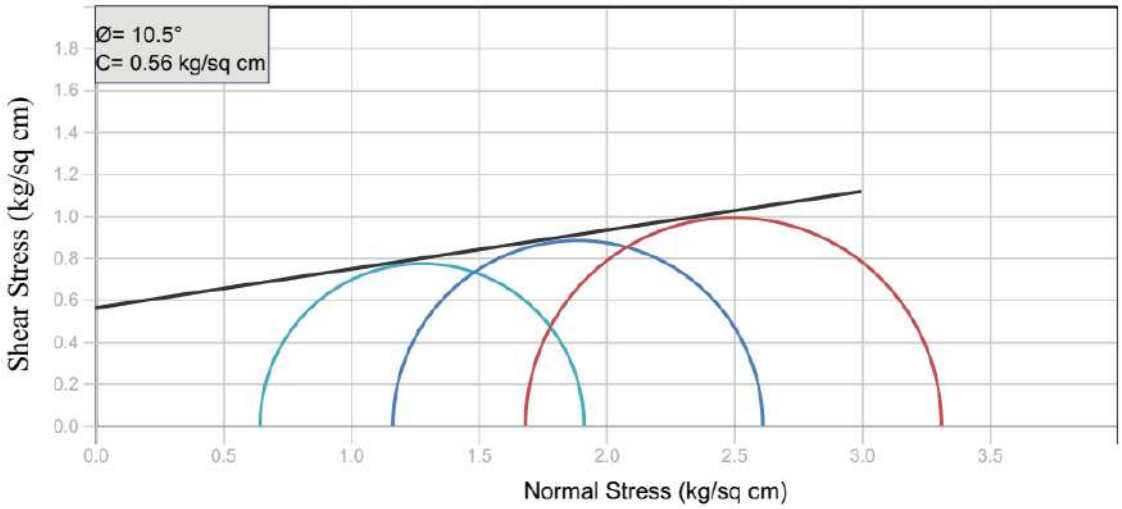


APPENDIX-G
GRAPH 10: UU GRAPH

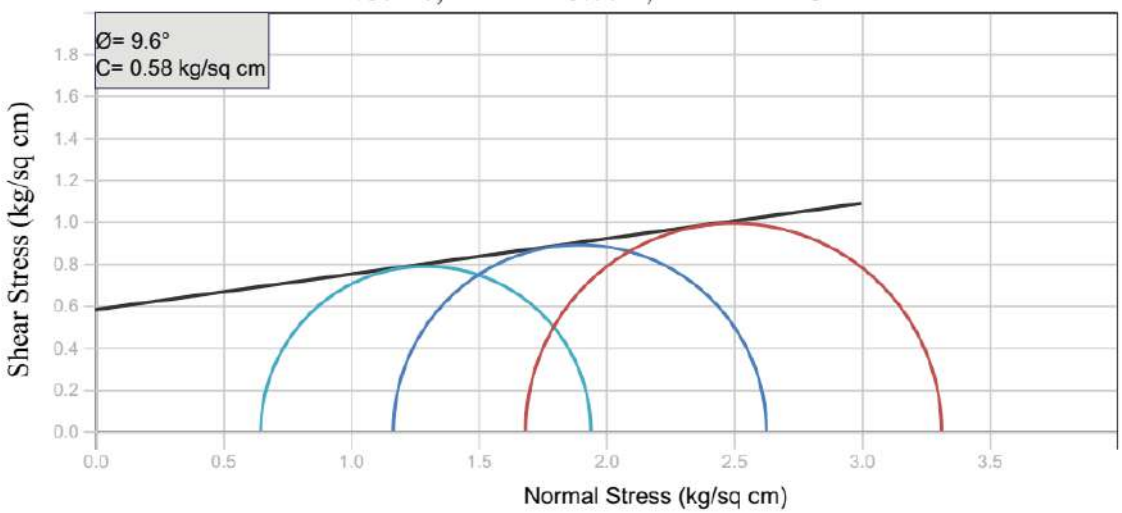
1901-HRIDC-II-21937.6870
BH-NO.P39, DEPTH-25.00M, TRIAXIAL GRAPH



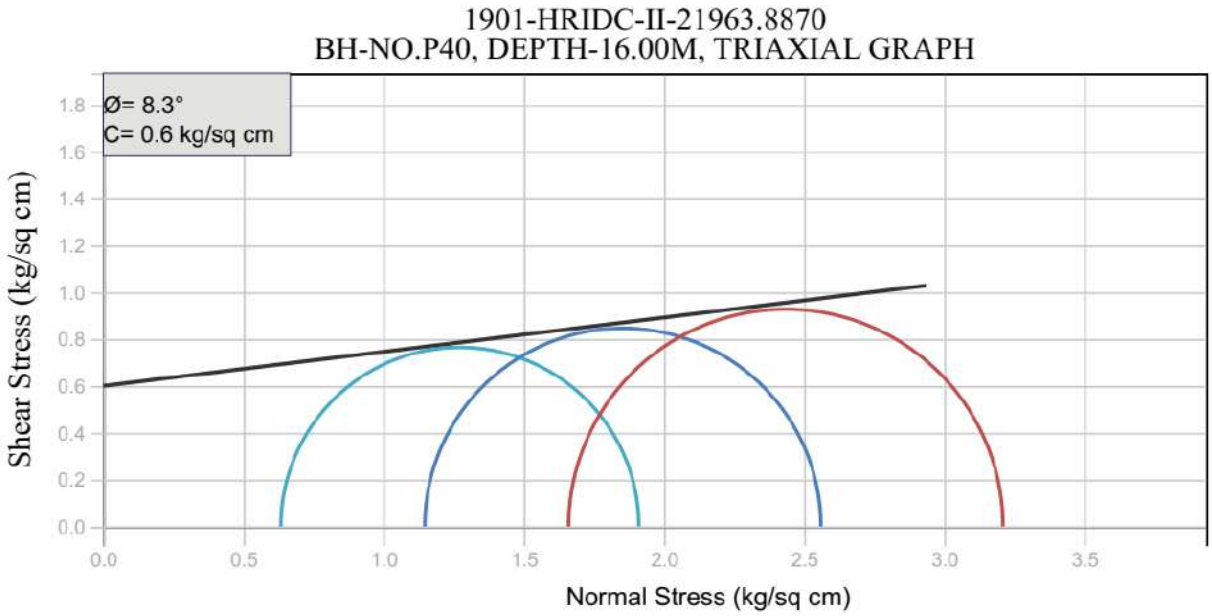
1901-HRIDC-II-21963.8870
BH-NO.P40, DEPTH-10.00M, TRIAXIAL GRAPH

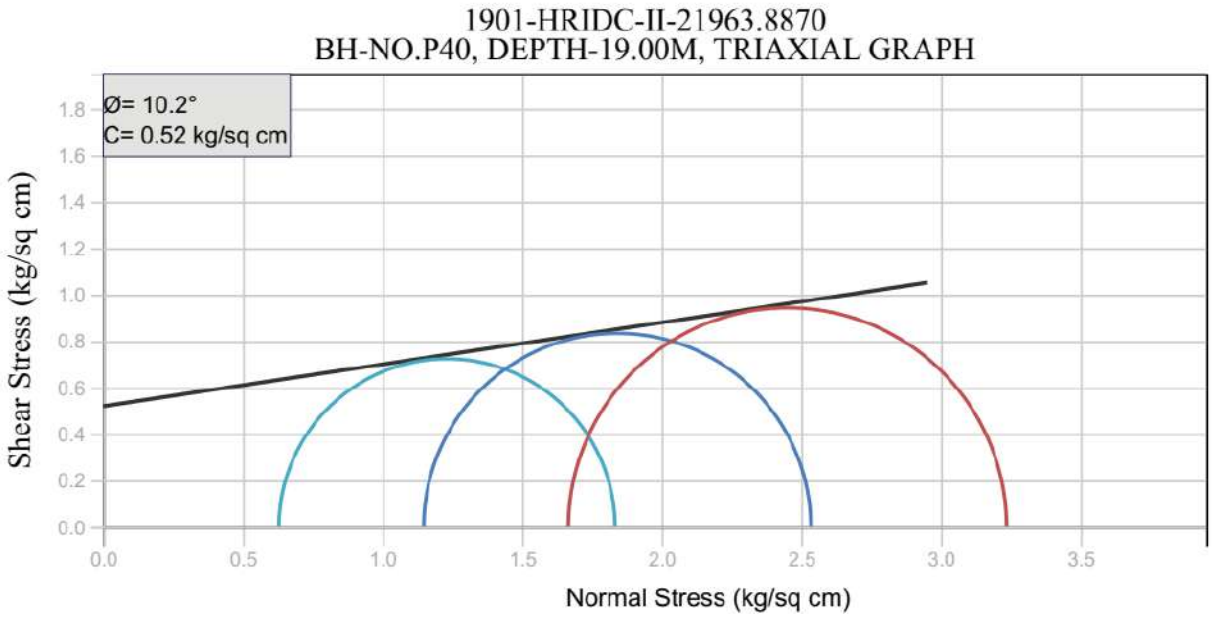


1901-HRIDC-II-21963.8870
BH-NO.P40, DEPTH-13.00M, TRIAXIAL GRAPH



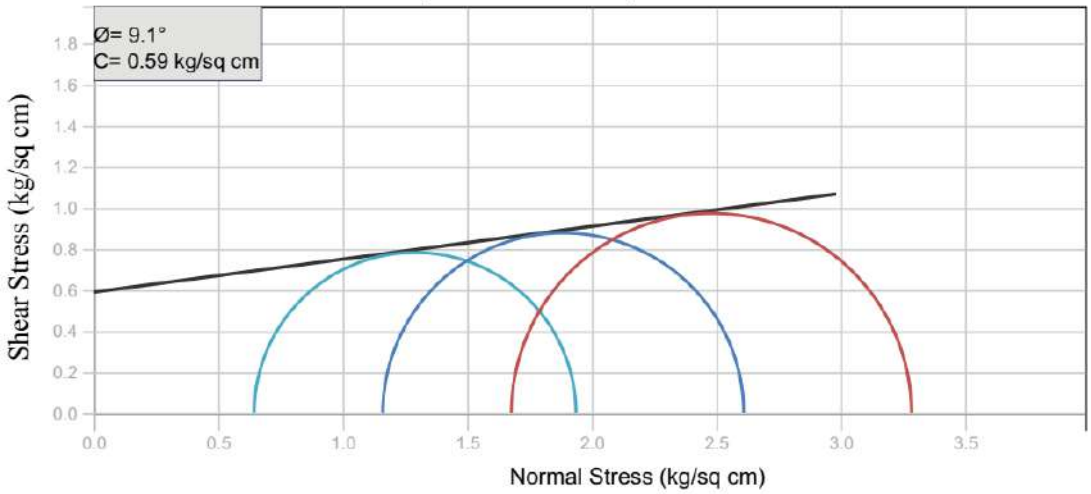
APPENDIX-G
GRAPH 11: UU GRAPH



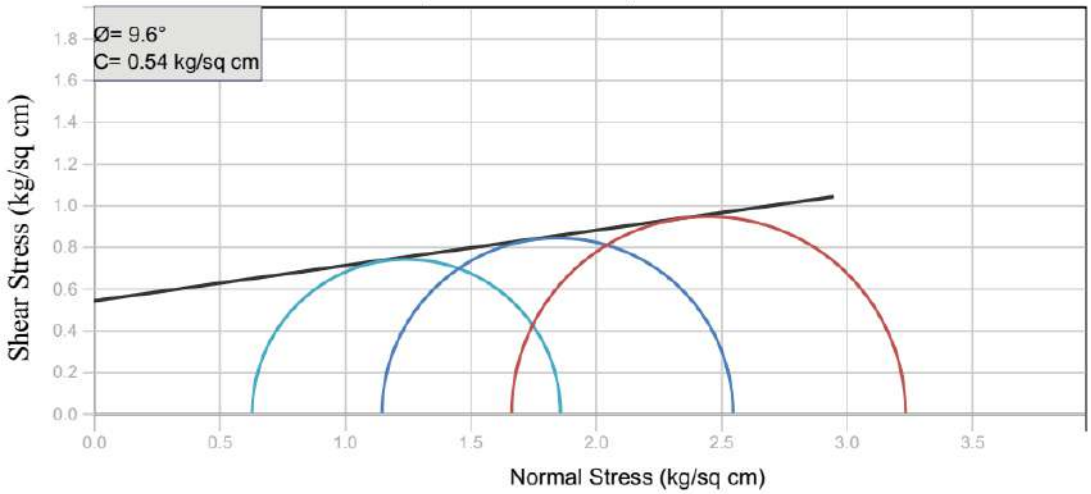


APPENDIX-G
GRAPH 12: RUU GRAPH

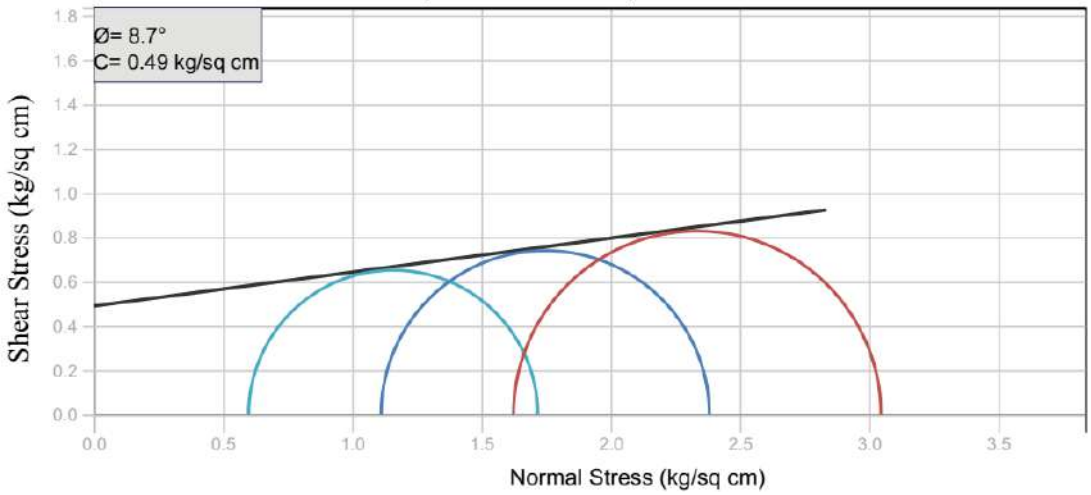
1901-HRIDC-II-21806.6870
BH-NO.P34, DEPTH-29.00M, TRIAXIAL GRAPH



1901-HRIDC-II-21937.6870
BH-NO.P39, DEPTH-37.00M, TRIAXIAL GRAPH



1901-HRIDC-II-21963.8870
BH-NO.P40, DEPTH-28.00M, TRIAXIAL GRAPH



APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
BORE NO: P24, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	20.95	10.95	30.11	1.57	7.5	7.5	1.0	6.23	0	51	1.0	80.1	0	3.0	29.5	0	10.95	20.13	21.25	32.9	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.5	20.95	10.95	38.33	3.14	29.5	29.5	1.0	68.15	0	0	1.0	0.0	0	4.0	28.2	0	10.95	17.21	18.25	43.8	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	6.00	5.00	2.00	3.5	20.95	10.95	54.75	6.29	28.2	28.2	1.0	184.53	0	0	1.0	0.0	0	6.0	28.0	2	8.97	16.76	17.79	65.7	0	0.0	41.2	41.2	**0.00**	**13.74**
6.00	7.00	6.50	1.00	4.5	18.97	8.97	70.19	3.14	28.0	28.0	1.0	117.29	0	2	1.0	6.3	0	7.0	28.0	2	8.97	16.76	17.79	74.7	1059.9	1059.9	53.0	53.0	**423.95**	**17.67**
7.00	8.00	7.50	1.00	5.5	18.97	8.97	79.16	3.14	28.0	28.0	1.0	132.27	132.27	2	1.0	6.3	6.3	8.0	28.0	2	8.97	16.76	17.79	83.6	1178.0	1316.5	64.8	203.4	**526.62**	**67.79**
8.00	9.00	8.50	1.00	6.5	18.97	8.97	88.13	3.14	28.0	28.0	1.0	147.26	279.54	2	1.0	6.3	12.6	9.0	28.0	2	8.97	16.76	17.79	92.6	1296.1	1588.2	76.6	368.7	**635.27**	**122.90**
9.00	10.00	9.50	1.00	7.5	18.97	8.97	97.10	3.14	28.0	28.0	1.0	162.25	441.79	2	1.0	6.3	18.9	10.0	32.8	0	9.14	35.36	36.75	101.6	2954.5	3415.1	88.4	549.0	**1366.06**	**183.00**
10.00	12.50	11.25	2.50	10.0	19.14	9.14	113.01	7.86	32.8	32.8	1.1	652.32	1094.11	0	1.0	0.0	18.9	12.5	32.8	0	9.14	35.36	36.75	124.4	3589.4	4702.4	117.8	1230.8	**1880.95**	**410.26**
12.50	14.00	13.25	1.50	11.5	19.14	9.14	131.29	4.71	32.8	32.8	1.1	454.70	1548.82	0	1.0	0.0	18.9	14.0	26.5	14	10.96	13.38	14.34	138.1	1612.7	3180.4	135.5	1703.2	**1272.17**	**567.72**
14.00	15.50	14.75	1.50	13.0	20.96	10.96	146.36	4.71	26.5	26.5	1.0	344.01	1892.83	14	1.0	66.0	84.9	15.5	26.5	0	10.96	13.38	14.34	138.1	1513.7	3491.4	153.2	2130.8	**1396.57**	**710.28**
15.50	17.00	16.25	1.50	14.5	20.96	10.96	146.36	4.71	26.5	26.5	1.0	344.01	2236.84	0	1.0	0.0	84.9	17.0	14.6	45	10.85	3.82	2.54	138.1	744.1	3065.8	170.8	2492.5	**1226.31**	**830.84**
17.00	18.50	17.75	1.50	16.0	20.85	10.85	146.36	4.71	14.6	14.6	1.0	179.73	2416.57	45	1.0	212.1	297.0	18.5	14.6	45	10.86	3.82	2.54	138.1	744.1	3457.7	188.5	2902.1	**1383.06**	**967.36**
18.50	21.50	20.00	3.00	19.0	20.86	10.86	146.36	9.43	14.6	14.6	1.0	359.45	2776.02	45	1.0	424.3	721.3	21.5	11.1	44	10.23	2.79	1.53	138.1	620.5	4117.8	223.8	3721.1	**1647.12**	**1240.38**
21.50	24.50	23.00	3.00	22.0	20.23	10.23	146.36	9.43	11.1	11.1	1.0	270.74	3046.76	44	1.0	414.9	1136.1	24.5	10.5	56	10.23	2.62	1.36	138.1	685.5	4868.4	259.2	4442.1	**1947.37**	**1480.70**
24.50	26.00	25.25	1.50	23.5	20.23	10.23	146.36	4.71	10.5	10.5	1.0	127.88	3174.64	56	1.0	264.0	1400.1	26.0	10.5	75	10.35	2.62	1.36	138.1	819.9	5394.7	276.9	4851.6	**2157.89**	**1617.21**
26.00	27.50	26.75	1.50	25.0	20.35	10.35	146.36	4.71	10.5	10.5	1.0	127.88	3302.52	75	1.0	353.6	1753.7	27.5	10.5	75	10.35	2.62	1.36	138.1	819.9	5876.2	294.5	5350.8	**2350.47**	**1783.59**
27.50	29.00	28.25	1.50	26.5	20.35	10.35	146.36	4.71	10.5	10.5	1.0	127.88	3430.41	75	1.0	353.6	2107.3	29.0	13.3	54	9.14	3.44	2.16	138.1	763.0	6300.7	312.2	5849.9	**2520.28**	**1949.96**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
29.00	30.00	29.50	1.00	27.5	19.14	9.14	146.36	3.14	13.3	13.3	1.0	108.74	3539.14	54	1.0	169.7	2277.0	30.0	13.3	54	9.14	3.44	2.16	138.1	763.0	6579.1	324.0	6140.1	**2631.66**	**2046.71**
30.00	30.50	30.25	0.50	28.0	19.14	9.14	146.36	1.57	13.3	13.3	1.0	54.37	3593.51	54	1.0	84.9	2361.9	30.5	13.3	54	9.14	3.44	2.16	138.1	763.0	6718.4	329.9	6285.2	**2687.35**	**2095.08**
30.50	32.50	31.50	2.00	30.0	19.14	9.14	146.36	6.29	13.3	13.3	1.0	217.47	3810.98	54	1.0	339.4	2701.3	32.5	13.0	50	9.17	3.35	2.08	138.1	724.7	7236.9	353.4	6865.7	**2894.77**	**2288.57**
32.50	33.50	33.00	1.00	31.0	19.17	9.17	146.36	3.14	13.0	13.0	1.0	106.20	3917.18	50	1.0	157.1	2858.4	33.5	13.0	50	8.93	3.35	2.08	138.1	724.5	7500.1	365.2	7140.8	**3000.03**	**2380.27**
33.50	35.00	34.25	1.50	32.5	18.93	8.93	146.36	4.71	13.0	13.0	1.0	159.30	4076.48	50	1.0	235.7	3094.1	35.0	27.7	0	8.93	16.08	17.10	138.1	1805.3	8975.9	382.9	7553.5	**3590.37**	**2517.83**
35.00	36.50	35.75	1.50	34.0	18.93	8.93	146.36	4.71	27.7	27.7	1.0	362.25	4438.72	0	1.0	0.0	3094.1	36.5	31.2	0	9.79	27.30	28.55	138.1	3073.4	10606.3	400.6	7933.4	**4242.51**	**2644.47**
36.50	37.50	37.00	1.00	35.0	19.79	9.79	146.36	3.14	31.2	31.2	1.1	295.29	4734.02	0	1.0	0.0	3094.1	37.5	31.2	0	9.79	27.30	28.55	138.1	3073.4	10901.6	412.3	8240.5	**4360.62**	**2746.83**
37.50	40.00	38.75	2.50	37.5	19.79	9.79	146.36	7.86	31.2	31.2	1.1	738.23	5472.25	0	1.0	0.0	3094.1	40.0	31.2	0	9.79	27.30	28.55	138.1	3073.4	11639.8	441.8	9008.2	**4655.92**	**3002.73**
BORE NO: P30, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	17.98	7.98	21.95	1.57	27.2	27.2	1.0	17.72	0	12	1.0	18.9	0	3.0	28.3	9	9.16	17.43	18.48	23.9	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	5.00	4.00	2.00	2.5	19.16	9.16	33.10	6.29	28.3	28.3	1.0	112.03	0	9	1.0	56.6	0	5.0	28.3	9	9.16	17.43	18.48	42.3	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.5	19.16	9.16	46.84	3.14	28.3	28.3	1.0	79.27	0	9	1.0	28.3	0	6.0	28.3	0	9.16	17.43	18.48	51.4	0	0.0	41.2	41.2	**0.00**	**13.74**
6.00	8.00	7.00	2.00	5.5	19.16	9.16	60.58	6.29	28.3	28.3	1.0	205.03	0	0	1.0	0.0	0	8.0	28.3	0	11.05	17.43	18.48	69.7	0	0.0	64.8	64.8	**0.00**	**21.60**
8.00	9.00	8.50	1.00	6.5	21.05	11.05	75.27	3.14	28.3	28.3	1.0	127.37	0	0	1.0	0.0	0	9.0	28.3	0	11.05	17.43	18.48	80.8	0	0.0	76.6	76.6	**0.00**	**25.53**
9.00	10.00	9.50	1.00	7.5	21.05	11.05	86.32	3.14	28.3	28.3	1.0	146.07	0	0	1.0	0.0	0	10.0	10.6	40	11.05	2.65	1.39	91.8	479.9	479.9	88.4	88.4	**191.94**	**29.45**
10.00	11.00	10.50	1.00	8.5	21.05	11.05	97.37	3.14	10.6	10.6	1.0	57.27	57.27	40	1.0	125.7	125.7	11.0	10.6	40	11.05	2.65	1.39	102.9	502.8	685.8	100.1	283.1	**274.33**	**94.37**
11.00	12.00	11.50	1.00	9.5	21.05	11.05	108.42	3.14	10.6	10.6	1.0	63.77	121.03	40	1.0	125.7	251.4	12.0	11.4	45	11.54	2.88	1.62	113.9	583.5	956.0	111.9	484.4	**382.40**	**161.46**
12.00	14.50	13.25	2.50	12.0	21.54	11.54	128.37	7.86	11.4	11.4	1.0	203.37	324.40	45	1.0	353.6	605.0	14.5	11.2	45	11.36	2.82	1.56	142.8	641.9	1571.3	141.4	1070.8	**628.51**	**356.92**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
14.50	17.50	16.00	3.00	15.0	21.36	11.36	128.37	9.43	11.2	11.2	1.0	239.65	564.04	45	1.0	424.3	1029.3	17.5	11.2	45	11.36	2.82	1.56	142.8	641.9	2235.2	176.7	1770.0	**894.09**	**590.02**
17.50	19.00	18.25	1.50	16.5	21.36	11.36	128.37	4.71	11.2	11.2	1.0	119.82	683.87	45	1.0	212.1	1241.4	19.0	24.3	10	10.67	9.50	10.11	142.8	1178.5	3103.8	194.4	2119.7	**1241.51**	**706.56**
19.00	20.50	19.75	1.50	18.0	20.67	10.67	128.37	4.71	24.3	24.3	1.0	273.24	957.10	10	1.0	47.1	1288.6	20.5	15.5	42	10.67	4.19	2.92	142.8	778.9	3024.6	212.1	2457.7	**1209.83**	**819.24**
20.50	23.50	22.00	3.00	21.0	20.67	10.67	128.37	9.43	15.5	15.5	1.0	335.65	1292.75	42	1.0	396.0	1684.6	23.5	8.6	41	11.75	2.22	1.00	142.8	543.4	3520.7	247.4	3224.7	**1408.29**	**1074.91**
23.50	26.50	25.00	3.00	24.0	21.75	11.75	128.37	9.43	8.6	8.6	1.0	183.04	1475.79	41	1.0	386.6	2071.1	26.5	8.6	41	11.75	2.22	1.00	142.8	543.4	4090.3	282.7	3829.7	**1636.14**	**1276.56**
26.50	27.50	27.00	1.00	25.0	21.75	11.75	128.37	3.14	8.6	8.6	1.0	61.01	1536.80	41	1.0	128.9	2200.0	27.5	9.0	41	11.75	2.29	1.07	142.8	551.8	4288.6	294.5	4031.3	**1715.43**	**1343.78**
27.50	29.50	28.50	2.00	27.0	21.75	11.75	128.37	6.29	9.0	9.0	1.0	127.79	1664.60	41	1.0	257.7	2457.7	29.5	11.0	41	9.27	2.76	1.51	142.8	605.5	4727.8	318.1	4440.4	**1891.13**	**1480.13**
29.50	30.00	29.75	0.50	27.5	19.27	9.27	128.37	1.57	11.0	11.0	1.0	39.21	1703.81	41	1.0	64.4	2522.1	30.0	11.0	41	9.27	2.76	1.51	142.8	605.5	4831.5	324.0	4549.9	**1932.58**	**1516.64**
30.00	31.00	30.50	1.00	28.5	19.27	9.27	128.37	3.14	11.0	11.0	1.0	78.42	1782.23	41	1.0	128.9	2651.0	31.0	27.8	5	9.27	16.31	17.33	142.8	1927.8	6361.0	335.8	4769.0	**2544.41**	**1589.66**
31.00	32.50	31.75	1.50	30.0	19.27	9.27	128.37	4.71	27.8	27.8	1.0	319.06	2101.29	5	1.0	23.6	2674.6	32.5	8.5	48	9.27	2.20	0.99	142.8	589.9	5365.7	353.4	5129.3	**2146.28**	**1709.76**
32.50	35.00	33.75	2.50	32.5	19.27	9.27	128.37	7.86	8.5	8.5	1.0	150.73	2252.02	48	1.0	377.1	3051.7	35.0	8.1	48	8.55	2.13	0.93	142.8	581.3	5885.0	382.9	5686.6	**2354.01**	**1895.54**
35.00	35.50	35.25	0.50	33.0	18.55	8.55	128.37	1.57	8.1	8.1	1.0	28.71	2280.73	48	1.0	75.4	3127.1	35.5	10.8	33	9.21	2.71	1.45	142.8	542.1	5950.0	388.8	5796.6	**2379.99**	**1932.21**
35.50	37.00	36.25	1.50	34.5	19.21	9.21	128.37	4.71	10.8	10.8	1.0	115.44	2396.17	33	1.0	155.6	3282.7	37.0	9.4	56	9.21	2.36	1.13	142.8	665.1	6344.0	406.4	6085.3	**2537.58**	**2028.44**
37.00	37.50	37.25	0.50	35.0	19.21	9.21	128.37	1.57	9.4	9.4	1.0	33.39	2429.56	56	1.0	88.0	3370.7	37.5	10.2	56	9.21	2.53	1.28	142.8	684.3	6484.6	412.3	6212.6	**2593.84**	**2070.87**
37.50	38.50	38.00	1.00	36.0	19.21	9.21	128.37	3.14	10.2	10.2	1.0	72.59	2502.15	56	1.0	176.0	3546.7	38.5	14.3	48	9.97	3.74	2.45	142.8	768.3	6817.1	424.1	6473.0	**2726.86**	**2157.66**
38.50	40.00	39.25	1.50	37.5	19.97	9.97	128.37	4.71	14.3	14.3	1.0	154.25	2656.40	48	1.0	226.3	3773.0	40.0	14.3	48	9.97	3.74	2.45	142.8	768.3	7197.7	441.8	6871.2	**2879.07**	**2290.40**
BORE NO: P32, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	19.70	9.70	26.68	1.57	28.2	28.2	1.0	22.48	0	0	1.0	0.0	0	3.0	28.2	0	9.39	17.21	18.25	29.1	0	0.0	5.9	5.9	**0.00**	**1.96**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
3.00	5.00	4.00	2.00	2.5	19.39	9.39	38.49	6.29	28.2	28.2	1.0	129.73	0	0	1.0	0.0	0	5.0	28.5	0	9.39	17.88	18.94	47.9	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.5	19.39	9.39	52.58	3.14	28.5	28.5	1.0	89.72	0	0	1.0	0.0	0	6.0	28.5	0	9.64	17.88	18.94	57.3	0	0.0	41.2	41.2	**0.00**	**13.74**
6.00	8.00	7.00	2.00	5.5	19.64	9.64	66.91	6.29	28.5	28.5	1.0	228.35	0	0	1.0	0.0	0	8.0	11.6	54	9.64	2.94	1.68	76.6	565.1	565.1	64.8	64.8	**226.03**	**21.60**
8.00	9.00	8.50	1.00	6.5	19.64	9.64	81.37	3.14	11.6	11.6	1.0	52.49	52.49	54	1.0	169.7	169.7	9.0	11.6	54	9.64	2.94	1.68	86.2	587.3	809.5	76.6	298.8	**323.82**	**99.60**
9.00	10.00	9.50	1.00	7.5	19.64	9.64	91.01	3.14	11.6	11.6	1.0	58.71	111.21	54	1.0	169.7	339.4	10.0	11.6	54	10.40	2.94	1.68	95.8	610.1	1060.7	88.4	539.0	**424.30**	**179.66**
10.00	11.00	10.50	1.00	8.5	20.40	10.40	101.03	3.14	11.6	11.6	1.0	65.18	176.39	54	1.0	169.7	509.1	11.0	11.6	54	10.40	2.94	1.68	106.2	634.1	1319.7	100.1	785.7	**527.87**	**261.89**
11.00	12.00	11.50	1.00	9.5	20.40	10.40	111.43	3.14	11.6	11.6	1.0	71.89	248.27	54	1.0	169.7	678.9	12.0	9.0	66	10.40	2.29	1.07	116.6	680.9	1608.1	111.9	1039.1	**643.22**	**346.35**
12.00	13.00	12.50	1.00	10.5	20.40	10.40	121.83	3.14	9.0	9.0	1.0	60.64	308.92	66	1.0	207.4	886.3	13.0	29.0	0	10.40	19.01	20.10	127.0	1979.2	3174.4	123.7	1318.9	**1269.78**	**439.63**
13.00	14.50	13.75	1.50	12.0	20.40	10.40	134.83	4.71	29.0	29.0	1.0	352.33	661.25	0	1.0	0.0	886.3	14.5	29.0	0	10.18	19.01	20.10	142.6	2210.5	3758.0	141.4	1688.9	**1503.21**	**562.97**
14.50	16.00	15.25	1.50	13.5	20.18	10.18	134.83	4.71	29.0	29.0	1.0	352.33	1013.59	0	1.0	0.0	886.3	16.0	10.4	51	10.18	2.59	1.33	142.6	656.0	2555.8	159.0	2058.9	**1022.33**	**686.31**
16.00	17.50	16.75	1.50	15.0	20.18	10.18	134.83	4.71	10.4	10.4	1.0	116.66	1130.25	51	1.0	240.4	1126.7	17.5	10.4	51	10.18	2.59	1.33	142.6	656.0	2912.9	176.7	2433.7	**1165.17**	**811.22**
17.50	19.00	18.25	1.50	16.5	20.18	10.18	134.83	4.71	10.4	10.4	1.0	116.66	1246.91	51	1.0	240.4	1367.1	19.0	24.0	12	9.99	9.28	9.78	142.6	1163.2	3777.3	194.4	2808.4	**1510.91**	**936.14**
19.00	20.50	19.75	1.50	18.0	19.99	9.99	134.83	4.71	24.0	24.0	1.0	283.00	1529.90	12	1.0	56.6	1423.7	20.5	9.3	62	10.42	2.34	1.11	142.6	705.7	3659.3	212.1	3165.7	**1463.71**	**1055.23**
20.50	23.50	22.00	3.00	21.0	20.42	10.42	134.83	9.43	9.3	9.3	1.0	208.18	1738.08	62	1.0	584.6	2008.3	23.5	9.3	62	10.42	2.34	1.11	142.6	705.7	4452.0	247.4	3993.8	**1780.81**	**1331.26**
23.50	25.00	24.25	1.50	22.5	20.42	10.42	134.83	4.71	9.3	9.3	1.0	104.09	1842.17	62	1.0	292.3	2300.6	25.0	9.3	62	10.42	2.34	1.11	142.6	705.7	4848.4	265.1	4407.8	**1939.36**	**1469.27**
25.00	26.50	25.75	1.50	24.0	20.42	10.42	134.83	4.71	9.3	9.3	1.0	104.09	1946.26	62	1.0	292.3	2592.9	26.5	7.5	60	8.59	2.02	0.84	142.6	653.5	5192.6	282.7	4821.9	**2077.04**	**1607.29**
26.50	27.50	27.00	1.00	25.0	18.59	8.59	134.83	3.14	7.5	7.5	1.0	55.79	2002.04	60	1.0	188.6	2781.4	27.5	7.5	60	8.59	2.02	0.84	142.6	653.5	5437.0	294.5	5078.0	**2174.78**	**1692.67**
27.50	28.00	27.75	0.50	25.5	18.59	8.59	134.83	1.57	7.5	7.5	1.0	27.89	2029.94	60	1.0	94.3	2875.7	28.0	7.5	60	9.11	2.02	0.84	142.6	653.6	5559.3	300.4	5206.1	**2223.72**	**1735.36**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
28.00	29.50	28.75	1.50	27.0	19.11	9.11	134.83	4.71	7.5	7.5	1.0	83.68	2113.62	60	1.0	282.9	3158.6	29.5	7.5	60	8.85	2.02	0.84	142.6	653.6	5925.8	318.1	5590.3	**2370.30**	**1863.43**
29.50	30.00	29.75	0.50	27.5	18.85	8.85	134.83	1.57	7.5	7.5	1.0	27.89	2141.51	60	1.0	94.3	3252.9	30.0	8.0	54	8.85	2.11	0.91	142.6	621.5	6015.9	324.0	5718.3	**2406.34**	**1906.12**
30.00	31.00	30.50	1.00	28.5	18.85	8.85	134.83	3.14	8.0	8.0	1.0	59.55	2201.07	54	1.0	169.7	3422.6	31.0	9.2	44	9.73	2.33	1.10	142.6	576.0	6199.6	335.8	5959.4	**2479.86**	**1986.47**
31.00	32.50	31.75	1.50	30.0	19.73	9.73	134.83	4.71	9.2	9.2	1.0	102.95	2304.02	44	1.0	207.4	3630.0	32.5	7.0	51	8.54	1.93	0.76	142.6	579.5	6513.5	353.4	6287.4	**2605.40**	**2095.82**
32.50	34.00	33.25	1.50	31.5	18.54	8.54	134.83	4.71	7.0	7.0	1.0	78.05	2382.06	51	1.0	240.4	3870.4	34.0	11.5	48	9.73	2.91	1.65	142.6	672.0	6924.4	371.1	6623.6	**2769.78**	**2207.86**
34.00	35.00	34.50	1.00	32.5	19.73	9.73	134.83	3.14	11.5	11.5	1.0	86.21	2468.28	48	1.0	150.9	4021.3	35.0	11.5	48	9.73	2.91	1.65	142.6	672.0	7161.5	382.9	6872.4	**2864.61**	**2290.81**
35.00	35.50	35.25	0.50	33.0	19.73	9.73	134.83	1.57	11.5	11.5	1.0	43.11	2511.38	48	1.0	75.4	4096.7	35.5	8.0	60	8.79	2.11	0.91	142.6	663.9	7272.0	388.8	6996.9	**2908.80**	**2332.29**
35.50	37.00	36.25	1.50	34.5	18.79	8.79	134.83	4.71	8.0	8.0	1.0	89.33	2600.71	60	1.0	282.9	4379.6	37.0	8.0	60	9.18	2.11	0.91	142.6	664.0	7644.3	406.4	7386.7	**3057.73**	**2462.24**
37.00	37.50	37.25	0.50	35.0	19.18	9.18	134.83	1.57	8.0	8.0	1.0	29.78	2630.49	60	1.0	94.3	4473.9	37.5	8.0	60	9.18	2.11	0.91	142.6	664.0	7768.4	412.3	7516.7	**3107.35**	**2505.56**
37.50	38.50	38.00	1.00	36.0	19.18	9.18	134.83	3.14	8.0	8.0	1.0	59.55	2690.05	60	1.0	188.6	4662.4	38.5	9.2	56	8.83	2.33	1.10	142.6	660.5	8012.9	424.1	7776.6	**3205.18**	**2592.20**
38.50	40.00	39.25	1.50	37.5	18.83	8.83	134.83	4.71	9.2	9.2	1.0	102.95	2792.99	56	1.0	264.0	4926.4	40.0	9.2	56	0.00	2.33	1.10	142.6	656.7	8376.1	441.8	8161.2	**3350.44**	**2720.40**
BORE NO: P33, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	19.79	9.79	26.92	1.57	28.6	28.6	1.0	23.07	0	0	1.0	0.0	0	3.0	28.6	0	9.53	18.11	19.17	29.4	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	5.00	4.00	2.00	2.5	19.53	9.53	38.90	6.29	28.6	28.6	1.0	133.31	0	0	1.0	0.0	0	5.0	29.3	0	9.53	19.68	20.79	48.4	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.5	19.53	9.53	53.20	3.14	29.3	29.3	1.0	93.82	0	0	1.0	0.0	0	6.0	29.3	0	9.45	19.68	20.79	58.0	973.5	973.5	41.2	41.2	**389.42**	**13.74**
6.00	8.00	7.00	2.00	5.5	19.45	9.45	67.41	6.29	29.3	29.3	1.0	237.78	237.78	0	1.0	0.0	0.0	8.0	29.3	0	9.45	19.68	20.79	76.9	1265.8	1503.6	64.8	302.6	**601.45**	**100.86**
8.00	9.00	8.50	1.00	6.5	19.45	9.45	81.59	3.14	29.3	29.3	1.0	143.89	381.67	0	1.0	0.0	0.0	9.0	12.2	56	10.24	3.12	1.85	86.3	614.8	996.4	76.6	458.2	**398.58**	**152.75**
9.00	11.00	10.00	2.00	8.5	20.24	10.24	96.55	6.29	12.2	12.2	1.0	131.21	512.88	56	1.0	352.0	352.0	11.0	27.7	0	10.24	16.08	17.10	106.8	1418.0	2282.9	100.1	965.0	**913.16**	**321.67**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
11.00	12.00	11.50	1.00	9.5	20.24	10.24	111.91	3.14	27.7	27.7	1.0	184.66	697.54	0	1.0	0.0	352.0	12.0	28.0	0	10.24	16.76	17.79	117.0	1612.3	2661.8	111.9	1161.5	**1064.74**	**387.15**
12.00	13.00	12.50	1.00	10.5	20.24	10.24	122.15	3.14	28.0	28.0	1.0	204.12	901.66	0	1.0	0.0	352.0	13.0	8.6	59	10.39	2.22	1.00	127.3	643.1	1896.8	123.7	1377.4	**758.71**	**459.12**
13.00	14.50	13.75	1.50	12.0	20.39	10.39	135.06	4.71	8.6	8.6	1.0	96.30	997.96	59	1.0	278.1	630.1	14.5	8.6	59	10.61	2.22	1.00	142.9	670.4	2298.5	141.4	1769.5	**919.38**	**589.82**
14.50	17.50	16.00	3.00	15.0	20.61	10.61	135.06	9.43	8.6	8.6	1.0	192.59	1190.55	59	1.0	556.3	1186.4	17.5	10.3	62	10.42	2.56	1.31	142.9	730.9	3107.9	176.7	2553.7	**1243.16**	**851.23**
17.50	20.50	19.00	3.00	18.0	20.42	10.42	135.06	9.43	10.3	10.3	1.0	231.42	1421.97	62	1.0	584.6	1771.0	20.5	11.6	65	10.42	2.94	1.68	142.9	796.6	3989.5	212.1	3405.0	**1595.81**	**1135.01**
20.50	22.00	21.25	1.50	19.5	20.42	10.42	135.06	4.71	11.6	11.6	1.0	130.70	1552.67	65	1.0	306.4	2077.4	22.0	25.2	8	9.65	10.45	11.34	142.9	1272.5	4902.7	229.7	3859.8	**1961.06**	**1286.61**
22.00	23.50	22.75	1.50	21.0	19.65	9.65	135.06	4.71	25.2	25.2	1.0	299.62	1852.29	8	1.0	37.7	2115.1	23.5	11.0	56	9.65	2.76	1.51	142.9	711.9	4679.4	247.4	4214.8	**1871.75**	**1404.95**
23.50	25.00	24.25	1.50	22.5	19.65	9.65	135.06	4.71	11.0	11.0	1.0	123.77	1976.06	56	1.0	264.0	2379.1	25.0	11.0	56	9.65	2.76	1.51	142.9	711.9	5067.2	265.1	4620.3	**2026.86**	**1540.09**
25.00	26.50	25.75	1.50	24.0	19.65	9.65	135.06	4.71	11.0	11.0	1.0	123.77	2099.83	56	1.0	264.0	2643.1	26.5	11.0	56	8.78	2.76	1.51	142.9	711.4	5454.4	282.7	5025.7	**2181.76**	**1675.24**
26.50	27.50	27.00	1.00	25.0	18.78	8.78	135.06	3.14	11.0	11.0	1.0	82.51	2182.34	56	1.0	176.0	2819.1	27.5	11.0	56	8.78	2.76	1.51	142.9	711.4	5712.9	294.5	5296.0	**2285.17**	**1765.33**
27.50	28.00	27.75	0.50	25.5	18.78	8.78	135.06	1.57	11.0	11.0	1.0	41.26	2223.59	56	1.0	88.0	2907.1	28.0	11.6	65	9.46	2.94	1.68	142.9	795.9	5926.7	300.4	5431.2	**2370.66**	**1810.38**
28.00	29.50	28.75	1.50	27.0	19.46	9.46	135.06	4.71	11.6	11.6	1.0	130.70	2354.29	65	1.0	306.4	3213.6	29.5	11.6	65	8.75	2.94	1.68	142.9	795.4	6363.3	318.1	5886.0	**2545.33**	**1961.98**
29.50	30.00	29.75	0.50	27.5	18.75	8.75	135.06	1.57	11.6	11.6	1.0	43.57	2397.86	65	1.0	102.1	3315.7	30.0	11.6	65	8.75	2.94	1.68	142.9	795.4	6509.0	324.0	6037.6	**2603.61**	**2012.52**
30.00	31.00	30.50	1.00	28.5	18.75	8.75	135.06	3.14	11.6	11.6	1.0	87.13	2484.99	65	1.0	204.3	3520.0	31.0	11.6	65	8.97	2.94	1.68	142.9	795.6	6800.6	335.8	6340.8	**2720.24**	**2113.58**
31.00	32.50	31.75	1.50	30.0	18.97	8.97	135.06	4.71	11.6	11.6	1.0	130.70	2615.69	65	1.0	306.4	3826.4	32.5	11.5	57	8.96	2.91	1.65	142.9	735.6	7177.7	353.4	6795.6	**2871.10**	**2265.18**
32.50	34.00	33.25	1.50	31.5	18.96	8.96	135.06	4.71	11.5	11.5	1.0	129.54	2745.24	57	1.0	268.7	4095.1	34.0	11.5	57	8.95	2.91	1.65	142.9	735.6	7576.0	371.1	7211.5	**3030.40**	**2403.83**
34.00	35.00	34.50	1.00	32.5	18.95	8.95	135.06	3.14	11.5	11.5	1.0	86.36	2831.60	57	1.0	179.1	4274.3	35.0	11.5	57	8.95	2.91	1.65	142.9	735.6	7841.5	382.9	7488.8	**3136.60**	**2496.26**
35.00	35.50	35.25	0.50	33.0	18.95	8.95	135.06	1.57	11.5	11.5	1.0	43.18	2874.78	57	1.0	89.6	4363.9	35.5	8.5	46	8.64	2.20	0.99	142.9	575.6	7814.2	388.8	7627.4	**3125.69**	**2542.47**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
35.50	37.00	36.25	1.50	34.5	18.64	8.64	135.06	4.71	8.5	8.5	1.0	95.16	2969.94	46	1.0	216.9	4580.7	37.0	8.7	60	9.08	2.24	1.02	142.9	678.9	8229.6	406.4	7957.1	**3291.82**	**2652.37**
37.00	37.50	37.25	0.50	35.0	19.08	9.08	135.06	1.57	8.7	8.7	1.0	32.48	3002.42	60	1.0	94.3	4675.0	37.5	8.7	60	9.08	2.24	1.02	142.9	678.9	8356.3	412.3	8089.8	**3342.53**	**2696.58**
37.50	38.50	38.00	1.00	36.0	19.08	9.08	135.06	3.14	8.7	8.7	1.0	64.95	3067.37	60	1.0	188.6	4863.6	38.5	8.7	60	8.75	2.24	1.02	142.9	678.8	8609.7	424.1	8355.1	**3443.88**	**2785.02**
38.50	40.00	39.25	1.50	37.5	18.75	8.75	135.06	4.71	8.7	8.7	1.0	97.43	3164.80	60	1.0	282.9	5146.4	40.0	9.8	54	0.00	2.43	1.19	142.9	655.1	8966.3	441.8	8753.0	**3586.52**	**2917.67**
BORE NO: P34, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	19.58	9.58	26.35	1.57	23.3	23.3	1.0	17.83	0	0	1.0	0.0	0	3.0	15.9	26	9.58	4.38	3.14	28.7	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.5	19.58	9.58	33.53	3.14	15.9	15.9	1.0	30.02	0	26	1.0	81.7	0	4.0	30.8	0	9.29	25.29	26.50	38.3	858.1	858.1	17.7	17.7	**343.26**	**5.89**
4.00	6.00	5.00	2.00	3.5	19.29	9.29	47.61	6.29	30.8	30.8	1.0	185.53	185.53	0	1.0	0.0	0.0	6.0	30.8	0	9.29	25.29	26.50	56.9	1227.3	1412.9	41.2	226.8	**565.15**	**75.59**
6.00	7.00	6.50	1.00	4.5	19.29	9.29	61.55	3.14	30.8	30.8	1.0	119.92	305.45	0	1.0	0.0	0.0	7.0	27.4	0	9.29	15.40	16.41	66.2	861.0	1166.5	53.0	358.5	**466.59**	**119.49**
7.00	8.00	7.50	1.00	5.5	19.29	9.29	70.84	3.14	27.4	27.4	1.0	115.40	420.85	0	1.0	0.0	0.0	8.0	25.8	7	9.75	11.80	12.72	75.5	798.1	1219.0	64.8	485.6	**487.59**	**161.88**
8.00	9.00	8.50	1.00	6.5	19.75	9.75	80.36	3.14	25.8	25.8	1.0	122.08	542.93	7	1.0	22.0	22.0	9.0	26.2	9	9.75	12.70	13.64	85.2	966.5	1531.5	76.6	641.5	**612.59**	**213.84**
9.00	10.00	9.50	1.00	7.5	19.75	9.75	90.11	3.14	26.2	26.2	1.0	139.35	682.28	9	1.0	28.3	50.3	10.0	26.0	0	9.49	12.25	13.18	95.0	963.5	1696.0	88.4	820.9	**678.42**	**273.64**
10.00	12.50	11.25	2.50	10.0	19.49	9.49	106.84	7.86	26.0	26.0	1.0	409.44	1091.72	0	1.0	0.0	50.3	12.5	9.5	55	10.41	2.38	1.14	118.7	615.6	1757.6	117.8	1259.8	**703.03**	**419.94**
12.50	15.50	14.00	3.00	13.0	20.41	10.41	134.32	9.43	9.5	9.5	1.0	211.93	1303.65	55	1.0	518.6	568.9	15.5	9.5	55	10.41	2.38	1.14	118.7	615.6	2488.1	153.2	2025.7	**995.23**	**675.22**
15.50	18.50	17.00	3.00	16.0	20.41	10.41	134.32	9.43	9.5	9.5	1.0	211.93	1515.58	55	1.0	518.6	1087.4	18.5	9.5	55	10.62	2.38	1.14	118.7	615.7	3218.7	188.5	2791.5	**1287.47**	**930.50**
18.50	21.50	20.00	3.00	19.0	20.62	10.62	134.32	9.43	9.5	9.5	1.0	211.93	1727.51	55	1.0	518.6	1606.0	21.5	11.5	58	10.14	2.91	1.65	118.7	688.2	4021.7	223.8	3557.3	**1608.69**	**1185.78**
21.50	24.50	23.00	3.00	22.0	20.14	10.14	134.32	9.43	11.5	11.5	1.0	257.66	1985.17	58	1.0	546.9	2152.9	24.5	8.2	62	10.14	2.15	0.94	118.7	642.3	4780.4	259.2	4397.2	**1912.15**	**1465.74**
24.50	27.50	26.00	3.00	25.0	20.14	10.14	134.32	9.43	8.2	8.2	1.0	182.50	2167.67	62	1.0	584.6	2737.4	27.5	8.2	60	10.59	2.15	0.94	118.7	628.4	5533.5	294.5	5199.6	**2213.38**	**1733.21**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
27.50	30.00	28.75	2.50	27.5	20.59	10.59	134.32	7.86	8.2	8.2	1.0	152.08	2319.75	60	1.0	471.4	3208.9	30.0	9.1	59	10.59	2.31	1.08	118.7	637.0	6165.6	324.0	5852.6	**2466.23**	**1950.86**
30.00	30.50	30.25	0.50	28.0	20.59	10.59	134.32	1.57	9.1	9.1	1.0	33.81	2353.56	59	1.0	92.7	3301.6	30.5	32.5	0	10.59	33.85	35.22	118.7	3303.9	8959.1	329.9	5985.0	**3583.62**	**1995.00**
30.50	32.00	31.25	1.50	29.5	20.59	10.59	134.32	4.71	32.5	32.5	1.1	453.83	2807.39	0	1.0	0.0	3301.6	32.0	19.5	32	10.59	6.13	5.12	118.7	819.7	6928.6	347.5	6456.5	**2771.46**	**2152.17**
32.00	32.50	32.25	0.50	30.0	20.59	10.59	134.32	1.57	19.5	19.5	1.0	74.75	2882.14	32	1.0	50.3	3351.9	32.5	19.5	32	8.96	6.13	5.12	118.7	816.4	7050.4	353.4	6587.4	**2820.16**	**2195.81**
32.50	33.50	33.00	1.00	31.0	18.96	8.96	134.32	3.14	19.5	19.5	1.0	149.49	3031.63	32	1.0	100.6	3452.4	33.5	19.5	32	9.42	6.13	5.12	118.7	817.3	7301.4	365.2	6849.3	**2920.55**	**2283.09**
33.50	35.00	34.25	1.50	32.5	19.42	9.42	134.32	4.71	19.5	19.5	1.0	224.24	3255.86	32	1.0	150.9	3603.3	35.0	11.4	39	9.13	2.88	1.62	118.7	550.4	7409.5	382.9	7242.0	**2963.80**	**2414.01**
35.00	36.50	35.75	1.50	34.0	19.13	9.13	134.32	4.71	11.4	11.4	1.0	127.68	3383.54	39	1.0	183.9	3787.1	36.5	11.4	39	9.17	2.88	1.62	118.7	550.4	7721.1	400.6	7571.2	**3088.43**	**2523.75**
36.50	37.50	37.00	1.00	35.0	19.17	9.17	134.32	3.14	11.4	11.4	1.0	85.12	3468.66	39	1.0	122.6	3909.7	37.5	12.0	39	9.17	3.06	1.79	118.7	567.5	7945.8	412.3	7790.7	**3178.33**	**2596.90**
37.50	38.00	37.75	0.50	35.5	19.17	9.17	134.32	1.57	12.0	12.0	1.0	44.87	3513.53	39	1.0	61.3	3971.0	38.0	8.0	50	9.05	2.11	0.91	118.7	553.6	8038.1	418.2	7902.8	**3215.26**	**2634.25**
38.00	40.00	39.00	2.00	37.5	19.05	9.05	134.32	6.29	8.0	8.0	1.0	118.66	3632.19	50	1.0	314.3	4285.3	40.0	8.0	50	0.00	2.11	0.91	118.7	550.4	8467.8	441.8	8359.3	**3387.14**	**2786.42**
BORE NO: P36, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	20.43	10.43	28.68	1.57	29.5	29.5	1.0	25.50	0	0	1.0	0.0	0	3.0	29.5	0	10.71	20.13	21.25	31.3	584.4	584.4	5.9	5.9	**233.75**	**1.96**
3.00	5.00	4.00	2.00	2.5	20.71	10.71	42.00	6.29	29.5	29.5	1.0	149.36	149.36	0	1.0	0.0	0.0	5.0	29.5	0	10.71	20.13	21.25	52.7	923.2	1072.6	29.5	178.8	**429.04**	**59.61**
5.00	6.00	5.50	1.00	3.5	20.71	10.71	58.07	3.14	29.5	29.5	1.0	103.25	252.61	0	1.0	0.0	0.0	6.0	29.3	0	10.48	19.68	20.79	63.4	1066.4	1319.0	41.2	293.8	**527.60**	**97.95**
6.00	8.00	7.00	2.00	5.5	20.48	10.48	73.90	6.29	29.3	29.3	1.0	260.67	513.29	0	1.0	0.0	0.0	8.0	9.5	49	10.48	2.38	1.14	84.4	509.0	1022.3	64.8	578.1	**408.91**	**192.69**
8.00	9.00	8.50	1.00	6.5	20.48	10.48	89.62	3.14	9.5	9.5	1.0	47.13	560.42	49	1.0	154.0	154.0	9.0	9.5	49	10.48	2.38	1.14	94.9	528.6	1243.0	76.6	791.0	**497.21**	**263.67**
9.00	10.00	9.50	1.00	7.5	20.48	10.48	100.10	3.14	9.5	9.5	1.0	52.65	613.07	49	1.0	154.0	308.0	10.0	9.5	49	10.50	2.38	1.14	105.3	548.2	1469.3	88.4	1009.4	**587.71**	**336.47**
10.00	11.00	10.50	1.00	8.5	20.50	10.50	110.59	3.14	9.5	9.5	1.0	58.16	671.23	49	1.0	154.0	462.0	11.0	9.5	49	10.50	2.38	1.14	115.8	567.8	1701.1	100.1	1233.4	**680.43**	**411.12**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
11.00	12.00	11.50	1.00	9.5	20.50	10.50	121.09	3.14	9.5	9.5	1.0	63.69	734.91	49	1.0	154.0	616.0	12.0	6.7	69	10.50	1.88	0.71	126.3	677.1	2028.0	111.9	1462.8	**811.20**	**487.61**
12.00	13.00	12.50	1.00	10.5	20.50	10.50	131.59	3.14	6.7	6.7	1.0	48.58	783.50	69	1.0	216.9	832.9	13.0	26.9	0	9.99	14.28	15.26	136.8	1595.1	3211.4	123.7	1740.1	**1284.57**	**580.02**
13.00	14.50	13.75	1.50	12.0	19.99	9.99	144.33	4.71	26.9	26.9	1.0	345.20	1128.70	0	1.0	0.0	832.9	14.5	26.9	0	9.99	14.28	15.26	151.8	1763.2	3724.7	141.4	2102.9	**1489.90**	**700.97**
14.50	16.00	15.25	1.50	13.5	19.99	9.99	144.33	4.71	26.9	26.9	1.0	345.20	1473.90	0	1.0	0.0	832.9	16.0	9.0	54	10.56	2.29	1.07	151.8	659.5	2966.2	159.0	2465.8	**1186.48**	**821.93**
16.00	17.50	16.75	1.50	15.0	20.56	10.56	144.33	4.71	9.0	9.0	1.0	107.77	1581.66	54	1.0	254.6	1087.4	17.5	10.0	60	10.83	2.47	1.22	151.8	724.1	3393.2	176.7	2845.8	**1357.29**	**948.60**
17.50	20.50	19.00	3.00	18.0	20.83	10.83	144.33	9.43	10.0	10.0	1.0	239.95	1821.62	60	1.0	565.7	1653.1	20.5	9.5	64	10.69	2.38	1.14	151.8	741.3	4216.0	212.1	3686.8	**1686.42**	**1228.94**
20.50	23.50	22.00	3.00	21.0	20.69	10.69	144.33	9.43	9.5	9.5	1.0	227.73	2049.35	64	1.0	603.4	2256.6	23.5	9.5	64	10.69	2.38	1.14	151.8	741.3	5047.2	247.4	4553.3	**2018.88**	**1517.77**
23.50	26.50	25.00	3.00	24.0	20.69	10.69	144.33	9.43	9.5	9.5	1.0	227.73	2277.07	64	1.0	603.4	2860.0	26.5	9.5	64	10.52	2.38	1.14	151.8	741.2	5878.3	282.7	5419.8	**2351.31**	**1806.61**
26.50	27.50	27.00	1.00	25.0	20.52	10.52	144.33	3.14	9.5	9.5	1.0	75.91	2352.98	64	1.0	201.1	3061.1	27.5	10.5	60	10.52	2.62	1.36	151.8	742.1	6156.2	294.5	5708.7	**2462.49**	**1902.88**
27.50	28.00	27.75	0.50	25.5	20.52	10.52	144.33	1.57	10.5	10.5	1.0	42.04	2395.02	60	1.0	94.3	3155.4	28.0	11.5	68	10.52	2.91	1.65	151.8	834.9	6385.4	300.4	5850.9	**2554.15**	**1950.29**
28.00	29.50	28.75	1.50	27.0	20.52	10.52	144.33	4.71	11.5	11.5	1.0	138.43	2533.45	68	1.0	320.6	3476.0	29.5	11.5	68	10.52	2.91	1.65	151.8	834.9	6844.4	318.1	6327.5	**2737.75**	**2109.18**
29.50	30.00	29.75	0.50	27.5	20.52	10.52	144.33	1.57	11.5	11.5	1.0	46.14	2579.60	68	1.0	106.9	3582.9	30.0	11.5	60	10.52	2.91	1.65	151.8	778.4	6940.8	324.0	6486.4	**2776.33**	**2162.14**
30.00	31.00	30.50	1.00	28.5	20.52	10.52	144.33	3.14	11.5	11.5	1.0	92.29	2671.89	60	1.0	188.6	3771.4	31.0	12.9	38	10.52	3.32	2.05	151.8	673.3	7116.6	335.8	6779.1	**2846.66**	**2259.69**
31.00	32.50	31.75	1.50	30.0	20.52	10.52	144.33	4.71	12.9	12.9	1.0	155.84	2827.73	38	1.0	179.1	3950.6	32.5	19.8	45	10.46	6.29	5.28	151.8	1090.7	7869.0	353.4	7131.7	**3147.59**	**2377.24**
32.50	34.00	33.25	1.50	31.5	20.46	10.46	144.33	4.71	19.8	19.8	1.0	244.97	3072.69	45	1.0	212.1	4162.7	34.0	13.8	45	10.46	3.59	2.31	151.8	755.9	7991.4	371.1	7606.5	**3196.54**	**2535.50**
34.00	35.00	34.50	1.00	32.5	20.46	10.46	144.33	3.14	13.8	13.8	1.0	111.42	3184.11	45	1.0	141.4	4304.1	35.0	14.5	48	10.46	3.80	2.51	151.8	802.4	8290.7	382.9	7871.1	**3316.28**	**2623.71**
35.00	35.50	35.25	0.50	33.0	20.46	10.46	144.33	1.57	14.5	14.5	1.0	58.66	3242.77	48	1.0	75.4	4379.6	35.5	13.5	54	10.46	3.50	2.22	151.8	808.5	8430.8	388.8	8011.1	**3372.34**	**2670.37**
35.50	37.50	36.50	2.00	35.0	20.46	10.46	144.33	6.29	13.5	13.5	1.0	217.81	3460.58	54	1.0	339.4	4719.0	37.5	20.2	16	10.46	6.54	5.61	151.8	916.8	9096.4	412.3	8591.9	**3638.56**	**2863.97**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
37.50	38.50	38.00	1.00	36.0	20.46	10.46	144.33	3.14	20.2	20.2	1.0	166.90	3627.48	16	1.0	50.3	4769.3	38.5	20.0	16	10.46	6.40	5.39	151.8	898.8	9295.5	424.1	8820.9	**3718.21**	**2940.29**
38.50	40.00	39.25	1.50	37.5	20.46	10.46	144.33	4.71	20.0	20.0	1.0	247.65	3875.13	16	1.0	75.4	4844.7	40.0	20.0	16	10.46	6.40	5.39	151.8	898.8	9618.6	441.8	9161.6	**3847.44**	**3053.88**
BORE NO: P39, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	18.95	8.95	24.61	1.57	24.5	24.5	1.0	17.63	0	7	1.0	11.0	0	3.0	24.5	7	8.95	9.64	10.33	26.9	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	5.00	4.00	2.00	2.5	18.95	8.95	35.80	6.29	24.5	24.5	1.0	102.55	0	7	1.0	44.0	0	5.0	13.5	17	8.95	3.50	2.22	44.8	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.5	18.95	8.95	49.23	3.14	13.5	13.5	1.0	37.14	0	17	1.0	53.4	0	6.0	15.0	20	8.95	3.94	2.65	53.7	0	0.0	41.2	41.2	**0.00**	**13.74**
6.00	8.00	7.00	2.00	5.5	18.95	8.95	62.65	6.29	15.0	15.0	1.0	105.52	0	20	1.0	125.7	0	8.0	13.2	21	10.20	3.41	2.14	71.6	0	0.0	64.8	64.8	**0.00**	**21.60**
8.00	9.00	8.50	1.00	6.5	20.20	10.20	76.70	3.14	13.2	13.2	1.0	56.54	0	21	1.0	66.0	0	9.0	9.5	51	10.20	2.38	1.14	81.8	518.2	518.2	76.6	76.6	**207.28**	**25.53**
9.00	10.00	9.50	1.00	7.5	20.20	10.20	86.90	3.14	9.5	9.5	1.0	45.70	45.70	51	1.0	160.3	160.3	10.0	9.5	51	10.20	2.38	1.14	92.0	537.3	743.3	88.4	294.3	**297.30**	**98.12**
10.00	11.00	10.50	1.00	8.5	20.20	10.20	97.10	3.14	9.5	9.5	1.0	51.07	96.77	51	1.0	160.3	320.6	11.0	9.5	51	10.20	2.38	1.14	102.2	556.3	973.7	100.1	517.5	**389.47**	**172.49**
11.00	12.00	11.50	1.00	9.5	20.20	10.20	107.30	3.14	9.5	9.5	1.0	56.43	153.20	51	1.0	160.3	480.9	12.0	8.2	56	10.49	2.15	0.94	112.4	589.4	1223.5	111.9	746.0	**489.39**	**248.66**
12.00	14.50	13.25	2.50	12.0	20.49	10.49	125.51	7.86	8.2	8.2	1.0	142.11	295.31	56	1.0	440.0	920.9	14.5	12.8	27	10.49	3.29	2.02	138.6	557.8	1773.9	141.4	1357.5	**709.58**	**452.51**
14.50	16.00	15.25	1.50	13.5	20.49	10.49	125.51	4.71	12.8	12.8	1.0	134.43	429.75	27	1.0	127.3	1048.1	16.0	11.5	53	10.50	2.91	1.65	138.6	698.7	2176.5	159.0	1636.9	**870.62**	**545.64**
16.00	17.50	16.75	1.50	15.0	20.50	10.50	125.51	4.71	11.5	11.5	1.0	120.38	550.13	53	1.0	249.9	1298.0	17.5	10.5	58	9.89	2.62	1.36	138.6	700.5	2548.6	176.7	2024.8	**1019.44**	**674.95**
17.50	20.50	19.00	3.00	18.0	19.89	9.89	125.51	9.43	10.5	10.5	1.0	219.33	769.46	58	1.0	546.9	1844.9	20.5	14.4	80	9.89	3.77	2.48	138.6	985.5	3599.9	212.1	2826.4	**1439.94**	**942.12**
20.50	22.00	21.25	1.50	19.5	19.89	9.89	125.51	4.71	14.4	14.4	1.0	151.92	921.38	80	1.0	377.1	2222.0	22.0	9.7	62	10.30	2.42	1.17	138.6	706.3	3849.7	229.7	3373.1	**1539.88**	**1124.37**
22.00	23.50	22.75	1.50	21.0	20.30	10.30	125.51	4.71	9.7	9.7	1.0	101.14	1022.52	62	1.0	292.3	2514.3	23.5	9.7	62	10.30	2.42	1.17	138.6	706.3	4243.1	247.4	3784.2	**1697.26**	**1261.40**
23.50	25.00	24.25	1.50	22.5	20.30	10.30	125.51	4.71	9.7	9.7	1.0	101.14	1123.67	62	1.0	292.3	2806.6	25.0	10.4	46	10.60	2.59	1.33	138.6	612.7	4542.9	265.1	4195.3	**1817.17**	**1398.44**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
25.00	26.50	25.75	1.50	24.0	20.60	10.60	125.51	4.71	10.4	10.4	1.0	108.60	1232.26	46	1.0	216.9	3023.4	26.5	10.0	46	10.60	2.47	1.22	138.6	599.4	4855.1	282.7	4538.4	**1942.04**	**1512.81**
26.50	27.50	27.00	1.00	25.0	20.60	10.60	125.51	3.14	10.0	10.0	1.0	69.56	1301.82	46	1.0	144.6	3168.0	27.5	10.0	46	10.60	2.47	1.22	138.6	599.4	5069.2	294.5	4764.3	**2027.69**	**1588.11**
27.50	29.50	28.50	2.00	27.0	20.60	10.60	125.51	6.29	10.0	10.0	1.0	139.11	1440.93	46	1.0	289.1	3457.1	29.5	14.3	30	8.93	3.74	2.45	138.6	627.8	5525.8	318.1	5216.2	**2210.34**	**1738.72**
29.50	30.00	29.75	0.50	27.5	18.93	8.93	125.51	1.57	14.3	14.3	1.0	50.27	1491.20	30	1.0	47.1	3504.3	30.0	9.5	30	8.93	2.38	1.14	138.6	475.4	5470.9	324.0	5319.5	**2188.35**	**1773.16**
30.00	31.00	30.50	1.00	28.5	18.93	8.93	125.51	3.14	9.5	9.5	1.0	66.01	1557.21	30	1.0	94.3	3598.6	31.0	9.5	50	9.19	2.38	1.14	138.6	616.9	5772.7	335.8	5491.5	**2309.09**	**1830.51**
31.00	32.50	31.75	1.50	30.0	19.19	9.19	125.51	4.71	9.5	9.5	1.0	99.02	1656.23	50	1.0	235.7	3834.3	32.5	26.1	0	10.42	12.48	13.41	138.6	1413.9	6904.4	353.4	5843.9	**2761.77**	**1947.98**
32.50	34.00	33.25	1.50	31.5	20.42	10.42	125.51	4.71	27.5	27.5	1.0	308.02	1964.25	0	1.0	0.0	3834.3	34.0	10.9	47	10.42	2.73	1.48	138.6	636.3	6434.8	371.1	6169.6	**2573.92**	**2056.55**
34.00	35.00	34.50	1.00	32.5	20.42	10.42	125.51	3.14	10.9	10.9	1.0	75.96	2040.21	47	1.0	147.7	3982.0	35.0	10.9	47	10.42	2.73	1.48	138.6	636.3	6658.5	382.9	6405.1	**2663.39**	**2135.03**
35.00	35.50	35.25	0.50	33.0	20.42	10.42	125.51	1.57	10.9	10.9	1.0	37.98	2078.20	47	1.0	73.9	4055.9	35.5	15.8	39	10.42	4.33	3.09	138.6	760.4	6894.5	388.8	6522.8	**2757.80**	**2174.27**
35.50	37.00	36.25	1.50	34.5	20.42	10.42	125.51	4.71	15.8	15.8	1.0	167.43	2245.63	39	1.0	183.9	4239.7	37.0	9.6	54	10.42	2.40	1.16	138.6	647.8	7133.1	406.4	6891.8	**2853.25**	**2297.26**
37.00	37.50	37.25	0.50	35.0	20.42	10.42	125.51	1.57	9.6	9.6	1.0	33.36	2278.99	54	1.0	84.9	4324.6	37.5	9.6	54	10.42	2.40	1.16	138.6	647.8	7251.3	412.3	7015.9	**2900.54**	**2338.63**
37.50	38.50	38.00	1.00	36.0	20.42	10.42	125.51	3.14	9.6	9.6	1.0	66.72	2345.71	54	1.0	169.7	4494.3	38.5	8.0	54	10.42	2.11	0.91	138.6	615.4	7455.4	424.1	7264.1	**2982.16**	**2421.37**
38.50	40.00	39.25	1.50	37.5	20.42	10.42	125.51	4.71	8.0	8.0	1.0	83.16	2428.87	54	1.0	254.6	4748.9	40.0	8.0	96	10.42	2.11	0.91	138.6	912.4	8090.1	441.8	7619.5	**3236.05**	**2539.84**
BORE NO: P40, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	20.10	10.10	27.78	1.57	9.6	9.6	1.0	7.38	0	48	1.0	75.4	0	3.0	9.6	30	10.10	2.40	1.16	30.3	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.5	20.10	10.10	35.35	3.14	9.6	9.6	1.0	18.79	0	30	1.0	94.3	0	4.0	13.5	16	10.10	3.50	2.22	40.4	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	5.00	4.50	1.00	2.5	20.10	10.10	45.45	3.14	13.5	13.5	1.0	34.29	0	16	1.0	50.3	0	5.0	27.5	5	9.64	15.63	16.64	50.5	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.5	19.64	9.64	55.32	3.14	27.5	27.5	1.0	90.51	0	5	1.0	15.7	0	6.0	27.5	5	9.64	15.63	16.64	60.1	0	0.0	41.2	41.2	**0.00**	**13.74**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
6.00	8.00	7.00	2.00	5.5	19.64	9.64	69.78	6.29	27.5	27.5	1.0	228.33	0	5	1.0	31.4	0	8.0	25.2	0	9.64	10.45	11.34	79.4	0	0.0	64.8	64.8	**0.00**	**21.60**
8.00	9.00	8.50	1.00	6.5	19.64	9.64	84.24	3.14	25.2	25.2	1.0	124.58	0	0	1.0	0.0	0	9.0	10.5	56	10.39	2.62	1.36	89.1	584.7	584.7	76.6	76.6	**233.88**	**25.53**
9.00	11.00	10.00	2.00	8.5	20.39	10.39	99.45	6.29	10.5	10.5	1.0	115.86	115.86	56	1.0	352.0	352.0	11.0	9.6	58	10.39	2.40	1.16	109.8	621.8	1089.7	100.1	568.0	**435.87**	**189.33**
11.00	12.00	11.50	1.00	9.5	20.39	10.39	115.04	3.14	9.6	9.6	1.0	61.15	177.01	58	1.0	182.3	534.3	12.0	7.1	59	10.49	1.95	0.77	120.2	604.4	1315.7	111.9	823.2	**526.29**	**274.40**
12.00	14.50	13.25	2.50	12.0	20.49	10.49	133.34	7.86	7.1	7.1	1.0	130.50	307.50	59	1.0	463.6	997.9	14.5	9.5	46	10.49	2.38	1.14	146.5	603.9	1909.2	141.4	1446.7	**763.69**	**482.24**
14.50	16.00	15.25	1.50	13.5	20.49	10.49	133.34	4.71	9.5	9.5	1.0	105.19	412.70	46	1.0	216.9	1214.7	16.0	8.3	60	10.09	2.16	0.96	146.5	677.1	2304.5	159.0	1786.5	**921.80**	**595.49**
16.00	17.50	16.75	1.50	15.0	20.09	10.09	133.34	4.71	8.3	8.3	1.0	91.70	504.40	60	1.0	282.9	1497.6	17.5	8.3	52	10.31	2.16	0.96	146.5	620.6	2622.6	176.7	2178.7	**1049.03**	**726.23**
17.50	20.50	19.00	3.00	18.0	20.31	10.31	133.34	9.43	8.3	8.3	1.0	183.41	687.81	52	1.0	490.3	1987.9	20.5	18.5	28	10.31	5.64	4.57	146.5	865.7	3541.4	212.1	2887.7	**1416.56**	**962.58**
20.50	23.50	22.00	3.00	21.0	20.31	10.31	133.34	9.43	18.5	18.5	1.0	420.66	1108.48	28	1.0	264.0	2251.9	23.5	11.2	57	10.85	2.82	1.56	146.5	734.6	4094.9	247.4	3607.7	**1637.96**	**1202.58**
23.50	26.50	25.00	3.00	24.0	20.85	10.85	133.34	9.43	11.2	11.2	1.0	248.94	1357.41	57	1.0	537.4	2789.3	26.5	8.7	50	10.85	2.24	1.02	146.5	615.2	4761.9	282.7	4429.4	**1904.77**	**1476.48**
26.50	27.50	27.00	1.00	25.0	20.85	10.85	133.34	3.14	8.7	8.7	1.0	64.13	1421.54	50	1.0	157.1	2946.4	27.5	8.7	49	10.85	2.24	1.02	146.5	608.1	4976.1	294.5	4662.5	**1990.45**	**1554.17**
27.50	29.50	28.50	2.00	27.0	20.85	10.85	133.34	6.29	8.7	8.7	1.0	128.26	1549.80	49	1.0	308.0	3254.4	29.5	9.5	88	10.85	2.38	1.14	146.5	901.0	5705.3	318.1	5122.3	**2282.10**	**1707.44**
29.50	30.00	29.75	0.50	27.5	20.85	10.85	133.34	1.57	9.5	9.5	1.0	35.06	1584.86	88	1.0	138.3	3392.7	30.0	9.5	88	10.85	2.38	1.14	146.5	901.0	5878.6	324.0	5301.6	**2351.44**	**1767.18**
30.00	31.00	30.50	1.00	28.5	20.85	10.85	133.34	3.14	9.5	9.5	1.0	70.13	1654.99	88	1.0	276.6	3669.3	31.0	27.7	0	10.85	16.08	17.10	146.5	1923.3	7247.5	335.8	5660.0	**2899.02**	**1886.68**
31.00	32.50	31.75	1.50	30.0	20.85	10.85	133.34	4.71	27.7	27.7	1.0	330.03	1985.02	0	1.0	0.0	3669.3	32.5	27.7	0	10.01	16.08	17.10	146.5	1917.6	7571.9	353.4	6007.7	**3028.77**	**2002.58**
32.50	34.00	33.25	1.50	31.5	20.01	10.01	133.34	4.71	27.7	27.7	1.0	330.03	2315.05	0	1.0	0.0	3669.3	34.0	26.3	7	10.01	12.93	13.88	146.5	1591.7	7576.0	371.1	6355.4	**3030.40**	**2118.48**
34.00	35.00	34.50	1.00	32.5	20.01	10.01	133.34	3.14	26.3	26.3	1.0	207.12	2522.17	7	1.0	22.0	3691.3	35.0	26.0	7	10.01	12.25	13.18	146.5	1511.2	7724.7	382.9	6596.3	**3089.86**	**2198.78**
35.00	35.50	35.25	0.50	33.0	20.01	10.01	133.34	1.57	26.0	26.0	1.0	102.20	2624.37	7	1.0	11.0	3702.3	35.5	18.9	7	10.01	5.82	4.79	146.5	738.4	7065.0	388.8	6715.4	**2826.01**	**2238.48**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
35.50	37.00	36.25	1.50	34.5	20.01	10.01	133.34	4.71	18.9	18.9	1.0	215.22	2839.59	7	1.0	33.0	3735.3	37.0	8.9	56	10.01	2.27	1.05	146.5	661.6	7236.5	406.4	6981.3	**2894.58**	**2327.11**
37.00	37.50	37.25	0.50	35.0	20.01	10.01	133.34	1.57	8.9	8.9	1.0	32.81	2872.41	56	1.0	88.0	3823.3	37.5	8.9	56	10.16	2.27	1.05	146.5	661.6	7357.3	412.3	7108.0	**2942.93**	**2369.34**
37.50	38.50	38.00	1.00	36.0	20.16	10.16	133.34	3.14	8.9	8.9	1.0	65.63	2938.03	56	1.0	176.0	3999.3	38.5	8.9	56	9.31	2.27	1.05	146.5	661.3	7598.6	424.1	7361.4	**3039.44**	**2453.81**
38.50	40.00	39.25	1.50	37.5	19.31	9.31	133.34	4.71	8.9	8.9	1.0	98.44	3036.47	56	1.0	264.0	4263.3	40.0	18.9	10	9.31	5.82	4.79	146.5	758.3	8058.0	441.8	7741.5	**3223.21**	**2580.51**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
BORE NO: P24, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	20.95	10.95	30.11	1.89	7.5	7.5	1.0	7.48	0	51	1.0	96.2	0	3.0	29.5	0	10.95	20.13	21.25	32.9	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.5	20.95	10.95	38.33	3.77	29.5	29.5	1.0	81.78	0	0	1.0	0.0	0	4.0	28.2	0	10.95	17.21	18.25	43.8	0	0.0	25.4	25.4	**0.00**	**8.48**
4.00	6.00	5.00	2.00	3.5	20.95	10.95	54.75	7.54	28.2	28.2	1.0	221.43	0	0	1.0	0.0	0	6.0	28.0	2	8.97	16.76	17.79	65.7	0	0.0	59.4	59.4	**0.00**	**19.79**
6.00	7.00	6.50	1.00	4.5	18.97	8.97	70.19	3.77	28.0	28.0	1.0	140.74	0	2	1.0	7.5	0	7.0	28.0	2	8.97	16.76	17.79	74.7	1544.3	1544.3	76.3	76.3	**617.72**	**25.45**
7.00	8.00	7.50	1.00	5.5	18.97	8.97	79.16	3.77	28.0	28.0	1.0	158.73	158.73	2	1.0	7.5	7.5	8.0	28.0	2	8.97	16.76	17.79	83.6	1714.3	1880.6	93.3	259.6	**752.25**	**86.53**
8.00	9.00	8.50	1.00	6.5	18.97	8.97	88.13	3.77	28.0	28.0	1.0	176.72	335.45	2	1.0	7.5	15.1	9.0	28.0	2	8.97	16.76	17.79	92.6	1884.4	2234.9	110.3	460.8	**893.97**	**153.60**
9.00	10.00	9.50	1.00	7.5	18.97	8.97	97.10	3.77	28.0	28.0	1.0	194.71	530.15	2	1.0	7.5	22.6	10.0	32.8	0	9.14	35.36	36.75	101.6	4292.5	4845.3	127.2	680.0	**1938.11**	**226.67**
10.00	12.50	11.25	2.50	10.0	19.14	9.14	113.01	9.43	32.8	32.8	1.1	782.78	1312.94	0	1.0	0.0	22.6	12.5	32.8	0	9.14	35.36	36.75	124.4	5206.8	6542.3	169.6	1505.2	**2616.93**	**501.74**
12.50	14.00	13.25	1.50	11.5	19.14	9.14	131.29	5.66	32.8	32.8	1.1	545.65	1858.58	0	1.0	0.0	22.6	14.0	26.5	14	10.96	13.38	14.34	138.1	2340.1	4221.3	195.1	2076.3	**1688.53**	**692.10**
14.00	15.50	14.75	1.50	13.0	20.96	10.96	146.36	5.66	26.5	26.5	1.0	412.82	2271.40	14	1.0	79.2	101.8	15.5	26.5	0	10.96	13.38	14.34	154.6	2446.4	4819.6	220.5	2593.8	**1927.85**	**864.59**
15.50	17.00	16.25	1.50	14.5	20.96	10.96	162.80	5.66	26.5	26.5	1.0	459.19	2730.58	0	1.0	0.0	101.8	17.0	14.6	45	10.85	3.82	2.54	171.0	1216.8	4049.2	246.0	3078.4	**1619.70**	**1026.13**
17.00	18.50	17.75	1.50	16.0	20.85	10.85	179.16	5.66	14.6	14.6	1.0	264.00	2994.58	45	1.0	254.6	356.4	18.5	14.6	45	10.86	3.82	2.54	171.0	1216.9	4567.8	271.4	3622.4	**1827.14**	**1207.47**
18.50	21.50	20.00	3.00	19.0	20.86	10.86	179.16	11.31	14.6	14.6	1.0	528.00	3522.59	45	1.0	509.1	865.5	21.5	11.1	44	10.23	2.79	1.53	171.0	999.2	5387.3	322.3	4710.5	**2154.94**	**1570.15**
21.50	24.50	23.00	3.00	22.0	20.23	10.23	179.16	11.31	11.1	11.1	1.0	397.69	3920.28	44	1.0	497.8	1363.4	24.5	10.5	56	10.23	2.62	1.36	171.0	1086.1	6369.7	373.2	5656.9	**2547.89**	**1885.62**
24.50	26.00	25.25	1.50	23.5	20.23	10.23	179.16	5.66	10.5	10.5	1.0	187.84	4108.12	56	1.0	316.8	1680.2	26.0	10.5	75	10.35	2.62	1.36	171.0	1279.7	7068.0	398.7	6187.0	**2827.19**	**2062.32**
26.00	27.50	26.75	1.50	25.0	20.35	10.35	179.16	5.66	10.5	10.5	1.0	187.84	4295.97	75	1.0	424.3	2104.5	27.5	10.5	75	10.35	2.62	1.36	171.0	1279.7	7680.1	424.1	6824.5	**3072.04**	**2274.85**
27.50	29.00	28.25	1.50	26.5	20.35	10.35	179.16	5.66	10.5	10.5	1.0	187.84	4483.81	75	1.0	424.3	2528.7	29.0	13.3	54	9.14	3.44	2.16	171.0	1228.9	8241.5	449.6	7462.1	**3296.59**	**2487.37**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
29.00	30.00	29.50	1.00	27.5	19.14	9.14	179.16	3.77	13.3	13.3	1.0	159.72	4643.54	54	1.0	203.7	2732.4	30.0	13.3	54	9.14	3.44	2.16	171.0	1228.9	8604.9	466.5	7842.5	**3441.95**	**2614.15**
30.00	30.50	30.25	0.50	28.0	19.14	9.14	179.16	1.89	13.3	13.3	1.0	79.86	4723.40	54	1.0	101.8	2834.2	30.5	13.3	54	9.14	3.44	2.16	171.0	1228.9	8786.6	475.0	8032.6	**3514.62**	**2677.54**
30.50	32.50	31.50	2.00	30.0	19.14	9.14	179.16	7.54	13.3	13.3	1.0	319.45	5042.84	54	1.0	407.3	3241.5	32.5	13.0	50	9.17	3.35	2.08	171.0	1170.3	9454.7	508.9	8793.3	**3781.87**	**2931.11**
32.50	33.50	33.00	1.00	31.0	19.17	9.17	179.16	3.77	13.0	13.0	1.0	155.99	5198.84	50	1.0	188.6	3430.1	33.5	13.0	50	8.93	3.35	2.08	171.0	1170.0	9798.9	525.9	9154.9	**3919.56**	**3051.62**
33.50	35.00	34.25	1.50	32.5	18.93	8.93	179.16	5.66	13.0	13.0	1.0	233.99	5432.83	50	1.0	282.9	3713.0	35.0	27.7	0	8.93	16.08	17.10	171.0	3215.1	12360.9	551.3	9697.1	**4944.37**	**3232.38**
35.00	36.50	35.75	1.50	34.0	18.93	8.93	179.16	5.66	27.7	27.7	1.0	532.11	5964.94	0	1.0	0.0	3713.0	36.5	31.2	0	9.79	27.30	28.55	171.0	5473.1	15151.0	576.8	10254.7	**6060.39**	**3418.23**
36.50	37.50	37.00	1.00	35.0	19.79	9.79	179.16	3.77	31.2	31.2	1.1	433.76	6398.70	0	1.0	0.0	3713.0	37.5	31.2	0	9.79	27.30	28.55	171.0	5473.1	15584.7	593.8	10705.4	**6233.90**	**3568.48**
37.50	40.00	38.75	2.50	37.5	19.79	9.79	179.16	9.43	31.2	31.2	1.1	1084.40	7483.09	0	1.0	0.0	3713.0	40.0	31.2	0	9.79	27.30	28.55	171.0	5473.1	16669.1	636.2	11832.2	**6667.66**	**3944.08**
BORE NO: P30, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	17.98	7.98	21.95	1.89	27.2	27.2	1.0	21.27	0	12	1.0	22.6	0	3.0	28.3	9	9.16	17.43	18.48	23.9	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	5.00	4.00	2.00	2.5	19.16	9.16	33.10	7.54	28.3	28.3	1.0	134.43	0	9	1.0	67.9	0	5.0	28.3	9	9.16	17.43	18.48	42.3	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.5	19.16	9.16	46.84	3.77	28.3	28.3	1.0	95.12	0	9	1.0	33.9	0	6.0	28.3	0	9.16	17.43	18.48	51.4	0	0.0	59.4	59.4	**0.00**	**19.79**
6.00	8.00	7.00	2.00	5.5	19.16	9.16	60.58	7.54	28.3	28.3	1.0	246.04	0	0	1.0	0.0	0	8.0	28.3	0	11.05	17.43	18.48	69.7	0	0.0	93.3	93.3	**0.00**	**31.10**
8.00	9.00	8.50	1.00	6.5	21.05	11.05	75.27	3.77	28.3	28.3	1.0	152.84	0	0	1.0	0.0	0	9.0	28.3	0	11.05	17.43	18.48	80.8	0	0.0	110.3	110.3	**0.00**	**36.76**
9.00	10.00	9.50	1.00	7.5	21.05	11.05	86.32	3.77	28.3	28.3	1.0	175.28	0	0	1.0	0.0	0	10.0	10.6	40	11.05	2.65	1.39	91.8	692.7	692.7	127.2	127.2	**277.10**	**42.41**
10.00	11.00	10.50	1.00	8.5	21.05	11.05	97.37	3.77	10.6	10.6	1.0	68.72	68.72	40	1.0	150.9	150.9	11.0	10.6	40	11.05	2.65	1.39	102.9	725.8	945.4	144.2	363.8	**378.16**	**121.26**
11.00	12.00	11.50	1.00	9.5	21.05	11.05	108.42	3.77	10.6	10.6	1.0	76.52	145.24	40	1.0	150.9	301.7	12.0	11.4	45	11.54	2.88	1.62	113.9	842.4	1289.4	161.2	608.1	**515.74**	**202.71**
12.00	14.50	13.25	2.50	12.0	21.54	11.54	128.37	9.43	11.4	11.4	1.0	244.04	389.28	45	1.0	424.3	726.0	14.5	11.2	45	11.36	2.82	1.56	142.8	926.3	2041.6	203.6	1318.9	**816.64**	**439.62**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
14.50	17.50	16.00	3.00	15.0	21.36	11.36	159.83	11.31	11.2	11.2	1.0	358.07	747.34	45	1.0	509.1	1235.1	17.5	11.2	45	11.36	2.82	1.56	176.9	1035.2	3017.7	254.5	2237.0	**1207.06**	**745.65**
17.50	19.00	18.25	1.50	16.5	21.36	11.36	159.83	5.66	11.2	11.2	1.0	179.03	926.38	45	1.0	254.6	1489.7	19.0	24.3	10	10.67	9.50	10.11	176.9	2075.4	4491.5	279.9	2696.0	**1796.58**	**898.67**
19.00	20.50	19.75	1.50	18.0	20.67	10.67	159.83	5.66	24.3	24.3	1.0	408.25	1334.63	10	1.0	56.6	1546.3	20.5	15.5	42	10.67	4.19	2.92	176.9	1286.5	4167.5	305.4	3186.3	**1666.98**	**1062.09**
20.50	23.50	22.00	3.00	21.0	20.67	10.67	159.83	11.31	15.5	15.5	1.0	501.50	1836.13	42	1.0	475.2	2021.5	23.5	8.6	41	11.75	2.22	1.00	176.9	869.4	4727.0	356.3	4213.9	**1890.79**	**1404.63**
23.50	26.50	25.00	3.00	24.0	21.75	11.75	159.83	11.31	8.6	8.6	1.0	273.49	2109.62	41	1.0	463.9	2485.4	26.5	8.6	41	11.75	2.22	1.00	176.9	869.4	5464.4	407.2	5002.1	**2185.74**	**1667.38**
26.50	27.50	27.00	1.00	25.0	21.75	11.75	159.83	3.77	8.6	8.6	1.0	91.16	2200.79	41	1.0	154.6	2640.0	27.5	9.0	41	11.75	2.29	1.07	176.9	884.3	5725.1	424.1	5264.9	**2290.02**	**1754.97**
27.50	29.50	28.50	2.00	27.0	21.75	11.75	159.83	7.54	9.0	9.0	1.0	190.94	2391.73	41	1.0	309.3	2949.3	29.5	11.0	41	9.27	2.76	1.51	176.9	980.1	6321.1	458.0	5799.0	**2528.43**	**1933.01**
29.50	30.00	29.75	0.50	27.5	19.27	9.27	159.83	1.89	11.0	11.0	1.0	58.59	2450.32	41	1.0	77.3	3026.6	30.0	11.0	41	9.27	2.76	1.51	176.9	980.1	6457.0	466.5	5943.4	**2582.79**	**1981.14**
30.00	31.00	30.50	1.00	28.5	19.27	9.27	159.83	3.77	11.0	11.0	1.0	117.17	2567.49	41	1.0	154.6	3181.2	31.0	27.8	5	9.27	16.31	17.33	176.9	3422.9	9171.6	483.5	6232.2	**3668.65**	**2077.39**
31.00	32.50	31.75	1.50	30.0	19.27	9.27	159.83	5.66	27.8	27.8	1.0	476.72	3044.21	5	1.0	28.3	3209.5	32.5	8.5	48	9.27	2.20	0.99	176.9	935.3	7188.9	508.9	6762.6	**2875.58**	**2254.21**
32.50	35.00	33.75	2.50	32.5	19.27	9.27	159.83	9.43	8.5	8.5	1.0	225.22	3269.42	48	1.0	452.6	3662.1	35.0	8.1	48	8.55	2.13	0.93	176.9	920.0	7851.5	551.3	7482.8	**3140.60**	**2494.28**
35.00	35.50	35.25	0.50	33.0	18.55	8.55	159.83	1.89	8.1	8.1	1.0	42.89	3312.32	48	1.0	90.5	3752.6	35.5	10.8	33	9.21	2.71	1.45	176.9	886.4	7951.3	559.8	7624.7	**3180.53**	**2541.57**
35.50	37.00	36.25	1.50	34.5	19.21	9.21	159.83	5.66	10.8	10.8	1.0	172.48	3484.80	33	1.0	186.7	3939.3	37.0	9.4	56	9.21	2.36	1.13	176.9	1050.0	8474.0	585.3	8009.3	**3389.61**	**2669.78**
37.00	37.50	37.25	0.50	35.0	19.21	9.21	159.83	1.89	9.4	9.4	1.0	49.90	3534.70	56	1.0	105.6	4044.9	37.5	10.2	56	9.21	2.53	1.28	176.9	1084.3	8663.8	593.8	8173.3	**3465.53**	**2724.44**
37.50	38.50	38.00	1.00	36.0	19.21	9.21	159.83	3.77	10.2	10.2	1.0	108.46	3643.15	56	1.0	211.2	4256.1	38.5	14.3	48	9.97	3.74	2.45	176.9	1253.2	9152.4	610.7	8509.9	**3660.96**	**2836.65**
38.50	40.00	39.25	1.50	37.5	19.97	9.97	159.83	5.66	14.3	14.3	1.0	230.47	3873.63	48	1.0	271.5	4527.6	40.0	14.3	48	9.97	3.74	2.45	176.9	1253.2	9654.4	636.2	9037.4	**3861.77**	**3012.47**
BORE NO: P32, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	19.70	9.70	26.68	1.89	28.2	28.2	1.0	26.97	0	0	1.0	0.0	0	3.0	28.2	0	9.39	17.21	18.25	29.1	0	0.0	8.5	8.5	**0.00**	**2.83**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
3.00	5.00	4.00	2.00	2.5	19.39	9.39	38.49	7.54	28.2	28.2	1.0	155.67	0	0	1.0	0.0	0	5.0	28.5	0	9.39	17.88	18.94	47.9	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.5	19.39	9.39	52.58	3.77	28.5	28.5	1.0	107.66	0	0	1.0	0.0	0	6.0	28.5	0	9.64	17.88	18.94	57.3	0	0.0	59.4	59.4	**0.00**	**19.79**
6.00	8.00	7.00	2.00	5.5	19.64	9.64	66.91	7.54	28.5	28.5	1.0	274.03	0	0	1.0	0.0	0	8.0	11.6	54	9.64	2.94	1.68	76.6	815.5	815.5	93.3	93.3	**326.21**	**31.10**
8.00	9.00	8.50	1.00	6.5	19.64	9.64	81.37	3.77	11.6	11.6	1.0	62.99	62.99	54	1.0	203.7	203.7	9.0	11.6	54	9.64	2.94	1.68	86.2	847.6	1114.2	110.3	376.9	**445.70**	**125.64**
9.00	10.00	9.50	1.00	7.5	19.64	9.64	91.01	3.77	11.6	11.6	1.0	70.46	133.45	54	1.0	203.7	407.3	10.0	11.6	54	10.40	2.94	1.68	95.8	880.5	1421.3	127.2	668.0	**568.52**	**222.67**
10.00	11.00	10.50	1.00	8.5	20.40	10.40	101.03	3.77	11.6	11.6	1.0	78.21	211.66	54	1.0	203.7	611.0	11.0	11.6	54	10.40	2.94	1.68	106.2	915.1	1737.8	144.2	966.8	**695.11**	**322.28**
11.00	12.00	11.50	1.00	9.5	20.40	10.40	111.43	3.77	11.6	11.6	1.0	86.26	297.93	54	1.0	203.7	814.6	12.0	9.0	66	10.40	2.29	1.07	116.6	981.8	2094.3	161.2	1273.7	**837.73**	**424.57**
12.00	13.00	12.50	1.00	10.5	20.40	10.40	121.83	3.77	9.0	9.0	1.0	72.77	370.70	66	1.0	248.9	1063.5	13.0	29.0	0	10.40	19.01	20.10	127.0	2873.8	4308.0	178.1	1612.4	**1723.20**	**537.46**
13.00	14.50	13.75	1.50	12.0	20.40	10.40	134.83	5.66	29.0	29.0	1.0	422.80	793.50	0	1.0	0.0	1063.5	14.5	29.0	0	10.18	19.01	20.10	142.6	3206.2	5063.3	203.6	2060.6	**2025.32**	**686.87**
14.50	16.00	15.25	1.50	13.5	20.18	10.18	150.27	5.66	29.0	29.0	1.0	471.20	1264.70	0	1.0	0.0	1063.5	16.0	10.4	51	10.18	2.59	1.33	157.9	990.8	3319.1	229.0	2557.3	**1327.63**	**852.42**
16.00	17.50	16.75	1.50	15.0	20.18	10.18	165.54	5.66	10.4	10.4	1.0	171.87	1436.58	51	1.0	288.5	1352.1	17.5	10.4	51	10.18	2.59	1.33	173.2	1035.5	3824.2	254.5	3043.1	**1529.67**	**1014.37**
17.50	19.00	18.25	1.50	16.5	20.18	10.18	165.54	5.66	10.4	10.4	1.0	171.87	1608.45	51	1.0	288.5	1640.6	19.0	24.0	12	9.99	9.28	9.78	173.2	2006.8	5255.8	279.9	3528.9	**2102.31**	**1176.31**
19.00	20.50	19.75	1.50	18.0	19.99	9.99	165.54	5.66	24.0	24.0	1.0	416.94	2025.38	12	1.0	67.9	1708.5	20.5	9.3	62	10.42	2.34	1.11	173.2	1098.5	4832.3	305.4	4039.2	**1932.92**	**1346.40**
20.50	23.50	22.00	3.00	21.0	20.42	10.42	165.54	11.31	9.3	9.3	1.0	306.70	2332.09	62	1.0	701.5	2409.9	23.5	9.3	62	10.42	2.34	1.11	173.2	1098.5	5840.5	356.3	5098.3	**2336.20**	**1699.43**
23.50	25.00	24.25	1.50	22.5	20.42	10.42	165.54	5.66	9.3	9.3	1.0	153.35	2485.44	62	1.0	350.7	2760.7	25.0	9.3	62	10.42	2.34	1.11	173.2	1098.5	6344.6	381.7	5627.8	**2537.83**	**1875.94**
25.00	26.50	25.75	1.50	24.0	20.42	10.42	165.54	5.66	9.3	9.3	1.0	153.35	2638.79	62	1.0	350.7	3111.4	26.5	7.5	60	8.59	2.02	0.84	173.2	1011.6	6761.8	407.2	6157.4	**2704.73**	**2052.46**
26.50	27.50	27.00	1.00	25.0	18.59	8.59	165.54	3.77	7.5	7.5	1.0	82.19	2720.98	60	1.0	226.3	3337.7	27.5	7.5	60	8.59	2.02	0.84	173.2	1011.6	7070.3	424.1	6482.8	**2828.12**	**2160.94**
27.50	28.00	27.75	0.50	25.5	18.59	8.59	165.54	1.89	7.5	7.5	1.0	41.10	2762.07	60	1.0	113.1	3450.9	28.0	7.5	60	9.11	2.02	0.84	173.2	1011.9	7224.8	432.6	6645.5	**2889.94**	**2215.18**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
28.00	29.50	28.75	1.50	27.0	19.11	9.11	165.54	5.66	7.5	7.5	1.0	123.29	2885.36	60	1.0	339.4	3790.3	29.5	7.5	60	8.85	2.02	0.84	173.2	1011.8	7687.4	458.0	7133.7	**3074.96**	**2377.90**
29.50	30.00	29.75	0.50	27.5	18.85	8.85	165.54	1.89	7.5	7.5	1.0	41.10	2926.46	60	1.0	113.1	3903.4	30.0	8.0	54	8.85	2.11	0.91	173.2	968.8	7798.6	466.5	7296.4	**3119.46**	**2432.14**
30.00	31.00	30.50	1.00	28.5	18.85	8.85	165.54	3.77	8.0	8.0	1.0	87.74	3014.20	54	1.0	203.7	4107.1	31.0	9.2	44	9.73	2.33	1.10	173.2	911.0	8032.3	483.5	7604.8	**3212.92**	**2534.92**
31.00	32.50	31.75	1.50	30.0	19.73	9.73	165.54	5.66	9.2	9.2	1.0	151.67	3165.87	44	1.0	248.9	4356.0	32.5	7.0	51	8.54	1.93	0.76	173.2	901.9	8423.7	508.9	8030.8	**3369.49**	**2676.94**
32.50	34.00	33.25	1.50	31.5	18.54	8.54	165.54	5.66	7.0	7.0	1.0	114.98	3280.85	51	1.0	288.5	4644.5	34.0	11.5	48	9.73	2.91	1.65	173.2	1070.0	8995.4	534.4	8459.7	**3598.15**	**2819.92**
34.00	35.00	34.50	1.00	32.5	19.73	9.73	165.54	3.77	11.5	11.5	1.0	127.02	3407.87	48	1.0	181.0	4825.5	35.0	11.5	48	9.73	2.91	1.65	173.2	1070.0	9303.4	551.3	8784.8	**3721.37**	**2928.25**
35.00	35.50	35.25	0.50	33.0	19.73	9.73	165.54	1.89	11.5	11.5	1.0	63.51	3471.37	48	1.0	90.5	4916.1	35.5	8.0	60	8.79	2.11	0.91	173.2	1029.8	9417.3	559.8	8947.3	**3766.90**	**2982.42**
35.50	37.00	36.25	1.50	34.5	18.79	8.79	165.54	5.66	8.0	8.0	1.0	131.61	3602.98	60	1.0	339.4	5255.5	37.0	8.0	60	9.18	2.11	0.91	173.2	1030.1	9888.5	585.3	9443.7	**3955.41**	**3147.92**
37.00	37.50	37.25	0.50	35.0	19.18	9.18	165.54	1.89	8.0	8.0	1.0	43.87	3646.85	60	1.0	113.1	5368.6	37.5	8.0	60	9.18	2.11	0.91	173.2	1030.1	10045.5	593.8	9609.2	**4018.22**	**3203.08**
37.50	38.50	38.00	1.00	36.0	19.18	9.18	165.54	3.77	8.0	8.0	1.0	87.74	3734.59	60	1.0	226.3	5594.9	38.5	9.2	56	8.83	2.33	1.10	173.2	1032.5	10362.1	610.7	9940.2	**4144.82**	**3313.41**
38.50	40.00	39.25	1.50	37.5	18.83	8.83	165.54	5.66	9.2	9.2	1.0	151.67	3886.27	56	1.0	316.8	5911.7	40.0	9.2	56	0.00	2.33	1.10	173.2	1026.0	10824.0	636.2	10434.2	**4329.58**	**3478.05**
BORE NO: P33, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	19.79	9.79	26.92	1.89	28.6	28.6	1.0	27.68	0	0	1.0	0.0	0	3.0	28.6	0	9.53	18.11	19.17	29.4	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	5.00	4.00	2.00	2.5	19.53	9.53	38.90	7.54	28.6	28.6	1.0	159.98	0	0	1.0	0.0	0	5.0	29.3	0	9.53	19.68	20.79	48.4	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.5	19.53	9.53	53.20	3.77	29.3	29.3	1.0	112.58	0	0	1.0	0.0	0	6.0	29.3	0	9.45	19.68	20.79	58.0	1424.1	1424.1	59.4	59.4	**569.65**	**19.79**
6.00	8.00	7.00	2.00	5.5	19.45	9.45	67.41	7.54	29.3	29.3	1.0	285.34	285.34	0	1.0	0.0	0.0	8.0	29.3	0	9.45	19.68	20.79	76.9	1845.0	2130.4	93.3	378.6	**852.15**	**126.21**
8.00	9.00	8.50	1.00	6.5	19.45	9.45	81.59	3.77	29.3	29.3	1.0	172.67	458.01	0	1.0	0.0	0.0	9.0	12.2	56	10.24	3.12	1.85	86.3	887.4	1345.4	110.3	568.3	**538.17**	**189.43**
9.00	11.00	10.00	2.00	8.5	20.24	10.24	96.55	7.54	12.2	12.2	1.0	157.46	615.46	56	1.0	422.4	422.4	11.0	27.7	0	10.24	16.08	17.10	106.8	2061.8	3099.6	144.2	1182.1	**1239.85**	**394.02**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
11.00	12.00	11.50	1.00	9.5	20.24	10.24	111.91	3.77	27.7	27.7	1.0	221.59	837.05	0	1.0	0.0	422.4	12.0	28.0	0	10.24	16.76	17.79	117.0	2342.3	3601.8	161.2	1420.6	**1440.71**	**473.54**
12.00	13.00	12.50	1.00	10.5	20.24	10.24	122.15	3.77	28.0	28.0	1.0	244.95	1082.00	0	1.0	0.0	422.4	13.0	8.6	59	10.39	2.22	1.00	127.3	927.3	2431.7	178.1	1682.5	**972.66**	**560.84**
13.00	14.50	13.75	1.50	12.0	20.39	10.39	135.06	5.66	8.6	8.6	1.0	115.55	1197.55	59	1.0	333.8	756.2	14.5	8.6	59	10.61	2.22	1.00	142.9	966.5	2920.2	203.6	2157.3	**1168.10**	**719.10**
14.50	17.50	16.00	3.00	15.0	20.61	10.61	158.77	11.31	8.6	8.6	1.0	271.68	1469.23	59	1.0	667.5	1423.7	17.5	10.3	62	10.42	2.56	1.31	174.7	1146.2	4039.1	254.5	3147.4	**1615.65**	**1049.14**
17.50	20.50	19.00	3.00	18.0	20.42	10.42	158.77	11.31	10.3	10.3	1.0	326.46	1795.68	62	1.0	701.5	2125.2	20.5	11.6	65	10.42	2.94	1.68	174.7	1254.9	5175.8	305.4	4226.2	**2070.31**	**1408.75**
20.50	22.00	21.25	1.50	19.5	20.42	10.42	158.77	5.66	11.6	11.6	1.0	184.37	1980.05	65	1.0	367.7	2492.9	22.0	25.2	8	9.65	10.45	11.34	174.7	2221.2	6694.2	330.8	4803.8	**2677.67**	**1601.26**
22.00	23.50	22.75	1.50	21.0	19.65	9.65	158.77	5.66	25.2	25.2	1.0	422.65	2402.71	8	1.0	45.3	2538.2	23.5	11.0	56	9.65	2.76	1.51	174.7	1126.4	6067.3	356.3	5297.1	**2426.91**	**1765.71**
23.50	25.00	24.25	1.50	22.5	19.65	9.65	158.77	5.66	11.0	11.0	1.0	174.59	2577.30	56	1.0	316.8	2855.0	25.0	11.0	56	9.65	2.76	1.51	174.7	1126.4	6558.7	381.7	5814.0	**2623.46**	**1937.99**
25.00	26.50	25.75	1.50	24.0	19.65	9.65	158.77	5.66	11.0	11.0	1.0	174.59	2751.88	56	1.0	316.8	3171.8	26.5	11.0	56	8.78	2.76	1.51	174.7	1125.5	7049.2	407.2	6330.8	**2819.66**	**2110.27**
26.50	27.50	27.00	1.00	25.0	18.78	8.78	158.77	3.77	11.0	11.0	1.0	116.39	2868.28	56	1.0	211.2	3383.0	27.5	11.0	56	8.78	2.76	1.51	174.7	1125.5	7376.8	424.1	6675.4	**2950.70**	**2225.12**
27.50	28.00	27.75	0.50	25.5	18.78	8.78	158.77	1.89	11.0	11.0	1.0	58.20	2926.47	56	1.0	105.6	3488.6	28.0	11.6	65	9.46	2.94	1.68	174.7	1253.8	7668.9	432.6	6847.6	**3067.54**	**2282.55**
28.00	29.50	28.75	1.50	27.0	19.46	9.46	158.77	5.66	11.6	11.6	1.0	184.37	3110.84	65	1.0	367.7	3856.3	29.5	11.6	65	8.75	2.94	1.68	174.7	1253.0	8220.1	458.0	7425.2	**3288.05**	**2475.06**
29.50	30.00	29.75	0.50	27.5	18.75	8.75	158.77	1.89	11.6	11.6	1.0	61.46	3172.30	65	1.0	122.6	3978.9	30.0	11.6	65	8.75	2.94	1.68	174.7	1253.0	8404.2	466.5	7617.7	**3361.66**	**2539.23**
30.00	31.00	30.50	1.00	28.5	18.75	8.75	158.77	3.77	11.6	11.6	1.0	122.91	3295.22	65	1.0	245.1	4224.0	31.0	11.6	65	8.97	2.94	1.68	174.7	1253.3	8772.5	483.5	8002.7	**3508.99**	**2667.57**
31.00	32.50	31.75	1.50	30.0	18.97	8.97	158.77	5.66	11.6	11.6	1.0	184.37	3479.59	65	1.0	367.7	4591.7	32.5	11.5	57	8.96	2.91	1.65	174.7	1165.8	9237.1	508.9	8580.2	**3694.84**	**2860.08**
32.50	34.00	33.25	1.50	31.5	18.96	8.96	158.77	5.66	11.5	11.5	1.0	182.74	3662.32	57	1.0	322.5	4914.2	34.0	11.5	57	8.95	2.91	1.65	174.7	1165.8	9742.3	534.4	9110.9	**3896.91**	**3036.96**
34.00	35.00	34.50	1.00	32.5	18.95	8.95	158.77	3.77	11.5	11.5	1.0	121.83	3784.15	57	1.0	215.0	5129.1	35.0	11.5	57	8.95	2.91	1.65	174.7	1165.8	10079.1	551.3	9464.6	**4031.63**	**3154.88**
35.00	35.50	35.25	0.50	33.0	18.95	8.95	158.77	1.89	11.5	11.5	1.0	60.91	3845.06	57	1.0	107.5	5236.6	35.5	8.5	46	8.64	2.20	0.99	174.7	909.0	9990.7	559.8	9641.5	**3996.29**	**3213.84**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
35.50	37.00	36.25	1.50	34.5	18.64	8.64	158.77	5.66	8.5	8.5	1.0	134.23	3979.30	46	1.0	260.2	5496.9	37.0	8.7	60	9.08	2.24	1.02	174.7	1059.2	10535.3	585.3	10061.4	**4214.14**	**3353.81**
37.00	37.50	37.25	0.50	35.0	19.08	9.08	158.77	1.89	8.7	8.7	1.0	45.81	4025.11	60	1.0	113.1	5610.0	37.5	8.7	60	9.08	2.24	1.02	174.7	1059.2	10694.3	593.8	10228.9	**4277.72**	**3409.62**
37.50	38.50	38.00	1.00	36.0	19.08	9.08	158.77	3.77	8.7	8.7	1.0	91.63	4116.74	60	1.0	226.3	5836.3	38.5	8.7	60	8.75	2.24	1.02	174.7	1059.0	11012.0	610.7	10563.7	**4404.79**	**3521.25**
38.50	40.00	39.25	1.50	37.5	18.75	8.75	158.77	5.66	8.7	8.7	1.0	137.44	4254.18	60	1.0	339.4	6175.7	40.0	9.8	54	0.00	2.43	1.19	174.7	1030.9	11460.8	636.2	11066.1	**4584.33**	**3688.69**
BORE NO: P34, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	19.58	9.58	26.35	1.89	23.3	23.3	1.0	21.40	0	0	1.0	0.0	0	3.0	15.9	26	9.58	4.38	3.14	28.7	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.5	19.58	9.58	33.53	3.77	15.9	15.9	1.0	36.02	0	26	1.0	98.1	0	4.0	30.8	0	9.29	25.29	26.50	38.3	1263.6	1263.6	25.4	25.4	**505.44**	**8.48**
4.00	6.00	5.00	2.00	3.5	19.29	9.29	47.61	7.54	30.8	30.8	1.0	222.64	222.64	0	1.0	0.0	0.0	6.0	30.8	0	9.29	25.29	26.50	56.9	1795.2	2017.9	59.4	282.0	**807.14**	**94.00**
6.00	7.00	6.50	1.00	4.5	19.29	9.29	61.55	3.77	30.8	30.8	1.0	143.90	366.54	0	1.0	0.0	0.0	7.0	27.4	0	9.29	15.40	16.41	66.2	1257.1	1623.7	76.3	442.9	**649.47**	**147.63**
7.00	8.00	7.50	1.00	5.5	19.29	9.29	70.84	3.77	27.4	27.4	1.0	138.48	505.02	0	1.0	0.0	0.0	8.0	25.8	7	9.75	11.80	12.72	75.5	1163.3	1668.4	93.3	598.3	**667.35**	**199.44**
8.00	9.00	8.50	1.00	6.5	19.75	9.75	80.36	3.77	25.8	25.8	1.0	146.50	651.52	7	1.0	26.4	26.4	9.0	26.2	9	9.75	12.70	13.64	85.2	1406.9	2084.8	110.3	788.2	**833.91**	**262.73**
9.00	10.00	9.50	1.00	7.5	19.75	9.75	90.11	3.77	26.2	26.2	1.0	167.21	818.73	9	1.0	33.9	60.3	10.0	26.0	0	9.49	12.25	13.18	95.0	1401.6	2280.6	127.2	1006.3	**912.26**	**335.44**
10.00	12.50	11.25	2.50	10.0	19.49	9.49	106.84	9.43	26.0	26.0	1.0	491.33	1310.06	0	1.0	0.0	60.3	12.5	9.5	55	10.41	2.38	1.14	118.7	887.8	2258.2	169.6	1540.1	**903.28**	**513.35**
12.50	15.50	14.00	3.00	13.0	20.41	10.41	134.32	11.31	9.5	9.5	1.0	254.32	1564.38	55	1.0	622.3	682.6	15.5	9.5	55	10.41	2.38	1.14	149.9	971.9	3218.9	220.5	2467.5	**1287.55**	**822.52**
15.50	18.50	17.00	3.00	16.0	20.41	10.41	165.55	11.31	9.5	9.5	1.0	313.45	1877.82	55	1.0	622.3	1304.9	18.5	9.5	55	10.62	2.38	1.14	149.9	972.0	4154.8	271.4	3454.2	**1661.91**	**1151.39**
18.50	21.50	20.00	3.00	19.0	20.62	10.62	165.55	11.31	9.5	9.5	1.0	313.45	2191.27	55	1.0	622.3	1927.2	21.5	11.5	58	10.14	2.91	1.65	149.9	1095.8	5214.3	322.3	4440.8	**2085.70**	**1480.27**
21.50	24.50	23.00	3.00	22.0	20.14	10.14	165.55	11.31	11.5	11.5	1.0	381.08	2572.35	58	1.0	656.2	2583.4	24.5	8.2	62	10.14	2.15	0.94	149.9	1001.9	6157.7	373.2	5529.0	**2463.06**	**1843.00**
24.50	27.50	26.00	3.00	25.0	20.14	10.14	165.55	11.31	8.2	8.2	1.0	269.91	2842.27	62	1.0	701.5	3284.9	27.5	8.2	60	10.59	2.15	0.94	149.9	981.8	7109.0	424.1	6551.3	**2843.59**	**2183.77**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
27.50	30.00	28.75	2.50	27.5	20.59	10.59	165.55	9.43	8.2	8.2	1.0	224.93	3067.20	60	1.0	565.7	3850.6	30.0	9.1	59	10.59	2.31	1.08	149.9	1000.1	7917.9	466.5	7384.4	**3167.17**	**2461.45**
30.00	30.50	30.25	0.50	28.0	20.59	10.59	165.55	1.89	9.1	9.1	1.0	50.00	3117.20	59	1.0	111.3	3961.9	30.5	32.5	0	10.59	33.85	35.22	149.9	5996.0	13075.1	475.0	7554.1	**5230.05**	**2518.03**
30.50	32.00	31.25	1.50	29.5	20.59	10.59	165.55	5.66	32.5	32.5	1.1	671.22	3788.42	0	1.0	0.0	3961.9	32.0	19.5	32	10.59	6.13	5.12	149.9	1403.2	9153.5	500.5	8250.8	**3661.41**	**2750.25**
32.00	32.50	32.25	0.50	30.0	20.59	10.59	165.55	1.89	19.5	19.5	1.0	110.55	3898.97	32	1.0	60.3	4022.2	32.5	19.5	32	8.96	6.13	5.12	149.9	1397.5	9318.7	508.9	8430.1	**3727.50**	**2810.05**
32.50	33.50	33.00	1.00	31.0	18.96	8.96	165.55	3.77	19.5	19.5	1.0	221.10	4120.07	32	1.0	120.7	4142.9	33.5	19.5	32	9.42	6.13	5.12	149.9	1399.1	9662.1	525.9	8788.9	**3864.85**	**2929.63**
33.50	35.00	34.25	1.50	32.5	19.42	9.42	165.55	5.66	19.5	19.5	1.0	331.65	4451.71	32	1.0	181.0	4323.9	35.0	11.4	39	9.13	2.88	1.62	149.9	896.0	9671.7	551.3	9327.0	**3868.67**	**3109.00**
35.00	36.50	35.75	1.50	34.0	19.13	9.13	165.55	5.66	11.4	11.4	1.0	188.84	4640.55	39	1.0	220.6	4544.6	36.5	11.4	39	9.17	2.88	1.62	149.9	896.1	10081.2	576.8	9761.9	**4032.47**	**3253.97**
36.50	37.50	37.00	1.00	35.0	19.17	9.17	165.55	3.77	11.4	11.4	1.0	125.89	4766.45	39	1.0	147.1	4691.7	37.5	12.0	39	9.17	3.06	1.79	149.9	927.0	10385.2	593.8	10051.9	**4154.06**	**3350.62**
37.50	38.00	37.75	0.50	35.5	19.17	9.17	165.55	1.89	12.0	12.0	1.0	66.36	4832.80	39	1.0	73.5	4765.2	38.0	8.0	50	9.05	2.11	0.91	149.9	872.7	10470.7	602.2	10200.2	**4188.28**	**3400.08**
38.00	40.00	39.00	2.00	37.5	19.05	9.05	165.55	7.54	8.0	8.0	1.0	175.50	5008.30	50	1.0	377.1	5142.3	40.0	8.0	50	0.00	2.11	0.91	149.9	867.1	11017.7	636.2	10786.8	**4407.09**	**3595.60**
BORE NO: P36, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	20.43	10.43	28.68	1.89	29.5	29.5	1.0	30.60	0	0	1.0	0.0	0	3.0	29.5	0	10.71	20.13	21.25	31.3	867.3	867.3	8.5	8.5	**346.90**	**2.83**
3.00	5.00	4.00	2.00	2.5	20.71	10.71	42.00	7.54	29.5	29.5	1.0	179.24	179.24	0	1.0	0.0	0.0	5.0	29.5	0	10.71	20.13	21.25	52.7	1355.2	1534.4	42.4	221.6	**613.78**	**73.88**
5.00	6.00	5.50	1.00	3.5	20.71	10.71	58.07	3.77	29.5	29.5	1.0	123.90	303.13	0	1.0	0.0	0.0	6.0	29.3	0	10.48	19.68	20.79	63.4	1560.3	1863.4	59.4	362.5	**745.36**	**120.84**
6.00	8.00	7.00	2.00	5.5	20.48	10.48	73.90	7.54	29.3	29.3	1.0	312.81	615.94	0	1.0	0.0	0.0	8.0	9.5	49	10.48	2.38	1.14	84.4	734.3	1350.3	93.3	709.2	**540.10**	**236.42**
8.00	9.00	8.50	1.00	6.5	20.48	10.48	89.62	3.77	9.5	9.5	1.0	56.56	672.50	49	1.0	184.8	184.8	9.0	9.5	49	10.48	2.38	1.14	94.9	762.5	1619.8	110.3	967.6	**647.93**	**322.52**
9.00	10.00	9.50	1.00	7.5	20.48	10.48	100.10	3.77	9.5	9.5	1.0	63.18	735.68	49	1.0	184.8	369.6	10.0	9.5	49	10.50	2.38	1.14	105.3	790.8	1896.0	127.2	1232.5	**758.42**	**410.84**
10.00	11.00	10.50	1.00	8.5	20.50	10.50	110.59	3.77	9.5	9.5	1.0	69.80	805.47	49	1.0	184.8	554.4	11.0	9.5	49	10.50	2.38	1.14	115.8	819.0	2178.9	144.2	1504.1	**871.57**	**501.36**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
11.00	12.00	11.50	1.00	9.5	20.50	10.50	121.09	3.77	9.5	9.5	1.0	76.42	881.90	49	1.0	184.8	739.2	12.0	6.7	69	10.50	1.88	0.71	126.3	975.9	2597.0	161.2	1782.3	**1038.78**	**594.09**
12.00	13.00	12.50	1.00	10.5	20.50	10.50	131.59	3.77	6.7	6.7	1.0	58.30	940.20	69	1.0	260.2	999.4	13.0	26.9	0	9.99	14.28	15.26	136.8	2314.2	4253.8	178.1	2117.8	**1701.51**	**705.92**
13.00	14.50	13.75	1.50	12.0	19.99	9.99	144.33	5.66	26.9	26.9	1.0	414.24	1354.44	0	1.0	0.0	999.4	14.5	26.9	0	9.99	14.28	15.26	151.8	2556.2	4910.1	203.6	2557.4	**1964.04**	**852.48**
14.50	16.00	15.25	1.50	13.5	19.99	9.99	159.32	5.66	26.9	26.9	1.0	457.25	1811.68	0	1.0	0.0	999.4	16.0	9.0	54	10.56	2.29	1.07	166.8	989.7	3800.8	229.0	3040.1	**1520.33**	**1013.38**
16.00	17.50	16.75	1.50	15.0	20.56	10.56	174.73	5.66	9.0	9.0	1.0	156.56	1968.24	54	1.0	305.5	1304.9	17.5	10.0	60	10.83	2.47	1.22	182.7	1130.4	4403.5	254.5	3527.6	**1761.41**	**1175.87**
17.50	20.50	19.00	3.00	18.0	20.83	10.83	174.73	11.31	10.0	10.0	1.0	348.59	2316.83	60	1.0	678.9	1983.8	20.5	9.5	64	10.69	2.38	1.14	182.7	1151.8	5452.4	305.4	4606.0	**2180.98**	**1535.32**
20.50	23.50	22.00	3.00	21.0	20.69	10.69	174.73	11.31	9.5	9.5	1.0	330.83	2647.66	64	1.0	724.1	2707.9	23.5	9.5	64	10.69	2.38	1.14	182.7	1151.8	6507.4	356.3	5711.8	**2602.95**	**1903.93**
23.50	26.50	25.00	3.00	24.0	20.69	10.69	174.73	11.31	9.5	9.5	1.0	330.83	2978.48	64	1.0	724.1	3432.0	26.5	9.5	64	10.52	2.38	1.14	182.7	1151.7	7562.2	407.2	6817.6	**3024.88**	**2272.54**
26.50	27.50	27.00	1.00	25.0	20.52	10.52	174.73	3.77	9.5	9.5	1.0	110.28	3088.76	64	1.0	241.4	3673.4	27.5	10.5	60	10.52	2.62	1.36	182.7	1161.5	7923.7	424.1	7186.2	**3169.46**	**2395.42**
27.50	28.00	27.75	0.50	25.5	20.52	10.52	174.73	1.89	10.5	10.5	1.0	61.07	3149.83	60	1.0	113.1	3786.5	28.0	11.5	68	10.52	2.91	1.65	182.7	1305.8	8242.1	432.6	7368.9	**3296.85**	**2456.31**
28.00	29.50	28.75	1.50	27.0	20.52	10.52	174.73	5.66	11.5	11.5	1.0	201.11	3350.93	68	1.0	384.7	4171.2	29.5	11.5	68	10.52	2.91	1.65	182.7	1305.8	8827.9	458.0	7980.2	**3531.17**	**2660.06**
29.50	30.00	29.75	0.50	27.5	20.52	10.52	174.73	1.89	11.5	11.5	1.0	67.04	3417.97	68	1.0	128.2	4299.4	30.0	11.5	60	10.52	2.91	1.65	182.7	1224.3	8941.7	466.5	8183.9	**3576.69**	**2727.97**
30.00	31.00	30.50	1.00	28.5	20.52	10.52	174.73	3.77	11.5	11.5	1.0	134.07	3552.04	60	1.0	226.3	4525.7	31.0	12.9	38	10.52	3.32	2.05	182.7	1087.8	9165.6	483.5	8561.2	**3666.24**	**2853.75**
31.00	32.50	31.75	1.50	30.0	20.52	10.52	174.73	5.66	12.9	12.9	1.0	226.39	3778.43	38	1.0	215.0	4740.7	32.5	19.8	45	10.46	6.29	5.28	182.7	1796.3	10315.4	508.9	9028.1	**4126.18**	**3009.35**
32.50	34.00	33.25	1.50	31.5	20.46	10.46	174.73	5.66	19.8	19.8	1.0	355.87	4134.30	45	1.0	254.6	4995.3	34.0	13.8	45	10.46	3.59	2.31	182.7	1216.5	10346.1	534.4	9663.9	**4138.42**	**3221.32**
34.00	35.00	34.50	1.00	32.5	20.46	10.46	174.73	3.77	13.8	13.8	1.0	161.86	4296.16	45	1.0	169.7	5165.0	35.0	14.5	48	10.46	3.80	2.51	182.7	1290.8	10752.0	551.3	10012.5	**4300.79**	**3337.50**
35.00	35.50	35.25	0.50	33.0	20.46	10.46	174.73	1.89	14.5	14.5	1.0	85.21	4381.38	48	1.0	90.5	5255.5	35.5	13.5	54	10.46	3.50	2.22	182.7	1288.9	10925.8	559.8	10196.7	**4370.32**	**3398.90**
35.50	37.50	36.50	2.00	35.0	20.46	10.46	174.73	7.54	13.5	13.5	1.0	316.42	4697.79	54	1.0	407.3	5662.8	37.5	20.2	16	10.46	6.54	5.61	182.7	1555.1	11915.7	593.8	10954.4	**4766.28**	**3651.45**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
37.50	38.50	38.00	1.00	36.0	20.46	10.46	174.73	3.77	20.2	20.2	1.0	242.46	4940.25	16	1.0	60.3	5723.1	38.5	20.0	16	10.46	6.40	5.39	182.7	1523.8	12187.2	610.7	11274.1	**4874.87**	**3758.04**
38.50	40.00	39.25	1.50	37.5	20.46	10.46	174.73	5.66	20.0	20.0	1.0	359.77	5300.02	16	1.0	90.5	5813.7	40.0	20.0	16	10.46	6.40	5.39	182.7	1523.8	12637.5	636.2	11749.9	**5054.99**	**3916.62**
BORE NO: P39, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	18.95	8.95	24.61	1.89	24.5	24.5	1.0	21.15	0	7	1.0	13.2	0	3.0	24.5	7	8.95	9.64	10.33	26.9	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	5.00	4.00	2.00	2.5	18.95	8.95	35.80	7.54	24.5	24.5	1.0	123.06	0	7	1.0	52.8	0	5.0	13.5	17	8.95	3.50	2.22	44.8	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.5	18.95	8.95	49.23	3.77	13.5	13.5	1.0	44.57	0	17	1.0	64.1	0	6.0	15.0	20	8.95	3.94	2.65	53.7	0	0.0	59.4	59.4	**0.00**	**19.79**
6.00	8.00	7.00	2.00	5.5	18.95	8.95	62.65	7.54	15.0	15.0	1.0	126.62	0	20	1.0	150.9	0	8.0	13.2	21	10.20	3.41	2.14	71.6	0	0.0	93.3	93.3	**0.00**	**31.10**
8.00	9.00	8.50	1.00	6.5	20.20	10.20	76.70	3.77	13.2	13.2	1.0	67.85	0	21	1.0	79.2	0	9.0	9.5	51	10.20	2.38	1.14	81.8	747.5	747.5	110.3	110.3	**299.00**	**36.76**
9.00	10.00	9.50	1.00	7.5	20.20	10.20	86.90	3.77	9.5	9.5	1.0	54.84	54.84	51	1.0	192.3	192.3	10.0	9.5	51	10.20	2.38	1.14	92.0	775.0	1022.2	127.2	374.4	**408.87**	**124.81**
10.00	11.00	10.50	1.00	8.5	20.20	10.20	97.10	3.77	9.5	9.5	1.0	61.28	116.13	51	1.0	192.3	384.7	11.0	9.5	51	10.20	2.38	1.14	102.2	802.4	1303.3	144.2	645.0	**521.30**	**215.00**
11.00	12.00	11.50	1.00	9.5	20.20	10.20	107.30	3.77	9.5	9.5	1.0	67.72	183.85	51	1.0	192.3	577.0	12.0	8.2	56	10.49	2.15	0.94	112.4	849.9	1610.7	161.2	922.0	**644.30**	**307.35**
12.00	14.50	13.25	2.50	12.0	20.49	10.49	125.51	9.43	8.2	8.2	1.0	170.53	354.38	56	1.0	528.0	1105.0	14.5	12.8	27	10.49	3.29	2.02	138.6	805.6	2265.0	203.6	1663.0	**906.00**	**554.33**
14.50	16.00	15.25	1.50	13.5	20.49	10.49	146.49	5.66	12.8	12.8	1.0	188.28	542.66	27	1.0	152.7	1257.8	16.0	11.5	53	10.50	2.91	1.65	154.4	1059.8	2860.3	229.0	2029.5	**1144.11**	**676.48**
16.00	17.50	16.75	1.50	15.0	20.50	10.50	162.24	5.66	11.5	11.5	1.0	186.73	729.38	53	1.0	299.8	1557.6	17.5	10.5	58	9.89	2.62	1.36	170.1	1103.4	3390.4	254.5	2541.5	**1356.17**	**847.15**
17.50	20.50	19.00	3.00	18.0	19.89	9.89	162.24	11.31	10.5	10.5	1.0	340.20	1069.59	58	1.0	656.2	2213.8	20.5	14.4	80	9.89	3.77	2.48	170.1	1556.1	4839.5	305.4	3588.8	**1935.81**	**1196.26**
20.50	22.00	21.25	1.50	19.5	19.89	9.89	162.24	5.66	14.4	14.4	1.0	235.65	1305.24	80	1.0	452.6	2666.4	22.0	9.7	62	10.30	2.42	1.17	170.1	1104.5	5076.2	330.8	4302.4	**2030.47**	**1434.15**
22.00	23.50	22.75	1.50	21.0	20.30	10.30	162.24	5.66	9.7	9.7	1.0	156.88	1462.12	62	1.0	350.7	3017.1	23.5	9.7	62	10.30	2.42	1.17	170.1	1104.5	5583.8	356.3	4835.5	**2233.52**	**1611.84**
23.50	25.00	24.25	1.50	22.5	20.30	10.30	162.24	5.66	9.7	9.7	1.0	156.88	1619.00	62	1.0	350.7	3367.9	25.0	10.4	46	10.60	2.59	1.33	170.1	976.0	5962.9	381.7	5368.6	**2385.17**	**1789.53**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
25.00	26.50	25.75	1.50	24.0	20.60	10.60	162.24	5.66	10.4	10.4	1.0	168.45	1787.44	46	1.0	260.2	3628.1	26.5	10.0	46	10.60	2.47	1.22	170.1	952.6	6368.1	407.2	5822.7	**2547.26**	**1940.90**
26.50	27.50	27.00	1.00	25.0	20.60	10.60	162.24	3.77	10.0	10.0	1.0	107.89	1895.33	46	1.0	173.5	3801.6	27.5	10.0	46	10.60	2.47	1.22	170.1	952.6	6649.5	424.1	6121.0	**2659.81**	**2040.35**
27.50	29.50	28.50	2.00	27.0	20.60	10.60	162.24	7.54	10.0	10.0	1.0	215.77	2111.10	46	1.0	347.0	4148.6	29.5	14.3	30	8.93	3.74	2.45	170.1	1039.6	7299.3	458.0	6717.7	**2919.70**	**2239.24**
29.50	30.00	29.75	0.50	27.5	18.93	8.93	162.24	1.89	14.3	14.3	1.0	77.98	2189.08	30	1.0	56.6	4205.1	30.0	9.5	30	8.93	2.38	1.14	170.1	770.5	7164.7	466.5	6860.8	**2865.89**	**2286.92**
30.00	31.00	30.50	1.00	28.5	18.93	8.93	162.24	3.77	9.5	9.5	1.0	102.39	2291.47	30	1.0	113.1	4318.3	31.0	9.5	50	9.19	2.38	1.14	170.1	974.3	7584.1	483.5	7093.2	**3033.64**	**2364.42**
31.00	32.50	31.75	1.50	30.0	19.19	9.19	162.24	5.66	9.5	9.5	1.0	153.58	2445.06	50	1.0	282.9	4601.1	32.5	26.1	0	10.42	12.48	13.41	170.1	2496.3	9542.5	508.9	7555.1	**3817.01**	**2518.38**
32.50	34.00	33.25	1.50	31.5	20.42	10.42	162.24	5.66	27.5	27.5	1.0	477.77	2922.83	0	1.0	0.0	4601.1	34.0	10.9	47	10.42	2.73	1.48	170.1	1015.4	8539.3	534.4	8058.4	**3415.73**	**2686.12**
34.00	35.00	34.50	1.00	32.5	20.42	10.42	162.24	3.77	10.9	10.9	1.0	117.83	3040.65	47	1.0	177.3	4778.4	35.0	10.9	47	10.42	2.73	1.48	170.1	1015.4	8834.4	551.3	8370.4	**3533.77**	**2790.13**
35.00	35.50	35.25	0.50	33.0	20.42	10.42	162.24	1.89	10.9	10.9	1.0	58.91	3099.56	47	1.0	88.6	4867.0	35.5	15.8	39	10.42	4.33	3.09	170.1	1253.1	9219.6	559.8	8526.4	**3687.86**	**2842.14**
35.50	37.00	36.25	1.50	34.5	20.42	10.42	162.24	5.66	15.8	15.8	1.0	259.71	3359.27	39	1.0	220.6	5087.7	37.0	9.6	54	10.42	2.40	1.16	170.1	1019.6	9466.5	585.3	9032.2	**3786.61**	**3010.74**
37.00	37.50	37.25	0.50	35.0	20.42	10.42	162.24	1.89	9.6	9.6	1.0	51.74	3411.02	54	1.0	101.8	5189.5	37.5	9.6	54	10.42	2.40	1.16	170.1	1019.6	9620.1	593.8	9194.3	**3848.04**	**3064.75**
37.50	38.50	38.00	1.00	36.0	20.42	10.42	162.24	3.77	9.6	9.6	1.0	103.49	3514.50	54	1.0	203.7	5393.1	38.5	8.0	54	10.42	2.11	0.91	170.1	962.4	9870.1	610.7	9518.4	**3948.03**	**3172.79**
38.50	40.00	39.25	1.50	37.5	20.42	10.42	162.24	5.66	8.0	8.0	1.0	128.99	3643.49	54	1.0	305.5	5698.6	40.0	8.0	96	10.42	2.11	0.91	170.1	1390.1	10732.2	636.2	9978.3	**4292.89**	**3326.10**
BORE NO: P40, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	20.10	10.10	27.78	1.89	9.6	9.6	1.0	8.86	0	48	1.0	90.5	0	3.0	9.6	30	10.10	2.40	1.16	30.3	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.5	20.10	10.10	35.35	3.77	9.6	9.6	1.0	22.55	0	30	1.0	113.1	0	4.0	13.5	16	10.10	3.50	2.22	40.4	0	0.0	25.4	25.4	**0.00**	**8.48**
4.00	5.00	4.50	1.00	2.5	20.10	10.10	45.45	3.77	13.5	13.5	1.0	41.15	0	16	1.0	60.3	0	5.0	27.5	5	9.64	15.63	16.64	50.5	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.5	19.64	9.64	55.32	3.77	27.5	27.5	1.0	108.61	0	5	1.0	18.9	0	6.0	27.5	5	9.64	15.63	16.64	60.1	0	0.0	59.4	59.4	**0.00**	**19.79**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
6.00	8.00	7.00	2.00	5.5	19.64	9.64	69.78	7.54	27.5	27.5	1.0	274.00	0	5	1.0	37.7	0	8.0	25.2	0	9.64	10.45	11.34	79.4	0	0.0	93.3	93.3	**0.00**	**31.10**
8.00	9.00	8.50	1.00	6.5	19.64	9.64	84.24	3.77	25.2	25.2	1.0	149.50	0	0	1.0	0.0	0	9.0	10.5	56	10.39	2.62	1.36	89.1	843.6	843.6	110.3	110.3	**337.42**	**36.76**
9.00	11.00	10.00	2.00	8.5	20.39	10.39	99.45	7.54	10.5	10.5	1.0	139.03	139.03	56	1.0	422.4	422.4	11.0	9.6	58	10.39	2.40	1.16	109.8	896.8	1458.2	144.2	705.6	**583.29**	**235.21**
11.00	12.00	11.50	1.00	9.5	20.39	10.39	115.04	3.77	9.6	9.6	1.0	73.38	212.41	58	1.0	218.7	641.1	12.0	7.1	59	10.49	1.95	0.77	120.2	871.3	1724.8	161.2	1014.7	**689.94**	**338.24**
12.00	14.50	13.25	2.50	12.0	20.49	10.49	133.34	9.43	7.1	7.1	1.0	156.60	369.01	59	1.0	556.3	1197.4	14.5	9.5	46	10.49	2.38	1.14	146.5	870.9	2437.4	203.6	1770.0	**974.94**	**590.00**
14.50	16.00	15.25	1.50	13.5	20.49	10.49	154.32	5.66	9.5	9.5	1.0	146.09	515.10	46	1.0	260.2	1457.7	16.0	8.3	60	10.09	2.16	0.96	162.2	1014.6	2987.4	229.0	2201.8	**1194.96**	**733.93**
16.00	17.50	16.75	1.50	15.0	20.09	10.09	169.76	5.66	8.3	8.3	1.0	140.10	655.20	60	1.0	339.4	1797.1	17.5	8.3	52	10.31	2.16	0.96	177.3	970.4	3422.7	254.5	2706.8	**1369.07**	**902.25**
17.50	20.50	19.00	3.00	18.0	20.31	10.31	169.76	11.31	8.3	8.3	1.0	280.20	935.40	52	1.0	588.3	2385.4	20.5	18.5	28	10.31	5.64	4.57	177.3	1449.0	4769.9	305.4	3626.2	**1907.95**	**1208.73**
20.50	23.50	22.00	3.00	21.0	20.31	10.31	169.76	11.31	18.5	18.5	1.0	642.65	1578.05	28	1.0	316.8	2702.2	23.5	11.2	57	10.85	2.82	1.56	177.3	1158.3	5438.6	356.3	4636.5	**2175.42**	**1545.51**
23.50	26.50	25.00	3.00	24.0	20.85	10.85	169.76	11.31	11.2	11.2	1.0	380.31	1958.35	57	1.0	644.9	3347.1	26.5	8.7	50	10.85	2.24	1.02	177.3	965.3	6270.8	407.2	5712.6	**2508.30**	**1904.22**
26.50	27.50	27.00	1.00	25.0	20.85	10.85	169.76	3.77	8.7	8.7	1.0	97.97	2056.32	50	1.0	188.6	3535.7	27.5	8.7	49	10.85	2.24	1.02	177.3	955.1	6547.1	424.1	6016.2	**2618.85**	**2005.38**
27.50	29.50	28.50	2.00	27.0	20.85	10.85	169.76	7.54	8.7	8.7	1.0	195.94	2252.26	49	1.0	369.6	3905.3	29.5	9.5	88	10.85	2.38	1.14	177.3	1382.0	7539.6	458.0	6615.6	**3015.83**	**2205.21**
29.50	30.00	29.75	0.50	27.5	20.85	10.85	169.76	1.89	9.5	9.5	1.0	53.57	2305.83	88	1.0	165.9	4071.3	30.0	9.5	88	10.85	2.38	1.14	177.3	1382.0	7759.1	466.5	6843.6	**3103.64**	**2281.20**
30.00	31.00	30.50	1.00	28.5	20.85	10.85	169.76	3.77	9.5	9.5	1.0	107.14	2412.97	88	1.0	331.9	4403.1	31.0	27.7	0	10.85	16.08	17.10	177.3	3352.1	10168.2	483.5	7299.6	**4067.29**	**2433.20**
31.00	32.50	31.75	1.50	30.0	20.85	10.85	169.76	5.66	27.7	27.7	1.0	504.19	2917.16	0	1.0	0.0	4403.1	32.5	27.7	0	10.01	16.08	17.10	177.3	3342.4	10662.7	508.9	7829.2	**4265.07**	**2609.75**
32.50	34.00	33.25	1.50	31.5	20.01	10.01	169.76	5.66	27.7	27.7	1.0	504.19	3421.35	0	1.0	0.0	4403.1	34.0	26.3	7	10.01	12.93	13.88	177.3	2759.2	10583.7	534.4	8358.9	**4233.48**	**2786.29**
34.00	35.00	34.50	1.00	32.5	20.01	10.01	169.76	3.77	26.3	26.3	1.0	316.42	3737.77	7	1.0	26.4	4429.5	35.0	26.0	7	10.01	12.25	13.18	177.3	2619.0	10786.3	551.3	8718.7	**4314.52**	**2906.22**
35.00	35.50	35.25	0.50	33.0	20.01	10.01	169.76	1.89	26.0	26.0	1.0	156.13	3893.90	7	1.0	13.2	4442.7	35.5	18.9	7	10.01	5.82	4.79	177.3	1272.0	9608.7	559.8	8896.5	**3843.47**	**2965.49**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 1.13 m^2

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
35.50	37.00	36.25	1.50	34.5	20.01	10.01	169.76	5.66	18.9	18.9	1.0	328.80	4222.70	7	1.0	39.6	4482.3	37.0	8.9	56	10.01	2.27	1.05	177.3	1033.2	9738.3	585.3	9290.3	**3895.30**	**3096.77**
37.00	37.50	37.25	0.50	35.0	20.01	10.01	169.76	1.89	8.9	8.9	1.0	50.13	4272.83	56	1.0	105.6	4587.9	37.5	8.9	56	10.16	2.27	1.05	177.3	1033.3	9894.1	593.8	9454.5	**3957.64**	**3151.51**
37.50	38.50	38.00	1.00	36.0	20.16	10.16	169.76	3.77	8.9	8.9	1.0	100.26	4373.08	56	1.0	211.2	4799.1	38.5	8.9	56	9.31	2.27	1.05	177.3	1032.7	10204.9	610.7	9783.0	**4081.98**	**3260.98**
38.50	40.00	39.25	1.50	37.5	19.31	9.31	169.76	5.66	8.9	8.9	1.0	150.39	4523.47	56	1.0	316.8	5115.9	40.0	18.9	10	9.31	5.82	4.79	177.3	1300.3	10939.7	636.2	10275.6	**4375.89**	**3425.19**

APPENDIX-H

TABLE 3: COMPUTATION OF LATERAL PILE LOAD CAPACITY (Dia. 1000 mm)

Bore No.	Dia. of pile (m)	Cut-off length (m)	Scour depth (m)	Concrete Grade	Young's Modulus (kN/m^2)	Moment of Inertia (m^4)	Average SPT	Modulus of sub grade (k_1)	Stiffness Factor (T)	Cantilever length	L_1/T	L_f/T	Permissible deflection (m)	Depth of Fixity (m)	Allowable Load capacity of pile(kN)
P24	1.00	2.50	0.00	35	29580399	0.0491	19	2696	3.52	4.50	1.28	2.04	0.005	7.17	55
P30	1.00	2.50	0.00	35	29580399	0.0491	17	2408	3.60	7.50	2.08	1.93	0.005	6.94	29
P32	1.00	2.50	0.00	35	29580399	0.0491	17	2408	3.60	5.50	1.53	2.00	0.005	7.20	43
P33	1.00	2.50	0.00	35	29580399	0.0491	18	2552	3.56	3.50	0.98	2.08	0.005	7.41	67
P34	1.00	2.50	0.00	35	29580399	0.0491	17	2408	3.60	1.50	0.42	2.17	0.005	7.80	108
P36	1.00	2.50	0.00	35	29580399	0.0491	16	2264	3.64	0.50	0.14	2.21	0.005	8.05	139
P39	1.00	2.50	0.00	35	29580399	0.0491	18	2552	3.56	6.50	1.83	1.96	0.005	6.96	36
P40	1.00	2.50	0.00	35	29580399	0.0491	14	1976	3.74	6.50	1.74	1.97	0.005	7.37	33

APPENDIX-H

TABLE 4: COMPUTATION OF LATERAL PILE LOAD CAPACITY (Dia. 1200 mm)

Bore No.	Dia. of pile (m)	Cut-off length (m)	Scour depth (m)	Concrete Grade	Young's Modulus (kN/m^2)	Moment of Inertia (m^4)	Average SPT	Modulus of sub grade (k_1)	Stiffness Factor (T)	Cantilever length	L_1/T	L_f/T	Permissible deflection (m)	Depth of Fixity (m)	Allowable Load capacity of pile(kN)
P24	1.20	2.50	0.00	35	29580399	0.1018	19	2696	4.07	4.50	1.11	2.06	0.005	8.40	84
P30	1.20	2.50	0.00	35	29580399	0.1018	18	2552	4.11	7.50	1.82	1.96	0.005	8.05	48
P32	1.20	2.50	0.00	35	29580399	0.1018	18	2552	4.11	5.50	1.34	2.03	0.005	8.35	68
P33	1.20	2.50	0.00	35	29580399	0.1018	18	2552	4.11	3.50	0.85	2.10	0.005	8.65	101
P34	1.20	2.50	0.00	35	29580399	0.1018	17	2408	4.16	1.50	0.36	2.18	0.005	9.06	153
P36	1.20	2.50	0.00	35	29580399	0.1018	16	2264	4.21	0.50	0.12	2.21	0.005	9.32	191
P39	1.20	2.50	0.00	35	29580399	0.1018	18	2552	4.11	6.50	1.58	1.99	0.005	8.20	57
P40	1.20	2.50	0.00	35	29580399	0.1018	15	2120	4.27	6.50	1.52	2.00	0.005	8.55	53

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
P24	0.50	ML	64	4.00	10.50	5.00	5.50	1.00	0.30	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.17	0.571	Liquefiable
	1.00	CL-ML	72	4.00	21.00	10.00	11.00	0.99	0.30	1.70	6.80	5.00	1.20	13.16	0.14	1.00	-	-	Non-liquefiable
	2.00	CL	52	4.00	42.00	20.00	22.00	0.98	0.29	1.70	6.80	5.00	1.20	13.16	0.14	1.00	-	-	Non-liquefiable
	3.00	SM	26	14.00	63.00	30.00	33.00	0.98	0.29	1.70	23.80	4.39	1.12	31.11	0.52	1.00	0.62	2.131	Non-liquefiable
	4.00	SM	26	18.00	84.00	40.00	44.00	0.97	0.29	1.51	27.14	4.39	1.12	34.85	0.52	1.00	0.62	2.148	Non-liquefiable
	6.00	SM	23	12.00	126.00	60.00	66.00	0.95	0.28	1.23	14.77	4.06	1.10	20.31	0.22	1.00	0.26	0.921	Liquefiable
	7.00	SM	23	19.00	147.00	70.00	77.00	0.95	0.28	1.14	21.65	4.06	1.10	27.88	0.37	1.00	0.44	1.547	Non-liquefiable
	8.00	SP-ML	10	19.00	152.00	80.00	72.00	0.94	0.31	1.18	22.39	0.87	1.02	23.75	0.27	1.00	0.32	1.038	Non-liquefiable
	9.00	SP-ML	10	23.00	171.00	90.00	81.00	0.93	0.31	1.11	25.56	0.87	1.02	26.98	0.34	1.00	0.40	1.314	Non-liquefiable
	10.00	SM	13	26.00	190.00	100.00	90.00	0.91	0.30	1.05	27.41	1.89	1.04	30.31	0.49	1.00	0.59	1.959	Non-liquefiable
	12.50	SM	13	28.00	238.75	125.00	113.75	0.84	0.28	0.94	26.25	1.89	1.04	29.11	0.42	1.00	0.50	1.802	Non-liquefiable
	14.00	CL-ML	75	28.00	294.00	140.00	154.00	0.80	0.24	0.81	22.56	5.00	1.20	32.08	0.52	1.00	-	-	Non-liquefiable
	15.50	ML	66	18.00	325.50	155.00	170.50	0.76	0.23	0.77	13.79	5.00	1.20	21.54	0.24	0.96	0.27	1.192	Non-liquefiable
	17.00	CL	61	18.00	355.30	170.00	185.30	0.72	0.22	0.73	13.22	5.00	1.20	20.87	0.23	0.85	-	-	Non-liquefiable
	18.50	CL	61	22.00	386.65	185.00	201.65	0.68	0.20	0.70	15.49	5.00	1.20	23.59	0.27	0.83	-	-	Non-liquefiable
	21.50	CL	57	35.00	449.35	215.00	234.35	0.60	0.18	0.65	22.86	5.00	1.20	32.44	0.52	0.78	-	-	Non-liquefiable
	24.50	CL	79	32.00	494.90	245.00	249.90	0.56	0.17	0.63	20.24	5.00	1.20	29.29	0.42	0.74	-	-	Non-liquefiable
	26.00	CI	79	32.00	527.80	260.00	267.80	0.56	0.17	0.61	19.55	5.00	1.20	28.47	0.39	0.75	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	27.50	CI	79	38.00	558.25	275.00	283.25	0.56	0.17	0.59	22.58	5.00	1.20	32.09	0.52	0.74	-	-	Non-liquefiable
	29.00	CL	69	38.00	553.90	290.00	263.90	0.56	0.18	0.62	23.39	5.00	1.20	33.07	0.52	0.71	-	-	Non-liquefiable
	30.50	CL	69	33.00	582.55	305.00	277.55	0.56	0.18	0.60	19.81	5.00	1.20	28.77	0.40	0.70	-	-	Non-liquefiable
	33.50	CL	74	39.00	639.85	335.00	304.85	0.56	0.18	0.57	22.34	5.00	1.20	31.80	0.52	0.68	-	-	Non-liquefiable
	35.00	SM	37	39.00	668.50	350.00	318.50	0.56	0.18	0.56	21.85	5.00	1.20	31.22	0.52	0.67	0.42	2.267	Non-liquefiable
	36.50	SM	16	36.00	697.15	365.00	332.15	0.56	0.18	0.55	19.75	2.77	1.05	23.59	0.27	0.67	0.21	1.161	Non-liquefiable
	40.00	SM	16	69.00	764.00	400.00	364.00	0.56	0.18	0.52	36.17	2.77	1.05	40.89	0.52	0.65	0.40	2.199	Non-liquefiable
P30	0.50	SM	32	5.00	9.00	5.00	4.00	1.00	0.35	1.70	8.50	4.83	1.17	14.78	0.16	1.00	0.19	0.539	Liquefiable
	2.00	SM	30	5.00	36.00	20.00	16.00	0.98	0.35	1.70	8.50	4.71	1.15	14.52	0.16	1.00	0.19	0.536	Liquefiable
	3.00	SM	30	9.00	54.00	30.00	24.00	0.98	0.34	1.70	15.30	4.71	1.15	22.37	0.25	1.00	0.30	0.860	Liquefiable
	5.00	SM	13	11.00	96.00	50.00	46.00	0.96	0.31	1.47	16.22	1.89	1.04	18.71	0.20	1.00	0.24	0.761	Liquefiable
	6.00	SM	13	12.00	115.20	60.00	55.20	0.95	0.31	1.35	16.15	1.89	1.04	18.64	0.20	1.00	0.24	0.764	Liquefiable
	8.00	SM	13	14.00	153.60	80.00	73.60	0.94	0.31	1.17	16.32	1.89	1.04	18.81	0.20	1.00	0.24	0.785	Liquefiable
	9.00	SM	15	16.00	172.80	90.00	82.80	0.93	0.30	1.10	17.58	2.50	1.05	20.93	0.23	1.00	0.27	0.894	Liquefiable
	10.00	CL	66	16.00	210.00	100.00	110.00	0.91	0.27	0.95	15.26	5.00	1.20	23.31	0.26	1.00	-	-	Non-liquefiable
	11.00	CL	66	15.00	231.00	110.00	121.00	0.88	0.26	0.91	13.64	5.00	1.20	21.36	0.23	1.00	-	-	Non-liquefiable
	12.00	CL	66	17.00	252.00	120.00	132.00	0.85	0.25	0.87	14.80	5.00	1.20	22.76	0.25	1.00	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	14.50	CL	76	21.00	311.75	145.00	166.75	0.79	0.23	0.77	16.26	5.00	1.20	24.51	0.28	1.00	-	-	Non-liquefiable
	17.50	CL	76	22.00	374.50	175.00	199.50	0.71	0.21	0.71	15.58	5.00	1.20	23.69	0.27	0.85	-	-	Non-liquefiable
	19.00	SM-SC	49	22.00	393.30	190.00	203.30	0.67	0.20	0.70	15.43	5.00	1.20	23.52	0.27	0.79	0.25	1.242	Non-liquefiable
	20.50	CL	69	26.00	424.35	205.00	219.35	0.63	0.19	0.68	17.56	5.00	1.20	26.07	0.31	0.77	-	-	Non-liquefiable
	23.50	CL	69	23.00	486.45	235.00	251.45	0.56	0.17	0.63	14.50	5.00	1.20	22.41	0.25	0.73	-	-	Non-liquefiable
	26.50	CL	82	22.00	577.70	265.00	312.70	0.56	0.16	0.57	12.44	5.00	1.20	19.93	0.21	0.75	-	-	Non-liquefiable
	29.50	CL	78	26.00	643.10	295.00	348.10	0.56	0.16	0.54	13.94	5.00	1.20	21.72	0.24	0.72	-	-	Non-liquefiable
	31.00	CL-ML	57	26.00	598.30	310.00	288.30	0.56	0.18	0.59	15.31	5.00	1.20	23.38	0.26	0.65	-	-	Non-liquefiable
	32.50	CL	83	32.00	627.25	325.00	302.25	0.56	0.18	0.58	18.41	5.00	1.20	27.09	0.34	0.64	-	-	Non-liquefiable
	35.50	CL-ML	76	40.00	685.15	355.00	330.15	0.56	0.18	0.55	22.01	5.00	1.20	31.42	0.52	0.62	-	-	Non-liquefiable
	37.00	CL	86	40.00	714.10	370.00	344.10	0.56	0.18	0.54	21.56	5.00	1.20	30.88	0.52	0.61	-	-	Non-liquefiable
	38.50	CL	68	50.00	743.05	385.00	358.05	0.56	0.18	0.53	26.42	5.00	1.20	36.71	0.52	0.61	-	-	Non-liquefiable
	40.00	CL	68	59.00	772.00	400.00	372.00	0.56	0.18	0.52	30.59	5.00	1.20	41.71	0.52	0.60	-	-	Non-liquefiable
P32	0.50	SM	44	4	9.85	5.00	4.85	1.00	0.316	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.537	Liquefiable
	1.00	CL-ML	58	4	19.70	10.00	9.70	0.99	0.314	1.70	6.80	5.00	1.20	13.16	0.14	1.00	-	-	Non-liquefiable
	2.00	SM	24	4	39.40	20.00	19.40	0.98	0.312	1.70	6.80	4.18	1.11	11.71	0.13	1.00	0.153	0.491	Liquefiable
	3.00	SM	24	5	59.10	30.00	29.10	0.98	0.310	1.70	8.50	4.18	1.11	13.59	0.15	1.00	0.174	0.563	Liquefiable

APPENDIX-H

TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	5.00	SM-SC	48	7	98.50	50.00	48.50	0.96	0.305	1.44	10.05	5.00	1.20	17.06	0.18	1.00	0.216	0.710	Liquefiable
	6.00	SM	22	9	116.40	60.00	56.40	0.95	0.307	1.33	11.98	3.93	1.09	17.03	0.18	1.00	0.216	0.703	Liquefiable
	8.00	CL-ML	72	13	155.20	80.00	75.20	0.94	0.302	1.15	14.99	5.00	1.20	22.99	0.26	1.00	-	-	Non-liquefiable
	9.00	CL-ML	72	17	176.40	90.00	86.40	0.93	0.297	1.08	18.29	5.00	1.20	26.95	0.34	1.00	-	-	Non-liquefiable
	10.00	CL	81	17	196.00	100.00	96.00	0.91	0.289	1.02	17.35	5.00	1.20	25.82	0.31	1.00	-	-	Non-liquefiable
	11.00	CL	81	18	224.40	110.00	114.40	0.88	0.269	0.93	16.83	5.00	1.20	25.19	0.30	1.00	-	-	Non-liquefiable
	12.00	CL	81	22	244.80	120.00	124.80	0.85	0.261	0.90	19.69	5.00	1.20	28.63	0.39	1.00	-	-	Non-liquefiable
	13.00	SM	44	22	265.20	130.00	135.20	0.83	0.253	0.86	18.92	5.00	1.20	27.70	0.36	1.00	0.429	1.695	Non-liquefiable
	14.50	SM	44	36	295.80	145.00	150.80	0.79	0.241	0.81	29.32	5.00	1.20	40.18	0.52	1.00	0.620	2.576	Non-liquefiable
	16.00	CL	75	36	326.40	160.00	166.40	0.75	0.229	0.78	27.91	5.00	1.20	38.49	0.52	0.87	-	-	Non-liquefiable
	17.50	CL	75	19	353.50	175.00	178.50	0.71	0.218	0.75	14.22	5.00	1.20	22.07	0.24	0.86	-	-	Non-liquefiable
	19.00	CL-ML	67	19	383.80	190.00	193.80	0.67	0.206	0.72	13.65	5.00	1.20	21.38	0.23	0.84	-	-	Non-liquefiable
	20.50	CL	87	38	410.00	205.00	205.00	0.63	0.196	0.70	26.54	5.00	1.20	36.85	0.52	0.82	-	-	Non-liquefiable
	23.50	CL	87	75	470.00	235.00	235.00	0.56	0.175	0.65	48.92	5.00	1.20	63.71	0.52	0.75	-	-	Non-liquefiable
	25.00	CL	87	63	510.00	250.00	260.00	0.56	0.171	0.62	39.07	5.00	1.20	51.89	0.52	0.72	-	-	Non-liquefiable
	26.50	CL	90	71	540.60	265.00	275.60	0.56	0.171	0.60	42.77	5.00	1.20	56.32	0.52	0.71	-	-	Non-liquefiable
	28.00	CL	89	75	571.20	280.00	291.20	0.56	0.171	0.59	43.95	5.00	1.20	57.74	0.52	0.70	-	-	Non-liquefiable
	29.50	CL	89	62	601.80	295.00	306.80	0.56	0.171	0.57	35.40	5.00	1.20	47.48	0.52	0.68	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	31.00	CL-ML	89	102	632.40	310.00	322.40	0.56	0.171	0.56	56.81	5.00	1.20	73.17	0.52	0.67	-	-	Non-liquefiable
	32.50	CL	86	95	663.00	325.00	338.00	0.56	0.171	0.54	51.67	5.00	1.20	67.01	0.52	0.66	-	-	Non-liquefiable
	34.00	ML	77	103	693.60	340.00	353.60	0.56	0.171	0.53	54.77	5.00	1.20	70.73	0.52	0.65	0.404	2.356	Non-liquefiable
	35.50	CL	93	87	724.20	355.00	369.20	0.56	0.171	0.52	45.28	5.00	1.20	59.33	0.52	0.64	-	-	Non-liquefiable
	37.00	CL	93	91	754.80	370.00	384.80	0.56	0.171	0.51	46.39	5.00	1.20	60.67	0.52	0.63	-	-	Non-liquefiable
	38.50	CL	86	83	785.40	385.00	400.40	0.56	0.171	0.50	41.48	5.00	1.20	54.78	0.52	0.62	-	-	Non-liquefiable
	40.00	CL	86	56	816.00	400.00	416.00	0.56	0.171	0.49	27.46	5.00	1.20	37.95	0.52	0.62	-	-	Non-liquefiable
P33	2.00	SM	44	5	39.60	20.00	19.60	0.98	0.310	1.70	8.50	5.00	1.20	15.20	0.16	1.00	0.193	0.623	Liquefiable
	3.00	SM	44	7	59.40	30.00	29.40	0.98	0.308	1.70	11.90	5.00	1.20	19.28	0.21	1.00	0.246	0.800	Liquefiable
	5.00	SM	37	10	99.00	50.00	49.00	0.96	0.303	1.43	14.29	5.00	1.20	22.14	0.24	1.00	0.291	0.960	Liquefiable
	6.00	SM	37	12	117.00	60.00	57.00	0.95	0.306	1.32	15.89	5.00	1.20	24.07	0.27	1.00	0.328	1.072	Non-liquefiable
	8.00	SM	30	14	156.00	80.00	76.00	0.94	0.301	1.15	16.06	4.71	1.15	23.24	0.26	1.00	0.311	1.035	Non-liquefiable
	9.00	CL	87	20	175.50	90.00	85.50	0.93	0.298	1.08	21.63	5.00	1.20	30.96	0.52	1.00	-	-	Non-liquefiable
	11.00	SM-SC	46	30	214.50	110.00	104.50	0.88	0.282	0.98	29.35	5.00	1.20	40.22	0.52	1.00	0.620	2.200	Non-liquefiable
	12.00	SM	44	29	242.40	120.00	122.40	0.85	0.264	0.90	26.21	5.00	1.20	36.45	0.52	1.00	0.620	2.352	Non-liquefiable
	13.00	CL	86	29	262.60	130.00	132.60	0.83	0.255	0.87	25.18	5.00	1.20	35.22	0.52	1.00	-	-	Non-liquefiable
	14.50	CL	86	32	295.80	145.00	150.80	0.79	0.241	0.81	26.06	5.00	1.20	36.27	0.52	1.00	-	-	Non-liquefiable

APPENDIX-H

TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	17.50	CL	88	39	357.00	175.00	182.00	0.71	0.216	0.74	28.91	5.00	1.20	39.69	0.52	0.80	-	-	Non-liquefiable
	20.50	CL	93	42	422.30	205.00	217.30	0.63	0.190	0.68	28.49	5.00	1.20	39.19	0.52	0.75	-	-	Non-liquefiable
	22.00	CL-ML	53	42	448.80	220.00	228.80	0.59	0.179	0.66	27.77	5.00	1.20	38.32	0.52	0.80	-	-	Non-liquefiable
	23.50	CL	84	88	462.95	235.00	227.95	0.56	0.177	0.66	58.29	5.00	1.20	74.94	0.52	0.80	-	-	Non-liquefiable
	25.00	CL	84	75	492.50	250.00	242.50	0.56	0.177	0.64	48.16	5.00	1.20	62.79	0.52	0.79	-	-	Non-liquefiable
	26.50	CL	84	80	522.05	265.00	257.05	0.56	0.177	0.62	49.90	5.00	1.20	64.88	0.52	0.77	-	-	Non-liquefiable
	28.00	CL-CI	88	87	551.60	280.00	271.60	0.56	0.177	0.61	52.79	5.00	1.20	68.35	0.52	0.76	-	-	Non-liquefiable
	29.50	CL-CI	88	101	581.15	295.00	286.15	0.56	0.177	0.59	59.71	5.00	1.20	76.65	0.52	0.75	-	-	Non-liquefiable
	31.00	CL-CI	88	82	610.70	310.00	300.70	0.56	0.177	0.58	47.29	5.00	1.20	61.75	0.52	0.74	-	-	Non-liquefiable
	32.50	CL	77	90	640.25	325.00	315.25	0.56	0.177	0.56	50.69	5.00	1.20	65.83	0.52	0.73	-	-	Non-liquefiable
	34.00	CL	77	98	669.80	340.00	329.80	0.56	0.177	0.55	53.96	5.00	1.20	69.76	0.52	0.72	-	-	Non-liquefiable
	35.50	CL	83	72	699.35	355.00	344.35	0.56	0.177	0.54	38.80	5.00	1.20	51.56	0.52	0.71	-	-	Non-liquefiable
	37.00	CL	90	88	728.90	370.00	358.90	0.56	0.177	0.53	46.45	5.00	1.20	60.74	0.52	0.71	-	-	Non-liquefiable
	38.50	CL	90	100	758.45	385.00	373.45	0.56	0.177	0.52	51.75	5.00	1.20	67.10	0.52	0.70	-	-	Non-liquefiable
	40.00	CL	84	96	788.00	400.00	388.00	0.56	0.177	0.51	48.74	5.00	1.20	63.48	0.52	0.69	-	-	Non-liquefiable
P34	0.50	SM	47	3	9.80	5.00	4.80	1.00	0.317	1.70	5.10	5.00	1.20	11.12	0.12	1.00	0.147	0.463	Liquefiable
	1.00	SM-SC	50	3	19.60	10.00	9.60	0.99	0.316	1.70	5.10	5.00	1.20	11.12	0.12	1.00	0.147	0.465	Liquefiable

APPENDIX-H

TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	3.00	ML	51	6	58.80	30.00	28.80	0.98	0.311	1.70	10.20	5.00	1.20	17.24	0.18	1.00	0.219	0.703	Liquefiable
	4.00	SM	30	14	78.40	40.00	38.40	0.97	0.309	1.61	22.59	4.71	1.15	30.79	0.52	1.00	0.620	2.009	Non-liquefiable
	6.00	SM	20	18	117.60	60.00	57.60	0.95	0.304	1.32	23.72	3.61	1.08	29.22	0.42	1.00	0.502	1.652	Non-liquefiable
	7.00	SM	45	23	135.10	70.00	65.10	0.95	0.306	1.24	28.51	5.00	1.20	39.21	0.52	1.00	0.620	2.024	Non-liquefiable
	8.00	ML	51	23	154.40	80.00	74.40	0.94	0.304	1.16	26.66	5.00	1.20	37.00	0.52	1.00	0.620	2.041	Non-liquefiable
	9.00	SM	44	15	177.30	90.00	87.30	0.93	0.295	1.07	16.05	5.00	1.20	24.26	0.28	1.00	0.332	1.124	Non-liquefiable
	10.00	SM	44	20	197.00	100.00	97.00	0.91	0.287	1.02	20.31	5.00	1.20	29.37	0.43	1.00	0.512	1.780	Non-liquefiable
	12.50	CL	94	19	246.25	125.00	121.25	0.84	0.266	0.91	17.25	5.00	1.20	25.71	0.31	1.00	-	-	Non-liquefiable
	15.50	CL	92	12	302.25	155.00	147.25	0.76	0.243	0.82	9.89	5.00	1.20	16.87	0.18	0.89	-	-	Non-liquefiable
	18.50	CL	91	21	377.40	185.00	192.40	0.68	0.208	0.72	15.14	5.00	1.20	23.17	0.26	0.83	-	-	Non-liquefiable
	21.50	CL	80	30	438.60	215.00	223.60	0.60	0.184	0.67	20.06	5.00	1.20	29.08	0.41	0.73	-	-	Non-liquefiable
	24.50	CL	92	38	504.70	245.00	259.70	0.56	0.170	0.62	23.58	5.00	1.20	33.30	0.52	0.77	-	-	Non-liquefiable
	27.50	CL	92	47	552.75	275.00	277.75	0.56	0.174	0.60	28.20	5.00	1.20	38.84	0.52	0.76	-	-	Non-liquefiable
	30.50	SM	36	71	613.05	305.00	308.05	0.56	0.174	0.57	40.45	5.00	1.20	53.54	0.52	0.67	0.414	2.383	Non-liquefiable
	32.00	CL-ML	61	75	659.20	320.00	339.20	0.56	0.170	0.54	40.72	5.00	1.20	53.87	0.52	0.65	-	-	Non-liquefiable
	33.50	CL-ML	61	68	690.10	335.00	355.10	0.56	0.170	0.53	36.09	5.00	1.20	48.30	0.52	0.63	-	-	Non-liquefiable
	35.00	CL-ML	76	55	721.00	350.00	371.00	0.56	0.170	0.52	28.55	5.00	1.20	39.27	0.52	0.62	-	-	Non-liquefiable
	36.50	CL-ML	76	52	751.90	365.00	386.90	0.56	0.170	0.51	26.44	5.00	1.20	36.72	0.52	0.62	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	38.00	CL	84	65	782.80	380.00	402.80	0.56	0.170	0.50	32.39	5.00	1.20	43.86	0.52	0.61	-	-	Non-liquefiable
	40.00	CL	84	53	824.00	400.00	424.00	0.56	0.170	0.49	25.74	5.00	1.20	35.89	0.52	0.60	-	-	Non-liquefiable
P36	0.50	CL-ML	57	6.00	10.20	5.00	5.20	1.00	0.30	1.70	10.20	5.00	1.20	17.24	0.18	1.00	-	-	Non-liquefiable
	1.00	SM	41	6.00	20.40	10.00	10.40	0.99	0.30	1.70	10.20	5.00	1.20	17.24	0.18	1.00	0.22	0.720	Liquefiable
	2.00	SM-SC	50	6.00	40.80	20.00	20.80	0.98	0.30	1.70	10.20	5.00	1.20	17.24	0.18	1.00	0.22	0.726	Liquefiable
	3.00	SM	40	10.00	61.20	30.00	31.20	0.98	0.30	1.70	17.00	5.00	1.20	25.40	0.30	1.00	0.36	1.197	Non-liquefiable
	5.00	SM	24	16.00	103.50	50.00	53.50	0.96	0.29	1.37	21.87	4.18	1.11	28.41	0.38	1.00	0.46	1.581	Non-liquefiable
	6.00	SM	24	22.00	124.20	60.00	64.20	0.95	0.29	1.25	27.46	4.18	1.11	34.59	0.52	1.00	0.62	2.154	Non-liquefiable
	8.00	CL-ML	80	17.00	164.00	80.00	84.00	0.94	0.29	1.09	18.55	5.00	1.20	27.26	0.35	1.00	-	-	Non-liquefiable
	9.00	CL-ML	80	22.00	184.50	90.00	94.50	0.93	0.28	1.03	22.63	5.00	1.20	32.16	0.52	1.00	-	-	Non-liquefiable
	10.00	CL	77	22.00	205.00	100.00	105.00	0.91	0.28	0.98	21.47	5.00	1.20	30.76	0.52	1.00	-	-	Non-liquefiable
	11.00	CL-ML	86	29.00	225.50	110.00	115.50	0.88	0.27	0.93	26.98	5.00	1.20	37.38	0.52	1.00	-	-	Non-liquefiable
	12.00	CL-ML	86	26.00	246.00	120.00	126.00	0.85	0.26	0.89	23.16	5.00	1.20	32.80	0.52	1.00	-	-	Non-liquefiable
	13.00	SM	45	26.00	260.00	130.00	130.00	0.83	0.26	0.88	22.80	5.00	1.20	32.36	0.52	1.00	0.62	2.404	Non-liquefiable
	14.50	SM	45	27.00	290.00	145.00	145.00	0.79	0.25	0.83	22.42	5.00	1.20	31.91	0.52	1.00	0.62	2.526	Non-liquefiable
	16.00	CL	74	27.00	329.60	160.00	169.60	0.75	0.23	0.77	20.73	5.00	1.20	29.88	0.46	0.86	-	-	Non-liquefiable
	17.50	CL	79	23.00	360.50	175.00	185.50	0.71	0.21	0.73	16.89	5.00	1.20	25.26	0.30	0.84	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	20.50	CL	79	26.00	426.40	205.00	221.40	0.63	0.19	0.67	17.47	5.00	1.20	25.97	0.31	0.76	-	-	Non-liquefiable
	23.50	CL	76	29.00	486.45	235.00	251.45	0.56	0.17	0.63	18.29	5.00	1.20	26.95	0.34	0.73	-	-	Non-liquefiable
	26.50	CL	79	45.00	548.55	265.00	283.55	0.56	0.17	0.59	26.72	5.00	1.20	37.07	0.52	0.70	-	-	Non-liquefiable
	28.00	MI	84	45.00	574.00	280.00	294.00	0.56	0.17	0.58	26.24	5.00	1.20	36.49	0.52	0.71	-	-	Non-liquefiable
	29.50	MI	84	45.00	604.75	295.00	309.75	0.56	0.17	0.57	25.57	5.00	1.20	35.68	0.52	0.70	-	-	Non-liquefiable
	31.00	CL-ML	77	45.00	635.50	310.00	325.50	0.56	0.17	0.55	24.94	5.00	1.20	34.93	0.52	0.69	-	-	Non-liquefiable
	32.50	ML	56	56.00	666.25	325.00	341.25	0.56	0.17	0.54	30.31	5.00	1.20	41.38	0.52	0.68	0.42	2.473	Non-liquefiable
	34.00	CL-ML	71	62.00	697.00	340.00	357.00	0.56	0.17	0.53	32.81	5.00	1.20	44.38	0.52	0.67	-	-	Non-liquefiable
	35.50	CL	73	49.00	727.75	355.00	372.75	0.56	0.17	0.52	25.38	5.00	1.20	35.46	0.52	0.66	-	-	Non-liquefiable
	38.50	CL-ML	66	48.00	789.25	385.00	404.25	0.56	0.17	0.50	23.87	5.00	1.20	33.65	0.52	0.62	-	-	Non-liquefiable
	40.00	CL-ML	66	54.00	820.00	400.00	420.00	0.56	0.17	0.49	26.35	5.00	1.20	36.62	0.52	0.61	-	-	Non-liquefiable
P39	0.50	SM	44	7.00	9.50	5.00	4.50	1.00	0.33	1.70	11.90	5.00	1.20	19.28	0.21	1.00	0.25	0.751	Liquefiable
	1.00	ML	54	7.00	19.00	10.00	9.00	0.99	0.33	1.70	11.90	5.00	1.20	19.28	0.21	1.00	0.25	0.754	Liquefiable
	2.00	SM-SC	46	7.00	38.00	20.00	18.00	0.98	0.32	1.70	11.90	5.00	1.20	19.28	0.21	1.00	0.25	0.760	Liquefiable
	3.00	SM	42	6.00	57.00	30.00	27.00	0.98	0.32	1.70	10.20	5.00	1.20	17.24	0.18	1.00	0.22	0.680	Liquefiable
	5.00	ML	64	7.00	95.00	50.00	45.00	0.96	0.32	1.49	10.43	5.00	1.20	17.52	0.19	1.00	0.22	0.702	Liquefiable
	6.00	ML	60	8.00	114.00	60.00	54.00	0.95	0.31	1.36	10.89	5.00	1.20	18.06	0.19	1.00	0.23	0.731	Liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	8.00	ML	56	9.00	152.00	80.00	72.00	0.94	0.31	1.18	10.61	5.00	1.20	17.73	0.19	1.00	0.23	0.728	Liquefiable
	9.00	CL-ML	73	10.00	171.00	90.00	81.00	0.93	0.31	1.11	11.11	5.00	1.20	18.33	0.20	1.00	-	-	Non-liquefiable
	10.00	CL	68	10.00	202.00	100.00	102.00	0.91	0.28	0.99	9.90	5.00	1.20	16.88	0.18	1.00	-	-	Non-liquefiable
	11.00	CL	68	23.00	222.20	110.00	112.20	0.88	0.27	0.94	21.71	5.00	1.20	31.06	0.52	1.00	-	-	Non-liquefiable
	12.00	CL	68	25.00	242.40	120.00	122.40	0.85	0.26	0.90	22.60	5.00	1.20	32.12	0.52	1.00	-	-	Non-liquefiable
	14.50	CL-ML	66	18.00	297.25	145.00	152.25	0.79	0.24	0.81	14.59	5.00	1.20	22.51	0.25	1.00	-	-	Non-liquefiable
	16.00	CL	72	18.00	328.00	160.00	168.00	0.75	0.23	0.77	13.89	5.00	1.20	21.66	0.24	0.89	-	-	Non-liquefiable
	17.50	CL	83	15.00	358.75	175.00	183.75	0.71	0.22	0.74	11.07	5.00	1.20	18.28	0.19	0.86	-	-	Non-liquefiable
	20.50	CL	68	19.00	407.95	205.00	202.95	0.63	0.20	0.70	13.34	5.00	1.20	21.00	0.23	0.80	-	-	Non-liquefiable
	22.00	CI	80	19.00	446.60	220.00	226.60	0.59	0.18	0.66	12.62	5.00	1.20	20.15	0.22	0.78	-	-	Non-liquefiable
	23.50	CI	80	42.00	477.05	235.00	242.05	0.56	0.17	0.64	27.00	5.00	1.20	37.40	0.52	0.76	-	-	Non-liquefiable
	25.00	CL	80	42.00	515.00	250.00	265.00	0.56	0.17	0.61	25.80	5.00	1.20	35.96	0.52	0.78	-	-	Non-liquefiable
	26.50	CL	80	51.00	545.90	265.00	280.90	0.56	0.17	0.60	30.43	5.00	1.20	41.52	0.52	0.76	-	-	Non-liquefiable
	29.50	CL-ML	70	54.00	607.70	295.00	312.70	0.56	0.17	0.57	30.54	5.00	1.20	41.64	0.52	0.74	-	-	Non-liquefiable
	31.00	CL	85	46.00	638.60	310.00	328.60	0.56	0.17	0.55	25.38	5.00	1.20	35.45	0.52	0.73	-	-	Non-liquefiable
	32.50	SM	47	49.00	669.50	325.00	344.50	0.56	0.17	0.54	26.40	5.00	1.20	36.68	0.52	0.72	0.45	2.631	Non-liquefiable
	34.00	CL	77	49.00	700.40	340.00	360.40	0.56	0.17	0.53	25.81	5.00	1.20	35.97	0.52	0.71	-	-	Non-liquefiable
	35.50	ML	65	50.00	731.30	355.00	376.30	0.56	0.17	0.52	25.78	5.00	1.20	35.93	0.52	0.70	0.43	2.558	Non-liquefiable

APPENDIX-H

TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	37.00	CL	84	50.00	754.80	370.00	384.80	0.56	0.17	0.51	25.49	5.00	1.20	35.59	0.52	0.62	-	-	Non-liquefiable
	38.50	CL	84	52.00	785.40	385.00	400.40	0.56	0.17	0.50	25.99	5.00	1.20	36.18	0.52	0.61	-	-	Non-liquefiable
	40.00	CL	84	62.00	816.00	400.00	416.00	0.56	0.17	0.49	30.40	5.00	1.20	41.48	0.52	0.60	-	-	Non-liquefiable
P40	0.50	SM	38	4.00	10.05	5.00	5.05	1.00	0.31	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.17	0.548	Liquefiable
	1.00	CL	52	4.00	20.10	10.00	10.10	0.99	0.31	1.70	6.80	5.00	1.20	13.16	0.14	1.00	-	-	Non-liquefiable
	2.00	CL	76	4.00	40.20	20.00	20.20	0.98	0.31	1.70	6.80	5.00	1.20	13.16	0.14	1.00	-	-	Non-liquefiable
	3.00	CL	76	5.00	60.30	30.00	30.30	0.98	0.30	1.70	8.50	5.00	1.20	15.20	0.16	1.00	-	-	Non-liquefiable
	4.00	CL-ML	64	5.00	80.40	40.00	40.40	0.97	0.30	1.57	7.87	5.00	1.20	14.44	0.15	1.00	-	-	Non-liquefiable
	5.00	SM	41	7.00	100.50	50.00	50.50	0.96	0.30	1.41	9.85	5.00	1.20	16.82	0.18	1.00	0.21	0.715	Liquefiable
	6.00	SM	31	12.00	120.60	60.00	60.60	0.95	0.30	1.28	15.42	4.77	1.16	22.69	0.25	1.00	0.30	1.015	Non-liquefiable
	8.00	SM	37	9.00	156.80	80.00	76.80	0.94	0.30	1.14	10.27	5.00	1.20	17.32	0.18	1.00	0.22	0.735	Liquefiable
	9.00	CL	87	8.00	176.40	90.00	86.40	0.93	0.30	1.08	8.61	5.00	1.20	15.33	0.16	1.00	-	-	Non-liquefiable
	11.00	CL	82	23.00	224.40	110.00	114.40	0.88	0.27	0.93	21.50	5.00	1.20	30.80	0.52	1.00	-	-	Non-liquefiable
	12.00	CL	82	16.00	244.80	120.00	124.80	0.85	0.26	0.90	14.32	5.00	1.20	22.19	0.24	1.00	-	-	Non-liquefiable
	14.50	CL-ML	80	14.00	297.25	145.00	152.25	0.79	0.24	0.81	11.35	5.00	1.20	18.62	0.20	1.00	-	-	Non-liquefiable
	16.00	CL	78	14.00	321.60	160.00	161.60	0.75	0.23	0.79	11.01	5.00	1.20	18.22	0.19	0.87	-	-	Non-liquefiable
	17.50	CL	78	22.00	351.75	175.00	176.75	0.71	0.22	0.75	16.55	5.00	1.20	24.86	0.29	0.85	-	-	Non-liquefiable

APPENDIX-H

TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	20.50	CL-ML	63	24.00	416.15	205.00	211.15	0.63	0.19	0.69	16.52	5.00	1.20	24.82	0.29	0.80	-	-	Non-liquefiable
	23.50	CL	77	26.00	477.05	235.00	242.05	0.56	0.17	0.64	16.71	5.00	1.20	25.05	0.29	0.76	-	-	Non-liquefiable
	26.50	CL	84	49.00	537.95	265.00	272.95	0.56	0.17	0.61	29.66	5.00	1.20	40.59	0.52	0.73	-	-	Non-liquefiable
	29.50	CI	81	32.00	613.60	295.00	318.60	0.56	0.17	0.56	17.93	5.00	1.20	26.51	0.33	0.72	-	-	Non-liquefiable
	31.00	SM	46	32.00	644.80	310.00	334.80	0.56	0.17	0.55	17.49	5.00	1.20	25.99	0.31	0.71	0.26	1.575	Non-liquefiable
	32.50	SM	46	50.00	676.00	325.00	351.00	0.56	0.17	0.53	26.69	5.00	1.20	37.03	0.52	0.69	0.43	2.544	Non-liquefiable
	34.00	CL-ML	58	50.00	680.00	340.00	340.00	0.56	0.17	0.54	27.12	5.00	1.20	37.54	0.52	0.69	-	-	Non-liquefiable
	35.50	CL-ML	58	49.00	710.00	355.00	355.00	0.56	0.17	0.53	26.01	5.00	1.20	36.21	0.52	0.68	-	-	Non-liquefiable
	37.00	MI	85	49.00	740.00	370.00	370.00	0.56	0.17	0.52	25.47	5.00	1.20	35.57	0.52	0.67	-	-	Non-liquefiable
	38.50	CL-ML	58	53.00	770.00	385.00	385.00	0.56	0.17	0.51	27.01	5.00	1.20	37.41	0.52	0.67	-	-	Non-liquefiable
	40.00	CL-ML	58	61.00	800.00	400.00	400.00	0.56	0.17	0.50	30.50	5.00	1.20	41.60	0.52	0.66	-	-	Non-liquefiable

APPENDIX-I
SITE PHOTOGRAPHS

SPT sample at depth 4.00 m

SPT at depth 33.50 m

SPT sample at depth 20.50 m

UDS at depth 34.00 m

APPENDIX-I
SITE PHOTOGRAPHS

SPT sample at depth 12.00 m

SPT at depth 20.50 m

UDS at depth 22.00 m

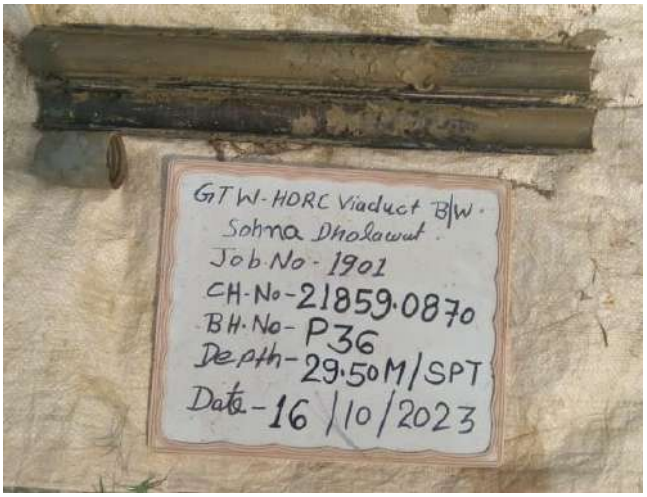
SPT sample at depth 31.00 m

APPENDIX-I
SITE PHOTOGRAPHS

SPT at depth 27.50 m

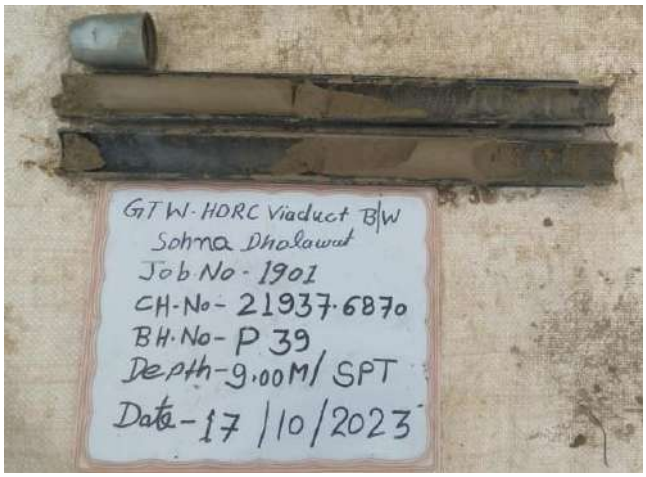
SPT sample at depth 30.50 m

SPT at depth 14.50 m



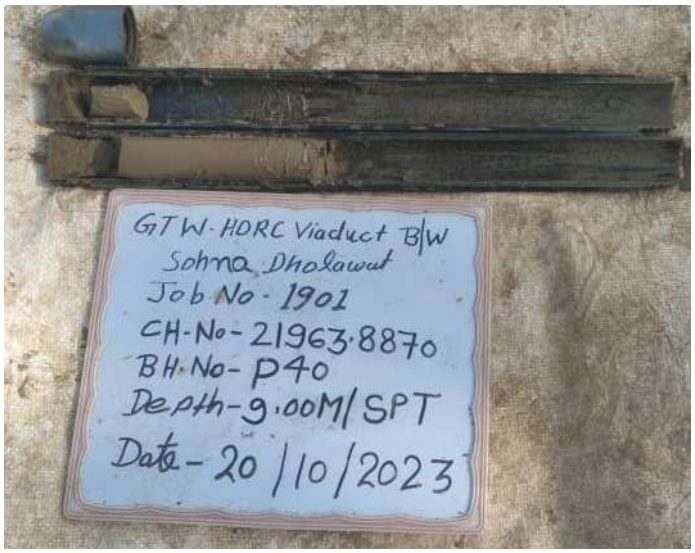
SPT sample at depth 29.50 m

APPENDIX-I
SITE PHOTOGRAPHS



SPT sample at depth 9.00 m

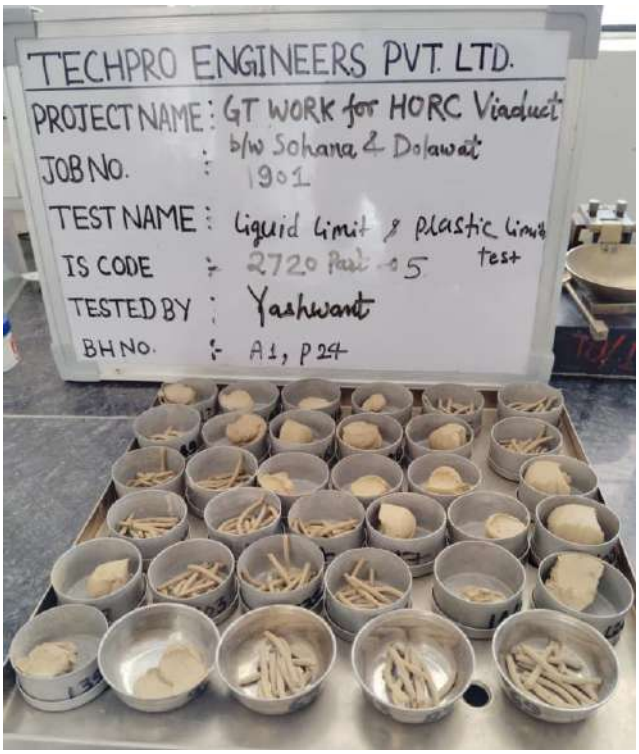
UDS at depth 25.00 m



SPT sample at depth 9.00 m

SPT at depth 26.50 m

APPENDIX-J
LABORATORY PHOTOGRAPHS



Atterbergs' limit test

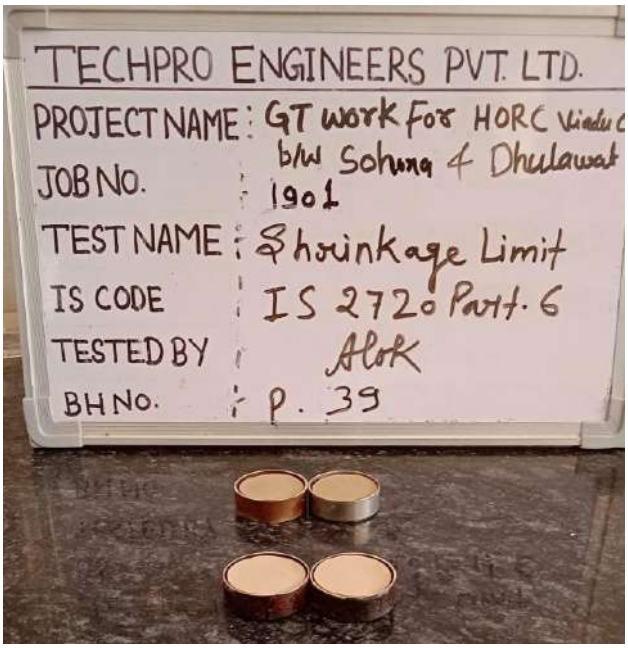
Triaxial test

UCS test soil

Grain size analysis

APPENDIX-J
LABORATORY PHOTOGRAPHS

Atterbergs' limit test

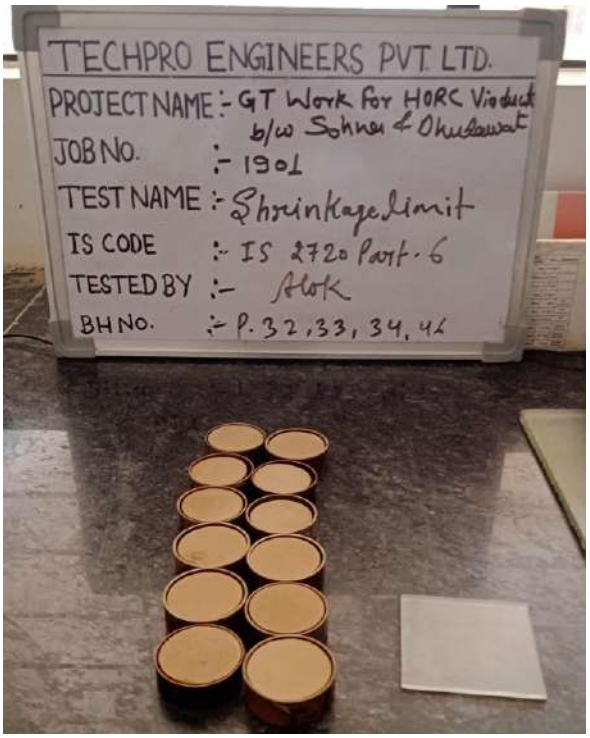


Triaxial test

UCS test soil

Direct shear test

APPENDIX-J
LABORATORY PHOTOGRAPHS



Shrinkage limit test

Atterbergs' limit test

APPENDIX-K
CHART 1: FIELD BORELOG CHARTS (P24)

TECHPRO ENGINEERS PVT. LTD. — **BORE/ DRILL LOG**

Doc No:	GT/003
Date of Issue:	01.04.2018
Rev. No.:	R03
Rev. Date.:	28.12.2021

Project Name: G.T. For HORC Viaduct b/w Sohana Dhulawat station — Project Code: 1901

Coordinate: N: 3118982.298 E: 702009.821 — Location/ Chainage: 21544.6870

Method of Drilling: Percussion — Drilling Equipment: Powerwinch — Bore No.: P24

Casing Lowered (M): 19.00 — Bentonite Used: Yes — Standard Sampler: Yes — Barrel Type: N/A

Ground Elevation: RL-192.043 — Date: From 24/09/23 to 27/9/23 — Water Table (M): 1.40

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
	0.0	0.50	0.50	DS	SX	Received										Brownish soil
	1.00	1.45	0.45	DP	11	1	2	2	4							Non-cohesive soil with Gra
	2.00	2.45	0.45	U	11	Received										— do —
	3.00	3.45	0.45	DP	11	5	6	8	14							Non-cohesive
	4.00	4.45	0.45	DP	11	6	8	10	18							— do —
	5.00	5.45	0.45	U	11	slipped										— do —
	6.00	6.45	0.45	DP	11	3	5	7	12							— do —
	7.00	7.45	0.45	DP	11	4	7	12	19							— do —
	8.00	8.45	0.45	U	11	Received										— do —
	9.00	9.45	0.45	DP	11	5	9	14	23							— do —
	10.00	10.45	0.45	DP	11	6	10	16	26							— do —
	11.00	11.45	0.45	U	11	Received										— do —
	12.50	12.95	0.45	DP	11	6	11	17	28							— do —
	14.00	14.45	0.45	U	11	Received										— Brownish Light Brownish
	15.50	15.95	0.45	DP	11	4	8	10	18							Non-cohesive Yellowish soil
	17.00	17.45	0.45	U	11	Received										cohesive soil with Gravel
	18.50	18.95	0.45	DP	11	5	10	12	22							— do —
	20.00	20.45	0.45	U	11	Received										— do —
	21.50	21.95	0.45	DP	11	8	15	20	35							— do —
	23.00	23.45	0.45	U	11	Received										— do —
	24.50	24.95	0.45	DP	11	9	16	16	32							— do —
	26.00	26.45	0.45	U	11	Received										Yellowish Grey soil Cohesive soil
	27.50	27.95	0.45	DP	11	10	18	20	38							— do —
	29.00	29.45	0.45	U	11	Received										— do —

Techpro Engineers Pvt. Ltd.

Supervisor — E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 2: FIELD BORELOG CHARTS (P24)

TECHPRO ENGINEERS PVT. LTD. — **BORE/ DRILL LOG**

Doc No:	GT/003
Date of Issue:	01.04.2018
Rev. No.:	R03
Rev. Date.:	28.12.2021

Project Name:	GT for HORC Viaduct blw Sohana Dhulawat station			Project Code:	1901
Coordinate:	N: 3118982.298	E: 702009.821		Location/ Chainage:	21544.6870
Method of Drilling:	Percussion		Drilling Equipment	Powerwinch	Bore No.: P24
Casing Lowered (M):	19.00	Bentonite Used: Yes	Standard Sampler :	Yes	Barrel Type : N/A
Ground Elevation:	RL-192.043	Date: From 24/09/23 to 27/9/23			Water Table (M): 1.40

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
	30.50	30.95	0.45	DP		10	15	18	33							— do —
	38.00	38.45	0.45	U		slipped										— do —
	33.50	33.95	0.45	DP		11	10	21	31							— do —
	35.00	35.45	0.45	U		slipped										Non-cohesive soil Brownish
	36.50	36.95	0.45	DP		12	14	22	36							— do —
	38.00	38.45	0.45	U		slipped										— do —
	40.50	40.45	0.45	DP		17	24	45	69							— do —

Jitender Parashar

Supervisor

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

E - in - C

APPENDIX-K
CHART 3: FIELD BORELOG CHARTS (P30)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GT Work For HORC Viaduct B/w Sohana & Dhulawat station			**Project Code:**	1901
Coordinate:	N: 3119020.255	E: 70185.6.668		**Location/ Chainage:**	21701.8870
Method of Drilling:	Percussion	**Drilling Equipment:**	Power Winch	**Bore No.:**	P30
Casing Lowered (M):	25M **Bentonite Used:** yes	**Standard Sampler :**	Yes	**Barrel Type :**	NA
Ground Elevation: RL	191.396	**Date: From** 25-9-23 **to** 27-9-23		**Water Table (M):**	1.50

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
1	0.0	0.50	0.50	D	SX	Collected				—	—	—	—	—	—	Non Cohesive Soil
"	1.00	1.45	0.45	U	—	Received				—	—	—	—	—	—	"
"	2.00	2.45	0.45	LP	—	2	2	3	5	—	—	—	—	—	—	"
"	3.00	3.45	0.45	DP	—	3	4	5	9	—	—	—	—	—	—	"
4	4.00	4.45	0.45	U	—	Received				—	—	—	—	—	—	"
"	5.00	5.45	0.45	DP	—	4	5	6	11	—	—	—	—	—	—	"
"	6.00	6.45	0.45	DP	—	3	5	7	12	—	—	—	—	—	—	"
"	7.00	7.45	0.45	U	—	Slipped				—	—	—	—	—	—	" / DS Collected
"	8.00	8.45	0.45	DP	—	4	6	8	14	—	—	—	—	—	—	"
"	9.00	9.45	0.45	DP	—	5	7	9	16	—	—	—	—	—	—	"
"	10.00	10.45	0.45	U	—	Received				—	—	—	—	—	—	Cohesive Soil
"	11.00	11.45	0.45	DP	—	4	7	8	15	—	—	—	—	—	—	"
"	12.00	12.45	0.45	DP	—	4	8	9	17	—	—	—	—	—	—	"
"	13.00	13.45	0.45	U	—	Received				—	—	—	—	—	—	"
"	14.50	14.95	0.45	DP	—	4	9	12	21	—	—	—	—	—	—	"
"	16.00	16.45	0.45	U	—	Received				—	—	—	—	—	—	Cohesive Soil with Gravel
"	17.50	17.95	0.45	DP	—	6	9	13	22	—	—	—	—	—	—	"
"	19.00	19.45	0.45	U	—	Received				—	—	—	—	—	—	"
"	20.50	20.95	0.45	DP	—	7	11	15	26	—	—	—	—	—	—	"
"	22.00	22.45	0.45	U	—	Slipped				—	—	—	—	—	—	" DS Collected
"	23.50	23.95	0.45	DP	—	6	10	13	23	—	—	—	—	—	—	"
"	25.00	25.45	0.45	U	—	Received				—	—	—	—	—	—	"
2	26.50	26.95	0.45	DP	—	5	9	13	22	—	—	—	—	—	—	"
"	28.00	28.45	0.45	U	—	Slipped				—	—	—	—	—	—	" DS Collected

C.P. Kashyap
Supervisor

Techpro Engineers Pvt. Ltd. Kanpur

S.E. - C / E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 4: FIELD BORELOG CHARTS (P30)

TECHPRO ENGINEERS PVT. LTD. — **BORE/ DRILL LOG**

Doc No:	GT/ 003
Date of Issue:	01.04.2018
Rev. No.:	R03
Rev. Date.:	28.12.2021

Project Name: GT Work For HORC Viaduct Blw Sohana & Dhulawat Station — **Project Code:** 1901

Coordinate: N: 3119020.255 — E: 70185 6.668 — **Location/ Chainage:** 21701.8870

Method of Drilling: Percussion — **Drilling Equipment:** Power winch — **Bore No.:** P30

Casing Lowered (M): 25 M — **Bentonite Used:** Yes — **Standard Sampler :** Yes — **Barrel Type :** NA

Ground Elevation: RL 191.396 — **Date:** From 25-9-23 to 27-9-23 — **Water Table (M):** 1.50

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
2	29.50	29.95	0.45	DP	SX	6	11	15	26	—	—	—	—	—	—	Cohesive Soil with Gravel
"	31.50	31.45	0.45	U	—	Received				—	—	—	—	—	—	"
"	32.50	32.95	0.45	DP	—	8	14	18	32	—	—	—	—	—	—	"
3	34.00	34.45	0.45	U	—	Slipped				—	—	—	—	—	—	Non Cohesive Soil
4	35.50	35.95	0.45	DP	—	9	18	22	40	—	—	—	—	—	—	"
"	37.00	37.45	0.45	U	—	Slipped				—	—	—	—	—	—	"
"	38.50	38.95	0.45	DP	—	10	20	30	50	—	—	—	—	—	—	"
"	4000	40.45	0.45	DP	—	11	23	36	59	—	—	—	—	—	—	"

Techpro Engineers Pvt. Ltd. Kaithal

Jitender Parashar

C.P Kashyap
Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 5: FIELD BORELOG CHARTS (P32)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name: GTW FOR HORC Viaduct B/w Sohana Dhulawat Station						Project Code:	1901
Coordinate:	N: 3119037.179		E: 701806.797		Location/ Chainage:	21754.7870	
Method of Drilling:	Rotary		Drilling Equipment:	Hydraulic		Bore No.:	P-32
Casing Lowered (M):	—	Bentonite Used: NA	Standard Sampler:	Yes.		Barrel Type:	NA
Ground Elevation:	R.L-191.338		Date: From 06/11/23 to 9/11/23			Water Table (M):	1.30

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	CR (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
6/11/23	0.00	0.56	0.56	D	SX	collected				—	—	—	—	—	—	Non Cohesive soil
"	1.00	1.45	0.45	U	"	Recovered				—	—	—	—	—	—	do
"	2.00	2.45	0.45	DP	"	1	2	2	4	—	—	—	—	—	—	do
"	3.00	3.45	0.45	DP	"	2	2	3	5	—	—	—	—	—	—	do
7/11/23	4.00	4.45	0.45	U/D	"	slipped				—	—	—	—	—	—	Non cohesive soil
"	5.00	5.45	0.45	DP	"	3	3	4	7	—	—	—	—	—	—	do
"	6.00	6.45	0.45	DP	"	3	4	5	9	—	—	—	—	—	—	do
"	7.00	7.45	0.45	U	"	slipped				—	—	—	—	—	—	do
"	8.00	8.45	0.45	DP	"	4	6	7	13	—	—	—	—	—	—	do
"	9.00	9.45	0.45	DP	"	5	8	9	17	—	—	—	—	—	—	do
"	10.00	10.45	0.45	U	"	Received				—	—	—	—	—	—	Non cohesive soil.
"	11.00	11.45	0.45	DP	SX	5	8	10	18	—	—	—	—	—	—	do
"	12.00	12.45	0.45	DP	"	6	10	12	22	—	—	—	—	—	—	do
"	13.00	13.45	0.45	U	"	slipped				—	—	—	—	—	—	do
"	14.50	14.95	0.45	DP	"	8	14	22	36	—	—	—	—	—	—	do
"	16.00	16.45	0.45	U	"	Received				—	—	—	—	—	—	Cohesive soil.
"	17.50	17.95	0.45	DP	"	5	9	10	19	—	—	—	—	—	—	Cohesive soil with Gravel
"	19.00	19.45	0.45	U	"	Received				—	—	—	—	—	—	do
"	20.50	20.95	0.45	DP	"	11	18	20	38	—	—	—	—	—	—	do
"	22.00	22.45	0.45	U	"	Received				—	—	—	—	—	—	Cohesive soil with Gravel
"	23.50	23.95	0.45	DP	"	27	35	40	75	—	—	—	—	—	—	do
"	25.00	25.45	0.45	U	"	17	28	35	63	—	—	—	—	—	—	do
"	26.50	26.95	0.45	DP	"	21	32	39	71	—	—	—	—	—	—	do
8/11/23	28.00	28.45	0.45	U	"	19	35	40	75	—	—	—	—	—	—	do

Supervisor

Techpro Engineers Pvt. Ltd. Kanpur

S.E. (Civil)

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 6: FIELD BORELOG CHARTS (P32)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW FOR HORC Viaduct B/W Sohana Dhulawat station					Project Code:	1901
Coordinate:	N: 3119037.179		E: 701806.797		Location/ Chainage:	71754.2870	
Method of Drilling:	Rotary			Drilling Equipment:	Hydraulic	Bore No.:	P-32
Casing Lowered (M):	—	Bentonite Used:	NA	Standard Sampler:	Yes	Barrel Type:	NA
Ground Elevation:	R.L-191.328	Date: From	06/11/23	to	9/11/23	Water Table (M):	1.30

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
8/11/23	29.50	29.95	0.45	DP	SX	14	25	37	62	—	—	—	—	—	—	Cohesive soil with Non Gravel.
"	31.00	31.45	0.45	DP	"	20	42	60	102	—	—	—	—	—	—	do
"	32.50	32.95	0.45	DP	"	21	45	50	95	—	—	—	—	—	—	do
"	34.00	34.45	0.45	DP	"	32	48	55	103	—	—	—	—	—	—	Non Cohesive soil
9/11/23	35.50	35.95	0.45	DP	"	22	40	47	87	—	—	—	—	—	—	do
"	37.00	37.45	0.45	DP	"	25	43	48	91	—	—	—	—	—	—	Cohesive soil with Gravel
"	38.50	38.95	0.45	DP	"	27	38	45	93	—	—	—	—	—	—	do
"	40.00	40.45	0.45	DP	"	14	19	37	56	—	—	—	—	—	—	do

Techpro Engineers Pvt. Ltd. Ranipur

Supervisor

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

E.S.In - C

APPENDIX-K
CHART 7: FIELD BORELOG CHARTS (P33)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev No:	R03
		Rev Date:	28.12.2021

Project Name:	GTW FOR HORC Viaduct B/w Sohana Dhulawat station			Project Code:	1901
Coordinate:	N: 3199946.389	E: 701782332		Location/ Chainage:	21780.4870
Method of Drilling:	Rotary	Drilling Equipment:	Hydrolic	Bore No.:	P 33
Casing Lowered (M):	2.45	Bentonite Used: NA	Standard Sampler:	Yes	Barrel Type:	NA
Ground Elevation:	R.L-191.287	Date: From 06/11/23 to 8/11/23			Water Table (M):	1.25

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
06/11/23	0.00	0.30	0.30	D	SX	Collected				–	–	–	–	–	–	Non cohesive soil
"	1.00	1.45	0.45	U	"	Received				–	–	–	–	–	–	do
"	2.00	2.45	0.45	DP	"	2	2	3	5	–	–	–	–	–	–	do
"	3.00	3.45	0.45	DP	"	2	3	4	7	–	–	–	–	–	–	do
07/11/23	4.00	4.45	0.45	U	"	Received				–	–	–	–	–	–	Non cohesive soil
"	5.00	5.45	0.45	DP	"	3	4	6	10	–	–	–	–	–	–	do
"	6.00	6.45	0.45	DP	"	4	5	7	12	–	–	–	–	–	–	do
"	7.00	7.45	0.45	U	"	Received				–	–	–	–	–	–	do
"	8.00	8.45	0.45	DP	"	5	6	8	14	–	–	–	–	–	–	do
"	9.00	9.45	0.45	DP	"	4	9	11	20	–	–	–	–	–	–	cohesive soil
"	10.00	10.45	0.45	U	"	Received				–	–	–	–	–	–	do
"	11.00	11.45	0.45	DP	SX	11	14	16	30	–	–	–	–	–	–	Non cohesive soil
"	12.00	12.45	0.45	DP	"	9	12	17	29	–	–	–	–	–	–	do
"	13.00	13.45	0.45	U	"	Received				–	–	–	–	–	–	Cohesive soil
"	14.30	14.95	0.45	DP	"	11	15	17	32	–	–	–	–	–	–	do
"	16.00	16.45	0.45	U	"	Received				–	–	–	–	–	–	do
"	17.50	17.95	0.45	DP	"	13	17	22	39	–	–	–	–	–	–	do
"	19.00	19.45	0.45	U	"	Received				–	–	–	–	–	–	Cohesive soil with Gravel
"	20.50	20.95	0.45	DP	"	15	19	23	42	–	–	–	–	–	–	do
"	22.00	22.45	0.45	U	"	Received				–	–	–	–	–	–	Non cohesive soil
"	23.50	23.95	0.45	DP	"	32	43	45	88	–	–	–	–	–	–	cohesive soil with Gravel
"	25.00	25.45	0.45	U	"	22	35	40	75	–	–	–	–	–	–	do
"	26.50	26.95	0.45	DP	"	25	38	42	80	–	–	–	–	–	–	do
"	28.00	28.45	0.45	U	"	27	42	45	87	–	–	–	–	–	–	do

Supervisor

Techpro Engineers PVT. LTD. Kanpur

E-in-C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test(N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 8: FIELD BORELOG CHARTS (P33)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name: GTW For HORC Viaduct B/w Sohana Dhulawat station				Project Code:	1901
Coordinate:	N: 3119046.389	E: 7017823.32	Location/ Chainage:	21780.4870	
Method of Drilling:	Rotary	Drilling Equipment: Auto Trip Hydraulic		Bore No.:	P-33
Casing Lowered (M):	— Bentonite Used: NA	Standard Sampler:	Yes	Barrel Type:	NA
Ground Elevation:	R.L-191.287	Date: From 06/11/23 to 08/11/23		Water Table (M):	1.35

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
7 11/23	29.50	29.95	0.45	DP	5X	32	45	56	101	—	—	—	—	—	—	cohesive soil with Gravel
8 11/23	31.00	31.45	0.45	DP	11	34	32	50	82	—	—	—	—	—	-	do
11	32.50	32.95	0.45	DP	11	23	35	55	90	—	—	—	—	—	—	do
4	34.00	34.45	0.45	DP	11	25	38	60	98	—	—	—	—	—	—	do
11	35.50	35.95	0.45	DP	11	21	35	37	72	—	—	—	—	—	—	cohesive soil with Gravel
11	37.00	37.45	0.45	DP	11	26	38	50	88	—	—	—	—	—	—	do
11	38.50	38.95	0.45	DP	11	30	42	58	100	—	—	—	—	—	—	do
11	40.00	40.45	0.45	DP	11	29	43	53	96	—	—	—	—	—	-	do

Supervisor

S.E-III

E - In - C

Techpro Engineers Pvt. Ltd. Kanpur

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 9: FIELD BORELOG CHARTS (P34)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW HORC Viaduct b/w Sohna & Dhulawat Station			Project Code:	1901
Coordinate:	N: 3119056.154	E: 7001757.766		Location/ Chainage:	21806.6870
Method of Drilling:	Rotary		Drilling Equipment:	Automatic Hydraulic	Bore No.: P-34
Casing Lowered (M):	—	Bentonite Used: Not	Standard Sampler:	Yes	Barrel Type: NA
Ground Elevation:	R.L-191.452	Date: From 06/11/2023 to 08/11/2023			Water Table (M): 1.40

Day / Date	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
06/11/23	0.00	0.50	0.50	DS	Sx	Collected										Non-Cohesive Soil.
11	1.00	1.45	0.45	DP	11	1	1	2	3							—do—
11	2.00	2.45	0.45	U	11	Received.										—do—
11	3.00	3.45	0.45	DP	11	2	2	4	6							Cohesive Soil with Gravel
11	4.00	4.45	0.45	DP	11	3	6	8	14							Non-Cohesive with Gravel.
11	5.00	5.45	0.45	U	11	Received.										—do—
11	6.00	6.45	0.45	DP	11	3	7	11	18							Non-Cohesive Soil
11	7.00	7.45	0.45	DP	11	5	11	12	23							Brownish Non-Cohesive Soil
11	8.00	8.45	0.45	U	11	Received										Cohesive Soil with Gravel
11	9.00	9.45	0.45	DP	11	4	7	8	15							Cohesive Soil.
11	10.00	10.45	0.45	DP	11	6	8	12	20							—do—
07/11/23	11.00	11.45	0.45	U	11	Received.										—do—
11	12.50	12.95	0.45	DP	11	5	9	10	19							—do—
11	14.00	14.45	0.45	U	11	Received.										Cohesive Soil with Gravel.
11	15.50	15.95	0.45	DP	11	4	5	7	12							—do—
11	17.00	17.45	0.45	U	11	Slipped.										—do— DS Collected
11	18.50	18.95	0.45	DP	11	6	8	13	21							Cohesive Soil.
11	20.00	20.45	0.45	U	11	Received										—do—
11	21.50	21.95	0.45	DP	11	8	14	16	30							—do—
11	23.00	23.45	0.45	U	11	Received.										—do—
11	24.50	24.95	0.45	DP	11	11	17	21	38							Cohesive Soil with Gravel.
11	26.00	26.45	0.45	U	11	Slipped.										—do— DS Collected.
11	27.50	27.95	0.45	DP	11	14	23	25	47							—do—
11	29.00	29.45	0.45	U	11	Slipped.										—do— DS Collected

Supervisor

Techpro Engineers Pvt. Ltd. Gurgaon

E-in-C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 10: FIELD BORELOG CHARTS (P34)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW HORC Viaduct blw Sohana & Dhulawat Station			Project Code:	1901
Coordinate:	N: 3119056.154	E: 701757.766		Location/ Chainage:	21806.6870
Method of Drilling:	Rotary	Drilling Equipment:	Hydraulic	Bore No.:	P-34
Casing Lowered (M):	—	Bentonite Used:	Not	Standard Sampler:	Yes	Barrel Type:	NA
Ground Elevation:	R.L-191.452	Date: From 06/11/2023 to 08/11/2023		Water Table (M):	1.40

Day / Date	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
1/	30.50	30.95	0.45	DP	SK	17	32	39	71							Non-Cohesive Soil with Gravel
1/	32.00	32.45	0.45	DP	1/	18	34	41	75							—do—
08/11/23	33.50	33.95	0.45	DP	1/	15	30	38	68							—do—
1/	35.00	35.45	0.45	DP	1/	11	20	35	55							Cohesive Soil with Gravel
1/	36.50	36.95	0.45	DP	1/	13	24	28	52							—do—
1/	38.00	38.45	0.45	DP	1/	16	29	36	65							—do—
1/	40.00	40.45	0.45	DP	1/	15	22	31	53							—do—

Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 11: FIELD BORELOG CHARTS (P36)

TECHPRO ENGINEERS PVT. LTD. — **BORE/ DRILL LOG**

Doc No:	GT/ 003
Date of Issue:	01.04.2018
Rev. No.:	R03
Rev. Date.:	28.12.2021

Project Name:	G/T. for HORC viaduct b/w Sohna Dhulawat station			Project Code:	1901
Coordinate:	N: 3119077.181	E: 701709.564		Location/ Chainage:	21859.087.0
Method of Drilling:	Percussion		Drilling Equipment	Power winch	Bore No.: P36
Casing Lowered (M):	22.00	Bentonite Used: NO	Standard Sampler :	Yes	Barrel Type : N/A
Ground Elevation:	R.L-191.271	Date: From 5/10/23 to 17/10/23			Water Table (M): 1.30

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
15/10	0.0	0.50	0.45	DS	SX	-	Received									NON cohesvie soil
23	1.00	1.45	0.45	U	11	-	Received									— do —
11	2.00	2.45	0.45	DP	11	2	3	3	6							— do —
11	3.00	3.45	0.45	DP	11	3	5	5	10							— do —
11	4.00	4.45	0.45	U	11	Received			—							— do —
11	5.00	5.45	0.45	DP	11	4	7	9	16							— do —
11	6.00	6.45	0.45	DP	11	3	9	13	22							— do —
11	7.00	7.45	0.45	U	11	Received			—							— do —
11	8.00	8.45	0.45	DP	11	3	6	11	17							— do —
11	9.00	9.45	0.45	DP	11	5	11	11	22							— do —
11	10.00	10.45	0.45	U	11	Received			—							— do —
11	11.00	11.45	0.45	DP	11	6	12	17	29							NON cohesvie soil with
11	12.00	12.45	0.45	DP	11	7	11	15	26							Gravel Soil
11	13.00	13.45	0.45	U	11	Received			—							— do
11	14.50	14.95	0.45	DP	11	5	12	15	27							NON cohesvie soil
11	16.00	16.45	0.45	U	11	Received			—							Cohesvie soil
11	17.50	17.95	0.45	DP	11	6	9	14	23							— do —
11	19.00	19.45	0.45	U	11	Received			—							— do —
11	20.50	20.95	0.45	DP	11	7	9	17	26							— do —
11	22.00	22.45	0.45	U	11	Received			—							— do —
11	23.50	23.95	0.45	DP	11	6	12	17	29							— do —
16/10	25.00	25.45	0.45	U	11	slipped			—							NON Cohesvie soil
11	26.50	26.95	0.45	DP	11	11	17	28	45							— do —
11	28.00	28.45	0.45	U	11	Received			—							Cohesvie soil with Gravel

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Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 12: FIELD BORELOG CHARTS (P36)

TECHPRO ENGINEERS PVT. LTD. — **BORE/ DRILL LOG**

Doc No:	GT/ 003
Date of Issue:	01.04.2018
Rev. No.:	R03
Rev. Date.:	28.12.2021

Project Name: CoT for HORC Viaduct b/w Sohna Dhulawat Station — Project Code: 1901

Coordinate: N: 3119077.181 — E: 701709.564 — Location/ Chainage: 21859.0870

Method of Drilling: Percussion — Drilling Equipment: Rawemach — Bore No.: P36

Casing Lowered (M): 22.00 — Bentonite Used: NO — Standard Sampler: YES — Barrel Type: N/A

Ground Elevation: R.L-191.271 — Date: From 16/10/23 to 17/10/23 — Water Table (M): 1.30

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
16/10/23	29.50	29.95	0.45	DP	SX	11	14	26	45							cohesvie soil with
"	31.00	31.45	0.45	U	"	Slipped										Gravel soil
"	32.50	32.95	0.45	DP	"	17	26	30	56							— do —
"	34.00	34.45	0.45	DP	"	16	29	33	62							NON cohesvie soil
"	35.50	35.95	0.45	DP	"	18	20	29	49							— do —
17/10/23	37.00	37.45	0.45	U	"	Slipped										— do —
"	38.50	38.95	0.45	DP	"	16	22	26	48							— do —
"	40.00	40.45	0.45	DP	"	17	24	30	54							— do —

Supervisor

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

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APPENDIX-K
CHART 13: FIELD BORELOG CHARTS (P39)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GT. for HORC viaduct b/w Sohna Dhulawat Station			Project Code:	1901
Coordinate:	N: 3119112.311	E: 701638.957		Location/ Chainage:	21937.6870
Method of Drilling:	Percussion	Drilling Equipment	Auto Tow. P/L Powerwinch	Bore No.:	P39
Casing Lowered (M):	27.00 Bentonite Used:	NO	Standard Sampler :	YES	Barrel Type : N/A
Ground Elevation:	R.L-191.204	Date: From 17/10/23 to 19/10/23		Water Table (M):	1.30

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
17/10/23	0.0	0.50	0.50	DS	SX	Received										NON cohesvie soil
"	1.00	1.45	0.45	U	"	Slipped										— do —
"	2.00	2.45	0.45	DP	"	2	3	4	7							NON cohesvie soil
"	3.00	3.45	0.45	DP	"	2	3	3	6							with Gravel soil
"	4.00	4.45	0.45	U	"	Received										— do —
"	5.00	5.45	0.45	DP	"	3	3	4	7							— do —
"	6.00	6.45	0.45	DP	"	3	3	5	8							— do —
"	7.00	7.45	0.45	U	"	Slipped										-do-
"	8.00	8.45	0.45	DP	"	3	4	5	9							-do-
"	9.00	9.45	0.45	DP	"	3	4	6	10							-do-
"	10.00	10.45	0.45	U	"	Received										-do-
"	11.00	11.45	0.45	DP	"	5	9	14	23							-do-
"	12.00	12.45	0.45	DP	"	6	12	13	25							NON Cohesvie soil
"	13.00	13.45	0.45	U	"	Received										cohesvie soil with
"	14.50	14.95	0.45	DP	"	4	7	11	18							Gravel soil
"	16.00	16.45	0.45	U	"	Received										— do —
"	17.50	17.95	0.45	DP	"	4	6	9	15							— do —
"	19.00	19.45	0.45	U	"	Received										— do —
"	20.50	20.95	0.45	DP	"	5	7	12	19							— do —
18/10/23	22.00	22.45	0.45	U	"	Received										— do —
"	23.50	23.95	0.45	DP	"	6	15	27	42							— do —
"	25.00	25.45	0.45	U	"	Received										NON cohesvie soil
"	27.50	27.95	0.45	DP	"	11	22	29	51							— do —
"	28.00	28.45	0.45	U	"	Slipped										— do —

Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 14: FIELD BORELOG CHARTS (P39)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GT for HORC viaduct b/w Sohna Dhulawat station			Project Code:	1901
Coordinate:	N: 3119112.511	E: 701638.957		Location/ Chainage:	21937.6870
Method of Drilling:	Percussion	Drilling Equipment:	Auto Trip Powerwinch	Bore No.:	P39
Casing Lowered (M):	22.00	Bentonite Used: NO	Standard Sampler: YES	Barrel Type:	N/A
Ground Elevation:	R.L-191.204	Date: From 17/10/23 to 19/10/23		Water Table (M):	1.30

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
18/10/23	29.50	29.95	0.45	DP	SX	12	24	30	54							NON cohesvie soil with
"	31.00	31.45	0.45	DP	"	16	19	27	46							Gravel
"	32.50	32.95	0.45	DP	"	14	20	29	49							— do —
"	34.00	34.45	0.45	U	"	Slipped										— do —
19/10/23	35.50	35.95	0.45	DP	"	17	24	26	50							— do —
"	37.00	37.45	0.45	U	"	Slipped										— do —
"	38.50	38.95	0.45	DP	"	16	22	30	52							NON cohesvie soil
"	40.00	40.45	0.45	DP	"	18	24	38	62							— do —

R.E. Civil

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E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 15: FIELD BORELOG CHARTS (P40)

TECHPRO ENGINEERS PVT. LTD.

BORE/ DRILL LOG

Doc No:	GT/ 003
Date of Issue:	01.04.2018
Rev. No:	R03
Rev. Date:	28.12.2021

Project Name:	GTW- HORC Viaduct B/w Sohana Dhulawat station	Project Code:	B01
Coordinate:	N: 2119125.287 E: 701615.805	Location/ Chainage:	21963.8870
Method of Drilling:	Percussion	Drilling Equipment	Powerwinch
Bore No.:	P-40		
Casing Lowered (M):	21.00	Bentonite Used:	NO
Standard Sampler :	YES	Barrel Type :	NA
Ground Elevation:	RL-191.009	Date: From 20/10/23 to 22/10/23	Water Table (M): 1.40

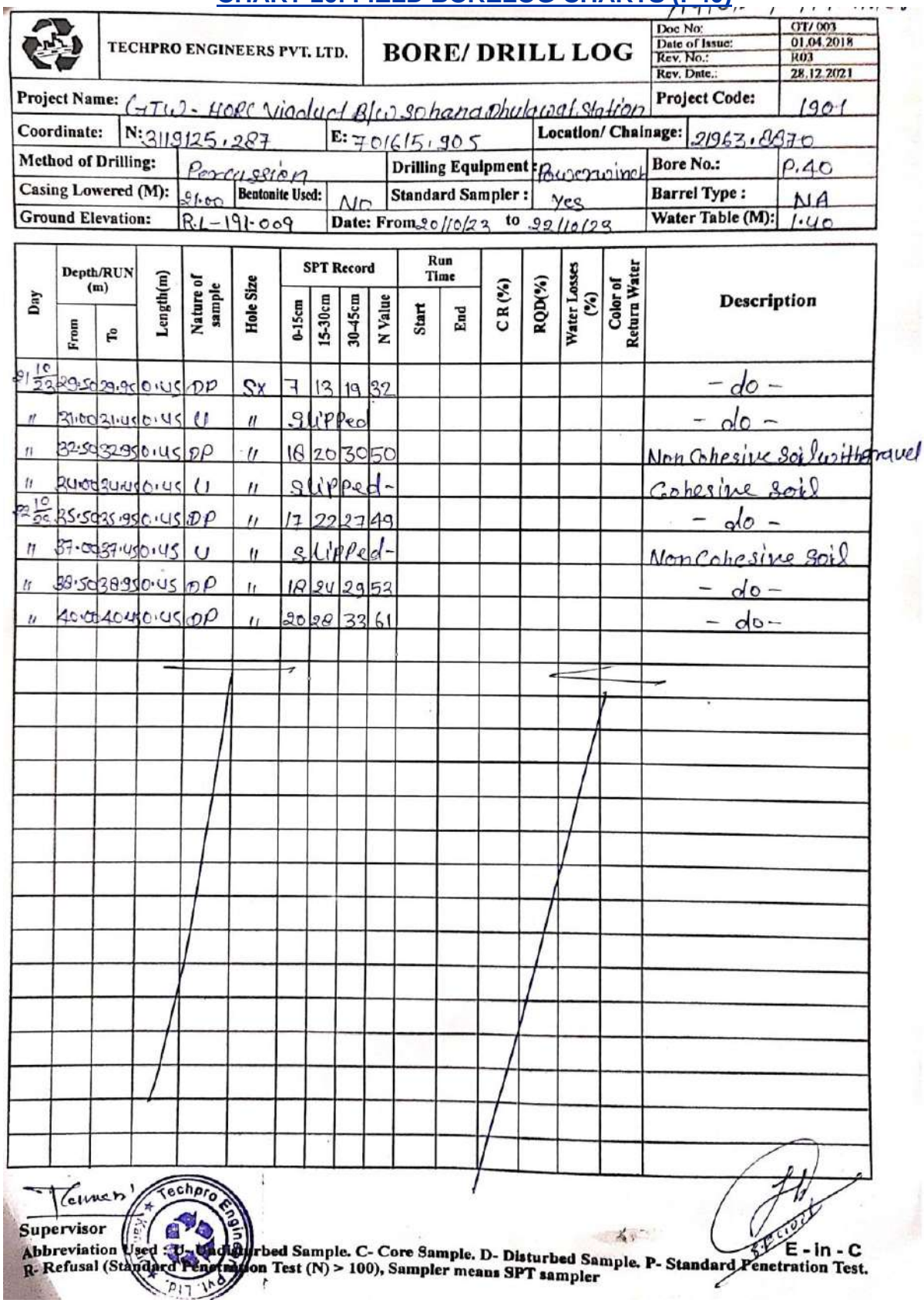
Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
20 10 23	0.00	0.50	0.50	DS	SX	Received										Non Cohesive Soil
"	1.00	1.45	0.45	U	"	Received										- do -
"	2.00	2.45	0.45	DP	"	1	2	2	4							- do -
"	3.00	3.45	0.45	DP	"	2	2	3	5							- do -
"	4.00	4.45	0.45	U	"	Slipped										- do -
"	5.00	5.45	0.45	DP	"	2	3	4	7							- do -
"	6.00	6.45	0.45	DP	"	3	6	6	12							- do -
"	7.00	7.45	0.45	U	"	Received										- do -
"	8.00	8.45	0.45	DP	"	2	3	6	9							- do -
"	9.00	9.45	0.45	DP	"	3	3	5	8							- do -
"	10.00	10.45	0.45	U	"	Received										Cohesive Soil with gravel
"	11.00	11.45	0.45	DP	"	5	10	13	23							- do -
"	12.00	12.45	0.45	DP	"	5	7	9	16							- do -
"	13.00	13.45	0.45	U	"	Received										- do -
"	14.50	14.95	0.45	DP	"	2	6	8	14							Cohesive Soil
"	16.00	16.45	0.45	U	"	Received										- do -
"	17.50	17.95	0.45	DP	"	5	10	12	22							- do -
"	19.00	19.45	0.45	U	"	Received										- do -
"	20.50	20.95	0.45	DP	"	8	10	14	24							Non Cohesive Soil
21 10 23	22.00	22.45	0.45	U	"	Slipped										- do -
"	23.50	23.95	0.45	DP	"	5	11	15	26							Cohesive Soil with gravel
"	25.00	25.45	0.45	U	"	Slipped										Non Cohesive Soil
"	26.50	26.95	0.45	DP	"	12	19	30	49							- do -
"	28.00	28.45	0.45	U	"	Slipped										- do -

Supervisor

Abbreviation Used: U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

E - In - C

APPENDIX-K
CHART 16: FIELD BORELOG CHARTS (P40)



TECHPRO ENGINEERS PVT. LTD. — BORE/ DRILL LOG

Doc No:	GT/ 003
Date of Issue:	01.04.2018
Rev. No.:	R03
Rev. Date.:	28.12.2021

Project Name: GTW - HORC Viaduct B/w Sohana-Dhulawat Station — Project Code: 1901

Coordinate: N: 3119125.287 E: 701615.905 — Location/ Chainage: 21963.8870

Method of Drilling: Percussion — Drilling Equipment: Power winch — Bore No.: P.40

Casing Lowered (M): 21.00 — Bentonite Used: NO — Standard Sampler: Yes — Barrel Type: NA

Ground Elevation: R.L-191.009 — Date: From 20/10/23 to 22/10/23 — Water Table (M): 1.40

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
21/10/23	29.50	29.95	0.45	DP	SX	7	13	19	32							- do -
"	31.00	21.45	0.45	U	"	Slipped										- do -
"	32.50	32.95	0.45	DP	"	18	20	30	50							Non Cohesive Soil with gravel
"	34.00	34.45	0.45	U	"	Slipped-										Cohesive Soil
22/10/23	35.50	35.95	0.45	DP	"	17	22	27	49							- do -
"	37.00	37.45	0.45	U	"	Slipped-										Non Cohesive Soil
"	38.50	38.95	0.45	DP	"	18	24	29	53							- do -
"	40.00	40.45	0.45	DP	"	20	28	33	61							- do -

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Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

E - in - C

End of Report

Report No: 1901-HORC-III

Report No.: 1901-HORC-III

Date: Nov 04th; 2023

GEOTECHNICAL INVESTIGATION REPORT

ULR No.: TC916923000000032P
REVISION-R1

AT THE SITE FOR

HORC VIADUCT BETWEEN SOHANA & DHULAWAT STATIONS OF HARYANA ORBITAL RAIL CORRIDOR (HORC) PROJECT, HARYANA

FROM BOREHOLES P41 TO P60

CLIENT

HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LTD.

Plot No. 143, 5th floor RailTel tower, Sector-44,
Gurugram, Haryana 122003

GENERAL CONSULTANTS

RITES-SMEC JV

Gurugram, Haryana

GEOTECHNICAL CONSULTANTS

TECHPRO ENGINEERS PVT. LTD.

114, RAM GANGA HOUSING SOCIETY, NARAMAU, G T ROAD, KANPUR-209 217, Phone: 9793209918

e-mail: info@techproindia.com

TC-9169

REVISION NOTES

REVISION NO.	DATE	DESCRIPTION
R1	14.12.23	• Lithological profile added in Appendix-C

REPORT FORMAT

Report No.	Bore included	Total Number of Bores
1901-HORC-I	A1 to P20	21
1901-HORC-II	P21 to P40	20
1901-HORC-III	P41 to P60	20
1901-HORC-IV	P61 to P80	20
1901-HORC-V	P81 to P100	20
1901-HORC-VI	P101 to P113	13
1901-HORC-VII	P114A to P133A	20
1901-HORC-VIII	P134A to A2A	16
1901-HORC-IX	P114B to P133B	20
1901-HORC-X	P134B to A2B	16

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Certificate Number: TC-9169

Issue Date: 23/12/2022 **Valid Until:** 22/12/2024

This certificate remains valid for the Scope of Accreditation as specified in the annexure subject to continued satisfactory compliance to the above standard & the relevant requirements of NABL.
(To see the scope of accreditation of this laboratory, you may also visit NABL website www.nabl-india.org)

Name of Legal Identity : Techpro Engineers Private Limited

Signed for and on behalf of NABL

N. Venkateswaran
Chief Executive Officer

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Web site: www.techproindia.com

Nov 04th; 2023

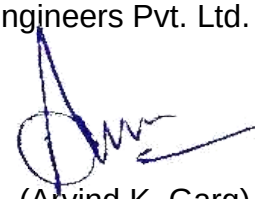
ACKNOWLEDGEMENTS

We are pleased to submit the part-3 of the report of Geotechnical investigation, conducted for the boreholes P41 to P60 for the design of foundations for HORC Viaduct between Sohana & Dhulawat stations of Haryana Orbital Rail Corridor (HORC) project in the state of Haryana, India.

We hereby, convey our sincere thanks to Mr. Neeraj Bhandari (CPM/South) and Mr. Raju Solanki (DGM/C/South), HRIDCL for trust and support during the investigation. We also acknowledge our thanks to Mr. Uma Maheshwara Rao B, DGM/C/West, HRIDCL for awarding the said work to us. We are also grateful Mr. Ravindra Dutta Upadhyay (Geotech Expert), Mr. PS Gautam & Mr. Jitender Parashar, Site Engineer from the RITES- SMEC JV and Mohd. Ishak (Executive/Civil) from HRIDCL, for their help rendered during and prior to the investigation work.

We are also thankful to our staff members for conducting field and laboratory test, preparing sketches, and typing the report.

for Techpro Engineers Pvt. Ltd.



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1. INTRODUCTION:

Haryana Rail Infrastructure Development Corporation Ltd. (HRIDC) and Ministry of Railways, Govt. of India has come together to form a new company namely Haryana Orbital Rail Corporation Limited (HORCL), to design and construction of new BG line from Palwal to Sonipat named Haryana Orbital Rail Corridor (HORC), in the state of Haryana, India. In this connection, a Geotechnical investigation has been planned for the design of foundations of Viaduct between Sohana & Dhulawat stations of Haryana Orbital Rail Corridor (HORC) Project in the state of Haryana. The work of conducting the detailed Geotechnical Investigation has been awarded to us by HRIDC, through work order No. HRIDC/HORC/GTI/211/2023-2024/Vol-0 dated 02-09-2023, which includes investigation in field, laboratory testing of disturbed and undisturbed samples, collected from the field, and submission of the geotechnical **investigation** test report.

A geotechnical investigation was carried out, with the locations, planned by the client. Purpose of the investigation is to determine the nature and properties of soil and rock strata across the bore holes and representing them through log sections showing the levels, nature, and properties of various strata up to a sufficient depth below the founding level, proneness of site to artesian conditions, seismic disturbance and other engineering properties of soil and rock strata.

This part -3 of the report includes the detailed methodology of investigation, collection of samples, field and laboratory test result including their interpretation/ analysis, recommendations on the properties of soils and rock required for design of foundation and suggesting suitable type and depth of foundation with allowable bearing capacity for safe and strong foundations for the Bore Hole numbers P41 to P60.

2. SCOPE OF WORK:

For the design of foundation of viaduct, it is required to determine the allowable bearing capacity together with necessary engineering characteristics of underlying soil & rock strata. In general, the geotechnical investigation has been planned as per IS:1892-2021 and further extended to IS: 1904, IS:2911 (part-1/Sec 2) & IRC 78:2014 for planning the laboratory testing and computing the allowable bearing capacity, hence the scope of work is as follows:

2.1. Mobilisation of all tools & plants along with accessories, materials, labours etc. at site of work for drilling and testing work, including setting up boring and shifting to different bore holes point etc.

2.2. Exploratory drilling of 150 mm diameter bore holes through soil deposits and 75 mm in rock within the proposed alignment upto the required depth.

2.3. Collection of disturbed soil samples at an interval of 3.00 meter in all the bore holes.

2.4. Collection of undisturbed soil samples at every 3.00 m interval or at change of stratum from all the boreholes.

2.5. To conduct Standard Penetration Test (SPT) at an interval of 3.00 m or noticeable change of stratum in soil deposits in all bore holes.

2.6. Collection of rock core samples and preserving them in core boxes.

2.7. To collect ground water sample on completion of bore holes.

2.8. To record the ground water table in all the bore holes.

2.9. Transporting all the disturbed, undisturbed soil and rock core samples collected during the field investigation to our NABL accredited Geotech Engineering laboratory at Kanpur.

2.10. To conduct the laboratory tests on all the soil and rock core samples collected during field investigation for determination of their engineering characteristics.

2.11. To compile of field and laboratory test results, working out the allowable bearing capacity and preparing the report including detailed recommendations and necessary precautions.

3. GEOLOGICAL INFORMATION OF THE REGION:

3.1. Geography:

The project location is in the bordering area of Gurugram and Nuh (recent old name-Mewat), districts in the Indian state of Haryana. The stretch of the alignment of the proposed corridor starts from southmost part of Gurugram in the town of Sohna and ends at Dhulawat, which is a village lying at the north of Nuh district.

Haryana is a state located in the northern part of India. Gurugram is among one

of the districts in Haryana which is also the part of National Capital Region (30km south of New Delhi). It lies at an elevation of 217 m above msl. Sohna is a small town located 25km in the south of Gurugram. Sohna is well known for its hot water springs and famous Shiva temple. Sohna is located in between 28°15' N latitude and 77°40' E longitude at the elevation of 212.14m above msl. Mewat district is located at 28 °12′ N latitude, 77 °3′ E longitude, at the south of Gurugram at an elevation of 199 m above msl. The location is bordered by Rewari district on west and Faridabad & Palwal district on the east.

3.2. Geology:

The Gurugram district is having of almost flat topography, however, in the north-eastern part small isolated hillocks of Precambrian rocks are exposed. Small hill ranges which are part of the Aravali and Mangar Bani ranges exists in the district. The major part of district is underlain by Quaternary alluvium consisting of sand, clay and silt. The alluvial plain is formed by the Sahibi river which is a tributary of River Yamuna. Soils of the Gurgaon district is classified as tropical and brown soils, existing in the north western extreme, northern and north eastern parts of the district and water logged and salt affected soils in the southern parts of the district. The soils are medium textured loamy sand is the average texture in Gurgaon and Sohna blocks.

3.3. Rainfall and Climate:

The area has hot semi-arid type of climate characterising extreme dryness of the air except in the monsoon season. Intense hot summer and cold winters. The total annual rainfall in the region is about 596 mm, of which 75 to 80% is because of the south-west monsoon.

3.4. Seismicity:

The site under consideration exists in the district of Gurugram and Mewat which lies in the Seismic Zone IV (high damage risk zone), as per the current seismic zonation map of India (IS 1893-2016): RA 2021 and have a zone factor of 0.24 for design basis earthquake. The region is surrounded by many in-homogeneities in the form of faults and ridges like Sohna Fault, Moradabad Fault, Delhi-Moradabad Fault, Delhi-Haridwar ridge, junction of Aravalli and Alluvium near Delhi. The Sohna fault line lies between the Delhi ridge and Sohna town and falls between the Arjangarh and

Manesar outcrops. All the developed area in Gurugram comes within 200 km of the fault line. The Sohna fault line is located at the junction between the hard rock terrain of the Aravalli hills and the sandy formation of the Yamuna River and is currently inactive from several years and is capable of a disastrous earthquake.

The project location has been marked in Fig.1 Seismic zone map of India.

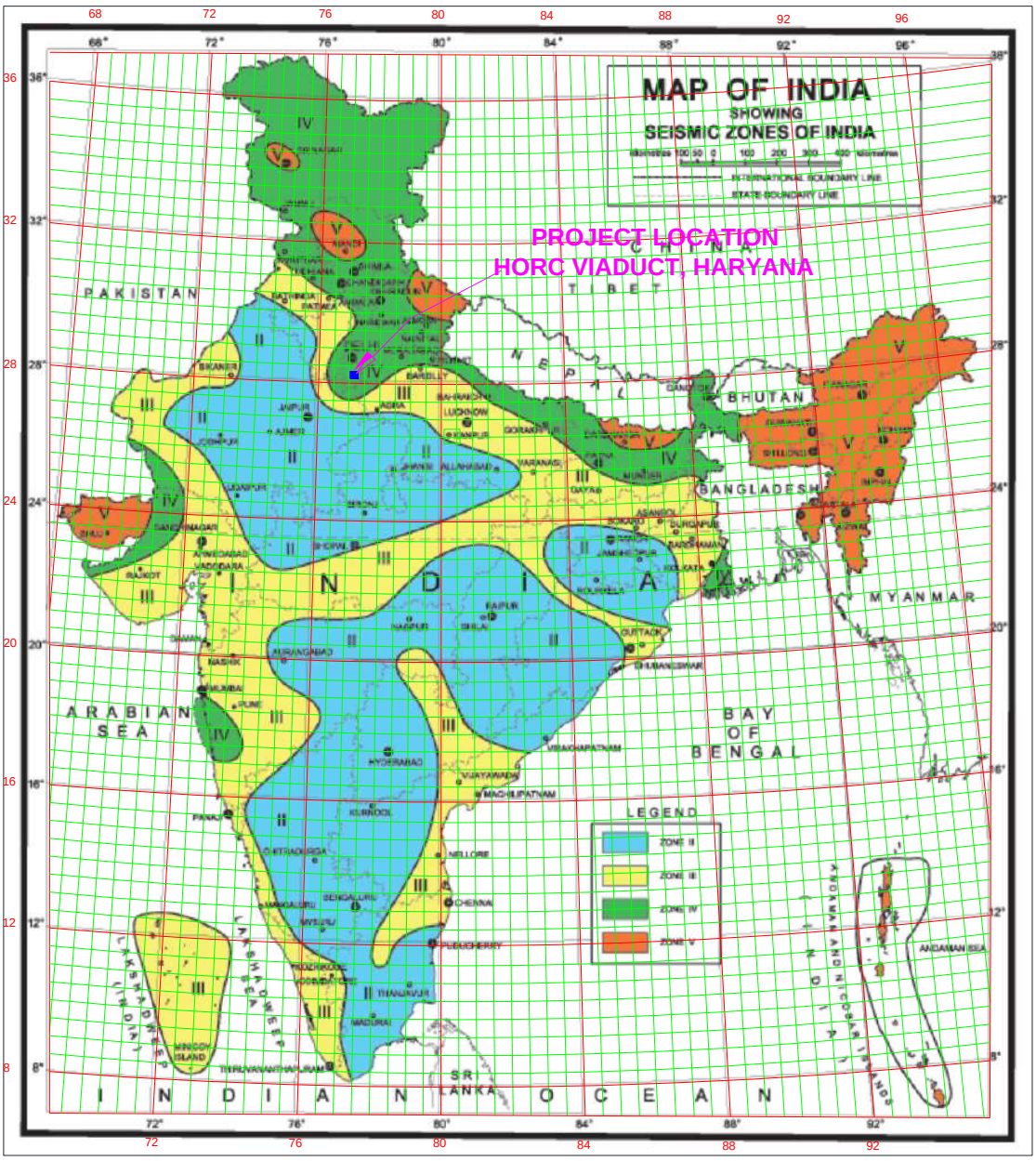


Fig.1: Seismic Zone Map of India

4. FIELD INVESTIGATION:

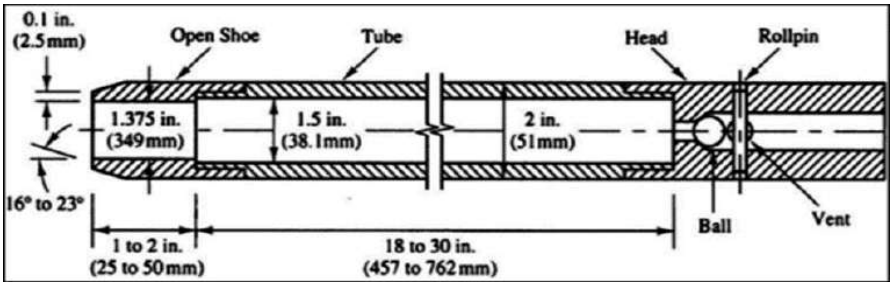
The field investigation work at this site was carried out from Sep 27th; 2023 to Oct 2nd; 2023 & Oct 12th; 2023 to Oct 22nd; 2023 & Oct 31st; 2023 to Nov 10th

2023. The following investigation work was carried out:

4.1. **Twenty number** of **boreholes** (marked as P41 to P60) of diameter 150 mm in soil were made within the proposed alignment for conducting Standard Penetration Test and collection of disturbed and undisturbed samples. The boreholes were progressed using power operated winch machine under **percussion** method of drilling. Casing was used to keep the borehole stable. The records of achieved depth of bore holes have been given in Para No. 6, the details of drilled bores along with depth of casing used have been reported in Appendix B. Locations of boreholes have been reported in "TEST LOCATION PLAN" in Appendix A.

4.2. **Standard Penetration Tests** were conducted at 1.00 to 2.00 metre interval upto the depth of 12.00 meter and 3.00 metre interval, beyond 12.00 metre depth, as per the procedure in IS: 2131-1981-(RA: 2021) in all the bore holes. The **standard SPT sampler** (without liner and with no space for liner) and **auto-trip and rope-pulley driven hammer** of standard weight of 63.50 kg have been used to perform the test.

For conducting the test, the bottom of the borehole was properly cleaned, and split spoon sampler was properly seated in position in the borehole. The split spoon sampler resting on the bottom of borehole was allowed to sink under its own weight; then the sampler was allowed to penetrate 15 cm with the blows of the hammer 63.50 kg weight falling free through 75cm, thereafter the split spoon sampler was further driven by another 15 cm. For the 3rd and final drive, the sampler was further allowed to penetrate 15 cm. The number of blows required to get each 15 cm of penetration, was recorded. The first 15 cm of drive is seating drive.



Structure of SPT Sampler

The total blows of penetration for the second and third 15 cm of penetration is termed the penetration resistance N. The N' values are indicative of the compactness/ relative density of cohesion less soils and consistency of cohesive soils.

In case the blows count of SPT in soil (including the number of blows of seating) exceeds 100, the corresponding penetration was recorded and this particular test at that depth stopped. If the total penetration is more than the seating penetration of 15 cm, then breakup of blow counts for 15 cm seating penetration and for remaining portion of penetration is also given.

SPT 'N' values are correlated with non-cohesive stratum as per BS: 5930 (1999) – for sandy strata and with consistency of cohesive stratum.

Correlation For Clay/Plastic Silt		**Correlation For Sand/Non-Plastic Silt**	
Consistency of clays	**Penetration Value**	**Relative Density of sand**	**Penetration Value**
Very Soft	0 to 2 Blows	Very loose	0 to 4 Blows
Soft	3 to 4 Blows	Loose	5 to 10 Blows
Medium Stiff	5 to 8 Blows	Medium	11 to 30 Blows
Stiff	9 to 16 Blows	Dense	31 to 50 Blows
Very Stiff	17 to 32 Blows	Very Dense	Above 50
Hard	Above 32		

In this method, the sampler acts as a probe and the driving energy is supplied by the fall of the drop weight. The values of 'N' depend on the compactness or relative density of the material. In hard formations, the testing is discontinued if 'N' value is found to be more than 100. It is termed as 'Refusal'. Refusal is also recorded when SPT blow count records 50 or more for any of the single drive of 15 cm.

'N' value depends upon degree of saturation and over burden pressure of the formation. Silty fine sand and fine sand below the water table develop pore water pressure depending on the in-situ void ratio which in turn affects the effective stress. This change in effective stress influences the 'N' value considerably.

Depth of overburden affects the SPT values in none to low cohesive soils and hence need correction. The SPT value after the overburden correction, N' is as follows:

$$N' = 0.77x \log (2000/q) \times N$$

Where, q= Overburden Pressure (kN/m^2) and N = observed SPT value

N' is corrected further for dilatancy in case of saturated fine sands and silts for the values of N' greater than 15.

Modified value after dilatancy correction N" = 15+ (N'-15)/2

Soil samples obtained from split spoon sampler were collected in the polythene bags of suitable size. These samples were property sealed, labelled, and carefully transported to the laboratory for testing. The results have been reported in Table 1 to 20 of Appendix B under the title "SUMMARY OF TEST RESULTS".

4.3. **Disturbed soil samples** were collected at 0.50 metre, then at 1.00 to 2.00 metre interval upto the depth of 12.00 meter and 3.00 metre interval, beyond 12.00 metre depth and at significant change of stratum. Soil from cutting edge of SPT samplers and retained in split spoon, used for Standard Penetration Tests was taken as disturbed samples. These samples were placed without delay in adequately sealed polythene bags. Where the collection of disturbed soil samples could not be collected from SPT samples, Shelby tubes were driven and retained soil samples were obtained. The laboratory tests were conducted on the collected soil samples and reported in Table 1 to 20 of Appendix-B under the title "SUMMARY OF TEST RESULTS".

4.4. **Undisturbed soil samples** were collected in accordance with IS: 2132-1986-(RA: 2021) at an interval of 3.00 metre or at change of stratum, starting from the depth of 1.00 or 2.00 m, by using 100 mm dia. and 450 mm long MS tubes provided with sampler head with ball check arrangement. However, the some of the samples could not be extracted due to the partial penetration or slippage during the evacuation.

Moreover, collection of Undisturbed samples in very hard cohesive soils/ dense granular soils/gravels/ cobbles/ pebbles/ boulders, refusal strata is practically not possible and such collected samples will not truly represent the undisturbed conditions.

Immediately after taking undisturbed sample in the tube, the adopter head was removed along with the disturbed material. The visible ends of the samples shall then be trimmed off any wet disturbed soil. The ends will then be coated alternately with four layers of molten wax. More molten wax will then be added to give a total thickness of not less than 25 mm. The laboratory test results have been reported in Table 1 to 20 of Appendix-B.

4.5. The **ground water table** in the borehole was allowed to stabilize and measured after 8, 16, 24 and 48 hours after completion of the bore hole. It was ensured that last two reading were identical. The records of ground water table have been given in Para No.6.

4.6. **Ground water samples** were collected from borehole as per IS: 6935-1973-(RA:2019) for chemical analysis to determine aggressiveness in relation to attack on concrete / reinforcement including determination of pH value.

5. LABORATORY TESTS:

The following laboratory tests were conducted to determine the engineering characteristics of sub-soils:

5.1. **Field moisture contents** were determined by oven drying method as per IS: 2720 (part II)-1973-(RA: 2020). The results have been reported in Table 1 to 20: "SUMMARY OF TEST RESULTS" of Appendix B.

5.2. **Bulk density** of soil strata was obtained using Shelby tubes in accordance with IS 2720 (part XXIX)-1975-(RA: 2020). The results have been reported in Table 1 to 20: "SUMMARY OF TEST RESULTS" of Appendix B.

5.3. **Mechanical sieve analysis** test was performed in accordance with IS: 2720 (Part IV) – 1985-(RA: 2020), for the purpose of identification by grain size analysis, on coarse part of the soil samples and the results have been reported in Table 1 to 20: "SUMMARY OF TEST RESULTS" of Appendix B.

5.4. **Particle size analysis** test by **Hydrometer method** were performed in accordance with IS: 2720 (Part IV) -1985-(RA: 2020) on the part of soil samples obtained after the sieve analysis. The results have been reported in Table 1 to 20: "SUMMARY OF TEST RESULTS" of Appendix B.

5.5. **Atterbergs' limits tests** were performed in accordance with IS: 2720 (part V)-1985-(RA: 2020) and results have been reported in Table 1 to 20: "SUMMARY OF TEST RESULTS" of Appendix B.

5.6. **Specific gravity tests** were performed in accordance with IS 2720 (part III-sec. 1) -1980-(RA: 2021) and the results have been reported in Table 1 to 20: "SUMMARY OF TEST RESULTS" of Appendix B.

5.7. **Consolidation tests** were performed on cohesive soil samples in accordance with IS: 2720 (part XV)-1965-(RA: 2021). The results have been reported in Table 1 to 20: "SUMMARY OF TEST RESULTS" of Appendix B.

5.8. **Direct shear tests** were performed as per IS: 2720 (part XIII)-1986-(RA: 2021), on the undisturbed soil samples obtained during the field investigation. The results and the density of samples have been reported in Table 1 to 20: "SUMMARY OF TEST RESULTS" of Appendix B.

5.9. **Tri-axial Compression Test** under Unconsolidated Un-drained (UU) condition as per IS: 2720 (Part-XI)-1993-(RA: 2021) were performed on the selected undisturbed soil samples, obtained during the field investigation. The results have been reported in Table 1 to 20: "SUMMARY OF TEST RESULTS" of Appendix B.

5.10. **Unconfined Compressive strength tests** were performed in accordance with IS 2720 (Part-X) -1991-(RA:2020) on selected undisturbed soil samples and the results have been reported in Table 22 of Appendix B.

5.11. **Shrinkage Limit tests** were performed in accordance with IS 2720 (part-VI) -1972-(RA: 2021) and the results have been reported in Table 1 to 20: "SUMMARY OF TEST RESULTS" of Appendix B.

5.12. **Free Swell Index** were performed in accordance with IS 2720 (part-XL) -1977-(RA: 2021) and the results have been reported in Table 1 to 20: "SUMMARY OF TEST RESULTS" of Appendix B.

5.13. **Chemical analysis on soil samples** was performed in accordance with IS: 2720 (Part-XXVI)-1987-(RA: 2021) for pH value, IS: 2720 (Part-XXVII)-1977-(RA: 2020) for Sulphate & BS:1377-3-2018 for chlorides and results have been reported in Table 21 "CHEMICAL TEST ON SOIL SAMPLES" of Appendix B.

6. GROUND WATER TABLE:

The water table at this site was encountered during the drilling operation up to the depth of investigation.

Borehole No.	Chainage	Global Co-ordinates (UTM format)		Reduced level (m)	Depth of Borehole (m)	Water table (m)
		Easting	Northing			
P41	21990.087	701593.231	3119138.485	191.144	40.00	1.40
P42	22016.287	701570.762	3119152.203	191.252	40.00	1.28
P43	22042.487	701548.586	3119166.393	191.241	40.00	1.30
P44	22068.687	701526.726	3119181.037	191.270	40.00	1.20
P45	22094.887	701505.144	3119196.164	191.379	40.00	1.50
P46	22121.087	701483.921	3119221.716	191.386	40.00	1.60
P47	22147.287	701463.030	3119227.711	191.466	40.00	1.60
P48	22173.487	701442.481	3119244.143	191.215	40.00	1.70
P49	22199.687	701422.282	3119261.003	191.249	40.00	1.80
P50	22225.887	701402.424	3119278.301	191.295	40.00	1.60
P51	22252.087	701383.032	3119295.948	191.293	40.00	1.60
P52	22278.287	701363.889	3119314.080	191.228	40.00	1.50
P53	22304.487	701345.190	3119332.567	192.054	40.00	1.40
P54	22330.687	701326.868	3119351.461	191.242	40.00	1.20
P55	22356.887	701308.964	3119370.719	191.309	40.00	1.40
P56	22383.087	701291.429	3119390.395	191.384	40.00	1.40
P57	22409.287	701274.370	3119410.368	191.353	40.00	1.20
P58	22435.487	701257.706	3119430.729	191.933	40.00	1.40
P59	22461.687	701241.448	3119459.473	191.466	40.00	1.50
P60	22487.887	701225.673	3119472.497	191.483	40.00	1.65

7. DESCRIPTION OF STRATA:

The classification of soil stratum has been done with the help of soil characteristics obtained in laboratory tests as per IS 1498-1970-(RA:2021). The classification of rock masses has been done based on RMR as per IS: 4464-1985, IS: 13365-1. The detailed nature of the strata has been reported in Table 1 to 20: “SUMMARY OF TEST RESULTS” of Appendix-B and represented through Lithological plots in Appendix-C.

The strata exhibited in the boreholes, is predominantly consisting of inorganic silty clays of low plasticity, inorganic silts of non to low plastic category and silty sands and silty

sands at varying depth and thickness. Inorganic silty clays, silts of intermediate plasticity and silty sands with clays binders were also found at varying depths and thickness in some of the boreholes. An exception of inorganic silty clays of high plastic category was found in borehole P60 at the upper depth of 2.00 to 3.00 metres.

8. SAFE BEARING CAPACITY COMPUTATIONS:

For the construction of viaducts, deep foundation **(Bored Cast-In-Situ RCC piles)** have been considered for computation of load bearing capacity of the underlying soil strata. The computation of load bearing capacity of bored cast-in-situ RCC piles have been done as per IS 2911 (part-1, section-2)-2010-(RA: 2020) with due consideration of effects of liquefaction.

8.1. Design Parameters:

Factor of safety in compression	=	2.50
Factor of safety in tension	=	3.00
Depth of critical water table	=	0.00 m
Diameter of pile	=	1.00 & 1.20 m
Cut off length	=	2.50 m
Type of pile head consider	=	Fixed

8.2. Computation of friction along pile stem:

$Q_{uf} = \sum K_i . P_{di} . \tan\delta_i . A_{si}$

where,

Q_{uf} = Ultimate shaft friction (kN/m^2)

K_i = Coefficient of earth pressure at mid-depth of ith layer

P_{di} = Effective overburden pressure at mid-depth of ith layer (kN/m^2)

A_{si} = Surface area of pile stem in i^{th} layer (m^2)

δ_i = Angle of wall friction between pile and soil of ith layer (= ϕ) (degree)

ϕ_i = Angle of internal friction of soil in i^{th} layer (degree)

$\sum$ = Sum of all layers up to i^{th} layer

8.3. Computation of Cohesion along the stem of pile:

$Q_{uc} = \sum \alpha_i . c_i . A_{si}$

Where,

c_i = Cohesion in i^{th} layer

A_{si} = Surface area of pile stem in i^{th} layer (m^2)

α_i = Adhesion factor for i^{th} layer of soil depending of consistency of soils

$\sum$ = Sum of cohesion of all layers considered

8.4. Computation of end bearing resistance:

$Q_{ub} = A_p (c.Nc + q.Nq + 0.5.\ \gamma.B.N\gamma)$

Where,

A_p = Area of the pile toe (m^2)

c = cohesion of soils at pile toe (kN/m^2)

γ = Effective Unit weight of soils at pile toe (kN/m^3)

B = Diameter of pile (m)

q = Effective overburden pressure at pile toe (kN/m^2)

N_c = Bearing Capacity Factor (Recommended equal to 9)

$Nq, N\gamma$ = Bearing Capacity Factor

8.5. Lateral load capacity of piles in soils:

$Q_u = 12.E.I.\delta/(L_1+L_f)^3$

where,

Q_u = Ultimate lateral load capacity of pile (kN)

δ = Permissible deflection (m) = 1% of diameter of pile

E = Young Modulus of pile material (kN/m^2)

I = Moment of Inertia of the pile cross section (m^4)

L_1 = Cantilever Length of pile (m)

L_f = Length of fixity (m)

Detailed calculations of pile load carrying capacity in compression & uplift in soil have been reported in **Table-1** to **2** of **Appendix-H.**

Pile lateral Load capacity has been given in **Table-3** to **4** of **Appendix-H**.

9. LIQUEFACTION ANALYSIS:

Liquefaction is the sudden loss of shear strength of the loose fine sands due to earthquake-induced vibration under saturated conditions. Liquefaction generally takes place in loose fine sands (fines < 10 %, D_{60}= 0.20 mm to 1.0 mm and C_u between 2 to 5) with N value less than 15. In case of soil strata having N>15, liquefaction of soil will not take place normally.

The present site falls in **seismic zone – IV.** Considering the history of past earthquakes and available seismic data, an earthquake of **magnitude 7.0** having peak ground acceleration **a_{max}= 0.24 g** is considered in the present analysis.

Preliminary assessment of liquefaction potential of foundation strata is made by simplified approach proposed by IS: 1893 (part-1)-2016-(RA: 2021) from the data obtained in Standard Penetration Test.

In this method, cyclic shear stress likely to be induced in the foundation strata by Design Basis Earthquake is first evaluated. Next threshold cyclic shear stress, which is good enough to cause liquefaction, is determined from SPT data and the empirical relations. Finally, comparison of these two stresses is used in the estimation of liquefaction susceptibility of the foundation strata.

Cyclic Stress Ratio (CSR):

The equivalent average of shear stress likely to be induced in the foundation material due to an earthquake is calculated by using the equations

Cyclic Resistance Ratio (CRR):

It expresses capacity of soil to resist liquefaction. CRR is determined using correlation between corrected blow count $(N_1)_{60}$ and CRR for earthquake of magnitude 7.5. $(N_1)_{60}$ is the SPT blow count corrected to an effective overburden pressure of 100 kPa and to hammer energy efficiency of 60 %.

Following variable have been adopted in calculation of N_{60} (SPT value for 60% efficiency)

Energy correction to SPT values:

C_{60} = 1.00 (Energy correction factor)

Design Earthquake Base:

Earthquake zone	= IV
Magnitude of earthquake	= 7
Seismic Zone factor	= 0.24

Status of Liquefaction:

The value of CSR and CRR are computed at different depth and then the ratio of CRR to CSR to get the factor of safety towards the susceptibility of the stratum towards liquefaction potential.

If factor of safety:

< 1.00 : Stratum is to be considered as liquefiable

> 1.20 : Non-Liquefiable

The detailed calculations of liquefaction, have been reported in **Table-5** of **Appendix-H.**

10. RECOMMENDATIONS:

Keeping in mind, the field test results, laboratory test results and IS codes of practice the following recommendations are hereby made:

10.1. **Bored Cast-In-Situ RCC Piles** of diameter 1000 and 1200 mm have been adopted for SBC computations of foundation for Viaduct.

10.2. **Cut off length** of piles have been considered as 2.50 m from the existing ground level for the purpose of computation of SBC.

10.3. **Pile length** recommended in the table below, shall be measured **after the cut-off depth.**

10.4. **Allowable load carrying capacity** of pile corresponding to the length and diameter of pile shall be read from the tables below:

10.4.1. For Pile diameter = 1000 mm

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
P41	25.00	2200	1750	65

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
	27.50	2600	1950	
	30.00	2600	2100	
	32.50	3150	2300	
	35.00	3100	2500	
P42	25.00	2050	1600	35
	27.50	2750	1800	
	30.00	2500	2000	
	32.50	2700	2200	
	35.00	3050	2400	
P43	25.00	2150	1650	80
	27.50	2400	1900	
	30.00	3300	2100	
	32.50	3350	2300	
	35.00	3400	2500	
P44	25.00	2250	1750	135
	27.50	2700	1950	
	30.00	2800	2150	
	32.50	3050	2350	
	35.00	3800	2550	
P45	25.00	2300	1750	80
	27.50	2700	2050	
	30.00	2900	2300	
	32.50	3150	2500	
	35.00	3400	2650	
P46	25.00	1900	1500	35
	27.50	2900	1700	
	30.00	4100	1900	
	32.50	4250	2200	
	35.00	4600	2450	
P47	25.00	2200	1700	135

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
	27.50	2400	1900	
	30.00	3500	2150	
	32.50	3750	2350	
	35.00	3900	2600	
P48	25.00	2150	1600	30
	27.50	2300	1850	
	30.00	2850	2050	
	32.50	2900	2250	
	35.00	3100	2450	
P49	25.00	2400	1500	30
	27.50	2550	1750	
	30.00	2450	1950	
	32.50	2650	2150	
	35.00	2950	2350	
P50	25.00	2250	1750	85
	27.50	2500	2000	
	30.00	2750	2200	
	32.50	3100	2400	
	35.00	3800	2600	
P51	25.00	2450	1600	80
	27.50	2800	1800	
	30.00	3050	2000	
	32.50	3450	2200	
	35.00	3700	2400	
P52	25.00	1650	1200	20
	27.50	2800	1450	
	30.00	3300	1700	
	32.50	3900	1950	
	35.00	2850	2200	
P53	25.00	2900	1650	70

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
	27.50	3050	1900	
	30.00	4000	2100	
	32.50	4750	2350	
	35.00	4250	2600	
P54	25.00	1950	1500	65
	27.50	2200	1700	
	30.00	2500	1950	
	32.50	2750	2200	
	35.00	2950	2400	
P55	25.00	1950	1450	30
	27.50	2300	1700	
	30.00	2650	1950	
	32.50	2750	2200	
	35.00	3050	2400	
P56	25.00	2150	1650	40
	27.50	2400	1900	
	30.00	2650	2100	
	32.50	2950	2350	
	35.00	3200	2600	
P57	25.00	2700	1650	65
	27.50	2450	1900	
	30.00	2650	2100	
	32.50	3550	2300	
	35.00	3950	2550	
P58	25.00	2150	1650	100
	27.50	2350	1900	
	30.00	2800	2100	
	32.50	3800	2350	
	35.00	4200	2600	
P59	25.00	1900	1450	40

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
	27.50	2200	1700	
	30.00	2900	1900	
	32.50	3300	2100	
	35.00	3450	2250	
P60	25.00	2250	1750	
	27.50	2450	1950	
	30.00	2650	2150	65
	32.50	3000	2350	
	35.00	3150	2550	

***** *Indicates Grade of Concrete*

10.4.2. For Pile diameter = 1200 mm

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
P41	25.00	2850	2200	
	27.50	3500	2500	
	30.00	3400	2750	95
	32.50	4300	3000	
	35.00	4100	3300	
P42	25.00	2750	2100	
	27.50	3900	2350	
	30.00	3400	2600	55
	32.50	3650	2900	
	35.00	4100	3200	
P43	25.00	2800	2100	
	27.50	3100	2400	
	30.00	4600	2650	130
	32.50	4650	2950	
	35.00	4600	3250	
P44	25.00	2900	2200	180

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
	27.50	3650	2500	
	30.00	3800	2800	
	32.50	4050	3050	
	35.00	5350	3350	
P45	25.00	2950	2250	115
	27.50	3500	2600	
	30.00	3700	2950	
	32.50	4150	3150	
	35.00	4550	3400	
P46	25.00	2550	1950	60
	27.50	4250	2250	
	30.00	6300	2550	
	32.50	6500	3000	
	35.00	7050	3400	
P47	25.00	2900	2150	180
	27.50	3150	2400	
	30.00	5050	2750	
	32.50	5350	3100	
	35.00	5550	3450	
P48	25.00	2850	2150	50
	27.50	3050	2400	
	30.00	4000	2700	
	32.50	3900	3000	
	35.00	4150	3250	
P49	25.00	3350	1950	50
	27.50	3600	2250	
	30.00	3250	2550	
	32.50	3550	2800	
	35.00	3950	3100	
P50	25.00	2950	2200	130

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
	27.50	3250	2500	
	30.00	3550	2750	
	32.50	4050	3050	
	35.00	5250	3300	
P51	25.00	3500	2100	120
	27.50	4050	2400	
	30.00	4350	2650	
	32.50	4950	2950	
	35.00	5300	3250	
P52	25.00	2250	1700	30
	27.50	4300	2000	
	30.00	5050	2350	
	32.50	6050	2700	
	35.00	4100	3050	
P53	25.00	4200	2150	105
	27.50	4400	2450	
	30.00	5950	2750	
	32.50	7150	3150	
	35.00	6250	3500	
P54	25.00	2600	1950	100
	27.50	2900	2200	
	30.00	3250	2500	
	32.50	3550	2800	
	35.00	3850	3050	
P55	25.00	2650	1900	50
	27.50	3150	2250	
	30.00	3600	2600	
	32.50	3700	2900	
	35.00	4100	3200	
P56	25.00	2750	2100	70

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
	27.50	3100	2350	
	30.00	3400	2650	
	32.50	3750	2950	
	35.00	4100	3250	
P57	25.00	3850	2150	95
	27.50	3250	2450	
	30.00	3500	2750	
	32.50	5000	3050	
	35.00	5650	3400	
P58	25.00	2900	2200	150
	27.50	3200	2450	
	30.00	3900	2800	
	32.50	5800	3200	
	35.00	6450	3550	
P59	25.00	2550	1900	65
	27.50	2950	2200	
	30.00	4150	2500	
	32.50	4700	2750	
	35.00	4950	3050	
P60	25.00	3000	2350	95
	27.50	3250	2600	
	30.00	3550	2850	
	32.50	4050	3100	
	35.00	4200	3400	

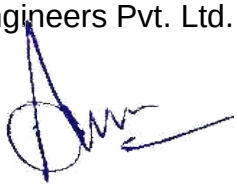
***** *Indicates Grade of Concrete*

10.5. Liquefaction Potential: All the bore holes have been analysed for Liquefaction potential as per IS: 1893 (part-1)-2016-(RA: 2021) with Seismic Zone IV, earthquake intensity of 7.0 on Richter scale and critical ground water table at existing ground level. Out of which several boreholes show the potential at various depths mentioned in the table below:

Bore No.	Liquefiable depth zone (meter)
P41	Top 1.00 & 5.00 to 6.00
P42	6.00 to 9.00
P43	Top 1.00 & 3.00 to 5.00
P44	Top 1.00 & 2.00 to 3.00
P45	4.00 to 5.00
P46	Top 9.00
P47	Top 1.00 & 2.00 to 3.00
P48	Top 1.00, 2.00 to 3.00 & 6.00 to 10.00
P49	Top 1.00, 3.00 to 4.00, 7.00 to 8.00 & 9.00 to 10.00
P50	Top 1.00 & 3.00 to 5.00
P51	Top 5.00
P52	Top 9.00 & 11.00 to 12.00
P53	Top 6.00
P54	Top 6.00
P55	Top 6.00 & 9.00 to 10.00
P56	Top 8.00
P57	Top 6.00
P58	Top 2.00 & 3.00 to 4.00
P59	Top 4.00 & 7.00 to 8.00
P60	Top 2.00 & 5.00 to 6.00

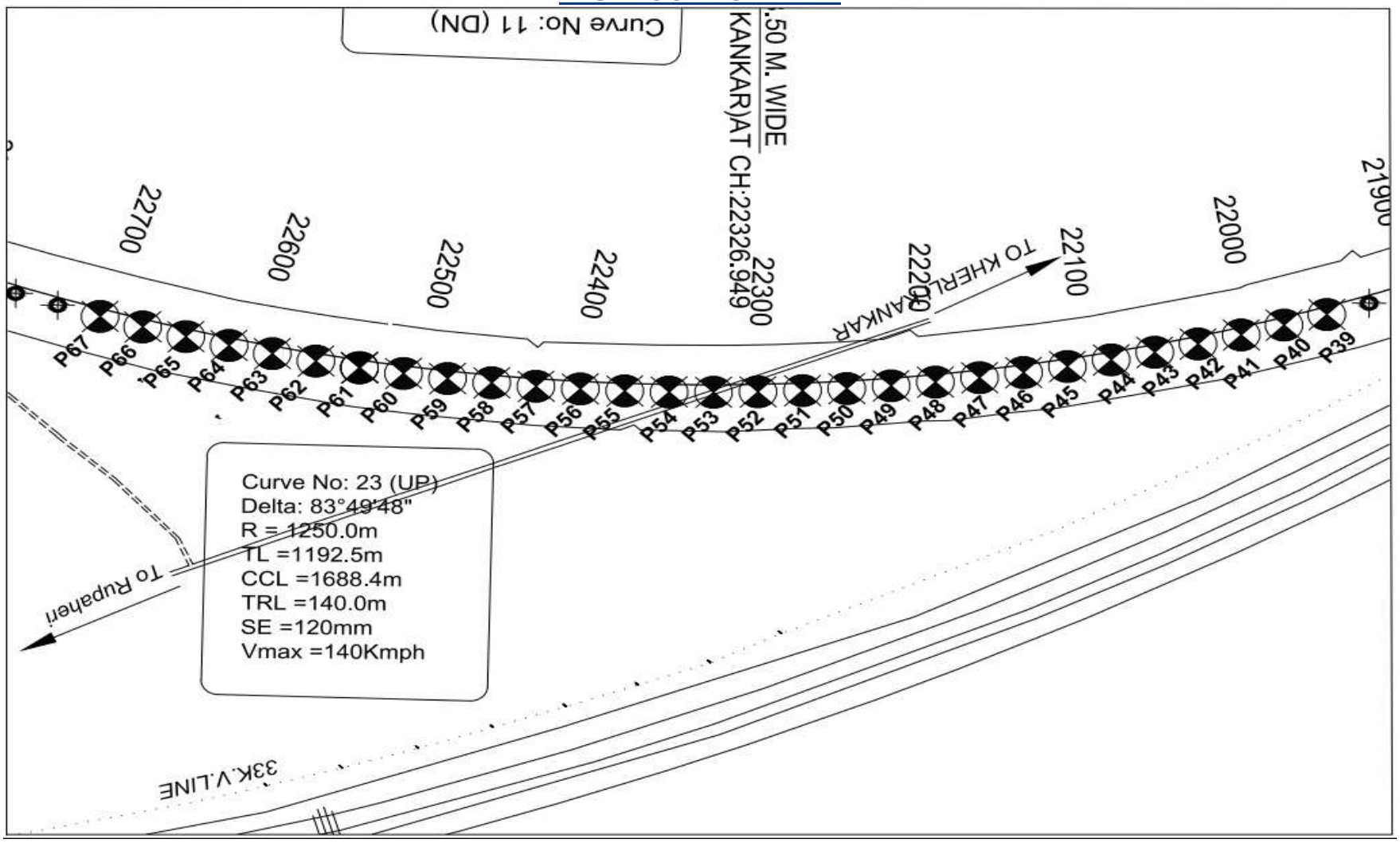
10.6. Type of cement to be used: No harmful chemicals are found within the soils. So, Ordinary Portland Cement or Portland Pozzolana Cement may be used for all civil constructions.

for Techpro Engineers Pvt. Ltd.



(Arvind K. Garg)
B.Tech.(Civil), M.Tech.
Principal Consultant &
Managing Director

APPENDIX-A
TEST LOCATION PLAN



APPENDIX "B"

TABLE 1: SUMMARY OF TEST RESULTS

Bore No : P41	**Ground Elevation : RL 191.144m**	**Method of drilling :Percussion**	**Depth of Water : 1.40 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 08/11/2023**	**SPT Sampler: Standard**
Location / Chainage : 21990.087	**Casing Lowered : 20.00 m**	**Ending Date : 10/11/2023**	**Hammer type: Rope-pulley**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	SM	0	1	1	48	50	0	13.24	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	1.00	D	2	1	1	2	3	3.00	CI	1	1	2	7	69	20	21.69	-	-	48.0	23.5	24.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of Intermediate plasticity											
	2.00	U	3	-	-	-	-	-	CL-CI	2	1	3	12	70	12	21.94	2.06	1.69	35.0	22.0	13.0	2.70	UU	62.0	7.4	-	0.598	-	18	13	-	Inorganic Clays of low to Intermediate plasticity											
	3.00	D	4	2	3	4	7	7.00	CI	0	0	1	7	75	17	22.88	-	-	44.0	23.0	21.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of Intermediate plasticity											
	4.00	D	5	3	3	6	9	9.00	CL	0	0	1	14	75	10	22.62	-	-	29.0	20.0	9.0	-	-	-	-	-	-	-	14	12	-	Inorganic clays of low plasticity											
	5.00	U	6	-	-	-	-	-	SM	0	0	0	64	36	0	26.29	1.93	1.53	Non Plastic			2.62	DST	1.0	28.3	-	0.712	-	-	-	-	Silty Sands											
	6.00	D	7	4	7	9	16	16.28	-	-	-	-	-	-	-	24.58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	7.00	D	8	4	8	9	17	16.50	ML	0	0	1	30	69	0	24.98	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	8.00	U	9	-	-	-	-	-	CL-ML	2	1	1	12	76	8	23.16	2.01	1.63	27.0	20.5	6.5	2.67	UU	43.0	12.2	0.106	0.638	-	-	-	-												
	9.00	D	10	5	8	10	18	16.38	-	-	-	-	-	-	-	19.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	10.00	U	11	4	9	11	20	17.06	-	-	-	-	-	-	-	21.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	11.00	U	12	-	-	-	-	-	CL	2	1	1	7	78	11	22.74	2.04	1.66	29.0	21.0	8.0	2.68	UU	53.0	10.7	-	0.614	-	6	16	-												
	12.50	D	13	6	7	12	19	19.00	-	-	-	-	-	-	-	21.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	14.00	U	14	-	-	-	-	-	CL	2	2	1	8	77	10	20.71	2.02	1.67	28.0	19.5	8.5	2.68	UU	58.0	11.5	-	0.605	-	-	-	-	Inorganic clays of low plasticity											
	15.50	D	15	8	10	13	23	23.00	-	-	-	-	-	-	-	19.81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	17.00	U	16	-	-	-	-	-	CL	0	0	2	11	75	12	19.28	2.04	1.71	30.0	20.0	10.0	2.68	UU	62.0	9.7	-	0.567	-	-	-	-												
	18.50	D	17	9	12	15	27	17.85	ML	3	0	0	34	63	0	20.96	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											

APPENDIX "B"
TABLE 1: SUMMARY OF TEST RESULTS

Bore No : P41	**Ground Elevation : RL 191.144m**	**Method of drilling :Percussion**	**Depth of Water : 1.40 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 08/11/2023**	**SPT Sampler: Standard**
Location / Chainage : 21990.087	**Casing Lowered : 20.00 m**	**Ending Date : 10/11/2023**	**Hammer type: Rope-pulley**

FIELD TEST RESULT										LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen												
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m²)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm²)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	20.00	D	18	-	-	-	-	-	CL	3	0	2	7	75	13	16.69	-	-	33.0	21.5	11.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	21.50	D	19	13	17	20	37	20.75	CL	2	1	2	10	78	7	19.41	-	-	28.0	21.0	7.0	-	-	-	-	-	-	-	-	-	-												
	23.00	D	20	-	-	-	-	-	-	-	-	-	-	-	-	22.00	2.09	1.71	-	-	-	-	RUU	48.0	8.9	-	-	-	-	-	-												
	24.50	D	21	14	20	22	42	21.63	-	-	-	-	-	-	-	23.98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	26.00	U	22	-	-	-	-	-	CL-ML	1	0	1	35	57	6	21.81	1.95	1.60	25.0	20.0	5.0	2.65	DST	8.0	24.8	-	0.656	-	-	-	-	Inorganic Silty Clays of low plasticity											
	27.50	D	23	12	19	21	40	20.28	CL	0	0	1	10	81	8	22.00	-	-	28.0	21.0	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	29.00	U	24	-	-	-	-	-	CL-ML	0	0	0	24	69	7	21.25	1.98	1.63	27.0	20.5	6.5	2.66	DST	10.0	24.7	-	0.632	-	-	-	-	Inorganic Silty Clays of low plasticity											
	30.50	D	25	15	21	26	47	21.78	ML	0	0	1	42	57	0	19.70	-	-		Non Plastic		-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	32.00	D	26	-	-	-	-	-	CL-ML	0	2	1	8	80	9	18.07	2.04	1.73	28	21.5	6.5	-	RUU	41.0	7.6	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	33.50	D	27	17	20	29	49	21.63	SM	0	0	1	54	45	0	19.15	-	-		Non Plastic		-	-	-	-	-	-	-	-	-	-	Silty Sands											
	35.00	D	28	-	-	-	-	-	-	-	-	-	-	-	-	18.40	2.08	1.76	-	-	-	2.65	RDST	4.0	26.1	-	0.506	-	-	-	-												
	36.50	D	29	21	25	29	54	54.00	CL	2	1	1	7	78	11	13.75	-	-	30.0	20.0	10.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	38.00	D	30	22	25	32	57	57.00	-	-	-	-	-	-	-	22.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	40.00	D	31	26	29	35	64	64.00	-	-	-	-	-	-	-	22.33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 2: SUMMARY OF TEST RESULTS

Bore No: P42	**Ground Elevation: RL 191.252 m**	**Method of drilling: Percussion**	**Depth of Water: 1.28 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 14/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 22016.287	**Casing Lowered: 19.00 m**	**Ending Date: 17/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen												
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	0.50	D	1	-	-	-	-	-	SM	0	0	1	55	44	0	14.15	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	1.00	U	2	-	-	-	-	-	CI	0	0	0	17	66	17	21.44	2.03	1.67	39.5	22.0	17.5	2.67	UU	69.0	8.6	0.208	0.599	-	20	19	-	Inorganic clays of Intermediate plasticity										
	2.00	D	3	4	4	6	10	10.00	CL	1	1	0	12	74	12	19.64	-	-	33.0	21.0	12.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	3.00	D	4	2	4	8	12	12.00	CL	0	1	0	47	43	9	19.82	-	-	29.0	19.5	9.5	-	-	-	-	-	-	-	-	-	-											
	4.00	U	5	-	-	-	-	-	CI	0	1	0	6	76	17	28.69	2.01	1.56	38.0	23.0	15.0	2.68	UU	71.0	7.8	-	0.718	-	-	-	-	Inorganic clays of Intermediate plasticity										
	5.00	D	6	5	7	9	16	16.72	SM	0	0	1	77	22	0	23.94	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	6.00	D	7	3	5	9	14	15.22	SM	0	0	0	83	17	0	24.96	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-											
	7.00	D	8	-	-	-	-	-	-	-	-	-	-	-	-	24.91	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	8.00	D	9	4	5	8	13	13.34	-	-	-	-	-	-	-	25.95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	9.00	D	10	3	4	7	11	11.00	CL	5	2	2	7	72	12	17.92	-	-	30.0	19.5	10.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	10.00	U	11	-	-	-	-	-	CL	7	3	3	10	67	10	23.58	2.08	1.68	28.5	18.5	10.0	2.67	UU	52.0	11.6	-	0.589	-	8	15	-											
	11.00	D	12	5	7	11	18	18.00	-	-	-	-	-	-	-	19.33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	12.00	D	13	6	11	14	25	25.00	CL	2	1	0	8	82	7	21.13	-	-	27.5	20.0	7.5	-	-	-	-	-	-	-	-	-	-											
	13.00	U	14	-	-	-	-	-	CL	1	0	2	9	77	11	20.68	2.04	1.69	31.0	19.5	11.5	2.67	UU	56.0	10.4	-	0.580	-	14	15	-											
	14.50	D	15	4	7	10	17	17.00	CL	5	2	3	11	66	13	20.99	-	-	33.0	20.0	13.0	-	-	-	-	-	-	-	-	-	-											
	16.00	U	16	-	-	-	-	-	CL	0	1	1	16	75	7	21.74	2.03	1.67	28.0	21.0	7.0	2.66	DST	14.0	24.6	-	0.593	-	-	-	-											
	17.50	D	17	4	7	11	18	18.00	CL	6	2	3	15	62	12	18.72	-	-	31.0	19.5	11.5	-	-	-	-	-	-	-	-	-	-											

APPENDIX "B"
TABLE 2: SUMMARY OF TEST RESULTS

Bore No: P42	**Ground Elevation: RL 191.252 m**	**Method of drilling: Percussion**	**Depth of Water: 1.28 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 14/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 22016.287	**Casing Lowered: 19.00 m**	**Ending Date: 17/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																														
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen										
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	19.00	U	18	-	-	-	-	-	CL	6	3	2	20	62	7	22.14	2.00	1.64	28.5	21.5	7.0	2.67	DST	11.0	26.3	-	0.628	-	8	20	-	Inorganic clays of low plasticity										
	20.50	D	19	3	7	21	28	17.77	-	-	-	-	-	-	-	22.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	22.00	U	20	-	-	-	-	-	CI	1	1	1	5	78	14	19.24	2.02	1.69	37.0	22.0	15.0	2.68	UU	62.0	8.3	-	0.586	-	-	-	-	Inorganic clays of Intermediate plasticity										
	23.50	D	21	6	17	19	36	36.00	-	-	-	-	-	-	-	18.54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	25.00	U	22	-	-	-	-	-	CL	3	1	1	10	76	9	19.72	2.04	1.70	29.0	21.0	8.0	2.66	UU	49.0	10.6	-	0.565	-	-	-	-	Inorganic clays of low plasticity										
	26.50	D	23	17	27	29	56	56.00	-	-	-	-	-	-	-	18.66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	28.00	U	24	-	-	-	-	-	MI	0	0	0	6	82	12	27.95	2.07	1.62	36.0	26.0	10.0	2.68	UU	54.0	9.7	-	0.654	-	-	-	-	Inorganic Silts of Intermediate plasticity										
	29.50	D	25	13	18	29	47	21.98	SM	0	0	0	65	35	0	19.78	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	31.00	U	26	-	-	-	-	-	ML	0	0	0	48	52	0	17.24	2.00	1.71	Non-Plastic			2.62	DST	2.0	26.5	-	0.532	-	-	-	-	Inorganic Silts of low plasticity										
	32.50	D	27	17	26	30	56	23.90	CL-ML	0	0	1	18	76	5	19.77	-	-	26.5	21.5	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	34.00	D	28	16	24	29	53	22.65	-	-	-	-	-	-	-	17.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	35.50	D	29	16	18	32	50	50.00	CL	2	1	1	22	66	8	18.74	-	-	27.5	19.5	8.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	37.00	D	30	12	14	35	49	49.00	-	-	-	-	-	-	-	20.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	38.50	D	31	14	20	27	47	47.00	CL	0	1	2	32	58	7	20.00	-	-	27.5	19.5	8.0	-	-	-	-	-	-	-	-	-	-											
	40.00	D	32	16	21	29	50	50.00	-	-	-	-	-	-	-	19.39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"

TABLE 3: SUMMARY OF TEST RESULTS

Bore No: P43	**Ground Elevation: RL 191.241 m**	**Method of drilling: Percussion**	**Depth of Water: 1.30 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 20/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 22042.487	**Casing Lowered: 20.00 m**	**Ending Date: 22/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	SM	0	0	1	54	45	0	11.65	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	1.00	D	2	-	-	-	-	-	CL	0	0	1	34	58	7	20.67	-	-	27.5	19.5	8.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	2.00	D	3	1	2	4	6	6.00	CL	0	0	0	28	60	12	21.01	-	-	32.0	20.0	12.0	-	-	-	-	-	-	-	-	-	-												
	3.00	D	4	2	3	3	6	7.85	SM	0	0	0	55	45	0	21.55	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	4.00	U	5	-	-	-	-	-	SM	0	0	0	65	35	0	28.36	1.94	1.51	Non-Plastic			2.62	DST	0.0	27.3	-	0.735	-	-	-	-												
	5.00	D	6	4	4	8	12	14.16	-	-	-	-	-	-	-	25.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	6.00	D	7	3	5	7	12	13.57	-	-	-	-	-	-	-	26.08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	7.00	U	8	-	-	-	-	-	CL-ML	0	1	1	25	66	7	19.04	2.04	1.71	26.0	21.5	4.5	2.66	DST	8.0	26.5	-	0.556	-	8	17	-	Inorganic Silty Clays of low plasticity											
	8.00	D	9	4	6	7	13	13.54	CL	0	0	1	18	72	9	19.30	-	-	27.5	20.5	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	9.00	D	10	5	7	9	16	15.54	-	-	-	-	-	-	-	20.28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	10.00	U	11	-	-	-	-	-	CL	3	1	1	14	71	10	23.64	2.02	1.63	29.0	19.5	9.5	2.67	UU	44.0	9.5	0.139	0.638	-	-	-	-												
	11.00	D	12	8	12	15	27	27.00	-	-	-	-	-	-	-	18.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	12.00	D	13	10	13	18	31	31.00	CL	1	1	1	8	77	12	21.12	-	-	31.0	20.5	10.5	-	-	-	-	-	-	-	17	19	-												
	13.00	U	14	-	-	-	-	-	-	-	-	-	-	-	-	20.75	2.06	1.71	-	-	-	2.67	UU	54.0	8.5	-	0.561	-	-	-	-												
	14.50	D	15	4	6	8	14	14.00	-	-	-	-	-	-	-	21.60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	16.00	U	16	-	-	-	-	-	CL	0	1	1	10	77	11	21.39	2.03	1.67	31.0	20.0	11.0	2.68	UU	57.0	9.3	-	0.605	-	-	-	-												
	17.50	D	17	4	8	10	18	18.00	CL	0	0	1	8	81	10	21.56	-	-	30.5	20.0	10.5	-	-	-	-	-	-	-	-	-	-												

APPENDIX "B"
TABLE 3: SUMMARY OF TEST RESULTS

Bore No: P43	**Ground Elevation: RL 191.241 m**	**Method of drilling: Percussion**	**Depth of Water: 1.30 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 20/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 22042.487	**Casing Lowered: 20.00 m**	**Ending Date: 22/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen													
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	19.00	D	18	-	-	-	-	-	-	-	-	-	-	-	-	25.34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	20.50	D	19	7	8	14	22	15.65	CL-ML	2	1	1	34	55	7	19.74	-	-	27.0	21.0	6.0	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	22.00	U	20	-	-	-	-	-	CL	0	2	3	14	72	9	20.77	2.04	1.69	28.0	20.0	8.0	2.66	UU	52.0	9.4	-	0.574	-	9	18	-	Inorganic clays of low plasticity											
	23.50	D	21	13	15	16	31	31.00	CL	6	2	3	27	56	6	17.59	-	-	28.0	20.0	8.0	-	-	-	-	-	-	-	-	-	-												
	25.00	D	22	-	-	-	-	-	CL	1	1	1	14	73	10	22.62	-	-	29.0	20.0	9.0	-	-	-	-	-	-	-	-	-	-												
	26.50	D	23	9	17	32	49	49.00	-	-	-	-	-	-	-	21.20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	28.00	D	24	-	-	-	-	-	CL	0	0	1	11	76	12	23.35	2.10	1.70	32.0	21.0	11.0	2.67	RUU	62.0	9.2	-	0.571	-	-	-	-												
	29.50	D	25	13	17	22	39	39.00	-	-	-	-	-	-	-	16.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	31.00	U	26	-	-	-	-	-	CL	2	1	2	34	53	8	18.22	1.96	1.66	28.0	19.5	8.5	2.66	UU	46.0	10.8	-	0.602	-	-	-	-												
	32.50	D	27	28	32	35	67	27.21	SM	0	0	0	55	45	0	19.96	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	34.00	D	28	20	28	30	58	24.17	-	-	-	-	-	-	-	17.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Silty Sands											
	35.50	D	29	17	20	28	48	20.96	-	-	-	-	-	-	-	18.65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	37.00	D	30	-	-	-	-	-	CL-ML	5	2	2	38	45	8	17.31	2.03	1.73	27.5	21.5	6.0	2.66	RDST	18.0	25.4	-	0.538	-	-	-	-												
	38.50	D	31	16	20	30	50	20.85	-	-	-	-	-	-	-	14.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	40.00	D	32	15	24	33	57	22.37	CL-ML	1	1	4	35	52	7	12.95	-	-	27.0	21.5	5.5	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 4: SUMMARY OF TEST RESULTS

Bore No: P44	**Ground Elevation: RL 191.27 m**	**Method of drilling: Percussion**	**Depth of Water: 1.20 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 17/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 22068.687	**Casing Lowered: 19.00 m**	**Ending Date: 19/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	0.50	D	1	-	-	-	-	-	SM	0	0	0	52	48	0	11.72	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	1.00	U	2	-	-	-	-	-	MI	4	2	3	8	70	13	15.92	2.07	1.79	36.0	25.0	11.0	2.67	UU	57.0	10.2	-	0.492	-	-	-	-	Inorganic Silts of Intermediate plasticity										
	2.00	D	3	2	3	3	6	8.21	ML	0	0	1	44	55	0	18.25	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity										
	3.00	D	4	4	7	10	17	18.33	SM	0	0	1	59	40	0	18.59	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	4.00	U	5	-	-	-	-	-	SM	0	0	0	82	18	0	20.42	1.94	1.61	Non-Plastic			2.65	DST	5.0	26.7	-	0.646	-	-	-	-											
	5.00	D	6	5	6	8	14	15.59	-	-	-	-	-	-	-	24.82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	6.00	D	7	5	7	9	16	16.38	SM	0	0	1	55	44	0	27.62	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-											
	7.00	U	8	-	-	-	-	-	CL-ML	3	1	2	38	49	7	16.82	2.01	1.72	26.0	21.0	5.0	2.65	DST	8.0	26.2	0.133	0.541	-	-	-	-	Inorganic Silty Clays of low plasticity										
	8.00	D	9	3	5	7	12	12.33	-	-	-	-	-	-	-	18.32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	9.00	D	10	3	4	8	12	12.00	CL	5	4	7	8	64	12	17.19	-	-	31.0	20.5	10.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	10.00	U	11	-	-	-	-	-	CL	0	0	1	9	79	11	15.42	1.90	1.65	32.0	22.0	10.0	2.67	UU	58.0	8.6	-	0.618	-	14	19	-											
	11.00	D	12	5	6	9	15	15.00	-	-	-	-	-	-	-	17.70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	12.00	D	13	5	7	9	16	16.00	CL	0	0	1	14	75	10	21.37	-	-	29.0	20.0	9.0	-	-	-	-	-	-	-	-	-	-											
	13.00	U	14	-	-	-	-	-	CL	3	1	2	8	74	12	17.08	2.06	1.76	33.0	22.0	11.0	2.68	UU	57.0	9.8	-	0.523	-	16	17	-											
	14.50	D	15	3	6	8	14	14.00	-	-	-	-	-	-	-	13.45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	16.00	D	16	-	-	-	-	-	CL	1	1	2	12	74	10	10.84	-	-	32.0	22.0	10.0	-	-	-	-	-	-	-	-	-	-											
	17.50	D	17	4	6	12	18	18.00	-	-	-	-	-	-	-	15.73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											

APPENDIX "B"
TABLE 4: SUMMARY OF TEST RESULTS

Bore No: P44	**Ground Elevation: RL 191.27 m**	**Method of drilling: Percussion**	**Depth of Water: 1.20 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 17/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 22068.687	**Casing Lowered: 19.00 m**	**Ending Date: 19/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	19.00	U	18	-	-	-	-	-	-	-	-	-	-	-	-	17.31	2.02	1.72	-	-	-	2.67	UU	52.0	9.5	-	0.552	-	-	-	-	Inorganic clays of low plasticity										
	20.50	D	19	6	11	18	29	18.26	CL	0	1	1	24	65	9	18.23	-	-	28.0	21.0	7.0	-	-	-	-	-	-	-	-	-											
	22.00	D	20	-	-	-	-	-	-	-	-	-	-	-	-	15.91	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	23.50	D	21	7	8	14	22	15.16	CL-ML	3	1	2	36	53	5	12.00	-	-	26.0	21.5	4.5	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	25.00	U	22	-	-	-	-	-	CL	4	2	1	8	73	12	18.12	2.06	1.74	31.0	19.5	11.5	2.68	UU	55.0	10.2	-	0.540	-	-	-	-	Inorganic clays of low plasticity										
	26.50	D	23	8	12	23	35	18.99	CL-ML	4	1	2	15	70	8	12.50	-	-	28.0	21.5	6.5	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	28.00	U	24	-	-	-	-	-	SM-SC	6	3	5	41	40	5	15.96	1.97	1.70	25.0	20.0	5.0	2.64	DST	2.0	28.5	-	0.553	-	-	-	-	Silty Sands with clay binder										
	29.50	D	25	12	24	28	52	23.71	ML	0	0	1	48	51	0	15.43	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity										
	31.00	D	26	15	18	27	45	21.19	SM-SC	6	2	4	41	42	5	11.67	-	-	26.0	21.0	5.0	-	-	-	-	-	-	-	-	-	Silty Sands with clay binder										
	32.50	D	27	18	22	28	50	22.41	ML	0	0	1	44	55	0	10.95	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity										
	34.00	D	28	19	25	26	51	22.41	CL-ML	3	2	1	34	54	6	13.18	-	-	27.0	21.0	6.0	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	35.50	D	29	20	28	22	50	21.83	SM-SC	7	2	3	46	37	5	13.19	-	-	26.0	21.0	5.0	-	-	-	-	-	-	-	-	-	Silty Sands with clay binder										
	37.00	D	30	14	24	29	53	22.41	-	-	-	-	-	-	-	9.75	-	-	-	-	-	2.65	-	-	-	-	-	-	-	-	-											
	38.50	D	31	13	23	28	51	21.58	ML	2	1	1	42	54	0	12.97	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity										
	40.00	D	32	14	21	27	48	20.49	SM	1	3	2	46	48	0	14.23	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 5: SUMMARY OF TEST RESULTS

Bore No : P45	**Ground Elevation : RL 191.379 m**	**Method of drilling :Percussion**	**Depth of Water : 1.50 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 08/11/2023**	**SPT Sampler: Standard**
Location / Chainage : 22094.887	**Casing Lowered : 18.00 m**	**Ending Date : 10/11/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	CL-ML	1	1	1	42	49	6	12.74	-	-	26.0	20.5	5.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	1.00	U	2	-	-	-	-	-	CL-ML	1	0	1	44	47	7	11.28	1.95	1.75	25.0	20.0	5.0	2.66	DST	4.0	26.7	-	0.520	-	-	-	-												
	2.00	D	3	2	3	4	7	7.00	CL	4	2	1	16	67	10	19.78	-	-	29.0	20.5	8.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	3.00	D	4	2	2	4	6	6.00	-	-	-	-	-	-	-	18.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	4.00	U	5	-	-	-	-	-	SM	0	0	0	65	35	0	22.50	1.96	1.60	Non-Plastic			2.62	DST	0.0	27.2	-	0.638	-	-	-	-	Silty Sands											
	5.00	D	6	5	7	9	16	16.77	SM	0	0	1	62	37	0	29.51	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	6.00	D	7	4	6	8	14	15.27	-	-	-	-	-	-	-	21.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	7.00	U	8	-	-	-	-	-	SM	0	0	1	67	32	0	24.66	1.97	1.58	Non-Plastic			2.63	DST	0.0	28.1	-	-	-	-	-	-												
	8.00	D	9	3	5	8	13	13.40	SM	0	1	2	61	36	0	25.12	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	9.00	D	10	5	7	12	19	16.98	-	-	-	-	-	-	-	22.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	10.00	U	11	-	-	-	-	-	CL	2	1	1	10	77	9	22.22	2.02	1.65	28.0	21.0	7.0	2.67	UU	47.0	12.3	0.123	0.618	-	8	18	-	Inorganic clays of low plasticity											
	11.00	D	12	5	9	14	23	18.27	-	-	-	-	-	-	-	20.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	12.00	D	13	6	8	13	21	17.05	-	-	-	-	-	-	-	19.70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	13.00	U	15	-	-	-	-	-	CL	2	1	1	8	77	11	22.26	2.04	1.67	29.0	19.5	9.5	2.68	UU	55.0	10.9	-	-	-	6	15	-												
	14.50	D	16	5	9	14	23	23.00	-	-	-	-	-	-	-	18.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	16.00	U	17	-	-	-	-	-	CL	4	1	2	7	74	12	21.72	2.06	1.69	31.0	21.0	10.0	2.68	UU	59.0	9.3	-	0.586	-	-	-	-												
	17.50	D	18	9	14	24	38	38.00	-	-	-	-	-	-	-	15.86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

APPENDIX "B"
TABLE 5: SUMMARY OF TEST RESULTS

Bore No : P45	Ground Elevation : RL 191.379 m	Method of drilling :Percussion	Depth of Water : 1.50 m
Diameter of Bore Hole : 150 mm	Bore Retained using : Casing	Starting Date : 08/11/2023	SPT Sampler: Standard
Location / Chainage : 22094.887	Casing Lowered : 18.00 m	Ending Date : 10/11/2023	Hammer type: Auto-trip

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	19.00	U	19	-	-	-	-	-	CL	2	1	1	9	76	11	19.90	2.05	1.71	29.0	19.0	10.0	2.68	UU	57.0	11.2	-	0.567	-	-	-	-												
	20.50	D	20	11	17	26	43	43.00	-	-	-	-	-	-	-	21.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	22.00	U	21	-	-	-	-	-	CL	2	1	2	5	77	13	19.04	2.04	1.71	30.0	20.5	9.5	2.67	UU	61.0	8.2	-	0.561	-	-	-	-	Inorganic clays of low plasticity											
	23.50	D	22	8	18	27	45	45.00	-	-	-	-	-	-	-	21.08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	25.00	U	23	-	-	-	-	-	CL	1	1	2	7	78	11	15.84	2.05	1.77	32.0	22.5	9.5	2.68	UU	55.0	10.4	-	-	-	-	-	-												
	26.50	D	24	12	17	25	42	21.22	ML	0	0	1	27	68	4	21.24	-	-	24.0	20.0	4.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	28.00	U	25	-	-	-	-	-	MI	0	0	1	7	74	18	33.36	2.04	1.53	42.0	28.0	14.0	2.70	UU	77.0	12.3	-	0.765	-	-	-	-												
	29.50	D	26	18	27	35	62	62.00	-	-	-	-	-	-	-	28.41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of Intermediate plasticity											
	31.00	D	27	17	22	33	55	55.00	-	-	-	-	-	-	-	27.34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	32.50	D	28	13	20	25	45	20.71	CL-ML	4	2	2	12	73	7	16.80	-	-	26.0	20.5	5.5	-	-	-	-	-	-	-	-	-	-												
	34.00	D	29	-	-	-	-	-	CL-ML	3	2	3	22	62	8	15.99	2.01	1.73	27.0	20.5	6.5	2.66	RDST	14.0	20.1	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	35.50	D	30	14	25	35	60	24.27	-	-	-	-	-	-	-	16.82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	37.00	D	31	16	28	28	56	22.79	ML	0	0	0	44	56	0	17.32	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	38.50	D	32	13	21	25	46	19.80	-	-	-	-	-	-	-	17.56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	40.00	D	33	14	22	32	54	21.65	CL-ML	5	2	3	32	52	6	17.37	-	-	26	20.5	5.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 6: SUMMARY OF TEST RESULTS

Bore No : P46	**Ground Elevation : RL 191.386 m**	**Method of drilling :Percussion**	**Depth of Water : 1.60 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 06/11/2023**	**SPT Sampler: Standard**
Location / Chainage : 22121.087	**Casing Lowered : 20.00 m**	**Ending Date : 09/11/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (KN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	SM	0	0	1	55	44	0	9.36	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	1.00	U	2	-	-	-	-	-	SM-SC	1	1	0	53	40	5	13.54	1.94	1.71	25.0	20.5	4.5	2.65	DST	6.0	25.7	-	0.550	-	-	-	-												
	2.00	D	3	1	2	3	5	6.77	SM-SC	5	2	3	43	40	7	17.97	-	-	27.0	21.0	6.0	-	-	-	-	-	-	-	-	-	-	Silty Sands with clay binder											
	3.00	D	4	3	3	6	9	11.47	-	-	-	-	-	-	-	18.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	4.00	D	5	-	-	-	-	-	SM	0	0	0	75	25	0	23.60	2.00	1.62	Non-Plastic			-	RDST	1.0	26.3	-	-	-	-	-	-												
	5.00	D	6	2	2	4	6	6.90	-	-	-	-	-	-	-	25.58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	6.00	D	7	2	3	5	8	8.81	-	-	-	-	-	-	-	23.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Silty Sands											
	7.00	U	8	-	-	-	-	-	SM	0	0	1	82	17	0	23.93	1.90	1.53	Non-Plastic			2.61	DST	0.0	29.5	-	0.706	-	-	-	-												
	8.00	D	9	3	5	7	12	12.35	-	-	-	-	-	-	-	22.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	9.00	D	10	5	8	9	17	17.00	CL	7	2	4	22	56	9	18.30	-	-	28.0	20.5	7.5	-	-	-	-	-	-	-	-	-	-												
	10.00	U	11	-	-	-	-	-	CL	4	2	1	24	59	10	20.49	2.02	1.68	28.0	19.0	9.0	2.66	UU	47.0	10.2	0.140	0.583	-	6	17	-												
	11.00	D	12	4	8	11	19	19.00	-	-	-	-	-	-	-	19.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	12.00	D	13	6	10	12	22	22.00	-	-	-	-	-	-	-	19.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	13.00	U	14	-	-	-	-	-	CL	0	0	1	8	79	12	18.76	2.04	1.72	31.0	20.5	10.5	2.67	UU	57.0	9.2	-	0.552	-	8	18	-												
	14.50	D	15	8	14	17	31	31.00	-	-	-	-	-	-	-	19.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	16.00	U	16	-	-	-	-	-	CL-ML	2	1	1	32	58	6	18.54	2.02	1.70	25.0	20.0	5.0	2.66	DST	7.0	26.2	-	0.565	-	-	-	-	Inorganic Silty Clays of low plasticity											
	17.50	D	17	6	12	16	28	18.56	-	-	-	-	-	-	-	19.65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

APPENDIX "B"
TABLE 6: SUMMARY OF TEST RESULTS

Bore No : P46	Ground Elevation : RL 191.386 m	Method of drilling :Percussion	Depth of Water : 1.60 m
Diameter of Bore Hole : 150 mm	Bore Retained using : Casing	Starting Date : 06/11/2023	SPT Sampler: Standard
Location / Chainage : 22121.087	Casing Lowered : 20.00 m	Ending Date : 09/11/2023	Hammer type: Auto-trip

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	19.00	U	18	-	-	-	-	-	CL	3	2	1	22	63	9	17.95	2.02	1.71	28.0	20.5	7.5	2.66	UU	48.0	10.7	-	0.556	-	-	-	-	Inorganic clays of low plasticity											
	20.50	D	19	9	17	22	39	39.00	CL	0	0	0	6	82	12	14.99	-	-	29.0	19.0	10.0	-	-	-	-	-	-	-	-	-	-												
	22.00	U	20	-	-	-	-	-	CL	1	1	0	12	77	9	19.62	2.03	1.70	28.0	20.0	8.0	2.68	UU	52.0	11.6	-	0.576	-	-	-	-												
	23.50	D	21	18	24	31	55	26.62	CL-ML	0	0	1	32	62	5	16.43	-	-	26.0	21.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	25.00	D	22	15	20	29	49	49.00	CL	0	0	1	14	75	10	14.57	-	-	29.0	19.5	9.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	26.50	D	23	15	24	32	56	56.00	-	-	-	-	-	-	-	21.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	28.00	D	24	17	28	33	61	61.00	CL	0	1	0	6	80	13	24.14	-	-	33.0	19.0	14.0	-	-	-	-	-	-	-	-	-	-												
	29.50	D	25	20	31	34	65	27.87	SM-SC	2	1	2	46	44	5	14.74	-	-	24.0	20.0	4.0	-	-	-	-	-	-	-	-	-	-	Silty Sands with clay binder											
	31.00	D	26	22	34	34	68	28.35	-	-	-	-	-	-	-	15.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	32.50	D	27	19	28	29	57	24.47	SM	0	0	0	81	19	0	22.42	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	34.00	D	28	-	-	-	-	-	SM	0	1	2	79	18	0	22.33	2.17	1.77	Non-Plastic			2.65	RDST	0.0	32.1	-	0.497	-	-	-	-												
	35.50	D	29	16	25	27	52	22.12	-	-	-	-	-	-	-	21.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	37.00	D	30	-	-	-	-	-	SM	0	0	1	82	17	0	22.48	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	38.50	D	31	17	26	29	55	22.29	-	-	-	-	-	-	-	21.49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	40.00	D	32	20	28	31	59	23.03	SM	0	0	2	77	21	0	19.95	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"

TABLE 7: SUMMARY OF TEST RESULTS

Bore No : P47	**Ground Elevation : RL 191.466 m**	**Method of drilling :Percussion**	**Depth of Water : 1.60 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 05/11/2023**	**SPT Sampler: Standard**
Location / Chainage : 22147.287	**Casing Lowered : 20.00 m**	**Ending Date : 08/11/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	SM	0	0	1	55	44	0	7.54	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	1.00	D	2	1	1	1	2	2.00	CL	0	0	1	28	63	8	22.00	-	-	27.0	19.5	7.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	2.00	D	3	-	-	-	-	-	ML	4	2	3	36	51	4	18.33	-	-	24.0	20.0	4.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	3.00	D	4	2	4	5	9	11.68	CL-ML	3	2	1	14	71	9	17.41	-	-	28.0	21.5	6.5	-	-	-	-	-	-	-	8	20	-	Inorganic Silty Clays of low plasticity											
	4.00	D	5	4	5	6	11	13.55	SM	0	0	0	65	35	0	25.78	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	5.00	U	6	-	-	-	-	-	SM	0	0	0	75	25	0	26.43	1.89	1.49	Non-Plastic			2.62	DST	0.0	27.4	-	0.753	-	-	-	-												
	6.00	D	7	5	7	9	16	16.55	-	-	-	-	-	-	-	24.66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	7.00	D	8	5	10	11	21	18.94	-	-	-	-	-	-	-	30.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	8.00	U	9	-	-	-	-	-	SM	0	0	1	70	29	0	22.45	1.93	1.58	Non-Plastic			2.61	DST	0.0	28.2	-	0.652	-	-	-	-												
	9.00	D	10	4	8	9	17	16.14	SM	0	0	2	62	36	0	28.53	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	10.00	D	11	5	8	11	19	16.86	-	-	-	-	-	-	-	28.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	11.00	U	12	-	-	-	-	-	CL	2	1	1	7	79	10	20.77	2.02	1.67	28.0	20.5	7.5	2.67	UU	50.0	9.1	0.139	0.599	-	-	-	-	Inorganic clays of low plasticity											
	12.50	D	13	8	13	15	28	28.00	-	-	-	-	-	-	-	21.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	14.00	D	15	-	-	-	-	-	SM	0	0	0	66	34	0	21.09	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	15.50	D	16	5	9	11	20	15.92	CL-ML	0	0	1	18	74	7	19.99	-	-	26.0	20.5	5.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	17.00	U	17	-	-	-	-	-	CL	7	2	3	7	70	11	16.14	2.03	1.75	29.0	19.5	9.5	2.67	UU	54.0	10.4	-	0.526	-	10	17	-	Inorganic clays of low plasticity											
	18.50	D	18	9	14	20	34	34.00	-	-	-	-	-	-	-	16.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

APPENDIX "B"

TABLE 7: SUMMARY OF TEST RESULTS

Bore No : P47	**Ground Elevation : RL 191.466 m**	**Method of drilling :Percussion**	**Depth of Water : 1.60 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 05/11/2023**	**SPT Sampler: Standard**
Location / Chainage : 22147.287	**Casing Lowered : 20.00 m**	**Ending Date : 08/11/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	20.00	U	19	-	-	-	-	-	-	-	-	-	-	-	-	18.45	2.02	1.70	-	-	-	2.67	UU	53.0	10.6	-	0.566	-	-	-	-	Inorganic clays of low plasticity											
	21.50	D	20	8	15	22	37	37.00	CL	2	1	1	8	80	8	16.59	-	-	27.0	19.5	7.5	-	-	-	-	-	-	-	-	-	-												
	23.00	U	21	-	-	-	-	-	CL	2	1	0	5	79	13	17.76	2.05	1.74	33.0	22.5	10.5	2.69	UU	63.0	9.4	-	0.546	-	-	-	-												
	24.50	D	22	12	22	30	52	52.00	CL	0	0	1	7	82	10	18.53	-	-	29.0	21.0	8.0	-	-	-	-	-	-	-	-	-	-												
	26.00	D	23	9	17	24	41	21.23	ML	0	0	1	38	57	4	22.07	-	-	24.0	20.0	4.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	27.50	D	24	11	20	25	45	22.15	-	-	-	-	-	-	-	18.32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	29.00	U	25	-	-	-	-	-	CL	2	1	0	7	78	12	15.84	2.02	1.74	30.0	20.5	9.5	2.68	UU	57.0	11.6	-	0.540	-	-	-	-	Inorganic clays of low plasticity											
	30.50	D	26	13	22	26	48	22.31	SM	0	0	0	72	28	0	22.94	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	32.00	D	27	-	-	-	-	-	SM	0	0	1	67	32	0	20.56	2.09	1.73	Non-Plastic			-	RDST	0.0	29.3	-	-	-	-	-	-												
	33.50	D	28	15	24	27	51	22.40	-	-	-	-	-	-	-	18.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	35.00	D	29	-	-	-	-	-	SM	0	0	0	62	38	0	19.98	2.08	1.73	Non-Plastic			2.65	RDST	0.0	30.6	-	0.532	-	-	-	-												
	36.50	D	30	16	28	32	60	24.14	-	-	-	-	-	-	-	23.15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	38.00	D	31	18	25	31	56	22.65	SM	0	1	2	57	40	0	23.93	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	40.00	D	32	21	29	33	62	23.86	-	-	-	-	-	-	-	13.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 8: SUMMARY OF TEST RESULTS

Bore No: P48	Ground Elevation: RL 191.215 m	Method of drilling: Percussion	Depth of Water: 1.70 m
Diameter of Bore Hole: 150 mm	Bore Retained using: Casing	Starting Date: 12/10/2023	SPT Sampler: Standard
Location / Chainage: 22173.487	Casing Lowered: 18.00 m	Ending Date: 15/10/2023	Hammer type: Auto-trip

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	ML	0	0	1	42	57	0	6.24	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	1.00	D	2	1	1	2	3	3.00	CL	1	1	0	14	76	8	17.33	-	-	27.5	20.0	7.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	2.00	U	3	-	-	-	-	-	SM-SC	2	1	1	55	36	5	21.83	2.01	1.65	26.0	20.5	5.5	2.65	DST	3.0	27.6	-	0.606	-	0	19	-	Silty Sands with clay binder											
	3.00	D	4	3	5	6	11	13.77	CL-ML	2	2	2	10	76	8	21.31	-	-	28.0	22.0	6.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	4.00	D	5	3	5	7	12	14.25	SM	0	0	0	53	47	0	25.40	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	5.00	D	6	-	-	-	-	-	-	-	-	-	-	-	-	22.68	2.00	1.63	-	-	-	2.65	RDST	0.0	25.9	-	0.626	-	-	-	-												
	6.00	D	7	3	4	6	10	10.87	SM	0	0	1	62	37	0	27.07	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	7.00	D	8	4	5	7	12	12.56	-	-	-	-	-	-	-	24.49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	8.00	D	9	-	-	-	-	-	SM	0	0	0	61	39	0	25.31	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	9.00	D	10	3	4	5	9	8.91	ML	1	1	1	35	62	0	16.22	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	10.00	D	11	3	6	7	13	13.00	CL	7	3	3	9	66	12	18.91	-	-	32.0	22.5	9.5	2.67	-	-	-	-	-	-	8	19	-												
	11.00	U	12	-	-	-	-	-	-	-	-	-	-	-	-	20.32	2.02	1.68	-	-	-	2.67	UU	55.0	9.8	0.164	0.589	-	-	-	-	Inorganic clays of low plasticity											
	12.50	D	13	8	14	17	31	31.00	CL	1	1	2	8	80	8	21.39	-	-	27.5	19.5	8.0	-	-	-	-	-	-	-	-	-	-												
	14.00	U	14	-	-	-	-	-	CI	0	2	4	7	73	14	16.63	2.06	1.77	36.0	21.5	14.5	2.67	UU	71.0	11.2	-	0.508	-	15	17	-	Inorganic clays of Intermediate plasticity											
	15.50	D	15	6	12	15	27	27.00	CL	4	2	3	9	69	13	18.88	-	-	34.0	20.0	14.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	17.00	U	16	-	-	-	-	-	CI	0	2	2	26	57	13	16.20	2.02	1.74	36.0	23.5	12.5	2.67	UU	57.0	10.6	-	0.534	-	-	-	-	Inorganic clays of Intermediate plasticity											
	18.50	D	17	8	17	19	36	36.00	CL	3	1	1	22	63	10	17.95	-	-	29.0	19.5	9.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											

APPENDIX "B"
TABLE 8: SUMMARY OF TEST RESULTS

Bore No: P48	**Ground Elevation: RL 191.215 m**	**Method of drilling: Percussion**	**Depth of Water: 1.70 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 12/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 22173.487	**Casing Lowered: 18.00 m**	**Ending Date: 15/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen													
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	20.00	U	18	-	-	-	-	-	CL	1	1	2	14	70	12	19.89	2.07	1.73	29.0	20.5	8.5	2.66	UU	53.0	11.2	-	0.538	-	-	18	-	Inorganic clays of low plasticity										
	21.50	D	19	12	20	25	45	23.64	CL-ML	3	0	1	21	68	7	23.15	-	-	26.5	21.5	5.0	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	23.00	D	20	-	-	-	-	-	SM	0	0	1	55	44	0	10.02	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	24.50	D	21	9	18	27	45	22.70	SM	3	2	2	45	48	0	19.41	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-										
	26.00	U	22	-	-	-	-	-	CL-ML	2	2	1	34	56	5	20.08	2.04	1.70	24.5	20.0	4.5	2.65	DST	2.0	27.1	-	0.559	-	-	-	-	Inorganic Silty Clays of low plasticity										
	27.50	D	23	8	21	29	50	50.00	MI	1	1	1	9	73	15	26.49	-	-	40.0	26.5	13.5	-	-	-	-	-	-	-	-	15	-	Inorganic Silts of Intermediate plasticity										
	29.00	D	24	-	-	-	-	-	CL-ML	0	1	1	16	75	7	15.68	-	-	26.5	21.5	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	30.50	D	25	10	20	31	51	22.94	ML	0	0	0	42	54	4	17.97	-	-	24.0	20.0	4.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity										
	32.00	D	26	-	-	-	-	-	-	-	-	-	-	-	-	18.10	2.02	1.71	-	-	-	2.65	RDST	3.0	27.6	-	0.550	-	-	-	-											
	33.50	D	27	11	23	33	56	23.62	CL-ML	2	1	1	22	67	7	16.57	-	-	26.0	21.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	35.00	D	28	-	-	-	-	-	CL-ML	0	1	1	19	74	5	14.56	-	-	25.0	20.5	4.5	-	-	-	-	-	-	-	-	-	-											
	36.50	D	29	12	25	30	55	22.66	-	-	-	-	-	-	-	18.62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	38.00	D	30	-	-	-	-	-	CL-ML	1	2	1	23	66	7	16.84	-	-	26.5	20.5	6.0	-	-	-	-	-	-	-	-	-	-											
	40.00	D	31	13	27	36	63	24.05	CL	2	0	2	19	69	8	17.95	-	-	27.0	20.0	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 9: SUMMARY OF TEST RESULTS

Bore No: P49	**Ground Elevation: RL 191.249 m**	**Method of drilling: Percussion**	**Depth of Water: 1.80 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 18/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 22199.687	**Casing Lowered: 18.00 m**	**Ending Date: 20/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen												
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	0.50	D	1	-	-	-	-	-	SM	1	1	0	54	44	0	4.48	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	1.00	D	2	1	2	3	5	7.88	CL-ML	1	0	0	46	47	6	16.19	-	-	26.0	20.0	6.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	2.00	D	3	-	-	-	-	-	-	-	-	-	-	-	-	15.61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	3.00	D	4	2	3	5	8	10.15	SM	0	0	0	62	38	0	25.94	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	4.00	D	5	3	5	7	12	14.42	ML	0	0	0	17	78	5	24.52	-	-	27.0	22.0	5.0	-	-	-	-	-	-	-	8	-	-	Inorganic Silts of low plasticity										
	5.00	D	6	-	-	-	-	-	ML	0	0	0	40	60	0	22.60	2.00	1.63	Non-Plastic			2.65	RDST	0.0	24.5	-	0.626	-	-	-	-											
	6.00	D	7	3	6	8	14	15.19	SM	0	0	1	77	22	0	21.93	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	7.00	D	8	5	6	7	13	13.73	-	-	-	-	-	-	-	15.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	8.00	D	9	-	-	-	-	-	ML	0	1	1	28	66	4	17.02	1.92	1.64	25.0	21.0	4.0	-	RDST	7.0	24.7	-	-	-	-	-	-	Inorganic Silts of low plasticity										
	9.00	D	10	4	4	5	9	8.92	-	-	-	-	-	-	-	16.33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	10.00	D	11	5	8	15	23	23.00	CL	2	1	1	12	75	9	18.52	-	-	29.0	19.5	9.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	11.00	U	12	-	-	-	-	-	-	-	-	-	-	-	-	18.41	2.05	1.73	-	-	-	2.66	UU	48.0	8.2	0.142	0.538	-	-	-	-											
	12.50	D	13	6	7	14	21	21.00	CL	0	0	1	12	75	12	14.98	-	-	30.0	17.5	12.5	-	-	-	-	-	-	-	-	-	-											
	14.00	U	14	-	-	-	-	-	-	-	-	-	-	-	-	18.81	2.03	1.71	-	-	-	2.67	UU	61.0	9.1	-	0.561	-	-	-	-											
	15.50	D	15	5	7	10	17	17.00	-	-	-	-	-	-	-	16.96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	17.00	U	16	-	-	-	-	-	CL	3	1	2	9	74	11	18.64	2.01	1.69	32.0	22.0	10.0	2.67	UU	56.0	8.7	-	0.580	-	0	18	-											

APPENDIX "B"
TABLE 9: SUMMARY OF TEST RESULTS

Bore No: P49	**Ground Elevation: RL 191.249 m**	**Method of drilling: Percussion**	**Depth of Water: 1.80 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 18/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 22199.687	**Casing Lowered: 18.00 m**	**Ending Date: 20/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	18.50	D	17	7	11	15	26	17.51	CL-ML	2	2	1	42	47	6	17.21	-	-	28.5	22.0	6.5	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	20.00	U	18	-	-	-	-	-	CL	4	2	3	22	57	12	19.02	1.96	1.65	31.0	21.5	9.5	2.66	UU	52.0	9.8	-	0.612	-	-	-	-											
	21.50	D	19	10	19	22	41	41.00	CL	1	1	0	12	78	8	15.25	-	-	28.0	20.5	7.5	-	-	-	-	-	-	-	-	-	-											
	23.00	U	20	-	-	-	-	-	CL	4	2	2	14	67	11	14.21	2.06	1.80	32.0	22.0	10.0	2.67	UU	58.0	10.4	-	0.483	-	-	-	-	Inorganic clays of low plasticity										
	24.50	D	21	10	17	27	44	44.00	-	-	-	-	-	-	-	18.59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	26.00	D	22	-	-	-	-	-	CL	2	1	1	10	73	13	20.77	-	-	33.0	21.0	12.0	-	-	-	-	-	-	-	-	-	-											
	27.50	D	23	9	15	28	43	21.37	SM	0	0	0	54	46	0	14.31	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	29.00	U	24	-	-	-	-	-	CL	4	1	2	34	48	11	12.88	2.00	1.77	29.0	20.0	9.0	2.66	DST	13.0	26.5	-	0.503	-	-	-	-	Inorganic clays of low plasticity										
	30.50	D	25	10	16	26	42	20.36	SM	3	2	2	46	47	0	13.78	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	32.00	U	26	-	-	-	-	-	CL	3	2	1	28	56	10	20.82	1.96	1.62	30.0	20.5	9.5	2.66	UU	49.0	11.5	-	0.642	-	-	-	-											
	33.50	D	27	12	18	28	46	46.00	-	-	-	-	-	-	-	16.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	35.00	D	28	-	-	-	-	-	-	-	-	-	-	-	-	18.45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	36.50	D	29	14	19	30	49	21.11	CL-ML	2	2	1	30	59	6	16.45	-	-	27.0	21.0	6.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	38.00	D	30	-	-	-	-	-	SM	2	3	1	47	47	0	17.65	2.02	1.72	Non-Plastic			-	RDST	0.0	27.6	-	-	-	-	-	-	Silty Sands										
	40.00	D	31	16	22	33	55	21.95	-	-	-	-	-	-	-	18.45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 10: SUMMARY OF TEST RESULTS

Bore No: P50	**Ground Elevation: RL 191.295 m**	**Method of drilling: Percussion**	**Depth of Water: 1.60 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 16/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 22225.887	**Casing Lowered: 18.00 m**	**Ending Date: 18/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen												
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	0.50	D	1	-	-	-	-	-	SM	0	0	1	55	44	0	4.99	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands									
	1.00	U	2	-	-	-	-	-	CL-ML	2	2	1	42	46	7	20.40	2.03	1.69	26.0	21.5	4.5	2.66	DST	8.0	24.5	-	0.578	-	0	19	-	Inorganic Silty Clays of low plasticity									
	2.00	D	3	1	1	2	3	4.01	-	-	-	-	-	-	-	19.68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	3.00	D	4	2	3	4	7	8.79	ML	0	0	1	38	61	0	19.99	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity									
	4.00	D	5	-	-	-	-	-	SM	0	0	1	70	29	0	25.68	1.92	1.53	Non-Plastic			2.65	RDST	0.0	27.6	-	0.732	-	-	-	-	Silty Sands									
	5.00	D	6	4	6	8	14	15.51	-	-	-	-	-	-	-	25.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	6.00	D	7	5	7	9	16	16.30	SM	0	0	1	65	34	0	25.35	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-											
	7.00	D	8	-	-	-	-	-	-	-	-	-	-	-	-	24.51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	8.00	D	9	7	9	13	22	18.72	SM	0	0	0	68	32	0	25.47	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-											
	9.00	D	10	7	10	15	25	19.82	-	-	-	-	-	-	-	28.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	10.00	U	11	-	-	-	-	-	CL	4	2	2	11	68	13	20.66	2.03	1.68	32.0	20.5	11.5	2.68	UU	54.0	8.5	0.162	0.593	-	25	16	-	Inorganic clays of low plasticity									
	11.00	D	12	5	9	15	24	24.00	-	-	-	-	-	-	-	19.86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	12.00	D	13	7	13	17	30	20.99	SM	3	2	2	55	38	0	18.18	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands									
	13.00	U	14	-	-	-	-	-	CL	2	1	1	14	70	12	18.30	2.03	1.72	31.0	22.0	9.0	2.67	UU	58.0	8.3	-	0.556	-	-	-	-	Inorganic clays of low plasticity									
	14.50	D	15	6	9	12	21	21.00	-	-	-	-	-	-	-	18.13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	16.00	U	16	-	-	-	-	-	-	-	-	-	-	-	-	18.52	2.01	1.70	-	-	-	2.67	UU	57.0	8.6	-	0.571	-	-	-	-											
	17.50	D	17	5	10	13	23	23.00	CL	2	1	1	14	69	13	18.45	-	-	32.0	21.0	11.0	-	-	-	-	-	-	-	-	-	-											

APPENDIX "B"
TABLE 10: SUMMARY OF TEST RESULTS

Bore No: P50	**Ground Elevation: RL 191.295 m**	**Method of drilling: Percussion**	**Depth of Water: 1.60 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 16/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 22225.887	**Casing Lowered: 18.00 m**	**Ending Date: 18/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	19.00	U	18	-	-	-	-	-	ML	0	1	1	47	51	0	19.13	1.98	1.66	Non-Plastic			2.63	DST	7.0	27.2	-	0.584	-	-	-	-	Inorganic Silts of low plasticity											
	20.50	D	19	4	8	14	22	15.60	CL-ML	0	0	1	28	63	8	21.72	-	-	28.0	21.5	6.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	22.00	D	20	-	-	-	-	-	-	-	-	-	-	-	-	20.58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	23.50	D	21	6	11	17	28	17.16	-	-	-	-	-	-	-	21.46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	25.00	D	22	-	-	-	-	-	CL	0	1	1	22	68	8	23.70	2.09	1.69	29.0	21.0	8.0	2.67	RUU	42.0	14.3	-	0.580	-	-	-	-	Inorganic clays of low plasticity											
	26.50	D	23	12	19	28	47	47.00	CL	0	1	2	18	70	9	22.51	-	-	29.0	20.5	8.5	-	-	-	-	-	-	-	-	-	-												
	28.00	D	24	-	-	-	-	-	-	-	-	-	-	-	-	19.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	29.50	D	25	11	20	27	47	47.00	CI	4	2	3	12	65	14	17.43	-	-	41.0	25.0	16.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of Intermediate plasticity											
	31.00	U	26	-	-	-	-	-	-	-	-	-	-	-	-	18.14	2.06	1.74	-	-	-	2.68	UU	61.0	7.5	-	0.540	-	-	-	-												
	32.50	D	27	12	22	28	50	50.00	CL	3	1	2	18	64	12	16.19	-	-	32.0	20.5	11.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	34.00	D	28	-	-	-	-	-	-	-	-	-	-	-	-	24.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	35.50	D	29	11	20	25	45	19.96	ML	0	0	1	48	51	0	20.58	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	37.00	D	30	-	-	-	-	-	-	-	-	-	-	-	-	17.70	2.06	1.75	-	-	-	2.65	RDST	0.0	28.5	-	0.514	-	-	-	-												
	38.50	D	31	14	21	27	48	20.14	ML	0	0	2	44	54	0	18.85	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	40.00	D	32	17	25	31	56	21.90	-	-	-	-	-	-	-	20.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 11: SUMMARY OF TEST RESULTS

Bore No: P51	**Ground Elevation: RL 191.293 m**	**Method of drilling: Percussion**	**Depth of Water: 1.60 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 20/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 22252.087	**Casing Lowered: 21.00 m**	**Ending Date: 22/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen												
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	0.50	D	1	-	-	-	-	-	ML	1	1	0	46	47	5	6.59	-	-	25.0	21.5	3.5	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity										
	1.00	D	2	-	-	-	-	-	-	-	-	-	-	-	-	21.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	2.00	D	3	1	2	3	5	6.85	SM	0	0	1	53	46	0	20.02	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	Silty Sands										
	3.00	D	4	2	2	4	6	7.71	-	-	-	-	-	-	-	20.78	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	4.00	D	5	-	-	-	-	-	SM	0	0	1	61	38	0	27.88	1.97	1.54	Non-Plastic			2.65	RDST	0.0	26.4	-	0.721	-	-	-	-												
	5.00	D	6	3	5	7	12	13.92	SM	0	0	1	72	27	0	27.00	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	6.00	D	7	3	6	8	14	15.28	SM	0	0	2	75	23	0	27.15	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	7.00	D	8	-	-	-	-	-	-	-	-	-	-	-	-	25.59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	8.00	D	9	6	9	12	21	18.31	SM	0	0	1	82	17	0	25.17	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	9.00	D	10	10	13	17	30	22.39	-	-	-	-	-	-	-	29.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	10.00	U	11	-	-	-	-	-	SM	0	0	0	78	22	0	21.53	2.07	1.70	Non-Plastic			2.61	DST	0.0	28.5	0.146	0.535	-	-	-	-												
	11.00	D	12	5	9	13	22	17.73	CL-ML	0	0	1	12	80	7	19.96	-	-	26.5	20.5	6.0	-	-	-	-	-	-	-	0	19	-	Inorganic Silty Clays of low plasticity										
	12.00	D	13	4	8	15	23	17.88	-	-	-	-	-	-	-	17.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	13.00	U	14	-	-	-	-	-	CL	2	1	1	9	75	12	17.77	2.05	1.74	31.0	19.5	11.5	2.67	UU	53.0	9.5	-	0.534	-	8	15	-	Inorganic clays of low plasticity										
	14.50	D	15	9	14	16	30	30.00	-	-	-	-	-	-	-	19.86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	16.00	U	16	-	-	-	-	-	CL	3	1	1	10	72	13	16.41	2.06	1.77	32.0	20.0	12.0	2.68	UU	58.0	10.4	-	0.514	-	-	-	-												
	17.50	D	17	6	9	14	23	23.00	-	-	-	-	-	-	-	17.51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

APPENDIX "B"

TABLE 11: SUMMARY OF TEST RESULTS

Bore No: P51	**Ground Elevation: RL 191.293 m**	**Method of drilling: Percussion**	**Depth of Water: 1.60 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 20/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 22252.087	**Casing Lowered: 21.00 m**	**Ending Date: 22/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	19.00	U	18	-	-	-	-	-	SM	0	1	2	53	44	0	20.68	1.87	1.55	Non-Plastic			2.65	DST	3.0	27.4	-	0.710	-	-	-	-	Silty Sands											
	20.50	D	19	6	8	13	21	15.27	SM	0	1	1	51	47	0	13.02	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	22.00	D	20	-	-	-	-	-	-	-	-	-	-	-	-	16.26	1.83	1.57	-	-	-	-	RDST	0.0	26.1	-	-	-	-	-	-												
	23.50	D	21	10	15	20	35	19.82	ML	0	0	0	48	52	0	19.55	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	25.00	D	22	-	-	-	-	-	-	-	-	-	-	-	-	14.57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	26.50	D	23	12	17	22	39	20.59	SM	0	0	0	58	42	0	19.35	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	28.00	U	24	-	-	-	-	-	-	-	-	-	-	-	-	16.26	1.84	1.58	-	-	-	2.63	DST	0.0	26.7	-	0.665	-	-	-	-												
	29.50	D	25	14	20	26	46	22.25	SM	0	0	0	55	45	0	15.38	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	31.00	D	26	-	-	-	-	-	SM	0	0	0	54	46	0	19.81	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	32.50	D	27	16	22	29	51	23.08	SM	0	0	1	58	41	0	17.00	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	34.00	U	28	-	-	-	-	-	-	-	-	-	-	-	-	17.63	1.93	1.64	-	-	-	2.64	DST	0.0	27.8	-	0.610	-	-	-	-												
	35.50	D	29	16	24	26	50	22.08	SM	0	0	1	62	37	0	16.12	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	37.00	D	30	-	-	-	-	-	SM	0	1	2	59	38	0	12.57	1.89	1.68	Non-Plastic			-	RDST	0.0	29.3	-	-	-	-	-	-												
	38.50	D	31	18	27	30	57	23.42	-	-	-	-	-	-	-	16.24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	40.00	D	32	20	29	33	62	24.46	SM	0	1	1	53	45	0	10.03	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"

TABLE 12: SUMMARY OF TEST RESULTS

Bore No : P52	**Ground Elevation : RL 191.228 m**	**Method of drilling :Percussion**	**Depth of Water : 1.50 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 05/11/2023**	**SPT Sampler: Standard**
Location / Chainage : 22278.287	**Casing Lowered : 18.00 m**	**Ending Date : 07/11/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	SM	3	0	0	54	43	0	4.23	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	1.00	U	2	-	-	-	-	-	SM	0	0	1	52	47	0	15.82	1.94	1.68	Non-Plastic			2.62	DST	4.0	26.6	-	0.560	-	-	-	-												
	2.00	D	3	2	3	3	6	8.18	-	-	-	-	-	-	-	14.76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	3.00	D	4	2	4	5	9	11.53	SM	0	0	0	64	36	0	22.47	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	4.00	U	5	-	-	-	-	-	SM	0	0	0	75	25	0	25.42	1.94	1.55	Non-Plastic			2.62	DST	0.0	28.6	-	0.690	-	-	-	-												
	5.00	D	6	3	4	6	10	11.60	-	-	-	-	-	-	-	25.61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	6.00	D	7	6	5	7	12	13.36	-	-	-	-	-	-	-	27.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	7.00	U	8	-	-	-	-	-	SM	0	0	1	72	27	0	24.57	1.95	1.57	Non-Plastic			2.63	DST	0.0	27.9	-	0.676	-	-	-	-												
	8.00	D	9	4	5	7	12	12.41	-	-	-	-	-	-	-	27.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	9.00	D	10	4	6	8	14	14.01	CL-ML	2	2	1	42	48	5	18.25	-	-	25.0	20.5	4.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	10.00	U	11	-	-	-	-	-	CL-ML	1	1	2	32	57	7	21.12	1.98	1.64	27.0	21.0	6.0	2.66	DST	6.0	26.2	-	0.624	-	-	-	-												
	11.00	D	12	3	5	8	13	12.23	ML	0	0	1	44	55	0	15.52	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	12.00	D	13	4	6	9	15	13.72	CL-ML	0	0	1	35	58	6	16.48	-	-	26.0	21.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	13.00	U	14	-	-	-	-	-	CL	2	1	1	25	63	8	19.16	2.01	1.69	28.0	21.0	7.0	2.66	UU	46.0	10.4	0.142	0.574	-	0	20	-	Inorganic clays of low plasticity											
	14.50	D	15	8	11	13	24	17.76	-	-	-	-	-	-	-	21.92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	16.00	U	16	-	-	-	-	-	CL-ML	0	0	1	18	72	9	17.01	2.02	1.73	27.0	20.5	6.5	2.66	UU	44.0	12.2	-	0.538	-	-	-	-	Inorganic Silty Clays of low plasticity											
	17.50	D	17	6	10	12	22	16.24	-	-	-	-	-	-	-	17.41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

APPENDIX "B"
TABLE 12: SUMMARY OF TEST RESULTS

Bore No : P52	Ground Elevation : RL 191.228 m	Method of drilling :Percussion	Depth of Water : 1.50 m
Diameter of Bore Hole : 150 mm	Bore Retained using : Casing	Starting Date : 05/11/2023	SPT Sampler: Standard
Location / Chainage : 22278.287	Casing Lowered : 18.00 m	Ending Date : 07/11/2023	Hammer type: Auto-trip

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	19.00	U	18	-	-	-	-	-	ML	1	0	0	42	53	4	17.44	1.94	1.65	24.0	20.0	4.0	2.65	DST	5.0	25.4	-	0.606	-	-	-	-	Inorganic Silts of low plasticity											
	20.50	D	19	8	15	18	33	19.83	-	-	-	-	-	-	-	18.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	22.00	U	20	-	-	-	-	-	SM	1	0	1	64	34	0	20.49	1.96	1.63	Non-Plastic			2.63	DST	1.0	28.3	-	0.613	-	-	-	-	Silty Sands											
	23.50	D	21	8	14	19	33	19.13	SM	0	1	1	52	46	0	19.17	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	25.00	D	22	-	-	-	-	-	SM	0	0	1	62	37	0	19.91	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	26.50	D	23	18	24	33	57	57.00	MI	1	1	1	4	76	17	26.78	-	-	41.0	27.0	14.0	2.70	-	-	-	-	-	-	-	-	-	Inorganic Silts of Intermediate plasticity											
	28.00	D	24	15	20	32	52	24.37	SM	0	0	1	55	44	0	18.63	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	29.50	D	25	12	27	32	59	26.19	-	-	-	-	-	-	-	19.19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	31.00	D	26	17	26	50	76	31.00	SM	0	0	1	64	35	0	19.86	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	32.50	D	27	18	25	35	60	25.64	-	-	-	-	-	-	-	18.22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	34.00	D	28	17	30	32	62	25.77	SM	0	0	1	72	27	0	26.44	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	35.50	D	29	15	28	33	61	25.08	ML	1	1	1	42	50	5	18.77	-	-	25.0	21.0	4.0	2.65	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	37.00	D	30	14	23	38	61	24.70	CL-ML	1	1	1	32	59	6	19.53	-	-	26.0	20.5	5.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	38.50	D	31	17	26	32	58	23.49	-	-	-	-	-	-	-	21.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	40.00	D	32	18	30	35	65	25.04	SM	2	1	1	48	48	0	19.12	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 13: SUMMARY OF TEST RESULTS

Bore No : P53	**Ground Elevation : RL 192.054 m**	**Method of drilling :Percussion**	**Depth of Water : 1.40 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 05/11/2023**	**SPT Sampler: Standard**
Location / Chainage : 22304.487	**Casing Lowered : 18.00 m**	**Ending Date : 08/11/2023**	**Hammer type: Rope-pulley**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m²)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm²)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	SM	0	0	1	53	46	0	8.14	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	1.00	U	2	-	-	-	-	-	SM-SC	2	1	0	48	45	4	19.70	1.96	1.64	24.0	20.0	4.0	2.62	DST	5.0	26.2	-	0.598	-	-	-	-	Silty Sands with clay binder											
	2.00	D	3	3	3	3	6	8.22	-	-	-	-	-	-	-	17.51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	3.00	D	4	2	3	4	7	8.99	-	-	-	-	-	-	-	17.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	4.00	U	5	-	-	-	-	-	SM	0	0	1	72	27	0	24.23	1.92	1.55	Non-Plastic			2.61	DST	0.0	28.9	-	0.688	-	-	-	-	Silty Sands											
	5.00	D	6	3	4	6	10	11.65	SM	0	1	1	75	23	0	25.52	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	6.00	D	7	3	5	8	13	14.54	-	-	-	-	-	-	-	24.98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	7.00	D	8	-	-	-	-	-	SM	0	0	2	77	21	0	26.05	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	8.00	D	9	8	12	16	28	22.02	-	-	-	-	-	-	-	23.32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	9.00	D	10	6	9	14	23	23.00	CL	3	2	1	12	71	11	18.38	-	-	30.0	21.5	8.5	-	-	-	-	-	-	-	0	18	-	Inorganic clays of low plasticity											
	10.00	U	11	-	-	-	-	-	CL-ML	2	1	1	24	65	7	18.93	1.98	1.66	27.0	20.5	6.5	2.64	DST	11.0	24.2	-	0.586	-	-	-	-	Inorganic Silty Clays of low plasticity											
	11.00	D	12	10	17	20	37	24.94	-	-	-	-	-	-	-	22.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	12.00	D	13	8	15	18	33	22.62	CL-ML	0	1	1	8	82	8	21.98	-	-	27.0	20.5	6.5	-	-	-	-	-	-	-	-	-	-												
	13.00	U	14	-	-	-	-	-	CL	5	2	3	14	66	10	19.31	2.04	1.71	28.0	21.0	7.0	2.67	UU	52.0	9.4	0.136	0.561	-	6	15	-	Inorganic clays of low plasticity											
	14.50	D	15	7	12	21	33	21.61	-	-	-	-	-	-	-	21.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	16.00	U	16	-	-	-	-	-	CL	8	3	3	16	59	11	16.27	2.02	1.74	29.0	21.0	8.0	2.68	UU	49.0	11.5	-	0.540	-	-	-	-												
	17.50	D	17	11	14	19	33	33.00	-	-	-	-	-	-	-	16.44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

APPENDIX "B"
TABLE 13: SUMMARY OF TEST RESULTS

Bore No : P53	**Ground Elevation : RL 192.054 m**	**Method of drilling :Percussion**	**Depth of Water : 1.40 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 05/11/2023**	**SPT Sampler: Standard**
Location / Chainage : 22304.487	**Casing Lowered : 18.00 m**	**Ending Date : 08/11/2023**	**Hammer type: Rope-pulley**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	19.00	U	18	-	-	-	-	-	CL-ML	6	1	2	27	56	8	18.06	2.00	1.69	24.0	18.0	6.0	2.66	DST	7.0	26.4	-	0.574	-	-	-	-	Inorganic Silty Clays of low plasticity											
	20.50	D	19	14	20	25	45	24.26	CL	2	1	1	12	74	10	27.55	-	-	29.0	22.0	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	22.00	U	20	-	-	-	-	-	CL-ML	4	2	1	17	68	8	18.43	1.96	1.65	25.0	18.5	6.5	2.66	DST	9.0	25.8	-	0.608	-	-	-	-	Inorganic Silty Clays of low plasticity											
	23.50	D	21	20	28	32	60	28.58	-	-	-	-	-	-	-	14.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	25.00	D	22	12	18	22	40	21.17	SM	0	0	0	74	26	0	22.55	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	26.50	D	23	10	15	20	35	19.11	-	-	-	-	-	-	-	24.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	28.00	U	24	-	-	-	-	-	MI	3	1	1	5	74	16	27.56	2.07	1.62	42.0	26.0	16.0	2.70	UU	74.0	11.4	-	0.667	-	-	-	-	Inorganic Silts of Intermediate plasticity											
	29.50	D	25	8	22	28	50	23.17	SM	1	0	1	70	28	0	22.10	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	31.00	D	26	-	-	-	-	-	-	-	-	-	-	-	-	24.66	2.11	1.69	-	-	-	-	RDST	2.0	29.3	-	-	-	-	-	-												
	32.50	D	27	18	28	32	60	25.27	SM	8	4	6	52	30	0	15.83	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	34.00	D	28	20	28	35	63	25.66	SM	0	0	0	75	25	0	17.67	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	35.50	D	29	25	32	40	72	27.81	SM	0	0	1	67	32	0	18.16	-	-	Non-Plastic			2.65	-	-	-	-	-	-	-	-	-												
	37.00	D	30	20	28	32	60	24.07	-	-	-	-	-	-	-	18.14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	38.50	D	31	18	23	35	58	23.19	SM	1	0	1	52	46	0	17.29	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	40.00	D	32	21	32	35	67	25.26	-	-	-	-	-	-	-	17.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 14: SUMMARY OF TEST RESULTS

Bore No: P54	**Ground Elevation: RL 191.242 m**	**Method of drilling: Percussion**	**Depth of Water: 1.20 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 12/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 22330.687	**Casing Lowered: 20.00 m**	**Ending Date: 14/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m²)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm²)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	SM	0	1	0	61	38	0	12.25	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	1.00	D	2	-	-	-	-	-	ML	0	0	0	48	48	4	20.09	-	-	24.0	20.0	4.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	2.00	D	3	1	2	3	5	7.07	-	-	-	-	-	-	-	19.84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	3.00	D	4	2	3	4	7	9.25	ML	5	1	0	34	60	0	21.49	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	4.00	D	5	-	-	-	-	-	-	-	-	-	-	-	-	22.59	1.94	1.58	-	-	-	2.63	RDST	4.0	21.9	-	-	-	-	-	-												
	5.00	D	6	2	3	6	9	10.69	ML	1	1	0	45	53	0	25.19	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	6.00	D	7	4	7	8	15	16.03	-	-	-	-	-	-	-	26.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	7.00	D	8	-	-	-	-	-	SM	0	0	0	58	42	0	26.28	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	8.00	D	9	4	10	11	21	18.59	-	-	-	-	-	-	-	19.93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	9.00	D	10	5	11	12	23	19.26	CL-ML	2	2	2	13	74	7	17.84	-	-	27.5	21.5	6.0	-	-	-	-	-	-	-	8	18	-	Inorganic Silty Clays of low plasticity											
	10.00	U	11	-	-	-	-	-	SM	1	1	2	67	29	0	19.79	1.90	1.59	Non-Plastic			2.62	DST	2.0	27.5	-	0.652	-	-	-	-	Silty Sands											
	11.00	D	12	5	8	13	21	21.00	CL	0	0	1	14	77	8	20.69	-	-	27.5	20.0	7.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	12.00	D	13	4	7	12	19	19.00	-	-	-	-	-	-	-	21.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	13.00	U	14	-	-	-	-	-	SM	0	1	0	78	21	0	21.16	1.92	1.58	Non-Plastic			2.63	DST	0.0	29.5	-	0.660	-	-	-	-	Silty Sands											
	14.50	D	15	5	9	13	22	22.00	CL	1	1	1	19	67	11	20.00	-	-	31.0	20.5	10.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	16.00	U	16	-	-	-	-	-	CL	1	1	1	37	50	10	18.80	2.06	1.73	29.0	19.5	9.5	2.66	UU	42.0	12.5	0.148	0.534	-	9	15	-												
	17.50	D	17	9	13	21	34	34.00	CL	8	4	4	24	51	9	16.96	-	-	27.5	20.0	7.5	-	-	-	-	-	-	-	-	-	-												

APPENDIX "B"
TABLE 14: SUMMARY OF TEST RESULTS

Bore No: P54	**Ground Elevation: RL 191.242 m**	**Method of drilling: Percussion**	**Depth of Water: 1.20 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 12/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 22330.687	**Casing Lowered: 20.00 m**	**Ending Date: 14/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen													
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	19.00	D	18	-	-	-	-	-	CL	3	1	2	14	72	8	20.65	-	-	26.5	19.5	7.0	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	20.50	D	19	8	16	20	36	21.27	-	-	-	-	-	-	-	19.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	22.00	D	20	-	-	-	-	-	SM	0	1	2	72	25	0	21.73	1.91	1.57	Non-Plastic			-	RDST	0.0	27.3	-	-	-	-	-	-	Silty Sands										
	23.50	D	21	9	17	26	43	23.04	ML	0	0	1	42	57	0	18.57	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity										
	25.00	U	22	-	-	-	-	-	CL	1	1	1	17	74	6	20.04	2.03	1.69	25.5	18.5	7.0	2.65	DST	13.0	25.5	-	0.568	-	-	-	-	Inorganic clays of low plasticity										
	26.50	D	23	10	14	20	34	19.07	-	-	-	-	-	-	-	18.46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	28.00	U	24	-	-	-	-	-	CI	1	0	1	8	74	16	28.01	1.92	1.50	39.5	25.0	14.5	2.68	UU	62.0	8.5	-	0.791	-	0	19	-	Inorganic clays of Intermediate plasticity										
	29.50	D	25	12	16	22	38	38.00	CL	0	0	1	14	73	12	16.35	-	-	34.0	22.0	12.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	31.00	D	26	-	-	-	-	-	CL	3	2	2	9	70	14	17.80	-	-	34.0	20.0	14.0	-	-	-	-	-	-	-	-	-	-												
	32.50	D	27	14	18	26	44	44.00	-	-	-	-	-	-	-	16.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	34.00	D	28	-	-	-	-	-	CL	1	1	2	11	73	12	17.63	2.02	1.72	31.0	20.5	10.5	2.67	RUU	54.0	9.1	-	0.552	-	-	-	-												
	35.50	D	29	16	19	28	47	47.00	-	-	-	-	-	-	-	18.10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	37.00	D	30	-	-	-	-	-	-	-	-	-	-	-	-	15.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	38.50	D	31	18	23	32	55	55.00	CL	2	1	3	14	67	13	19.01	-	-	32.0	22.0	10.0	-	-	-	-	-	-	-	-	-	-												
	40.00	D	32	17	24	36	60	60.00	-	-	-	-	-	-	-	18.32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 15: SUMMARY OF TEST RESULTS

Bore No : P55	**Ground Elevation : RL 191.309 m**	**Method of drilling :Percussion**	**Depth of Water : 1.40 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 03/11/2023**	**SPT Sampler: Standard**
Location / Chainage : 22356.887	**Casing Lowered : 22.00 m**	**Ending Date : 06/11/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen												
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	0.50	D	1	-	-	-	-	-	SM	0	0	1	54	45	0	10.72	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	1.00	U	2	-	-	-	-	-	ML	0	0	1	48	47	4	8.91	1.97	1.81	24.0	20.0	4.0	2.63	DST	5.0	25.7	-	0.453	-	-	-	-	Inorganic Silts of low plasticity										
	2.00	D	3	2	3	5	8	10.95	SM	1	1	1	56	41	0	20.38	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	3.00	D	4	2	3	3	6	7.70	SM	0	0	0	68	32	0	20.43	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-										
	4.00	U	5	-	-	-	-	-	SM	0	0	0	75	25	0	25.88	1.91	1.52	Non-Plastic			2.62	DST	0.0	28.7	-	0.724	-	-	-	-										
	5.00	D	6	3	5	6	11	12.81	-	-	-	-	-	-	-	25.68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	6.00	D	7	3	5	8	13	14.54	-	-	-	-	-	-	-	25.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	7.00	D	8	-	-	-	-	-	SM	0	0	0	80	20	0	25.60	1.90	1.51	Non-Plastic			2.61	RDST	0.0	29.6	-	0.728	-	-	-	-										
	8.00	D	9	5	6	9	15	15.32	SM	4	5	5	64	22	0	22.21	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-										
	9.00	D	10	4	6	8	14	14.15	-	-	-	-	-	-	-	19.69	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	10.00	U	11	-	-	-	-	-	CL-ML	1	1	0	16	73	9	20.11	2.01	1.67	26.0	19.5	6.5	2.66	UU	48.0	9.2	0.131	0.593	-	9	18	-	Inorganic Silty Clays of low plasticity										
	11.00	D	12	5	7	9	16	15.08	CL-ML	1	1	10	22	59	7	18.71	-	-	26.0	20.5	5.5	-	-	-	-	-	-	-	-	-	-										
	12.00	D	13	6	8	11	19	16.24	CL	1	0	0	7	82	10	19.94	-	-	27.0	20.0	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	13.00	U	14	-	-	-	-	-	-	-	-	-	-	-	-	17.63	2.00	1.70	-	-	-	2.67	UU	54.0	8.5	-	0.571	-	-	-	-										
	14.50	D	15	8	12	17	29	29.00	CL	2	1	1	8	76	12	16.52	-	-	30.0	18.5	11.5	-	-	-	-	-	-	-	-	-	-										
	16.00	U	16	-	-	-	-	-	CL	4	2	1	11	70	12	16.36	2.03	1.75	29.0	19.0	10.0	2.68	UU	56.0	11.6	-	0.536	-	-	-	-										
	17.50	D	17	5	13	19	32	20.28	ML	0	0	1	46	53	0	16.45	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity										

APPENDIX "B"
TABLE 15: SUMMARY OF TEST RESULTS

Bore No : P55	**Ground Elevation : RL 191.309 m**	**Method of drilling :Percussion**	**Depth of Water : 1.40 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 03/11/2023**	**SPT Sampler: Standard**
Location / Chainage : 22356.887	**Casing Lowered : 22.00 m**	**Ending Date : 06/11/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	19.00	U	18	-	-	-	-	-	CL	0	0	1	17	72	10	19.64	1.96	1.64	28.0	20.0	8.0	2.66	UU	51.0	10.5	-	0.622	-	-	-	-	Inorganic clays of low plasticity											
	20.50	D	19	11	17	22	39	22.12	CL-ML	5	2	1	24	61	7	20.95	-	-	26.0	19.5	6.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	22.00	U	20	-	-	-	-	-	-	-	-	-	-	-	-	16.44	1.99	1.71	-	-	-	2.66	DST	11.0	23.9	-	0.556	-	-	-	-												
	23.50	D	21	12	18	25	43	22.68	-	-	-	-	-	-	-	18.34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	25.00	U	22	-	-	-	-	-	MI	2	0	1	5	74	18	27.61	2.04	1.60	42.0	28.0	14.0	2.69	UU	70.0	12.6	-	0.681	-	-	-	-	Inorganic Silts of Intermediate plasticity											
	26.50	D	23	18	22	32	54	54.00	-	-	-	-	-	-	-	26.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	28.00	D	24	16	18	35	53	53.00	-	-	-	-	-	-	-	25.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	29.50	D	25	14	24	32	56	25.18	CL-ML	0	0	1	36	58	5	19.89	-	-	25.0	20.5	4.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	31.00	D	26	16	25	32	57	25.10	-	-	-	-	-	-	-	15.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	32.50	D	27	18	22	35	57	24.71	CL-ML	4	1	0	35	53	7	18.38	-	-	26.0	21.0	5.0	-	-	-	-	-	-	-	-	-	-												
	34.00	D	28	21	28	36	64	64.00	CL	0	1	1	14	74	10	21.34	-	-	28.0	19.0	9.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	35.50	D	29	20	31	38	69	69.00	CL	0	1	2	20	68	9	15.84	-	-	27.5	19.5	8.0	-	-	-	-	-	-	-	-	-	-												
	37.00	D	30	25	32	36	68	68.00	-	-	-	-	-	-	-	22.39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	38.50	D	31	20	31	38	69	26.52	CL-ML	0	0	1	28	64	7	22.74	-	-	26.0	20.0	6.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	40.00	D	32	22	36	42	78	28.55	-	-	-	-	-	-	-	19.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"

TABLE 16: SUMMARY OF TEST RESULTS

Bore No : P56	Ground Elevation : RL 191.384 m	Method of drilling :Percussion	Depth of Water : 1.40 m
Diameter of Bore Hole : 150 mm	Bore Retained using : Casing	Starting Date : 03/11/2023	SPT Sampler: Standard
Location / Chainage : 22383.087	Casing Lowered : 18.00 m	Ending Date : 05/11/2023	Hammer type: Rope-pulley

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	ML	0	0	1	48	51	0	11.29	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	1.00	U	2	-	-	-	-	-	SM-SC	2	1	2	52	38	5	17.90	1.95	1.65	24.0	20.0	4.0	2.63	DST	4.0	27.1	-	0.594	-	-	-	-	Silty Sands with clay binder											
	2.00	D	3	2	2	2	4	5.49	-	-	-	-	-	-	-	17.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	3.00	D	4	2	3	5	8	10.31	SM	2	1	1	56	40	0	20.69	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	4.00	U	5	-	-	-	-	-	-	-	-	-	-	-	-	21.75	1.93	1.59	-	-	-	2.63	DST	0.0	29.7	-	0.658	-	-	-	-												
	5.00	D	6	3	5	4	9	10.50	SM	1	1	2	60	36	0	26.14	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	6.00	D	7	2	4	4	8	8.96	-	-	-	-	-	-	-	26.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	7.00	U	8	-	-	-	-	-	SM	0	0	1	72	27	0	24.98	1.93	1.54	Non-Plastic			2.61	DST	0.0	28.9	-	0.690	-	-	-	-												
	8.00	D	9	3	5	7	12	12.00	CL	2	1	1	12	73	11	18.09	-	-	30.0	20.0	10.0	-	-	-	-	-	-	-	8	19	-												
	9.00	D	10	4	6	8	14	14.00	-	-	-	-	-	-	-	20.59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	10.00	U	11	-	-	-	-	-	CL	0	0	1	24	67	8	22.45	2.00	1.63	26.0	19.0	7.0	2.66	UU	42.0	11.4	0.146	0.632	-	-	-	-												
	11.00	D	12	3	5	7	12	11.35	-	-	-	-	-	-	-	18.63	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	12.50	D	13	4	6	8	14	14.00	CL	0	0	1	10	79	10	19.49	-	-	27.0	19.0	8.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	13.00	U	14	-	-	-	-	-	CL	1	0	0	14	76	9	20.68	2.01	1.67	25.0	18.0	7.0	2.67	UU	46.0	9.4	-	0.603	-	-	-	-												
	14.50	D	15	9	17	24	41	41.00	CL	0	0	1	8	79	12	20.87	-	-	32.0	22.0	10.0	-	-	-	-	-	-	-	-	-	-												
	16.00	U	16	-	-	-	-	-	CL	5	2	2	6	72	13	17.84	2.04	1.73	31.0	20.0	11.0	2.68	UU	58.0	8.2	-	0.549	-	-	-	-												
	17.50	D	17	8	15	22	37	37.00	-	-	-	-	-	-	-	17.90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

APPENDIX "B"

TABLE 16: SUMMARY OF TEST RESULTS

Bore No : P56	**Ground Elevation : RL 191.384 m**	**Method of drilling :Percussion**	**Depth of Water : 1.40 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 03/11/2023**	**SPT Sampler: Standard**
Location / Chainage : 22383.087	**Casing Lowered : 18.00 m**	**Ending Date : 05/11/2023**	**Hammer type: Rope-pulley**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	19.00	U	18	-	-	-	-	-	CL	4	2	2	14	67	11	14.46	2.03	1.77	29.0	20.5	8.5	2.67	UU	52.0	9.7	-	0.508	-	-	-	-												
	20.50	D	19	12	17	25	42	42.00	-	-	-	-	-	-	-	18.32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	22.00	U	20	-	-	-	-	-	CL	1	0	0	8	79	12	20.00	2.05	1.71	31.0	20.0	11.0	2.68	UU	60.0	8.0	-	0.567	-	-	-	-	Inorganic clays of low plasticity											
	23.50	D	21	15	21	27	48	48.00	-	-	-	-	-	-	-	21.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	25.00	D	22	-	-	-	-	-	CL	2	1	1	16	71	9	24.00	-	-	30.0	22.0	8.0	-	-	-	-	-	-	-	-	-	-												
	26.50	D	23	12	22	42	64	64.00	MI	0	0	1	5	77	17	25.61	-	-	38.0	26.0	12.0	2.68	-	-	-	-	-	-	-	-	-												
	28.00	D	24	11	21	32	53	53.00	-	-	-	-	-	-	-	23.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of Intermediate plasticity											
	29.50	D	25	8	19	21	40	40.00	-	-	-	-	-	-	-	17.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	31.00	D	26	-	-	-	-	-	CL	0	0	1	7	79	13	18.22	2.03	1.72	34.0	21.0	13.0	2.68	RUU	66.0	8.7	-	-	-	-	-	-												
	32.50	D	27	18	27	32	59	59.00	CL	2	1	1	12	75	9	17.12	-	-	29.0	21.5	7.5	-	-	-	-	-	-	-	-	-	-												
	34.00	D	28	17	26	31	57	57.00	CL	1	1	1	7	79	11	17.86	-	-	32.0	21.0	11.0	-	-	-	-	-	-	-	-	-	-												
	35.50	D	29	16	30	35	65	65.00	-	-	-	-	-	-	-	18.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	37.00	D	30	18	25	32	57	57.00	-	-	-	-	-	-	-	19.45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	38.50	D	31	19	32	35	67	67.00	CL	0	1	1	10	77	11	19.93	-	-	30.0	20.5	9.5	-	-	-	-	-	-	-	-	-	-												
	40.00	D	32	17	23	32	55	55.00	-	-	-	-	-	-	-	20.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"

TABLE 17: SUMMARY OF TEST RESULTS

Bore No : P57	**Ground Elevation : RL 191.353 m**	**Method of drilling :Percussion**	**Depth of Water : 1.20 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 31/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 22409.287	**Casing Lowered : 20.00 m**	**Ending Date : 02/11/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																														
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen										
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK																			Classification of SOIL
	0.50	D	1	-	-	-	-	-	SM-SC	0	0	1	53	43	3	9.51	-	-	24.0	20.0	4.0	-	-	-	-	-	-	-	-	-											
	1.00	U	2	-	-	-	-	-	SM-SC	0	1	1	58	33	7	21.67	1.96	1.61	26.0	21.5	4.5	2.64	DST	3.0	27.2	-	0.640	-	-	-	-											Silty Sands with clay binder
	2.00	D	3	1	1	2	3	4.17	-	-	-	-	-	-	-	21.24	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	3.00	D	4	1	2	2	4	5.21	SM-SC	1	1	2	60	28	8	19.26	-	-	26.5	21.5	5.0	-	-	-	-	-	-	-	-	-	-											
	4.00	D	5	-	-	-	-	-	-	-	-	-	-	-	-	24.73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	5.00	D	6	2	3	6	9	10.59	SM	1	0	1	68	30	0	24.26	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-											
	6.00	D	7	3	5	7	12	13.45	SM	0	0	2	64	34	0	25.69	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-											Silty Sands
	7.00	D	8	-	-	-	-	-	SM	0	1	1	60	38	0	27.22	2.07	1.63	Non-Plastic			2.63	RDST	2.0	27.6	-	0.613	-	-	-	-											
	8.00	D	9	5	7	10	17	16.27	-	-	-	-	-	-	-	27.08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	9.00	D	10	5	8	12	20	20.00	CL	2	1	1	5	82	9	20.21	-	-	29.0	21.0	8.0	-	-	-	-	-	-	-	-	-	-											
	10.00	U	11	-	-	-	-	-	CL	0	0	1	7	82	10	20.97	2.03	1.68	28.5	21.5	7.0	2.67	UU	53.0	9.6	0.106	0.589	-	0	20	-											Inorganic clays of low plasticity
	11.00	D	12	7	9	10	19	16.36	-	-	-	-	-	-	-	21.58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	12.00	D	13	5	9	12	21	17.01	-	-	-	-	-	-	-	22.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	13.00	U	14	-	-	-	-	-	CL-ML	2	1	0	9	79	9	19.32	2.04	1.71	27.0	20.5	6.5	2.66	UU	48.0	10.5	-	0.556	-	-	-	-											Inorganic Silty Clays of low plasticity
	14.50	D	15	8	13	18	31	20.62	-	-	-	-	-	-	-	16.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	16.00	U	16	-	-	-	-	-	CL	1	0	2	39	47	11	17.07	2.06	1.76	25.5	17.0	8.5	2.67	UU	56.0	11.3	-	0.517	-	0	17	-											Inorganic clays of low plasticity
	17.50	D	17	9	15	21	36	36.00	-	-	-	-	-	-	-	17.56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	19.00	U	18	-	-	-	-	-	SM-SC	2	2	2	46	43	5	16.39	1.96	1.68	25.0	21.0	4.0	2.66	DST	6.0	25.2	-	0.583	-	-	-	-											Silty Sands with clay binder

APPENDIX "B"

TABLE 17: SUMMARY OF TEST RESULTS

Bore No : P57	**Ground Elevation : RL 191.353 m**	**Method of drilling :Percussion**	**Depth of Water : 1.20 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 31/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 22409.287	**Casing Lowered : 20.00 m**	**Ending Date : 02/11/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																														
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen										
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	20.50	D	19	7	16	21	37	21.16	CL-ML	3	1	2	18	68	8	17.23	-	-	27.0	21.0	6.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity									
	22.50	U	20	-	-	-	-	-	CL	4	2	2	12	69	11	18.63	2.02	1.70	29.0	20.5	8.5	2.67	UU	57.0	9.1	-	0.571	-	-	-	-	Inorganic clays of low plasticity									
	23.50	D	21	10	19	23	42	42.00	-	-	-	-	-	-	-	18.30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	25.00	D	22	-	-	-	-	-	SM	1	0	1	70	28	0	25.59	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands									
	26.50	D	23	14	28	30	58	26.56	-	-	-	-	-	-	-	25.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	28.00	D	24	13	27	33	60	60.00	CL	1	1	3	20	65	10	15.75	-	-	29.0	20.0	9.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity									
	29.50	D	25	16	29	32	61	61.00	-	-	-	-	-	-	-	16.95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	31.00	D	26	14	26	30	56	56.00	CL	1	1	2	17	71	8	23.56	-	-	28.0	20.0	8.0	-	-	-	-	-	-	-	-	-	-									
	32.50	D	27	15	27	31	58	58.00	-	-	-	-	-	-	-	22.33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	34.00	D	28	-	-	-	-	-	SM	1	0	1	69	29	0	20.39	2.12	1.76	Non-Plastic			2.65	RDST	0.0	29.3	-	0.506	-	-	-	-	Silty Sands									
	35.50	D	29	15	25	27	52	22.14	SM	1	1	2	64	32	0	18.46	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-									
	37.00	D	30	-	-	-	-	-	-	-	-	-	-	-	-	17.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	38.50	D	31	13	24	25	49	20.72	SM	0	1	0	65	34	0	18.82	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands									
	40.00	D	32	16	23	27	50	20.71	-	-	-	-	-	-	-	19.69	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 18: SUMMARY OF TEST RESULTS

Bore No : P58	**Ground Elevation : RL 191.433 m**	**Method of drilling :Percussion**	**Depth of Water : 1.40 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 02/11/2023**	**SPT Sampler: Standard**
Location / Chainage : 22435.487	**Casing Lowered : 20.00 m**	**Ending Date : 05/11/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	SM	1	0	1	48	50	0	10.63	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	1.00	D	2	1	1	1	2	3.08	-	-	-	-	-	-	-	10.95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	2.00	U	3	-	-	-	-	-	CL-ML	1	0	1	42	48	8	25.32	2.01	1.60	28.0	21.5	6.5	2.67	UU	44.0	11.5	0.147	0.669	-	8	18	-	Inorganic Silty Clays of low plasticity											
	3.00	D	4	1	2	2	4	5.10	SM	0	0	0	55	45	0	23.16	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	4.00	D	5	3	4	6	10	12.07	-	-	-	-	-	-	-	23.96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	5.00	U	6	-	-	-	-	-	SM	0	0	0	52	48	0	23.37	1.98	1.60	Non-Plastic			2.62	DST	2.0	27.4	-	0.633	-	-	-	-												
	6.00	D	7	5	8	9	17	16.88	-	-	-	-	-	-	-	19.28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	7.00	D	8	6	9	11	20	18.12	-	-	-	-	-	-	-	29.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	8.00	U	9	-	-	-	-	-	SM	0	0	1	70	29	0	26.81	1.94	1.53	Non-Plastic			2.62	DST	0.0	28.7	-	0.712	-	-	-	-												
	9.00	D	10	4	7	8	15	14.91	-	-	-	-	-	-	-	26.93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	10.00	D	11	5	7	10	17	15.70	-	-	-	-	-	-	-	26.59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	11.00	U	12	-	-	-	-	-	ML	0	1	1	32	59	7	21.73	2.02	1.66	27.0	22.0	5.0	2.66	DST	8.0	24.8	-	0.602	-	-	-	-	Inorganic Silts of low plasticity											
	12.50	D	13	6	8	11	19	19.00	CL	0	1	0	8	82	9	22.31	-	-	28.0	20.5	7.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	14.00	U	14	-	-	-	-	-	CL	2	1	1	6	80	10	19.96	2.03	1.69	29.0	21.0	8.0	2.67	UU	50.0	10.6	-	0.580	-	-	20	-												
	15.50	D	15	8	10	12	22	22.00	-	-	-	-	-	-	-	22.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	17.00	U	16	-	-	-	-	-	SM	0	0	1	55	44	0	19.81	1.93	1.61	Non-Plastic			2.63	DST	4.0	26.8	-	0.634	-	-	-	-	Silty Sands											
	18.50	D	17	9	14	18	32	19.93	-	-	-	-	-	-	-	21.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

APPENDIX "B"

TABLE 18: SUMMARY OF TEST RESULTS

Bore No : P58	**Ground Elevation : RL 191.433 m**	**Method of drilling :Percussion**	**Depth of Water : 1.40 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 02/11/2023**	**SPT Sampler: Standard**
Location / Chainage : 22435.487	**Casing Lowered : 20.00 m**	**Ending Date : 05/11/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m²)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm²)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	20.00	U	18	-	-	-	-	-	ML	3	2	0	40	50	5	21.48	1.97	1.62	26.0	22.0	4.0	2.65	DST	6.0	27.2	-	0.636	-	-	-	-	Inorganic Silts of low plasticity											
	21.50	D	19	12	27	30	57	28.32	CL	0	1	0	12	78	9	10.56	-	-	28.0	21.0	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	23.00	D	20	15	29	31	60	28.79	-	-	-	-	-	-	-	16.19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	24.50	D	21	11	21	26	47	23.68	-	-	-	-	-	-	-	22.29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	26.00	U	22	-	-	-	-	-	CL	1	1	0	5	81	12	21.96	2.04	1.67	30.0	20.5	9.5	2.68	UU	58.0	9.4	-	0.605	-	-	-	-												
	27.50	D	23	17	27	35	62	62.00	MI	0	1	0	3	79	17	30.80	-	-	42.0	27.0	15.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of Intermediate plasticity											
	29.00	D	24	13	20	23	43	43.00	CL	2	1	0	10	76	11	17.31	-	-	30.0	21.0	9.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	30.50	D	25	19	80	-	R	-	SM	2	1	1	53	43	0	19.11	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	32.00	D	26	43	100	-	R	-	CL-ML	0	1	1	38	55	5	15.96	-	-	26.0	21.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	33.50	D	27	30	36	38	74	29.44	SM	0	0	0	62	38	0	17.88	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	35.00	D	28	27	30	32	62	25.49	-	-	-	-	-	-	-	16.81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	36.50	D	29	28	29	36	65	25.97	-	-	-	-	-	-	-	16.41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	38.00	D	30	29	33	38	71	27.26	SM	0	0	0	73	27	0	16.35	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	40.00	D	31	30	38	40	78	28.62	-	-	-	-	-	-	-	17.26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 19: SUMMARY OF TEST RESULTS

Bore No : P59	**Ground Elevation : RL 191.466 m**	**Method of drilling :Percussion**	**Depth of Water : 1.50 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 03/11/2023**	**SPT Sampler: Standard**
Location / Chainage : 22461.687	**Casing Lowered : 21.00 m**	**Ending Date : 05/11/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	SM	0	0	1	55	44	0	13.07	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	1.00	U	2	-	-	-	-	-	ML	0	0	1	48	47	4	14.20	1.94	1.70	24.0	20.0	4.0	2.64	DST	4.0	26.7	-	0.553	-	-	-	-	Inorganic Silts of low plasticity											
	2.00	D	3	1	2	2	4	5.46	-	-	-	-	-	-	-	20.66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	3.00	D	4	1	2	3	5	6.41	SM	0	0	1	72	27	0	25.43	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	4.00	D	5	-	-	-	-	-	MI	0	1	1	5	81	12	22.89	1.93	1.57	38.0	26.0	12.0	2.67	RUU	62.0	7.2	-	0.701	-	14	14	-	Inorganic Silts of Intermediate plasticity											
	5.00	D	6	3	3	4	7	7.00	-	-	-	-	-	-	-	30.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	6.00	D	7	4	5	5	10	10.00	-	-	-	-	-	-	-	30.93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	7.00	U	8	-	-	-	-	-	SM	0	0	0	72	28	0	26.30	1.90	1.50	Non-Plastic			2.61	DST	0.0	28.4	-	0.735	-	-	-	-	Silty Sands											
	8.00	D	9	6	7	9	16	15.82	-	-	-	-	-	-	-	26.10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	9.00	D	10	5	8	10	18	16.57	-	-	-	-	-	-	-	24.36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	10.00	U	11	-	-	-	-	-	CL-ML	4	2	1	14	72	7	19.30	2.01	1.68	27.0	21.0	6.0	2.66	UU	40.0	11.5	0.138	0.579	-	-	-	-	Inorganic Silty Clays of low plasticity											
	11.00	D	12	3	6	9	15	15.00	CL	1	0	0	8	82	9	23.80	-	-	28.0	20.5	7.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	12.00	D	13	5	8	12	20	20.00	-	-	-	-	-	-	-	20.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	13.00	U	14	-	-	-	-	-	CL	3	1	1	7	77	11	20.20	2.03	1.69	29.0	20.5	8.5	2.67	UU	55.0	8.4	-	0.580	-	10	17	-												
	14.50	D	15	5	9	13	22	22.00	-	-	-	-	-	-	-	20.62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	16.00	U	16	-	-	-	-	-	CL	1	1	0	18	72	8	19.84	1.98	1.65	27.0	20.0	7.0	2.66	UU	50.0	11.8	-	0.612	-	-	-	-												
	17.50	D	17	7	12	15	27	18.28	-	-	-	-	-	-	-	18.86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

APPENDIX "B"

TABLE 19: SUMMARY OF TEST RESULTS

Bore No : P59	Ground Elevation : RL 191.466 m	Method of drilling :Percussion	Depth of Water : 1.50 m
Diameter of Bore Hole : 150 mm	Bore Retained using : Casing	Starting Date : 03/11/2023	SPT Sampler: Standard
Location / Chainage : 22461.687	Casing Lowered : 21.00 m	Ending Date : 05/11/2023	Hammer type: Auto-trip

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	19.00	U	18	-	-	-	-	-	SM	2	0	0	54	44	0	18.31	1.95	1.65	Non-Plastic			2.63	DST	2.0	27.6	-	0.594	-	-	-	-	Silty Sands											
	20.50	D	19	9	15	18	33	19.88	-	-	-	-	-	-	-	17.46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	22.00	D	20	-	-	-	-	-	SM	0	0	0	74	26	0	24.20	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	23.50	D	21	17	26	38	64	30.22	CL-ML	1	1	0	14	77	7	19.20	-	-	28.0	22.0	6.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	25.00	D	22	14	23	32	55	26.50	-	-	-	-	-	-	-	21.34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	26.50	D	23	16	28	31	59	27.32	CL-ML	4	1	1	17	70	7	23.76	-	-	26.0	20.5	5.5	-	-	-	-	-	-	-	-	-	-												
	28.00	D	24	18	27	33	60	60.00	MI	0	0	0	4	80	16	31.69	-	-	42.0	27.0	15.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of Intermediate plasticity											
	29.50	D	25	14	18	29	47	22.41	CL	5	2	3	24	59	7	16.66	-	-	27.5	20.5	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	31.00	U	26	-	-	-	-	-	SM-SC	1	0	1	48	46	4	19.06	2.01	1.69	24.0	20.0	4.0	2.65	DST	6.0	28.4	-	0.568	-	-	-	-	Silty Sands with clay binder											
	32.50	D	27	12	20	30	50	22.56	-	-	-	-	-	-	-	16.54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	34.00	U	28	-	-	-	-	-	CL-ML	0	0	1	42	52	5	18.60	2.03	1.71	26.0	21.0	5.0	2.65	DST	5.0	29.6	-	0.550	-	-	-	-	Inorganic Silty Clays of low plasticity											
	35.50	D	29	15	25	32	57	23.81	SM	0	0	1	54	45	0	18.05	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	37.00	D	30	17	26	33	59	23.97	-	-	-	-	-	-	-	17.86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	38.50	D	31	20	25	35	60	23.91	SM	0	0	1	52	47	0	17.47	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	40.00	D	32	22	26	38	64	24.65	-	-	-	-	-	-	-	16.83	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 20: SUMMARY OF TEST RESULTS

Bore No: P60	**Ground Elevation: RL 191.483 m**	**Method of drilling: Percussion**	**Depth of Water: 1.65 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 27/09/2023**	**SPT Sampler: Standard**
Location / Chainage: 22487.887	**Casing Lowered: 28.50 m**	**Ending Date: 02/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen												
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	0.50	D	1	-	-	-	-	-	SM	0	0	0	65	35	0	13.02	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	-	-	Silty Sands									
	1.00	D	2	2	3	3	6	9.17	-	-	-	-	-	-	-	17.90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	2.00	U	3	-	-	-	-	-	CH	1	1	3	32	43	20	21.16	2.07	1.71	55.5	20.5	35.0	2.68	UU	62.0	9.7	0.250	0.567	-	-	15	-	Inorganic clays of high plasticity										
	3.00	D	4	3	5	9	14	14.00	CL	3	2	4	9	72	10	19.38	-	-	31.5	22.0	9.5	-	-	-	-	-	-	-	-	17	-	Inorganic clays of low plasticity										
	4.00	D	5	3	4	5	9	9.00	-	-	-	-	-	-	-	25.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	5.00	U	6	-	-	-	-	-	SM	0	1	0	70	29	0	19.77	1.96	1.64	Non-Plastic			2.66	DST	5.0	29.4	-	0.622	-	-	-	-	Silty Sands											
	6.00	D	7	5	7	8	15	15.62	-	-	-	-	-	-	-	25.41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	7.00	D	8	6	8	10	18	16.89	-	-	-	-	-	-	-	27.24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	8.00	D	9	-	-	-	-	-	SM	0	0	1	65	34	0	21.55	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	-											
	9.00	D	10	7	9	15	24	19.26	CL-ML	1	1	2	28	60	8	19.74	-	-	25.0	19.0	6.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	10.00	D	11	6	10	12	22	17.94	-	-	-	-	-	-	-	21.62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	11.00	U	12	-	-	-	-	-	CL	0	1	4	9	77	9	20.08	2.04	1.70	26.5	19.5	7.0	2.66	DST	14.0	24.6	-	0.565	-	-	-	-	Inorganic clays of low plasticity										
	12.50	D	13	7	11	15	26	18.97	-	-	-	-	-	-	-	18.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	14.00	U	14	-	-	-	-	-	CL-ML	3	0	1	11	77	8	22.68	2.09	1.70	27.5	21.5	6.0	2.66	-	-	-	-	0.565	-	-	-	-	Inorganic Silty Clays of low plasticity										
	15.50	D	15	7	12	13	25	17.67	CL-ML	2	2	1	16	72	7	18.42	-	-	25.0	19.0	6.0	-	-	-	-	-	-	-	-	-	-											
	17.00	U	16	-	-	-	-	-	CL	1	1	1	38	51	8	16.71	2.07	1.77	27.0	20.0	7.0	2.66	DST	15.0	23.9	-	0.503	-	-	-	-	Inorganic clays of low plasticity										

APPENDIX "B"
TABLE 20: SUMMARY OF TEST RESULTS

Bore No: P60	**Ground Elevation: RL 191.483 m**	**Method of drilling: Percussion**	**Depth of Water: 1.65 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 27/09/2023**	**SPT Sampler: Standard**
Location / Chainage: 22487.887	**Casing Lowered: 28.50 m**	**Ending Date: 02/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																			
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen													
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction (Deg)	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	18.50	D	17	7	14	19	33	20.00	ML	0	0	1	42	57	0	18.51	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity										
	20.00	U	18	-	-	-	-	-	CL	2	1	1	10	76	10	19.35	2.06	1.73	28.0	19.0	9.0	2.67	DST	19.0	23.7	-	0.543	-	-	-	-	Inorganic clays of low plasticity										
	21.50	D	19	9	15	20	35	35.00	-	-	-	-	-	-	-	20.29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	23.00	U	20	-	-	-	-	-	CL	2	1	1	12	75	9	18.46	1.98	1.67	28.0	20.0	8.0	-	-	-	-	-	-	-	-	-	-										
	24.50	D	21	12	17	19	36	36.00	-	-	-	-	-	-	-	20.22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	26.00	U	22	-	-	-	-	-	MI	0	0	0	1	81	18	28.76	2.00	1.55	47.5	27.5	20.0	2.69	UU	60.0	6.4	-	0.735	-	-	21	-	Inorganic Silts of Intermediate plasticity										
	27.50	D	23	10	15	19	34	34.00	-	-	-	-	-	-	-	32.56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	29.00	U	24	-	-	-	-	-	CL-ML	0	1	2	28	64	5	20.57	2.09	1.73	26.5	20.5	6.0	2.65	UU	39.0	9.1	-	0.532	-	-	-	-	Inorganic Silty Clays of low plasticity										
	30.50	D	25	11	17	21	38	38.00	MI	0	0	0	3	81	16	31.08	-	-	47.0	28.0	19.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of Intermediate plasticity										
	32.00	U	26	-	-	-	-	-	CL-ML	1	4	3	27	59	6	19.15	1.93	1.62	25.0	20.0	5.0	2.65	-	-	-	-	0.636	-	-	-	-	Inorganic Silty Clays of low plasticity										
	33.50	D	27	10	22	33	55	23.29	ML	0	0	1	45	54	0	18.69	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity										
	35.00	D	28	13	28	37	65	65.00	ML	3	2	4	22	61	8	15.88	-	-	33.0	24.0	9.0	-	-	-	-	-	-	-	-	-	-										
	36.50	D	29	19	35	42	77	28.63	ML	0	0	0	17	76	7	22.49	-	-	32.0	25.0	7.0	-	-	-	-	-	-	-	-	-	-										
	38.00	D	30	25	39	50	89	89.00	CL-CI	3	2	2	10	70	13	13.13	-	-	35.0	22.0	13.0	-	-	-	-	-	-	-	-	-	-	Inorganic Clays of low to Intermediate plasticity										
	40.00	D	31	22	66	34	100	100.00	-	-	-	-	-	-	-	15.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX-B
TABLE 21: CHEMICAL TEST ON SOIL SAMPLES

BH No.	DEPTH (m)	SULPHATE CONTENT AS SO_3 (%)	CHLORIDE CONTENT (%)	pH VALUE
P60	3.00	0.069	0.092	8.13

APPENDIX-B
TABLE 22: UCS TEST ON SOIL SAMPLES

BH No.	DEPTH (m)	UCS (kg/cm²)
P41	2.00	0.71
	8.00	0.49
	11.00	0.58
	14.00	0.64
	17.00	0.60
P42	1.00	0.91
	4.00	0.95
	10.00	0.65
	13.00	0.67
	22.00	0.71
	25.00	0.60
	28.00	0.65
P43	10.00	0.68
	13.00	0.76
	16.00	0.92
	22.00	0.83
	31.00	0.71
P44	1.00	0.76
	10.00	0.82
	13.00	0.72
	19.00	0.67
	25.00	0.75
P45	10.00	0.52
	13.00	0.63
	16.00	0.68
	19.00	0.60
	22.00	0.69
	25.00	0.60
	28.00	0.83
P46	10.00	0.58
	13.00	0.71

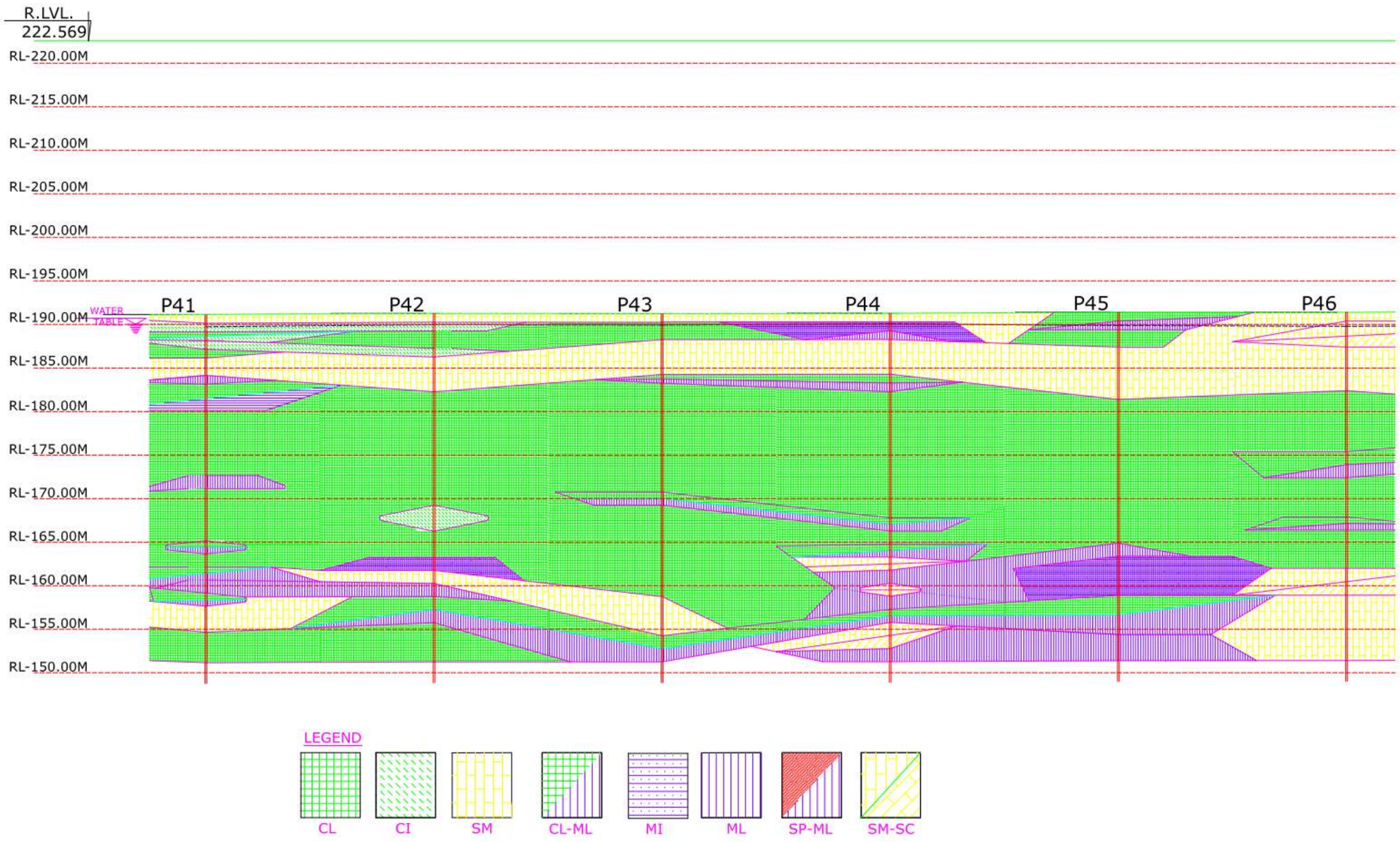
APPENDIX-B
TABLE 22: UCS TEST ON SOIL SAMPLES

BH No.	DEPTH (m)	UCS (kg/cm²)
	19.00	0.62
	22.00	0.69
P47	11.00	0.70
	17.00	0.64
	20.00	0.67
	23.00	0.69
	29.00	0.62
P48	11.00	0.64
	14.00	0.89
	17.00	0.62
	20.00	0.61
P49	11.00	0.63
	14.00	0.69
	17.00	0.73
	20.00	0.76
	23.00	0.86
	32.00	0.67
P50	10.00	0.79
	13.00	0.86
	16.00	0.89
	31.00	1.02
P51	13.00	0.78
	16.00	0.82
P52	13.00	0.58
	16.00	0.52
P53	13.00	0.70
	16.00	0.67
	28.00	0.87
P54	16.00	0.52
	28.00	0.71
P55	10.00	0.61

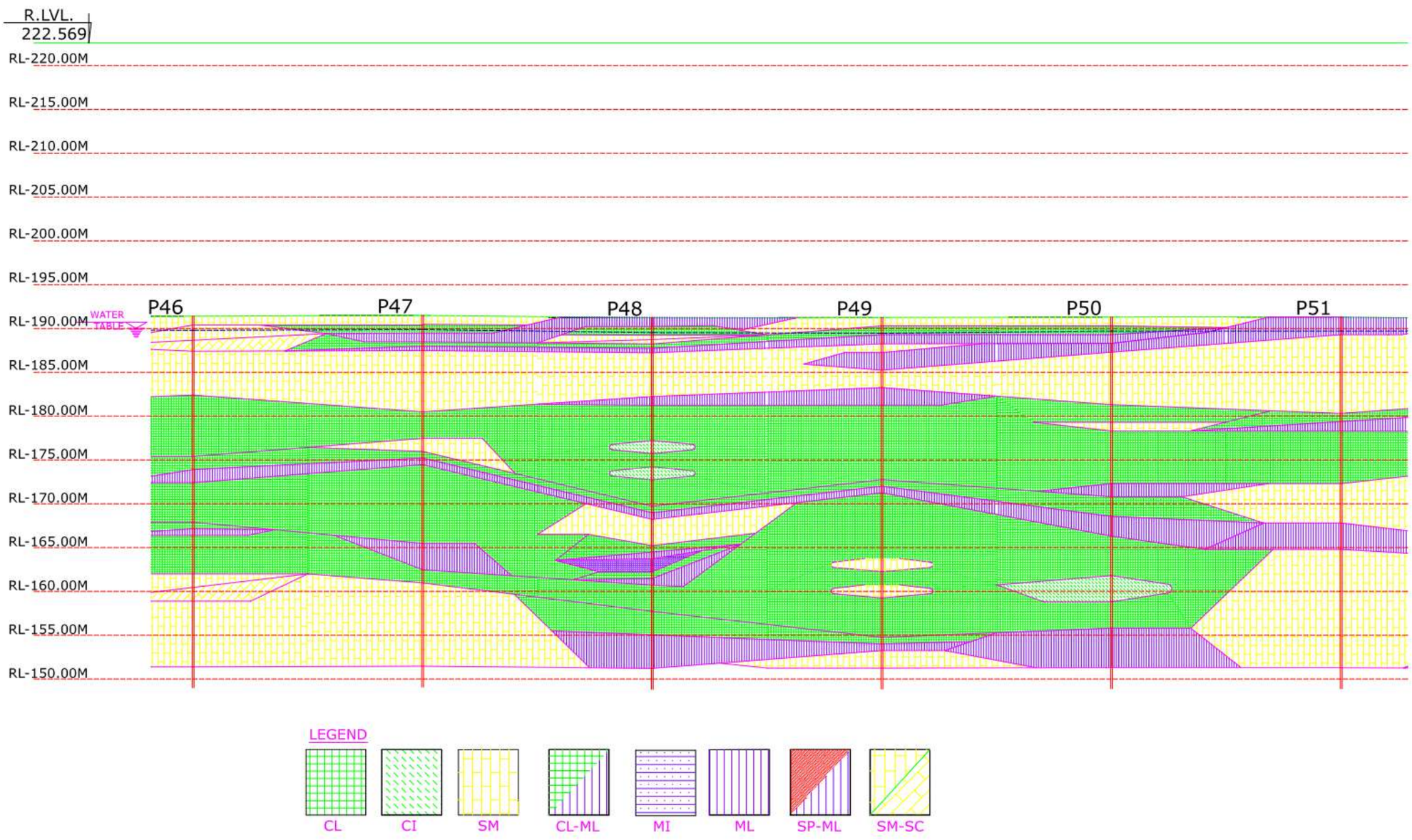
APPENDIX-B
TABLE 22: UCS TEST ON SOIL SAMPLES

BH No.	DEPTH (m)	UCS (kg/cm²)
	13.00	0.72
	16.00	0.69
	19.00	0.66
	25.00	0.85
P56	10.00	0.58
	13.00	0.54
	16.00	0.64
	19.00	0.63
	22.00	0.75
P57	10.00	0.68
	13.00	0.53
	16.00	0.62
	22.50	0.55
P58	2.00	0.49
	14.00	0.63
	26.00	0.68
P59	10.00	0.45
	13.00	0.58
	16.00	0.61
P60	2.00	0.70
	26.00	0.53
	29.00	0.64

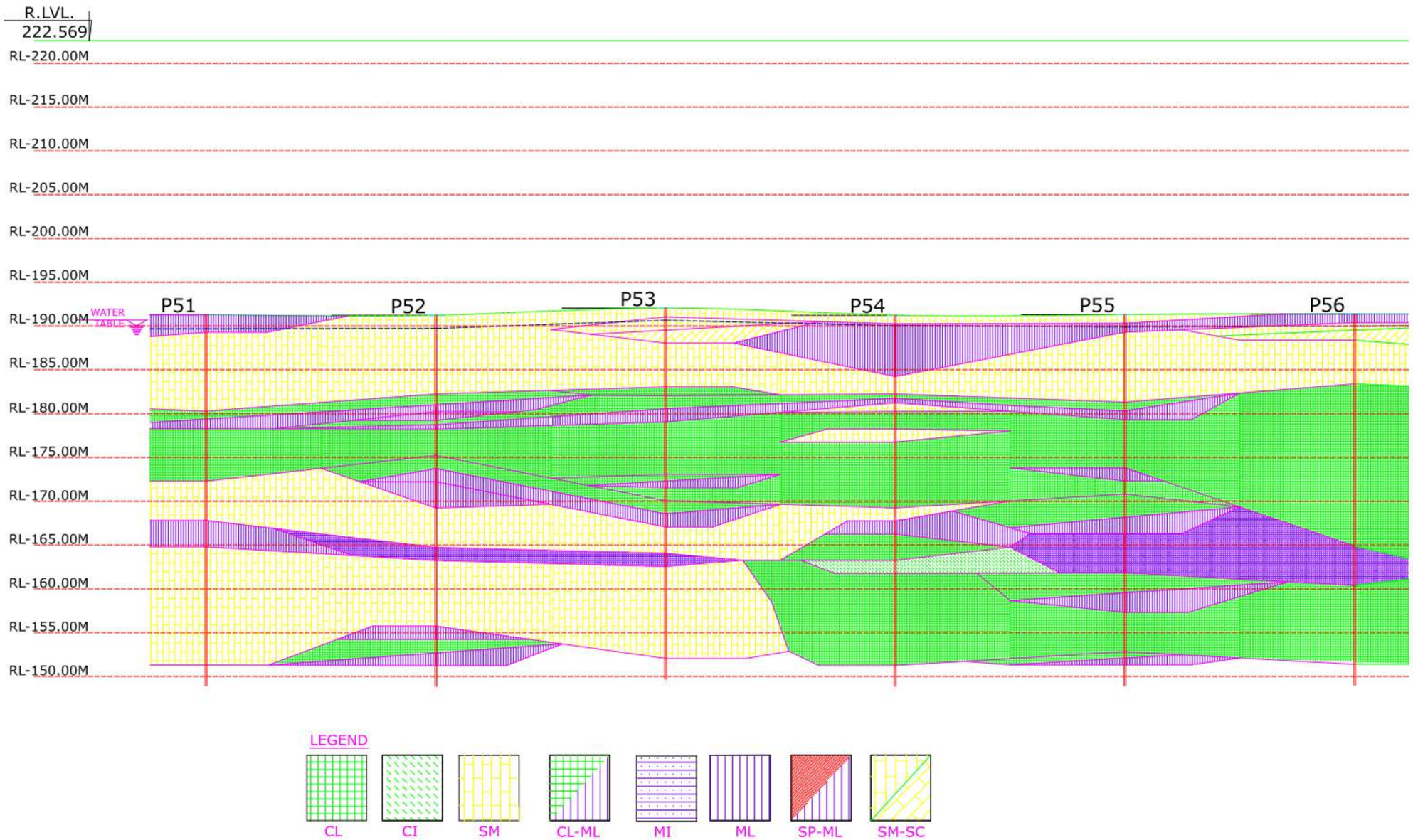
APPENDIX-C
PLOT 1: LITHOLOGICAL PROFILE-01



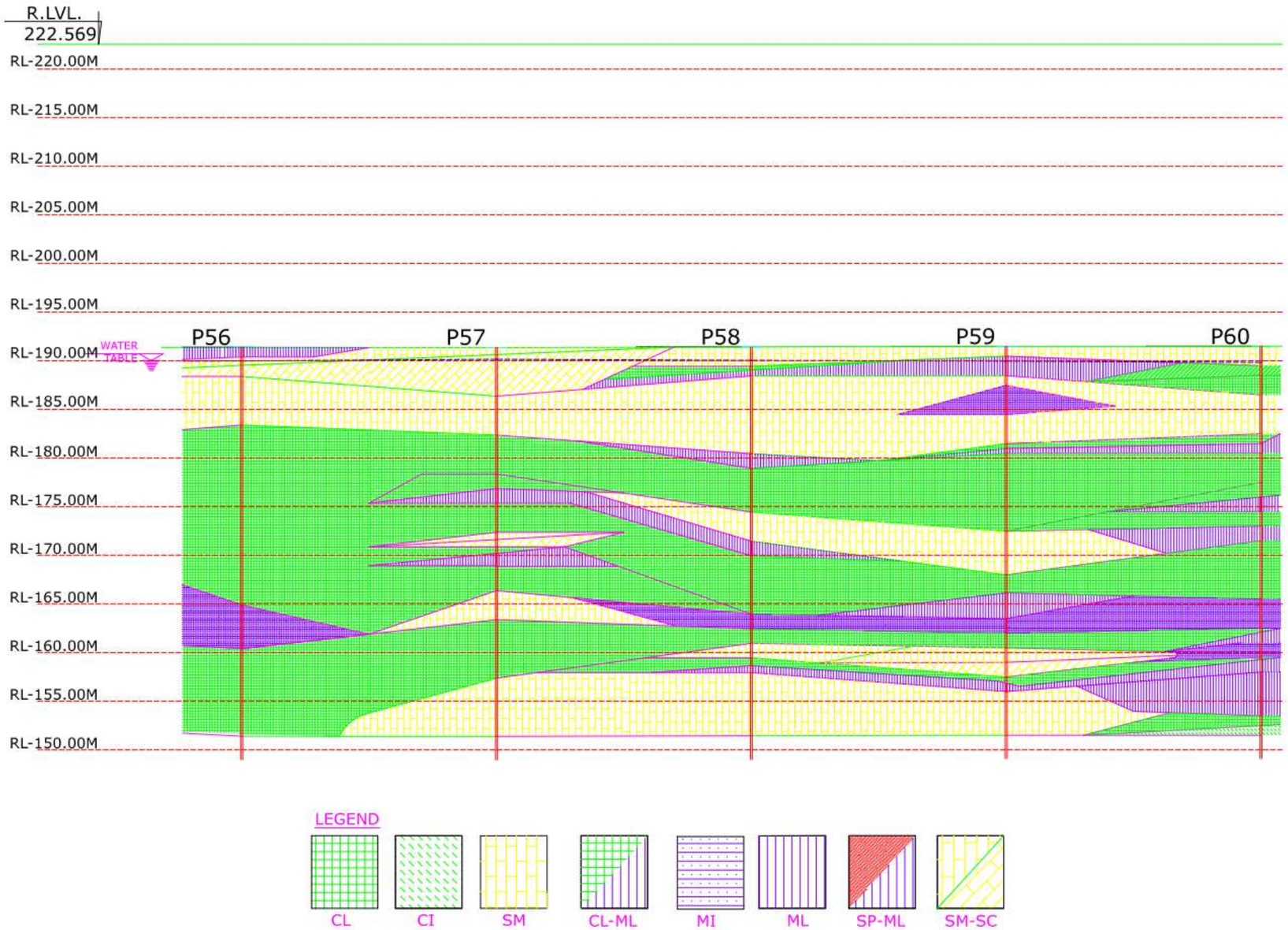
APPENDIX-C
PLOT 2: LITHOLOGICAL PROFILE-02



APPENDIX-C
PLOT 3: LITHOLOGICAL PROFILE-03



APPENDIX-C
PLOT 4: LITHOLOGICAL PROFILE-04



APPENDIX-C
PLOT 5: LITHOLOGICAL PLOTS

BH-P41-21990.087

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Silty Sands	SM		0.50	D		-	-
Inorganic clays of Intermediate plasticity	CI		1.00	D	3	-	-
Inorganic Clays of low to Intermediate plasticity	CL-CI		2.00	U		-	-
Inorganic clays of Intermediate plasticity	CI		3.00	D	7	-	-
Inorganic clays of low plasticity	CL		4.00	D	9	-	-
Silty Sands	SM		5.00	U		-	-
Inorganic Silts of low plasticity	ML		6.00	D	16	-	-
Inorganic Silty Clays of low plasticity	CL-ML		7.00	D	17	-	-
Inorganic clays of low plasticity	CL		8.00	U		-	-
Inorganic Silts of low plasticity	ML		9.00	D	18	-	-
			10.00	U	20	-	-
			11.00	U		-	-
			12.50	D	19	-	-
			14.00	U		-	-
			15.50	D	23	-	-
			17.00	U		-	-
			18.50	D	27	-	-
			20.00	D		-	-

BH-P41-21990.087

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			20.00	D		-	-
			21.50	D	37	-	-
Inorganic clays of low plasticity	CL		23.00	D		-	-
			24.50	D	42	-	-
Inorganic Silty Clays of low plasticity	CL-ML		26.00	U		-	-
Inorganic clays of low plasticity	CL		27.50	D	40	-	-
Inorganic Silty Clays of low plasticity	CL-ML		29.00	U		-	-
Inorganic Silts of low plasticity	ML		30.50	D	47	-	-
Inorganic Silty Clays of low plasticity	CL-ML		32.00	D		-	-
			33.50	D	49	-	-
Silty Sands	SM		35.00	D		-	-
			36.50	D	54	-	-
Inorganic clays of low plasticity	CL		38.00	D	57	-	-
			40.00	D	64	-	-

APPENDIX-C
PLOT 6: LITHOLOGICAL PLOTS

BH-P42-22016.2870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Silty Sands	SM		0.50	D		-	-
			1.00	U		-	-
Inorganic clays of Intermediate plasticity	CI		2.00	D	10	-	-
Inorganic clays of low plasticity	CL		3.00	D	12	-	-
			4.00	U		-	-
Inorganic clays of Intermediate plasticity	CI		5.00	D	16	-	-
			6.00	D	14	-	-
Silty Sands	SM		7.00	D		-	-
			8.00	D	13	-	-
			9.00	D	11	-	-
			10.00	U		-	-
			11.00	D	18	-	-
			12.00	D	25	-	-
			13.00	U		-	-
Inorganic clays of low plasticity	CL		14.50	D	17	-	-
			16.00	U		-	-
			17.50	D	18	-	-
			19.00	U		-	-
			20.00	D	28	-	-

BH-P42-22016.2870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Inorganic clays of low plasticity	CL		20.50	D	28	-	-
			22.00	U		-	-
Inorganic clays of Intermediate plasticity	CI		23.50	D	36	-	-
			25.00	U		-	-
Inorganic clays of low plasticity	CL		26.50	D	56	-	-
			28.00	U		-	-
Inorganic Silts of Intermediate plasticity	MI		29.50	D	47	-	-
Silty Sands	SM		31.00	U		-	-
Inorganic Silts of low plasticity	ML		32.50	D	56	-	-
Inorganic Silty Clays of low plasticity	CL-ML		34.00	D	53	-	-
			35.50	D	50	-	-
			37.00	D	49	-	-
Inorganic clays of low plasticity	CL		38.50	D	47	-	-
			40.00	D	50	-	-

APPENDIX-C
PLOT 7: LITHOLOGICAL PLOTS

BH-P43-22042.4870

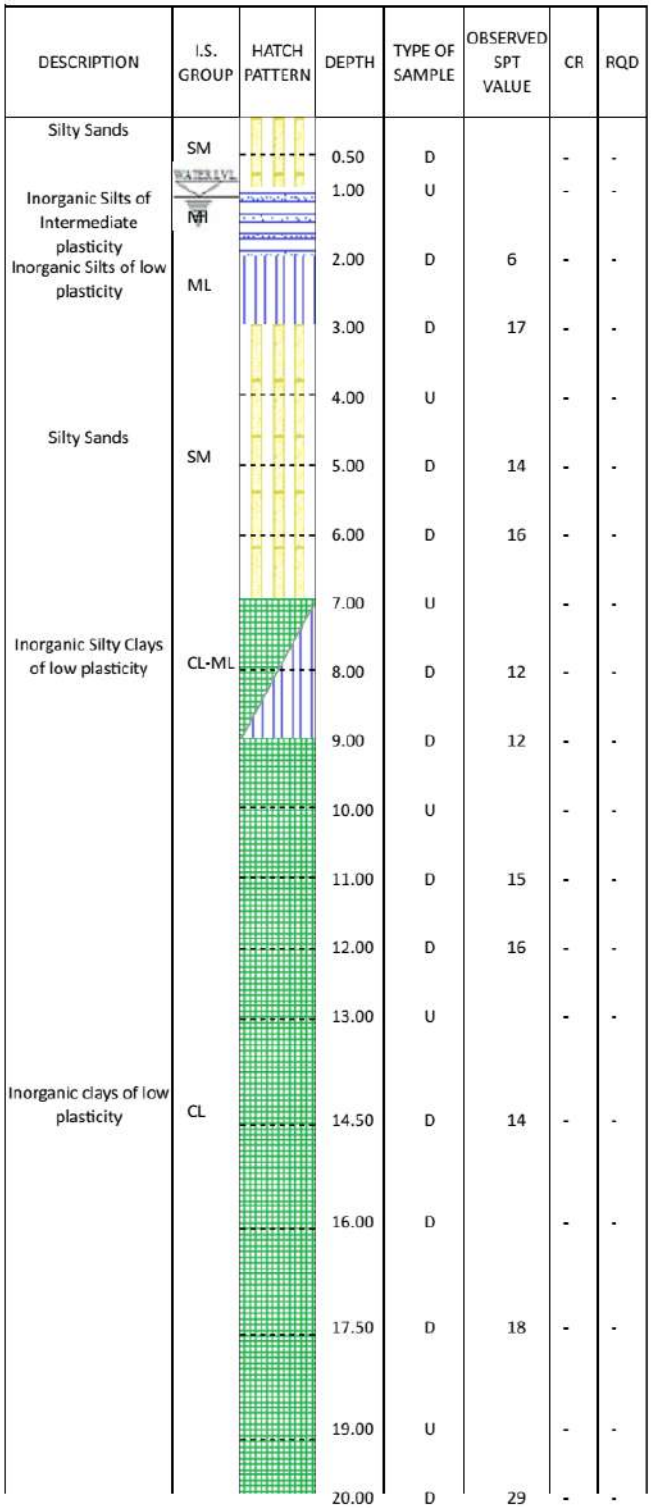
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Silty Sands	SM		0.50	D		-	-
			1.00	D		-	-
Inorganic clays of low plasticity	CL		2.00	D	6	-	-
			3.00	D	6	-	-
			4.00	U		-	-
Silty Sands	SM		5.00	D	12	-	-
			6.00	D	12	-	-
Inorganic Silty Clays of low plasticity	CL-ML		7.00	U		-	-
			8.00	D	13	-	-
			9.00	D	16	-	-
			10.00	U		-	-
			11.00	D	27	-	-
			12.00	D	31	-	-
			13.00	U		-	-
Inorganic clays of low plasticity	CL		14.50	D	14	-	-
			16.00	U		-	-
			17.50	D	18	-	-
			19.00	D		-	-
			20.00	D	22	-	-

BH-P43-22042.4870

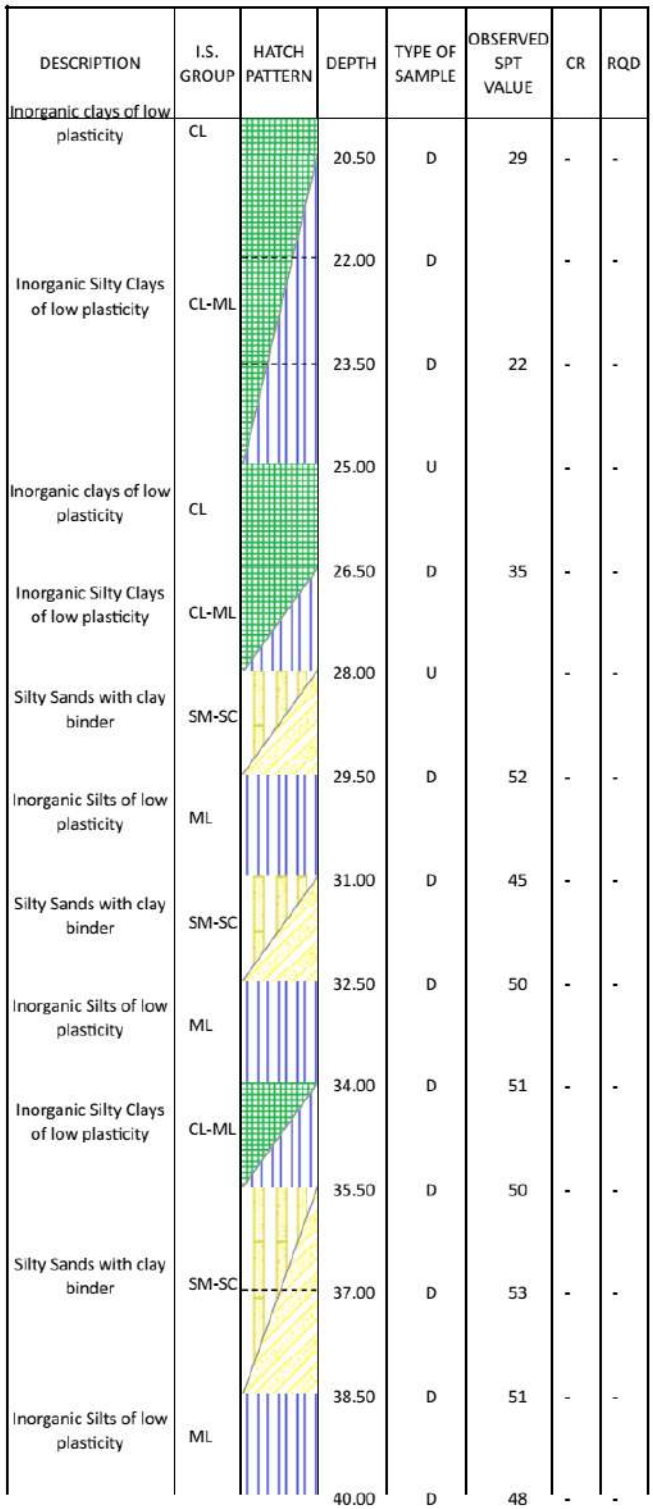
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Inorganic clays of low plasticity	CL		20.50	D	22	-	-
Inorganic Silty Clays of low plasticity	CL-ML		22.00	U		-	-
			23.50	D	31	-	-
			25.00	D		-	-
			26.50	D	49	-	-
Inorganic clays of low plasticity	CL		28.00	D		-	-
			29.50	D	39	-	-
			31.00	U		-	-
			32.50	D	67	-	-
			34.00	D	58	-	-
Silty Sands	SM		35.50	D	48	-	-
			37.00	D		-	-
Inorganic Silty Clays of low plasticity	CL-ML		38.50	D	50	-	-
			40.00	D	57	-	-

APPENDIX-C
PLOT 8: LITHOLOGICAL PLOTS

BH-P44-22068.6870

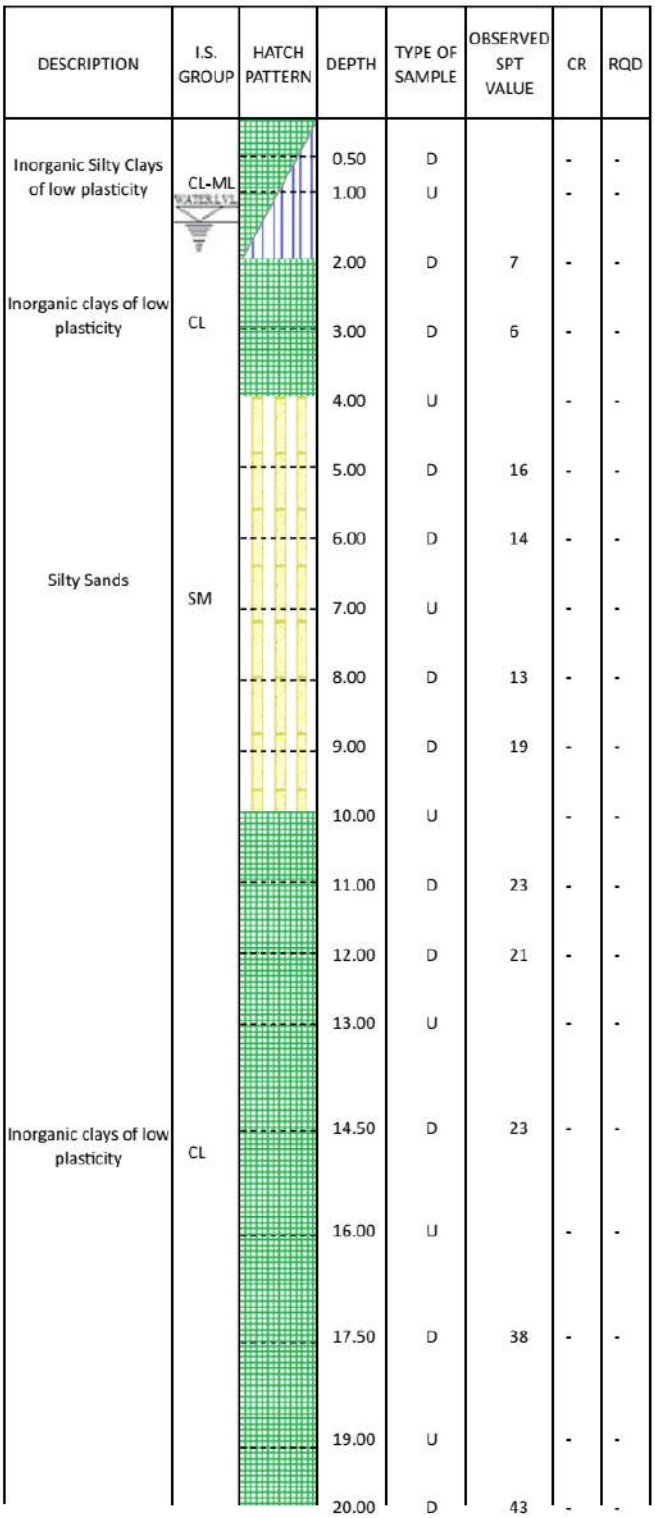


BH-P44-22068.6870

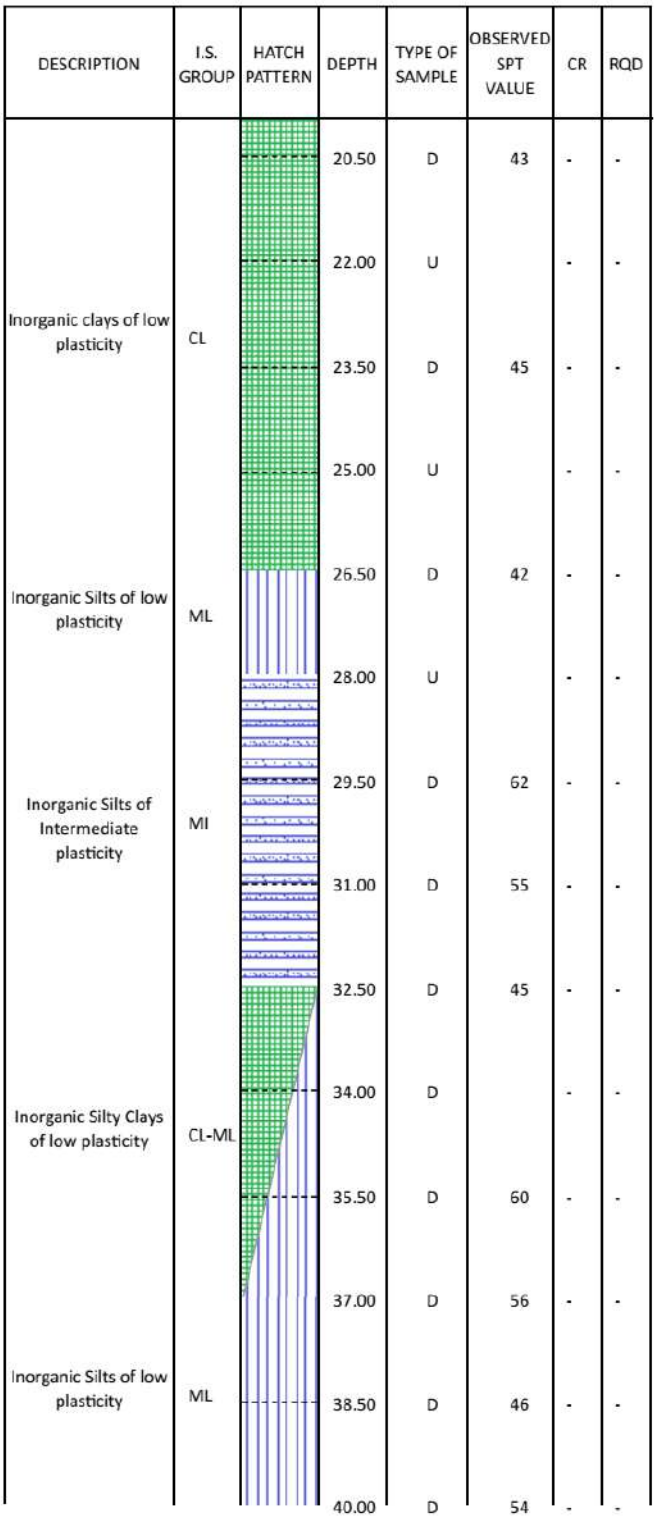


APPENDIX-C
PLOT 9: LITHOLOGICAL PLOTS

BH-P45-22094.887

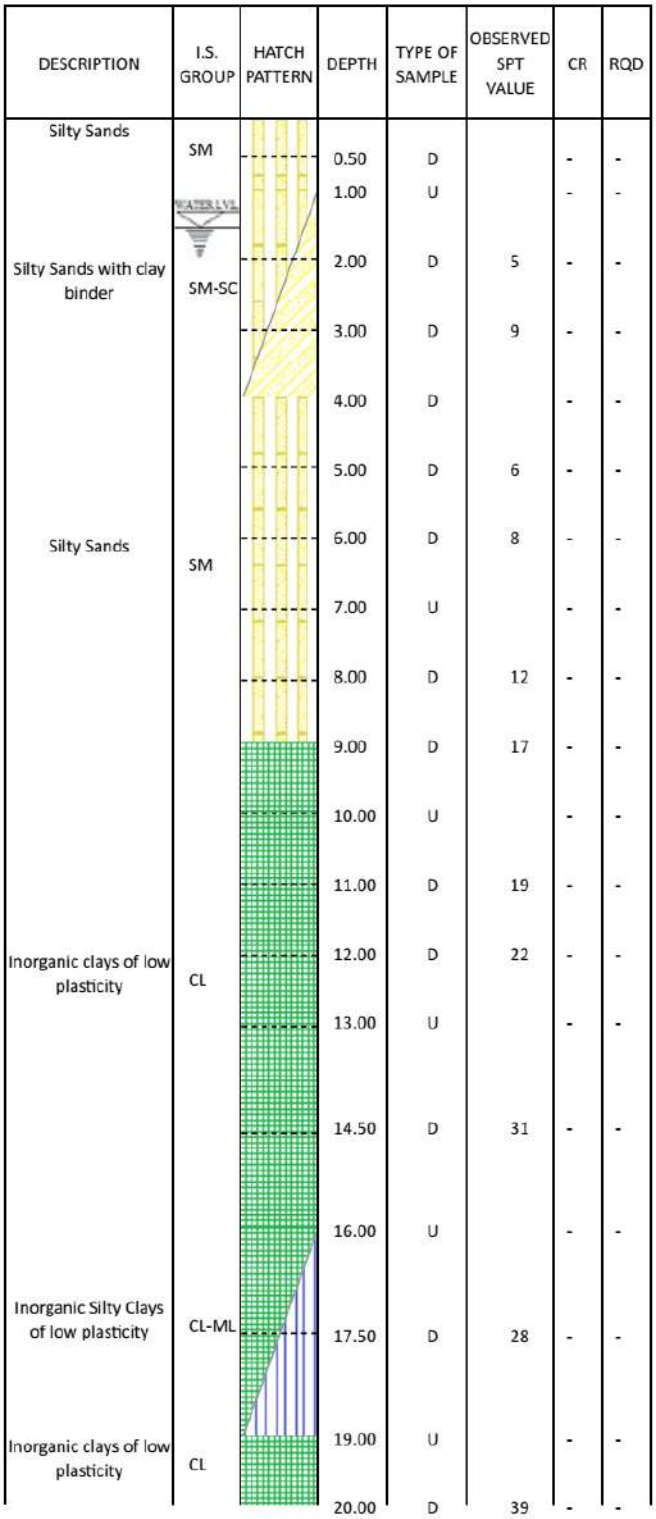


BH-P45-22094.887

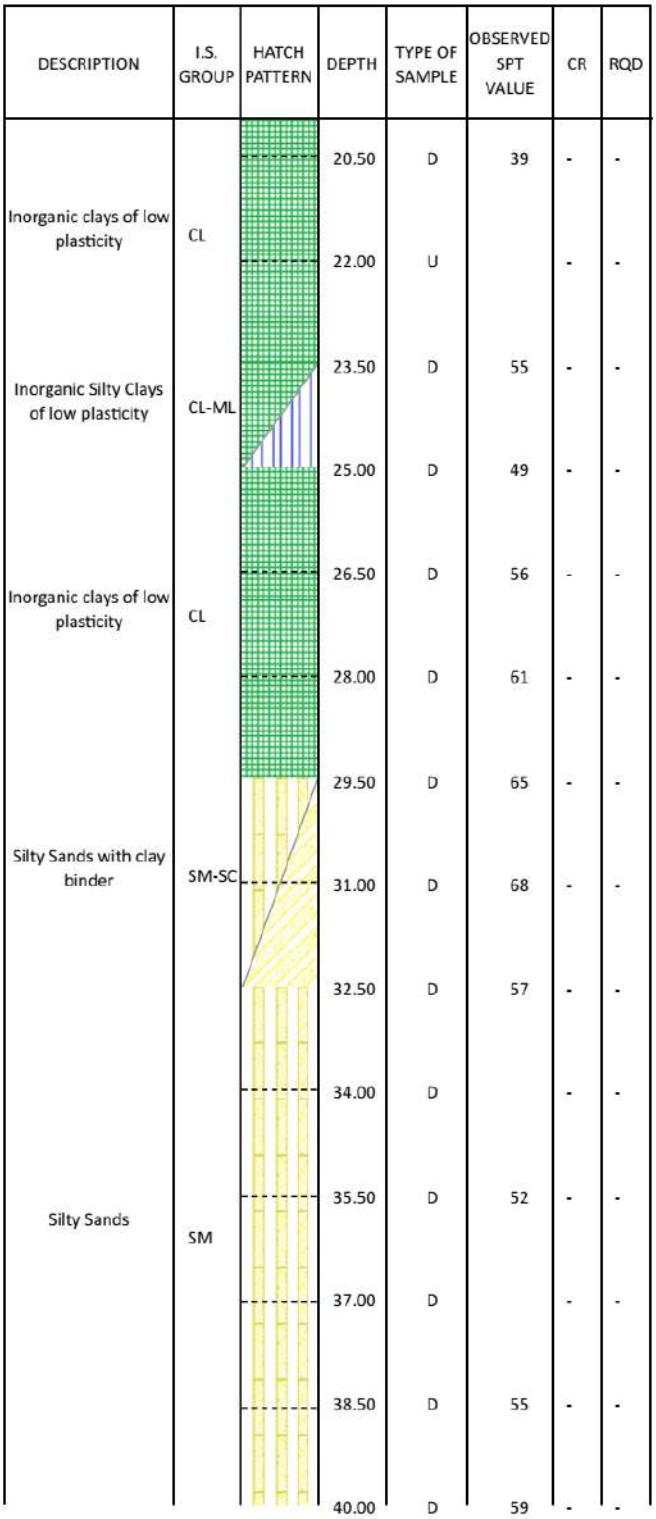


APPENDIX-C
PLOT 10: LITHOLOGICAL PLOTS

BH-P46-22121.087



BH-P46-22121.087



APPENDIX-C
PLOT 11: LITHOLOGICAL PLOTS

BH-P47-22147.287

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Silty Sands	SM		0.50	D		-	-
Inorganic clays of low plasticity	CL		1.00	D	2	-	-
			2.00	D		-	-
Inorganic Silts of low plasticity	ML						
Inorganic Silty Clays of low plasticity	CL-ML		3.00	D	9	-	-
			4.00	D	11	-	-
			5.00	U		-	-
			6.00	D	16	-	-
Silty Sands	SM		7.00	D	21	-	-
			8.00	U		-	-
			9.00	D	17	-	-
			10.00	D	19	-	-
			11.00	U		-	-
Inorganic clays of low plasticity	CL		12.50	D	28	-	-
			14.00	D		-	-
Silty Sands	SM						
			15.50	D	20	-	-
Inorganic Silty Clays of low plasticity	CL-ML						
			17.00	U		-	-
Inorganic clays of low plasticity	CL		18.50	D	34	-	-
			20.00	U		-	-

BH-P47-22147.287

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			20.00	U		-	-
			21.50	D	37	-	-
Inorganic clays of low plasticity	CL		23.00	U		-	-
			24.50	D	52	-	-
			26.00	D	41	-	-
Inorganic Silts of low plasticity	ML		27.50	D	45	-	-
			29.00	U		-	-
Inorganic clays of low plasticity	CL		30.50	D	48	-	-
			32.00	D		-	-
			33.50	D	51	-	-
Silty Sands	SM		35.00	D		-	-
			36.50	D	60	-	-
			38.00	D	56	-	-
			40.00	D	62	-	-

APPENDIX-C
PLOT 12: LITHOLOGICAL PLOTS

BH-P48-22173.4870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Inorganic Silts of low plasticity	ML		0.50	D		-	-
Inorganic clays of low plasticity	CL		1.00	D	3	-	-
			2.00	U		-	-
Silty Sands with clay binder	SM-SC		3.00	D	11	-	-
Inorganic Silty Clays of low plasticity	CL-ML		4.00	D	12	-	-
			5.00	D		-	-
Silty Sands	SM		6.00	D	10	-	-
			7.00	D	12	-	-
			8.00	D		-	-
Inorganic Silts of low plasticity	ML		9.00	D	9	-	-
			10.00	D	13	-	-
			11.00	U		-	-
Inorganic clays of low plasticity	CL		12.50	D	31	-	-
			14.00	U		-	-
Inorganic clays of Intermediate plasticity	CI		15.50	D	27	-	-
Inorganic clays of low plasticity	CL		17.00	U		-	-
Inorganic clays of Intermediate plasticity	CI		18.50	D	36	-	-
Inorganic clays of low plasticity	CL		20.00	U		-	-

BH-P48-22173.4870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			20.00	U		-	-
Inorganic clays of low plasticity	CL		21.50	D	45	-	-
Inorganic Silty Clays of low plasticity	CL-ML		23.00	D		-	-
Silty Sands	SM		24.50	D	45	-	-
			26.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML		27.50	D	50	-	-
Inorganic Silts of Intermediate plasticity	MI		29.00	D		-	-
Inorganic Silty Clays of low plasticity	CL-ML		30.50	D	51	-	-
Inorganic Silts of low plasticity	ML		32.00	D		-	-
			33.50	D	56	-	-
			35.00	D		-	-
Inorganic Silty Clays of low plasticity	CL-ML		36.50	D	55	-	-
			38.00	D		-	-
			40.00	D	63	-	-

APPENDIX-C
PLOT 13: LITHOLOGICAL PLOTS

BH-P49-22199.6870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Silty Sands	SM		0.50	D		-	-
			1.00	D	5	-	-
Inorganic Silty Clays of low plasticity	CL-ML		2.00	D		-	-
Silty Sands	SM		3.00	D	8	-	-
			4.00	D	12	-	-
Inorganic Silts of low plasticity	ML		5.00	D		-	-
			6.00	D	14	-	-
Silty Sands	SM		7.00	D	13	-	-
			8.00	D		-	-
Inorganic Silts of low plasticity	ML		9.00	D	9	-	-
			10.00	D	23	-	-
			11.00	U		-	-
			12.50	D	21	-	-
Inorganic clays of low plasticity	CL		14.00	U		-	-
			15.50	D	17	-	-
			17.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML		18.50	D	26	-	-
			20.00	U		-	-

BH-P49-22199.6870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			20.00	U		-	-
			21.50	D	41	-	-
Inorganic clays of low plasticity	CL		23.00	U		-	-
			24.50	D	44	-	-
			26.00	D		-	-
Silty Sands	SM		27.50	D	43	-	-
			29.00	U		-	-
Inorganic clays of low plasticity	CL		30.50	D	42	-	-
Silty Sands	SM		32.00	U		-	-
			33.50	D	46	-	-
Inorganic clays of low plasticity	CL		35.00	D		-	-
			36.50	D	49	-	-
Inorganic Silty Clays of low plasticity	CL-ML		38.00	D		-	-
Silty Sands	SM		40.00	D	55	-	-

APPENDIX-C
PLOT 14: LITHOLOGICAL PLOTS

BH-P50-22225.8870

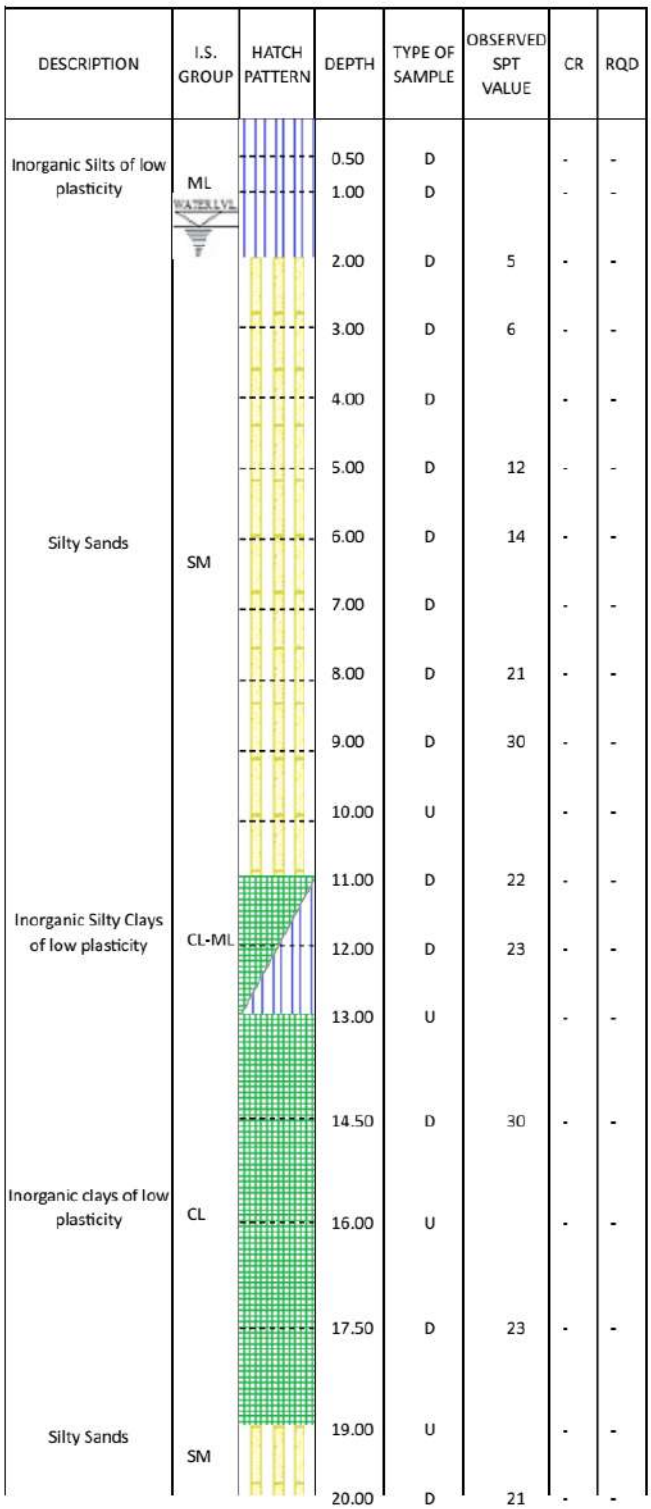
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Silty Sands	SM		0.50	D		-	-
			1.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML		2.00	D	3	-	-
Inorganic Silts of low plasticity	ML		3.00	D	7	-	-
			4.00	D		-	-
			5.00	D	14	-	-
			6.00	D	16	-	-
Silty Sands	SM		7.00	D		-	-
			8.00	D	22	-	-
			9.00	D	25	-	-
			10.00	U		-	-
Inorganic clays of low plasticity	CL		11.00	D	24	-	-
Silty Sands	SM		12.00	D	30	-	-
			13.00	U		-	-
			14.50	D	21	-	-
Inorganic clays of low plasticity	CL		16.00	U		-	-
			17.50	D	23	-	-
Inorganic Silts of low plasticity	ML		19.00	U		-	-
			20.00	D	22	-	-

BH-P50-22225.8870

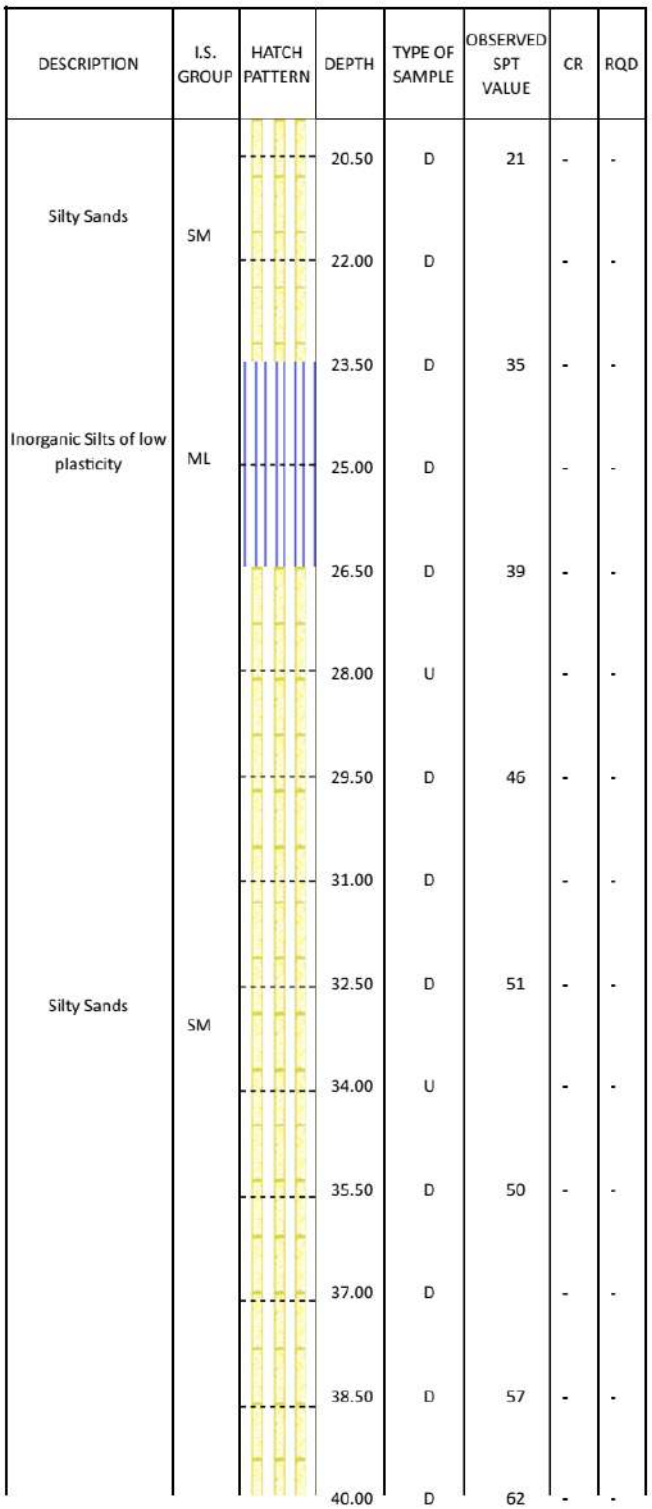
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Inorganic Silts of low plasticity	ML		20.50	D	22	-	-
			22.00	D		-	-
Inorganic Silty Clays of low plasticity	CL-ML		23.50	D	28	-	-
			25.00	D		-	-
			26.50	D	47	-	-
Inorganic clays of low plasticity	CL		28.00	D		-	-
			29.50	D	47	-	-
Inorganic clays of Intermediate plasticity	CI		31.00	U		-	-
			32.50	D	50	-	-
Inorganic clays of low plasticity	CL		34.00	D		-	-
			35.50	D	45	-	-
			37.00	D		-	-
Inorganic Silts of low plasticity	ML		38.50	D	48	-	-
			40.00	D	56	-	-

APPENDIX-C
PLOT 15: LITHOLOGICAL PLOTS

BH-P51-22252.0870

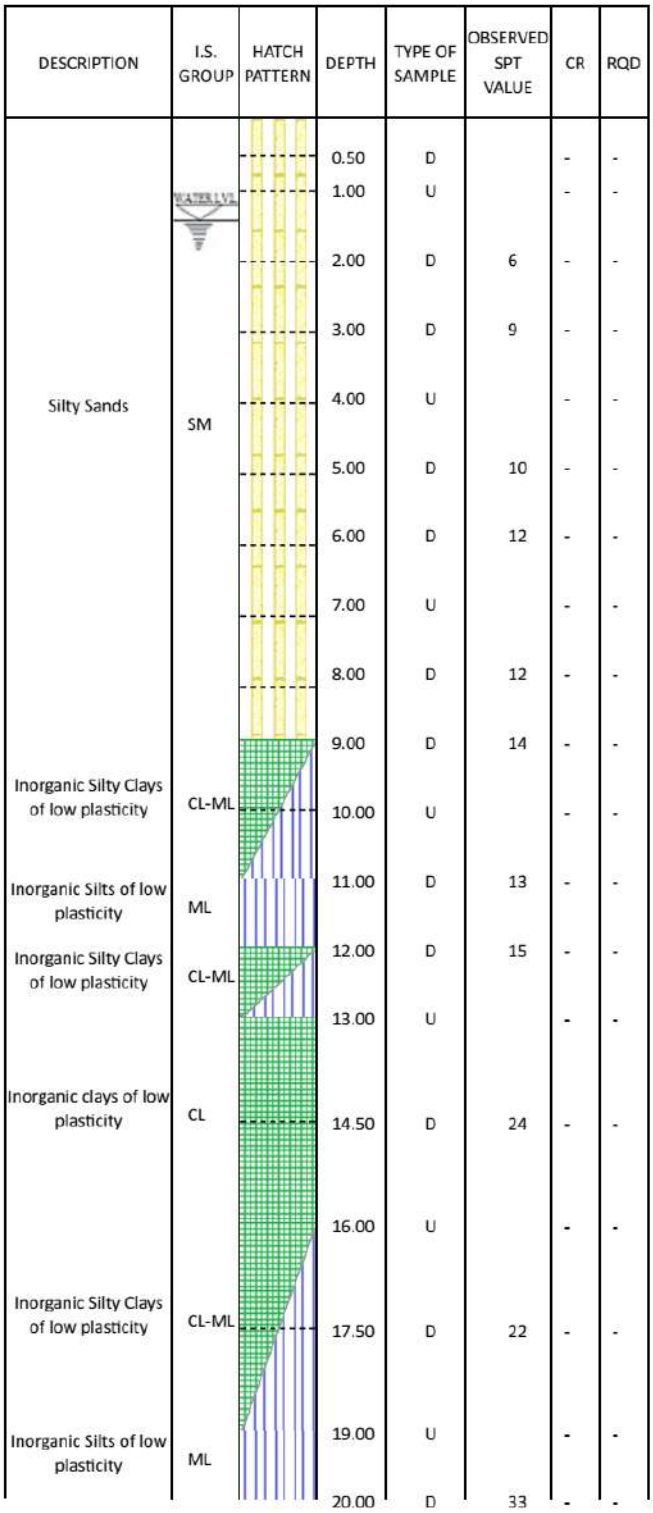


BH-P51-22252.0870

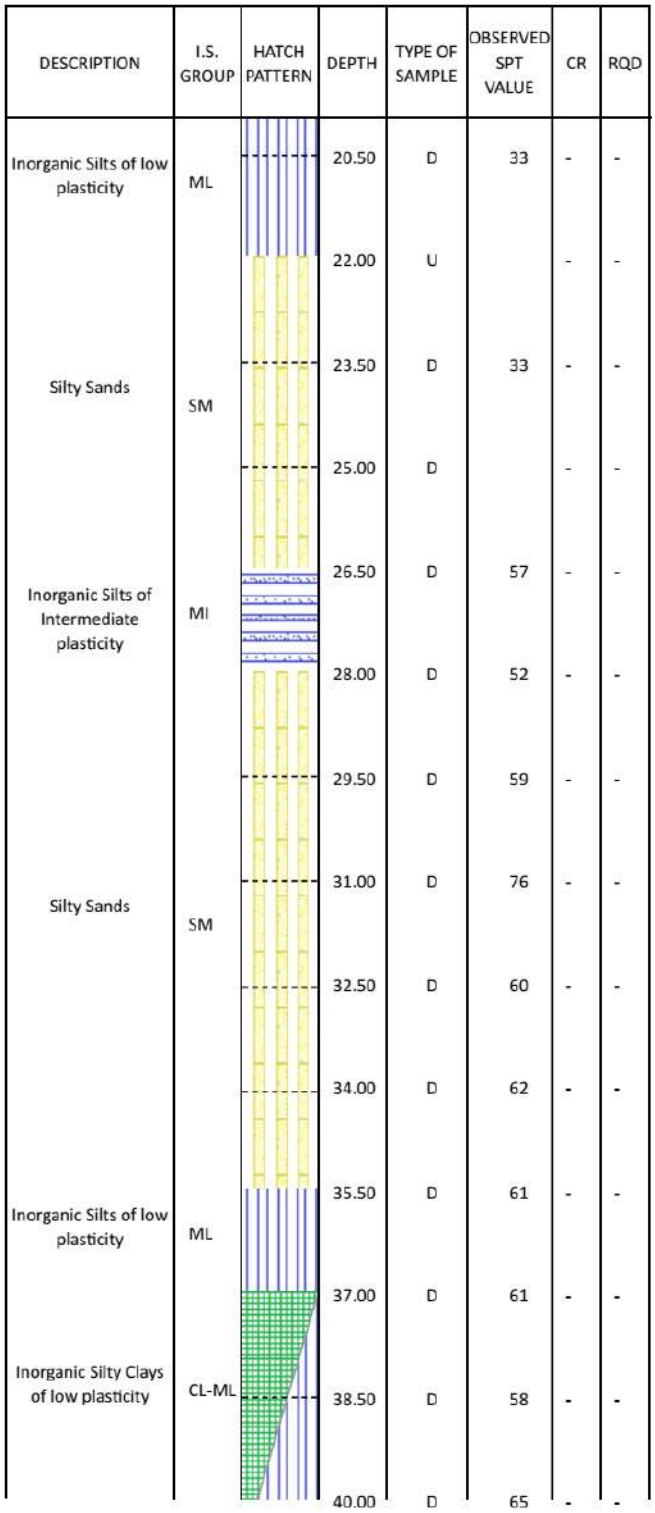


APPENDIX-C
PLOT 16: LITHOLOGICAL PLOTS

BH-P52-22278.287



BH-P52-22278.287



APPENDIX-C
PLOT 17: LITHOLOGICAL PLOTS

BH-P53-22304.487

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Silty Sands	SM		0.50	D		-	-
			1.00	U		-	-
Silty Sands with clay binder	SM-SC		2.00	D	6	-	-
			3.00	D	7	-	-
			4.00	U		-	-
			5.00	D	10	-	-
Silty Sands	SM		6.00	D	13	-	-
			7.00	D		-	-
			8.00	D	28	-	-
Inorganic clays of low plasticity	CL		9.00	D	23	-	-
			10.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML		11.00	D	37	-	-
			12.00	D	33	-	-
			13.00	U		-	-
			14.50	D	33	-	-
Inorganic clays of low plasticity	CL		16.00	U		-	-
			17.50	D	33	-	-
Inorganic Silty Clays of low plasticity	CL-ML		19.00	U		-	-
			20.00	D	45	-	-

BH-P53-22304.487

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Inorganic Silty Clays of low plasticity	CL-ML		20.50	D	45	-	-
Inorganic clays of low plasticity	CL		22.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML		23.50	D	60	-	-
			25.00	D	40	-	-
Silty Sands	SM		26.50	D	35	-	-
			28.00	U		-	-
Inorganic Silts of Intermediate plasticity	MI		29.50	D	50	-	-
			31.00	D		-	-
			32.50	D	60	-	-
			34.00	D	63	-	-
Silty Sands	SM		35.50	D	72	-	-
			37.00	D	60	-	-
			38.50	D	58	-	-
			40.00	D	67	-	-

APPENDIX-C
PLOT 18: LITHOLOGICAL PLOTS

BH-P54-22330.6870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Silty Sands	SM		0.50	D		-	-
		WATER LVL	1.00	D		-	-
			2.00	D	5	-	-
			3.00	D	7	-	-
Inorganic Silts of low plasticity	ML		4.00	D		-	-
			5.00	D	9	-	-
			6.00	D	15	-	-
			7.00	D		-	-
Silty Sands	SM		8.00	D	21	-	-
Inorganic Silty Clays of low plasticity	CL-ML		9.00	D	23	-	-
Silty Sands	SM		10.00	U		-	-
			11.00	D	21	-	-
Inorganic clays of low plasticity	CL		12.00	D	19	-	-
			13.00	U		-	-
Silty Sands	SM		14.50	D	22	-	-
			16.00	U		-	-
Inorganic clays of low plasticity	CL		17.50	D	34	-	-
			19.00	D		-	-
			20.00	D	36	-	-

BH-P54-22330.6870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Inorganic clays of low plasticity	CL		20.50	D	36	-	-
Silty Sands	SM		22.00	D		-	-
Inorganic Silts of low plasticity	ML		23.50	D	43	-	-
			25.00	U		-	-
Inorganic clays of low plasticity	CL		26.50	D	34	-	-
			28.00	U		-	-
Inorganic clays of Intermediate plasticity	CI		29.50	D	38	-	-
			31.00	D		-	-
			32.50	D	44	-	-
			34.00	D		-	-
Inorganic clays of low plasticity	CL		35.50	D	47	-	-
			37.00	D		-	-
			38.50	D	55	-	-
			40.00	D	60	-	-

APPENDIX-C
PLOT 19: LITHOLOGICAL PLOTS

BH-P55-22356.887

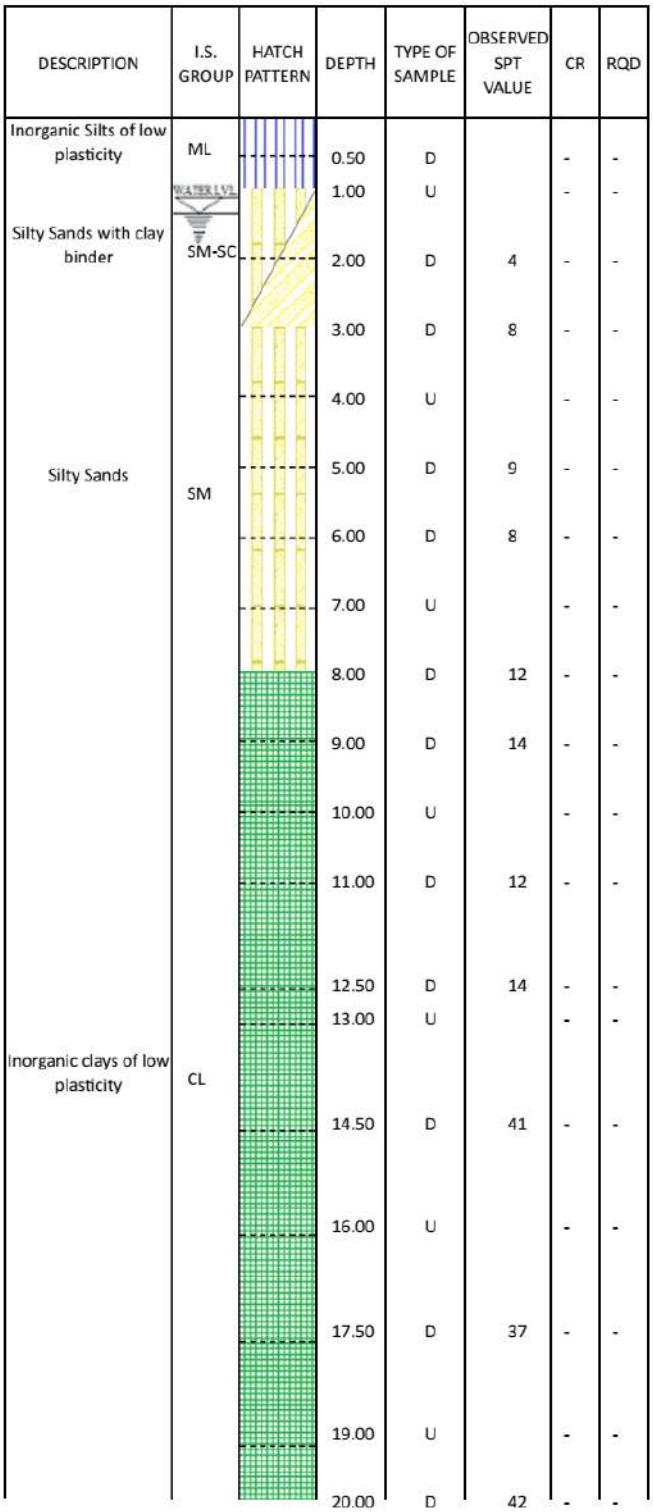
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Silty Sands	SM		0.50	D		-	-
Inorganic Silts of low plasticity	ML		1.00	U		-	-
			2.00	D	8	-	-
			3.00	D	6	-	-
			4.00	U		-	-
			5.00	D	11	-	-
Silty Sands	SM		6.00	D	13	-	-
			7.00	D		-	-
			8.00	D	15	-	-
			9.00	D	14	-	-
			10.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML		11.00	D	16	-	-
			12.00	D	19	-	-
			13.00	U		-	-
Inorganic clays of low plasticity	CL		14.50	D	29	-	-
			16.00	U		-	-
			17.50	D	32	-	-
Inorganic Silts of low plasticity	ML						
Inorganic clays of low plasticity	CL		19.00	U		-	-
			20.00	D	39	-	-

BH-P55-22356.887

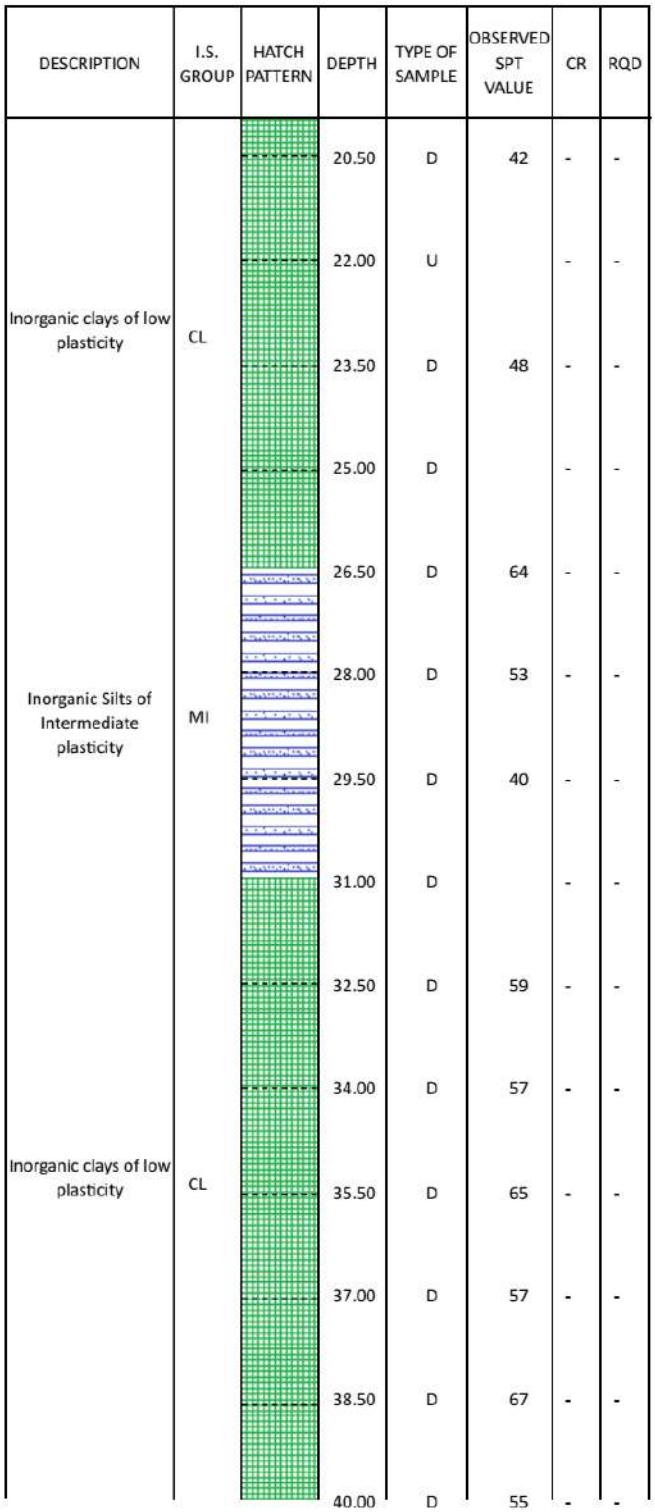
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Inorganic clays of low plasticity	CL		20.50	D	39	-	-
			22.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML		23.50	D	43	-	-
			25.00	U		-	-
			26.50	D	54	-	-
Inorganic Silts of Intermediate plasticity	MI		28.00	D	53	-	-
			29.50	D	56	-	-
			31.00	D	57	-	-
Inorganic Silty Clays of low plasticity	CL-ML		32.50	D	57	-	-
			34.00	D	64	-	-
			35.50	D	69	-	-
Inorganic clays of low plasticity	CL		37.00	D	68	-	-
			38.50	D	69	-	-
Inorganic Silty Clays of low plasticity	CL-ML		40.00	D	78	-	-

APPENDIX-C
PLOT 20: LITHOLOGICAL PLOTS

BH-P56-22383.087

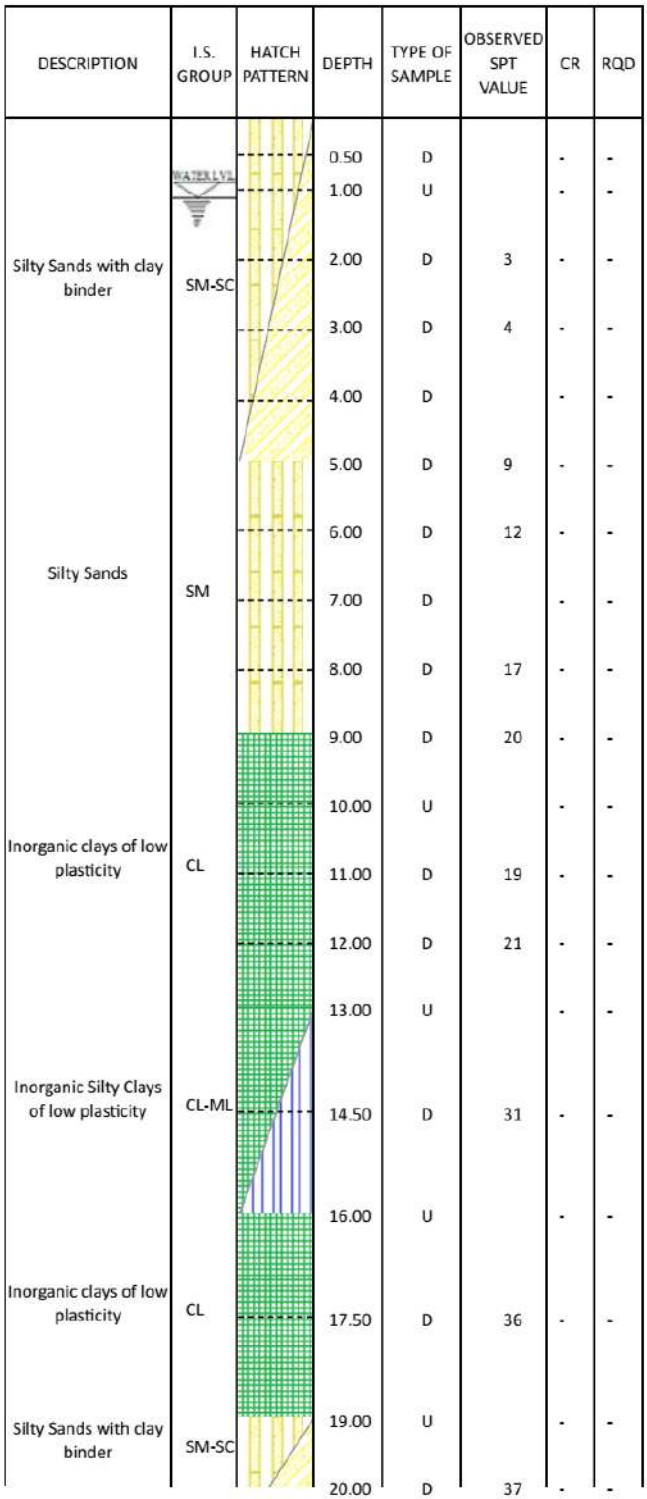


BH-P56-22383.087

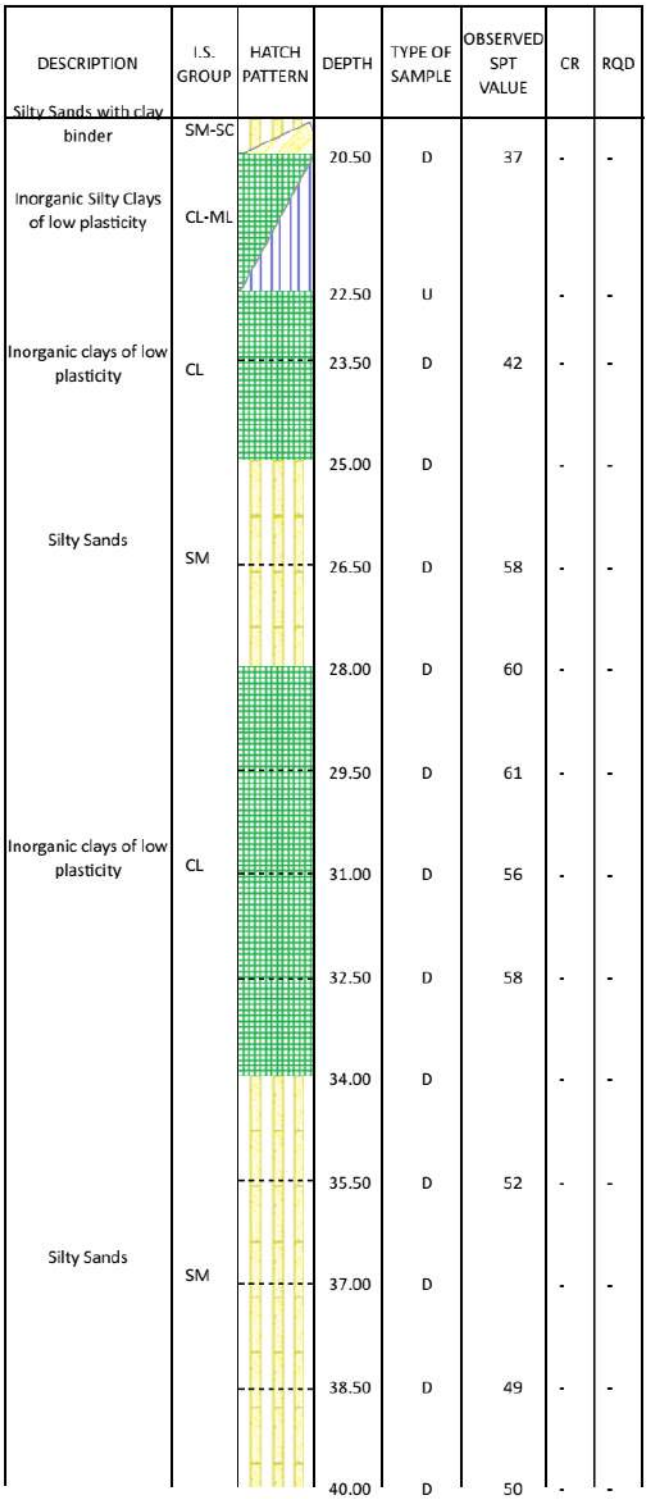


APPENDIX-C
PLOT 21: LITHOLOGICAL PLOTS

BH-P57-22409.287



BH-P57-22409.287



APPENDIX-C
PLOT 22: LITHOLOGICAL PLOTS

BH-P58-22435.487

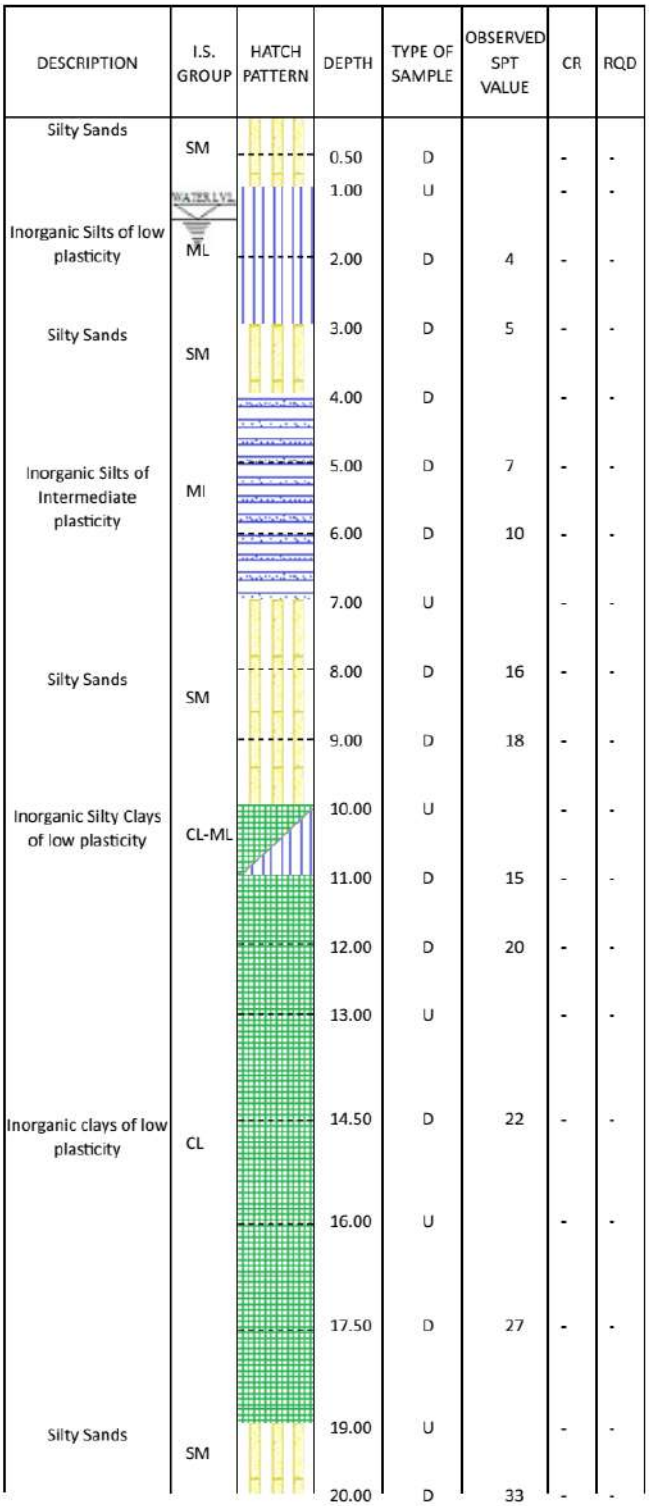
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Silty Sands	SM		0.50	D		-	-
			1.00	D	2	-	-
Inorganic Silty Clays of low plasticity	CL-ML		2.00	U		-	-
			3.00	D	4	-	-
			4.00	D	10	-	-
			5.00	U		-	-
			6.00	D	17	-	-
Silty Sands	SM		7.00	D	20	-	-
			8.00	U		-	-
			9.00	D	15	-	-
			10.00	D	17	-	-
			11.00	U		-	-
Inorganic Silts of low plasticity	ML		12.50	D	19	-	-
			14.00	U		-	-
Inorganic clays of low plasticity	CL		15.50	D	22	-	-
			17.00	U		-	-
Silty Sands	SM		18.50	D	32	-	-
			20.00	U		-	-

BH-P58-22435.487

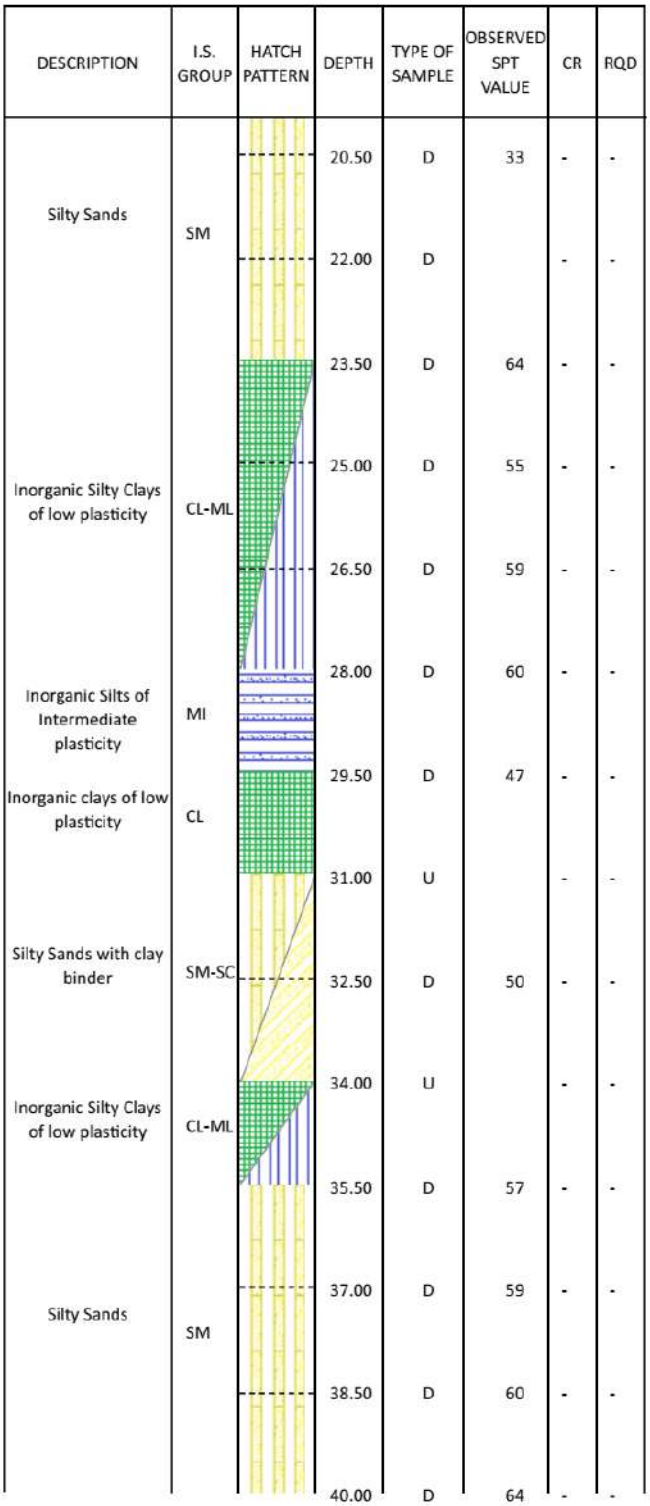
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			20.00	U		-	-
Inorganic Silts of low plasticity	ML		21.50	D	57	-	-
			23.00	D	60	-	-
Inorganic clays of low plasticity	CL		24.50	D	47	-	-
			26.00	U		-	-
			27.50	D	62	-	-
Inorganic Silts of Intermediate plasticity	MI		29.00	D	43	-	-
Inorganic clays of low plasticity	CL		30.50	D	R	-	-
Silty Sands	SM		32.00	D	R	-	-
Inorganic Silty Clays of low plasticity	CL-ML		33.50	D	74	-	-
			35.00	D	62	-	-
Silty Sands	SM		36.50	D	65	-	-
			38.00	D	71	-	-
			40.00	D	78	-	-

APPENDIX-C
PLOT 23: LITHOLOGICAL PLOTS

BH-P59-22461.687



BH-P59-22461.687



APPENDIX-C
PLOT 24: LITHOLOGICAL PLOTS

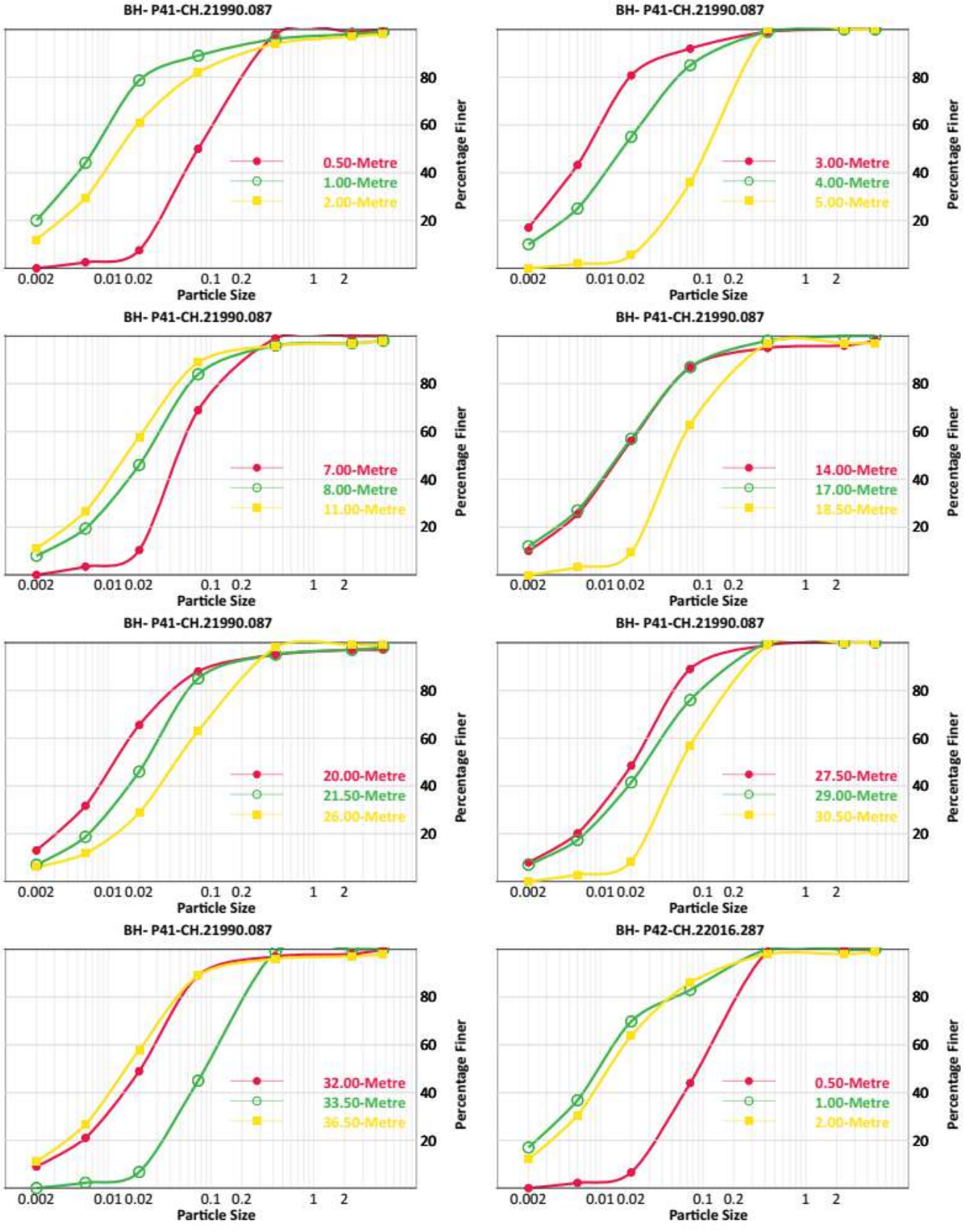
BH-P60-22487.8870

DESCRIPTION	I.S. GROUP	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Silty Sands	SM	0.50	D		-	-
		1.00	D	6	-	-
Inorganic clays of high plasticity	CH	2.00	U		-	-
		3.00	D	14	-	-
Inorganic clays of low plasticity	CL	4.00	D	9	-	-
		5.00	U		-	-
		6.00	D	15	-	-
Silty Sands	SM	7.00	D	18	-	-
		8.00	D		-	-
		9.00	D	24	-	-
Inorganic Silty Clays of low plasticity	CL-ML	10.00	D	22	-	-
		11.00	U		-	-
Inorganic clays of low plasticity	CL	12.50	D	26	-	-
		14.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML	15.50	D	25	-	-
		17.00	U		-	-
Inorganic clays of low plasticity	CL	18.50	D	33	-	-
Inorganic Silts of low plasticity	ML	20.00	U		-	-

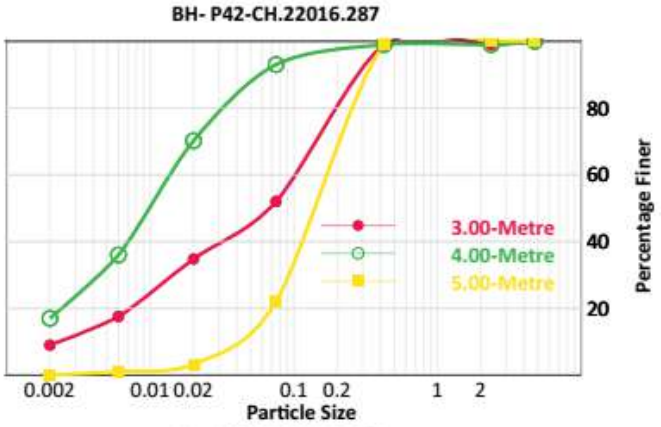
BH-P60-22487.8870

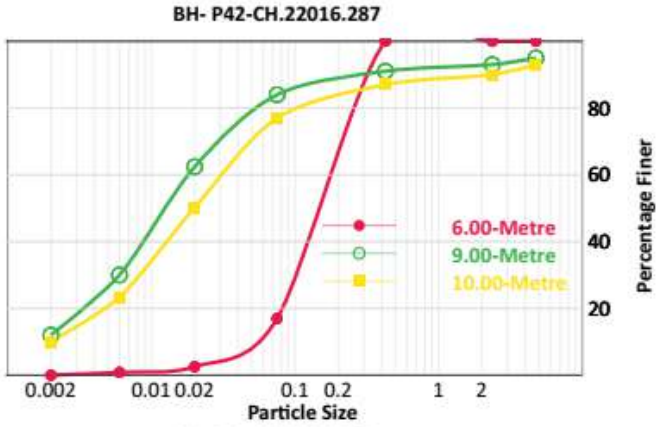
DESCRIPTION	I.S. GROUP	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
		20.00	U		-	-
		21.50	D	35	-	-
Inorganic clays of low plasticity	CL	23.00	U		-	-
		24.50	D	36	-	-
		26.00	U		-	-
Inorganic Silts of Intermediate plasticity	MI	27.50	D	34	-	-
		29.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML	30.50	D	38	-	-
Inorganic Silts of Intermediate plasticity	MI	32.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML	33.50	D	55	-	-
		35.00	D	65	-	-
Inorganic Silts of low plasticity	ML	36.50	D	77	-	-
		38.00	D	89	-	-
Inorganic Clays of low to Intermediate plasticity	CL-CI	40.00	D	100	-	-

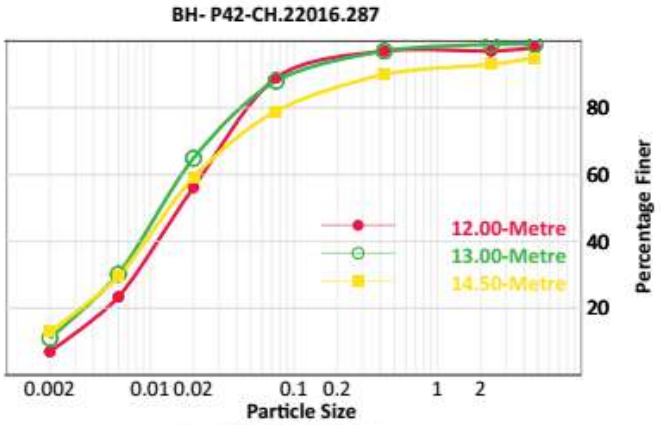
APPENDIX-D
PLOT 1: GRAIN SIZE DISTRIBUTION PLOTS

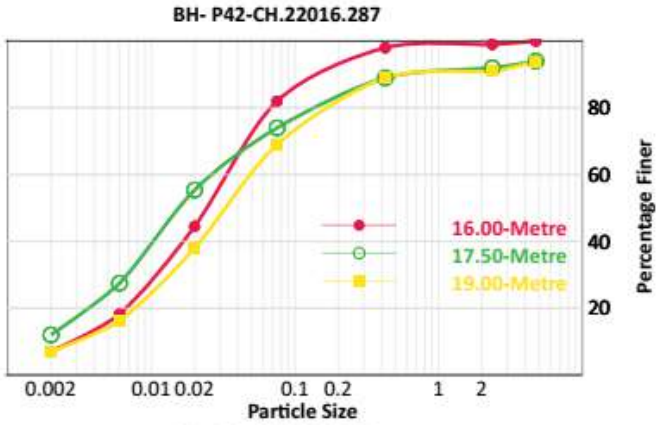


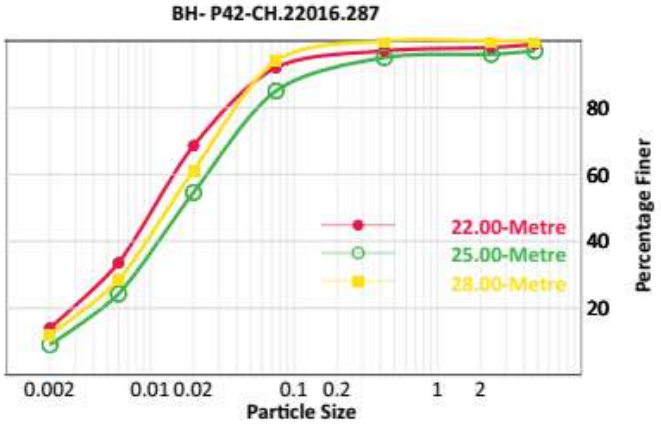
APPENDIX-D
PLOT 2: GRAIN SIZE DISTRIBUTION PLOTS

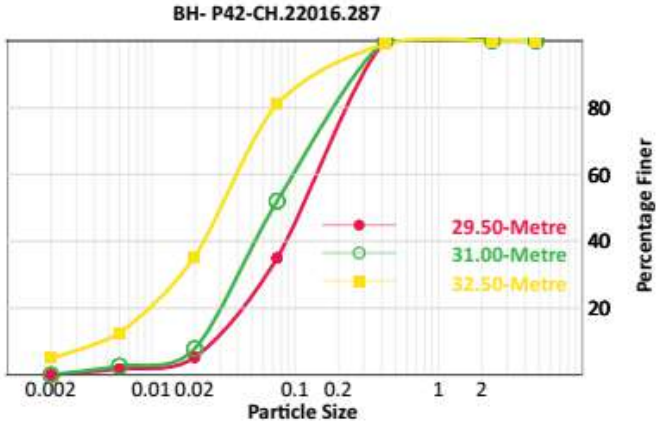


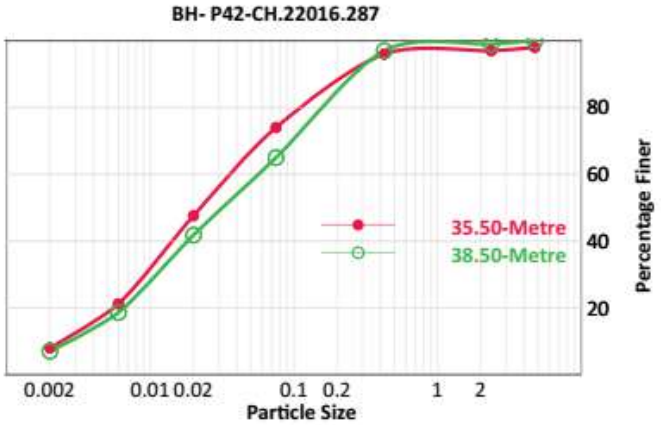


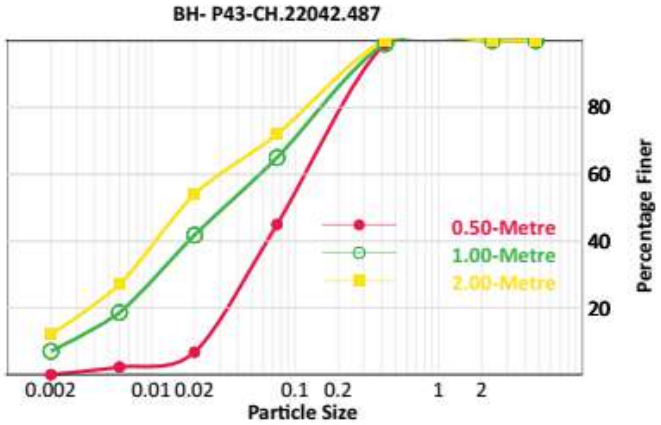




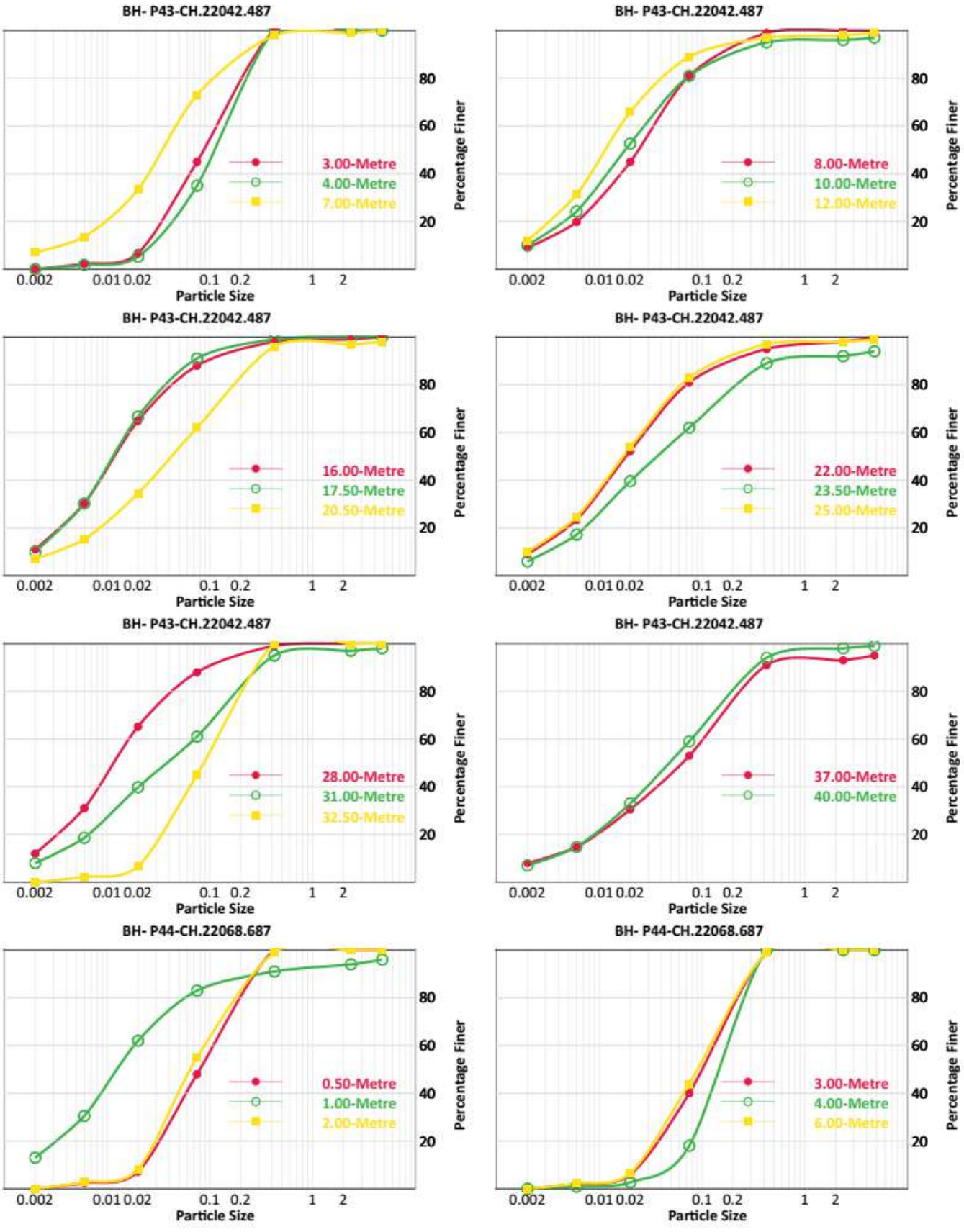






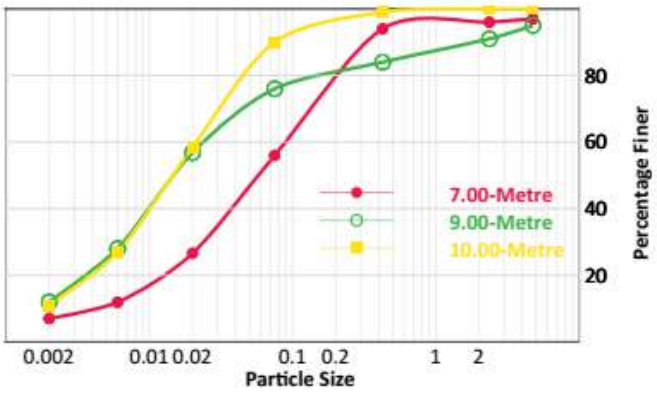


APPENDIX-D
PLOT 3: GRAIN SIZE DISTRIBUTION PLOTS

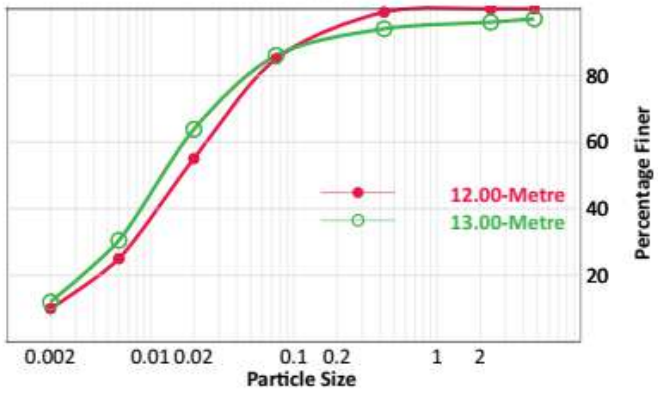


APPENDIX-D
PLOT 4: GRAIN SIZE DISTRIBUTION PLOTS

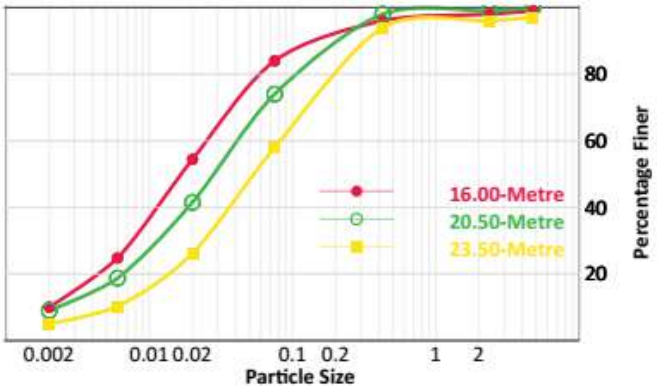
BH- P44-CH.22068.687



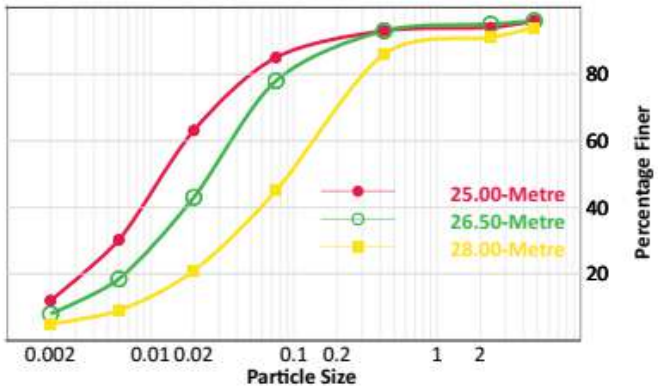
BH- P44-CH.22068.687



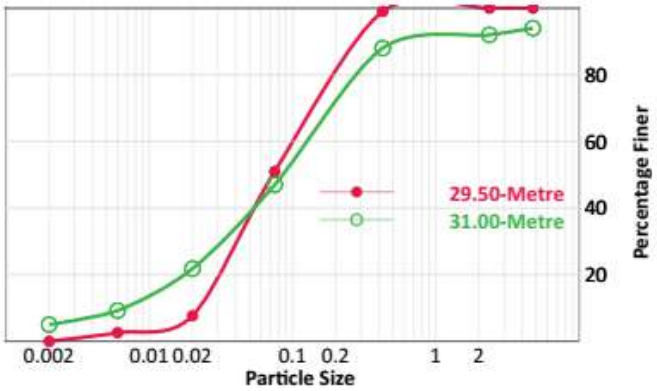
BH- P44-CH.22068.687



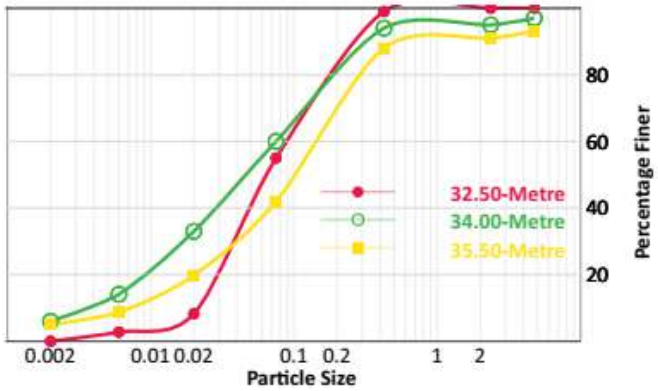
BH- P44-CH.22068.687



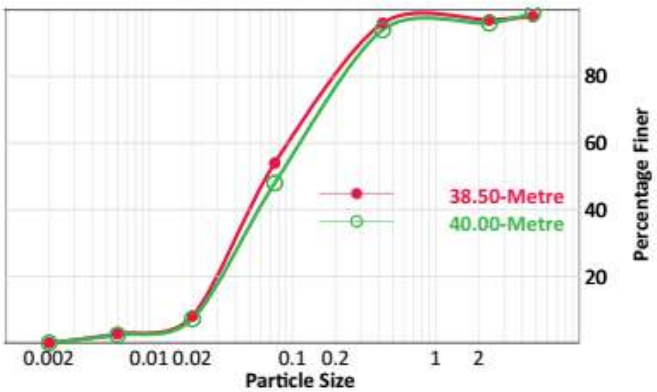
BH- P44-CH.22068.687



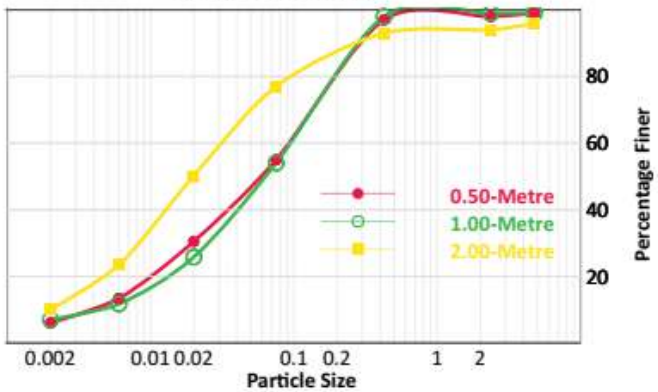
BH- P44-CH.22068.687



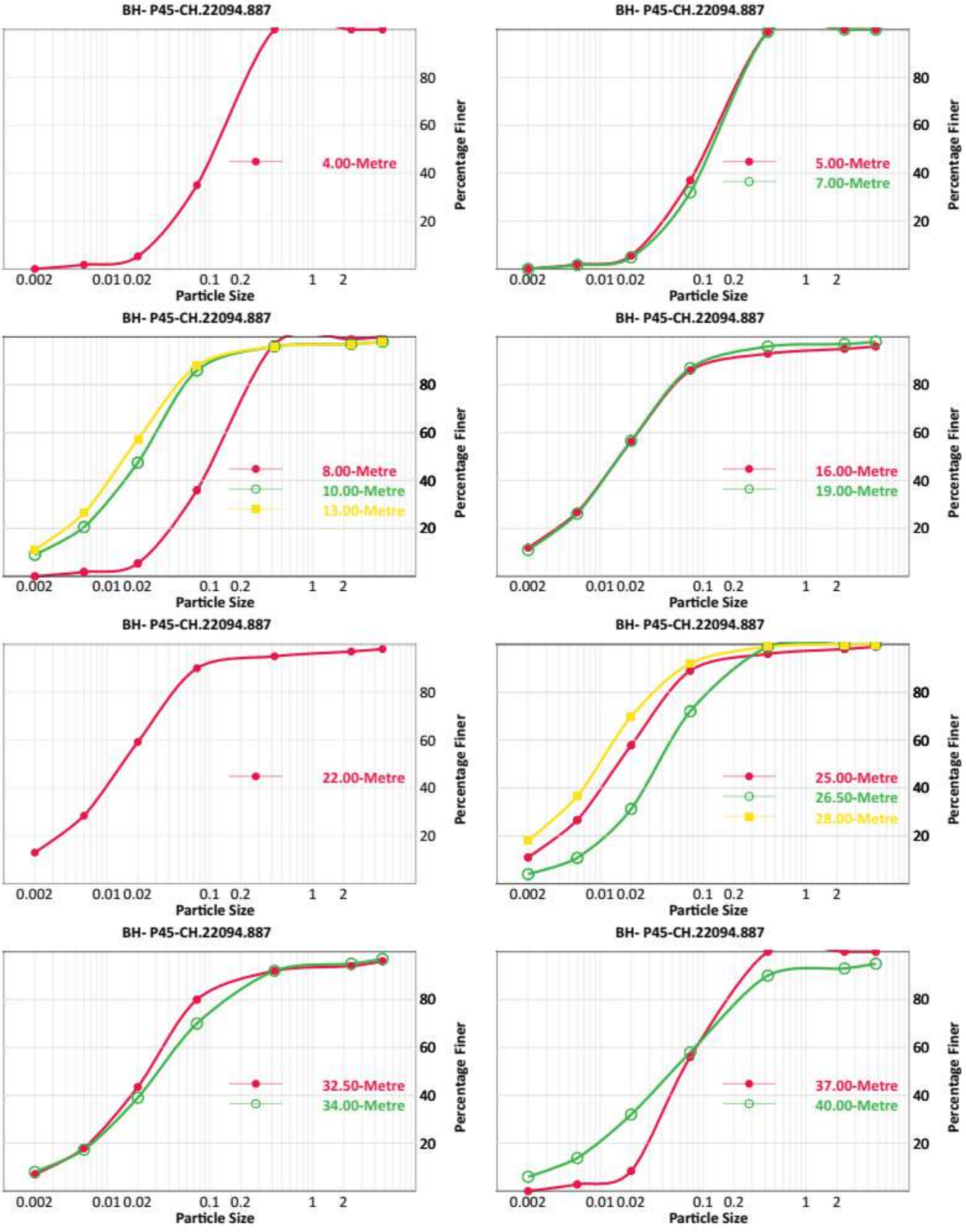
BH- P44-CH.22068.687



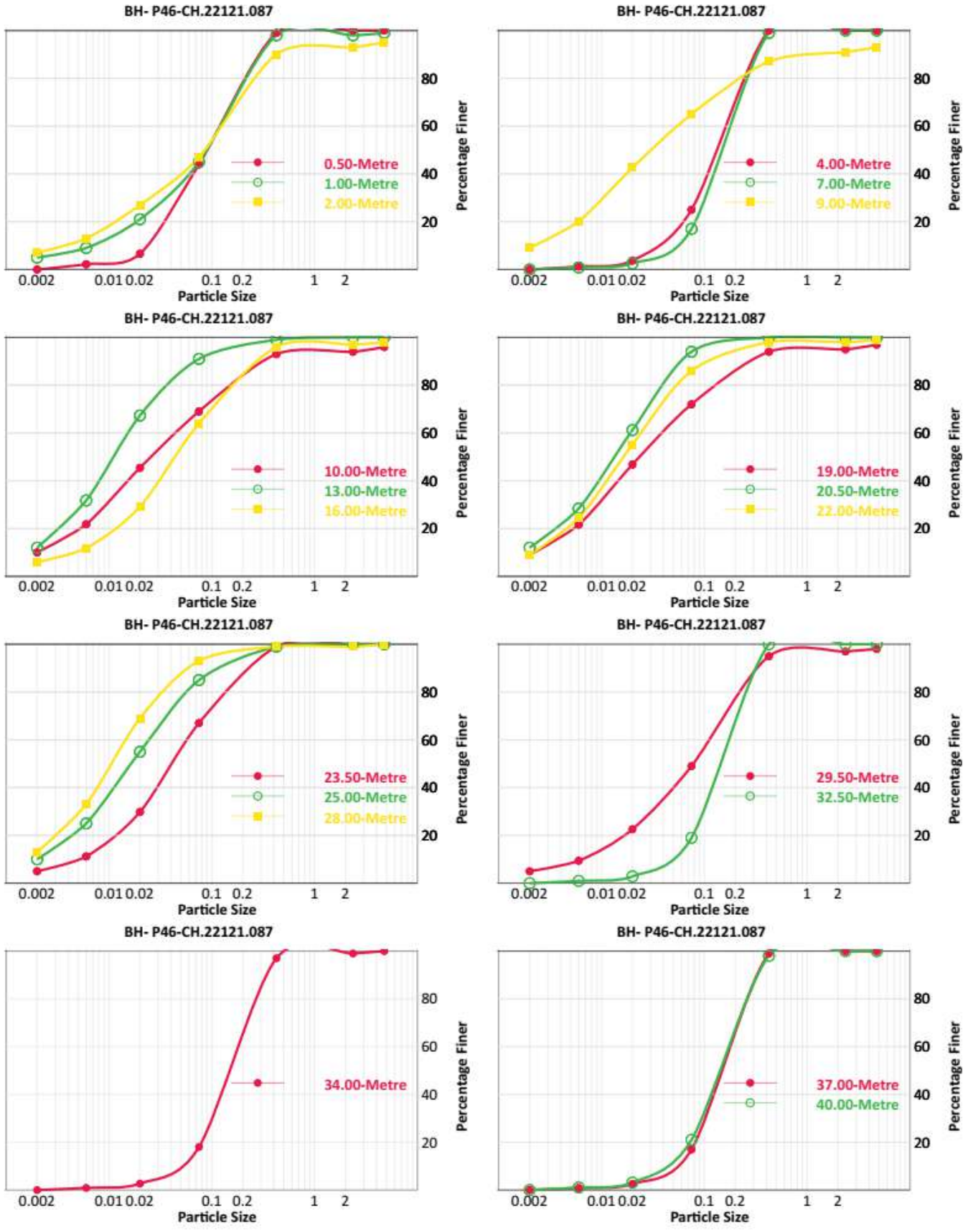
BH- P45-CH.22094.887



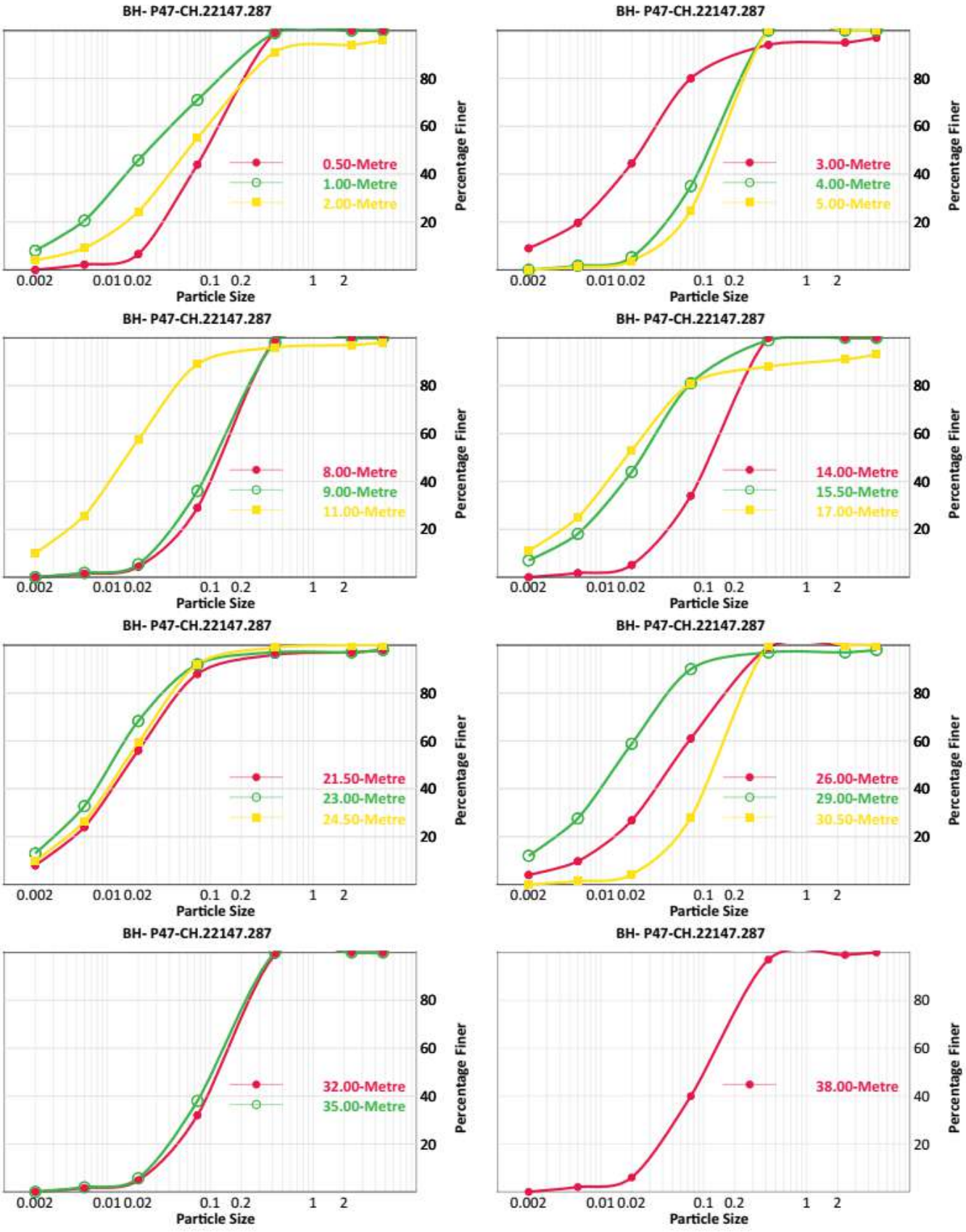
APPENDIX-D
PLOT 5: GRAIN SIZE DISTRIBUTION PLOTS



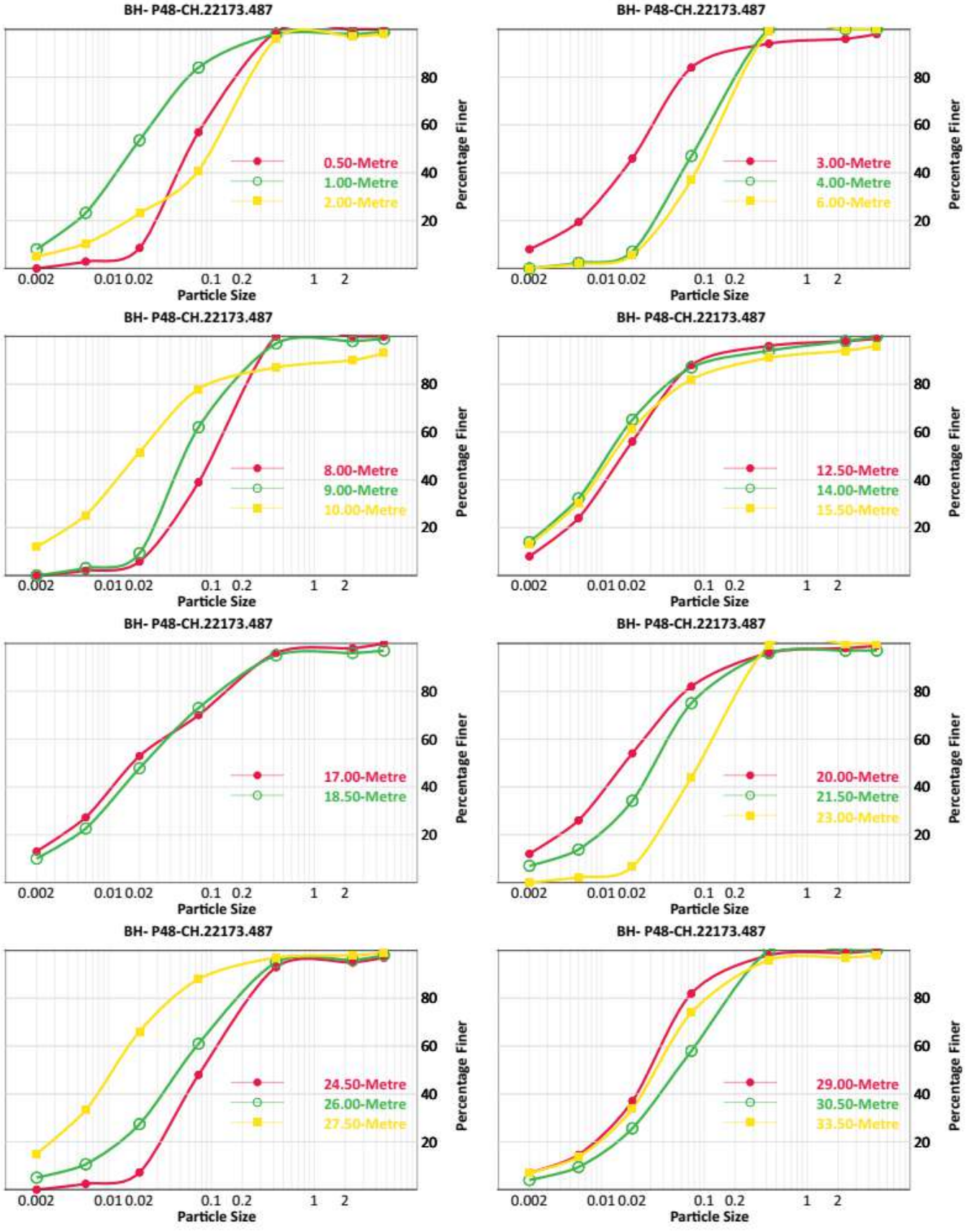
APPENDIX-D
PLOT 6: GRAIN SIZE DISTRIBUTION PLOTS



APPENDIX-D
PLOT 7: GRAIN SIZE DISTRIBUTION PLOTS

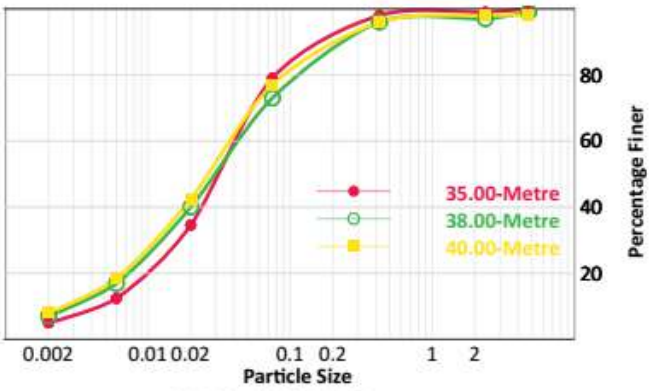


APPENDIX-D
PLOT 8: GRAIN SIZE DISTRIBUTION PLOTS

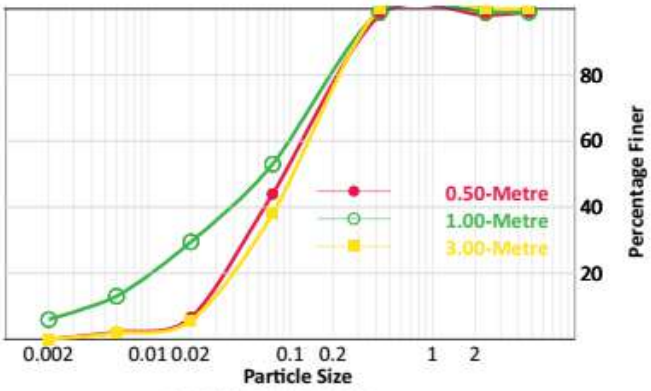


APPENDIX-D
PLOT 9: GRAIN SIZE DISTRIBUTION PLOTS

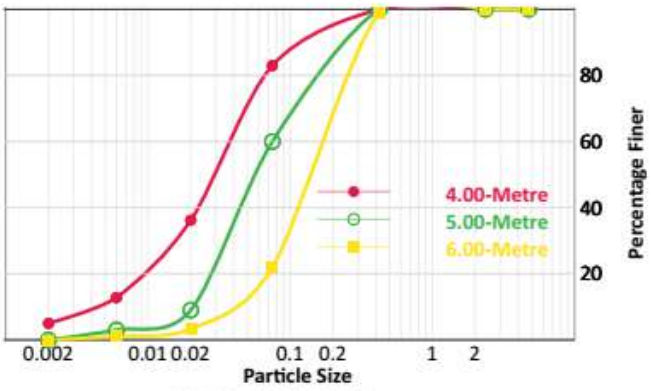
BH- P48-CH.22173.487



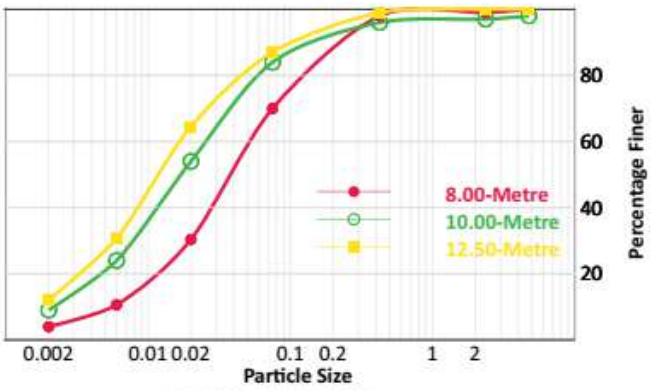
BH- P49-CH.22199.687



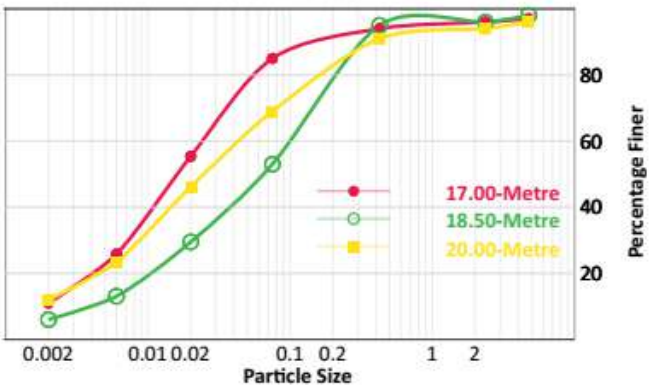
BH- P49-CH.22199.687



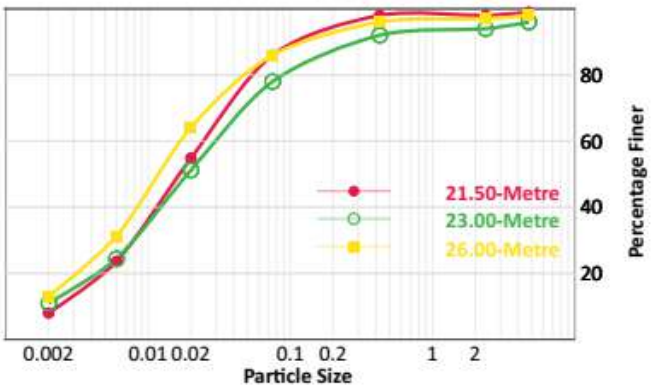
BH- P49-CH.22199.687



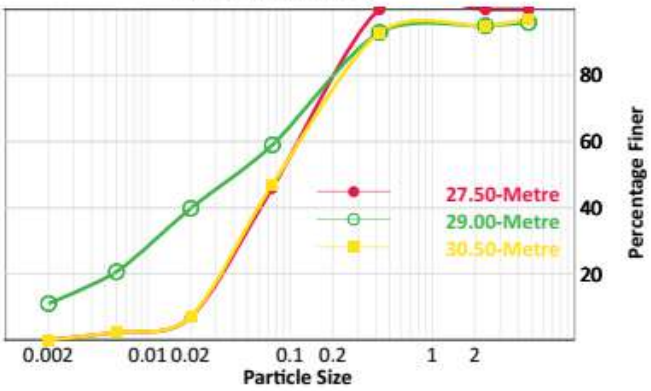
BH- P49-CH.22199.687



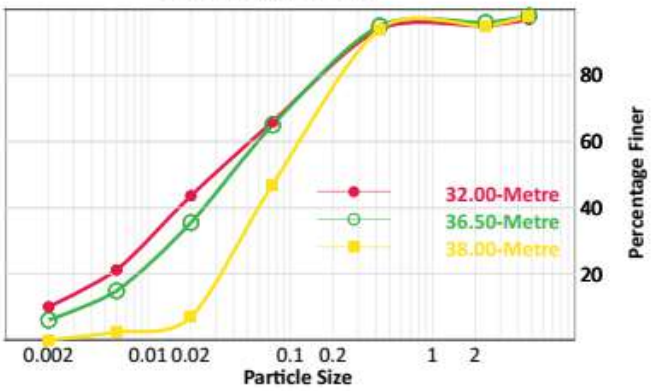
BH- P49-CH.22199.687



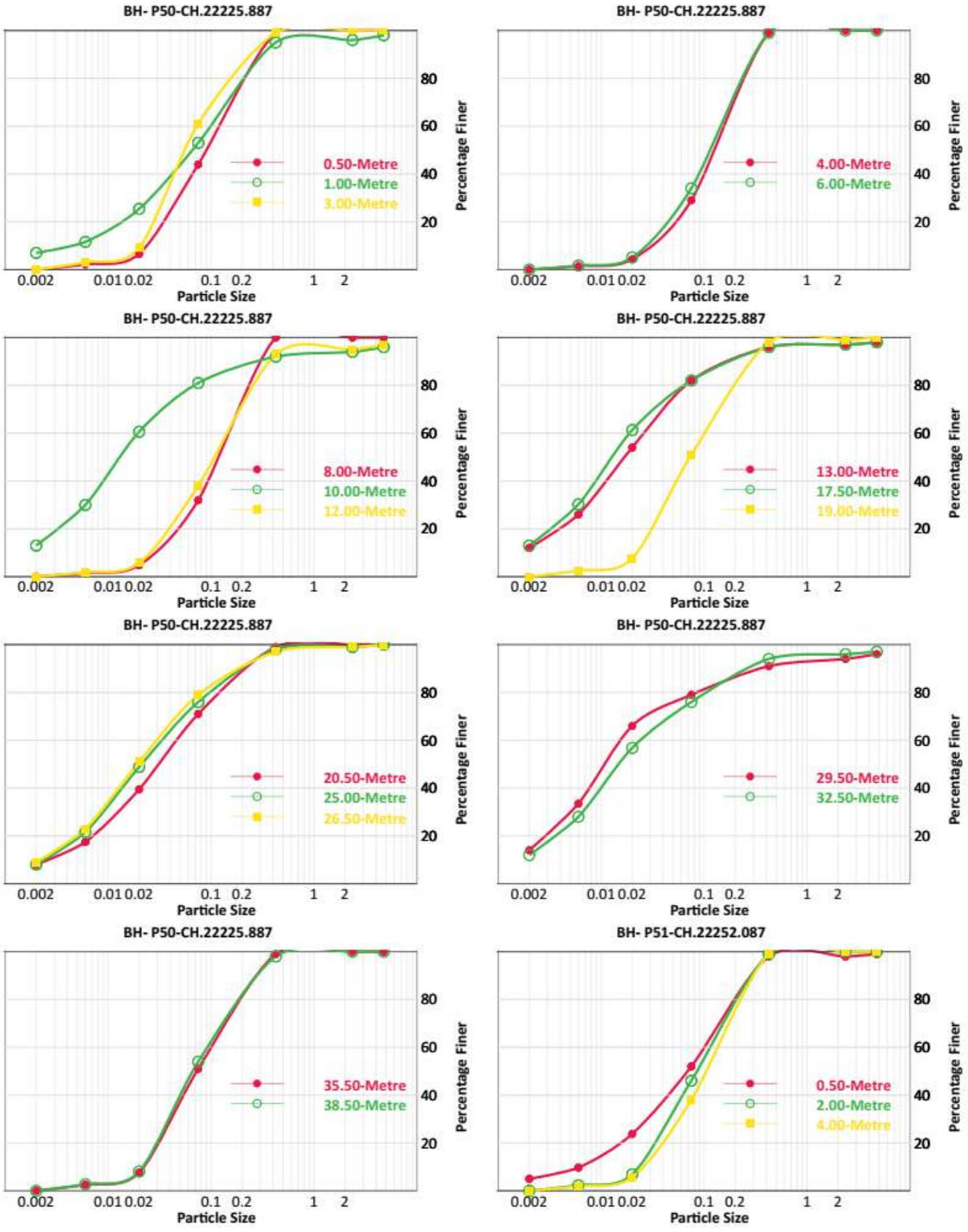
BH- P49-CH.22199.687



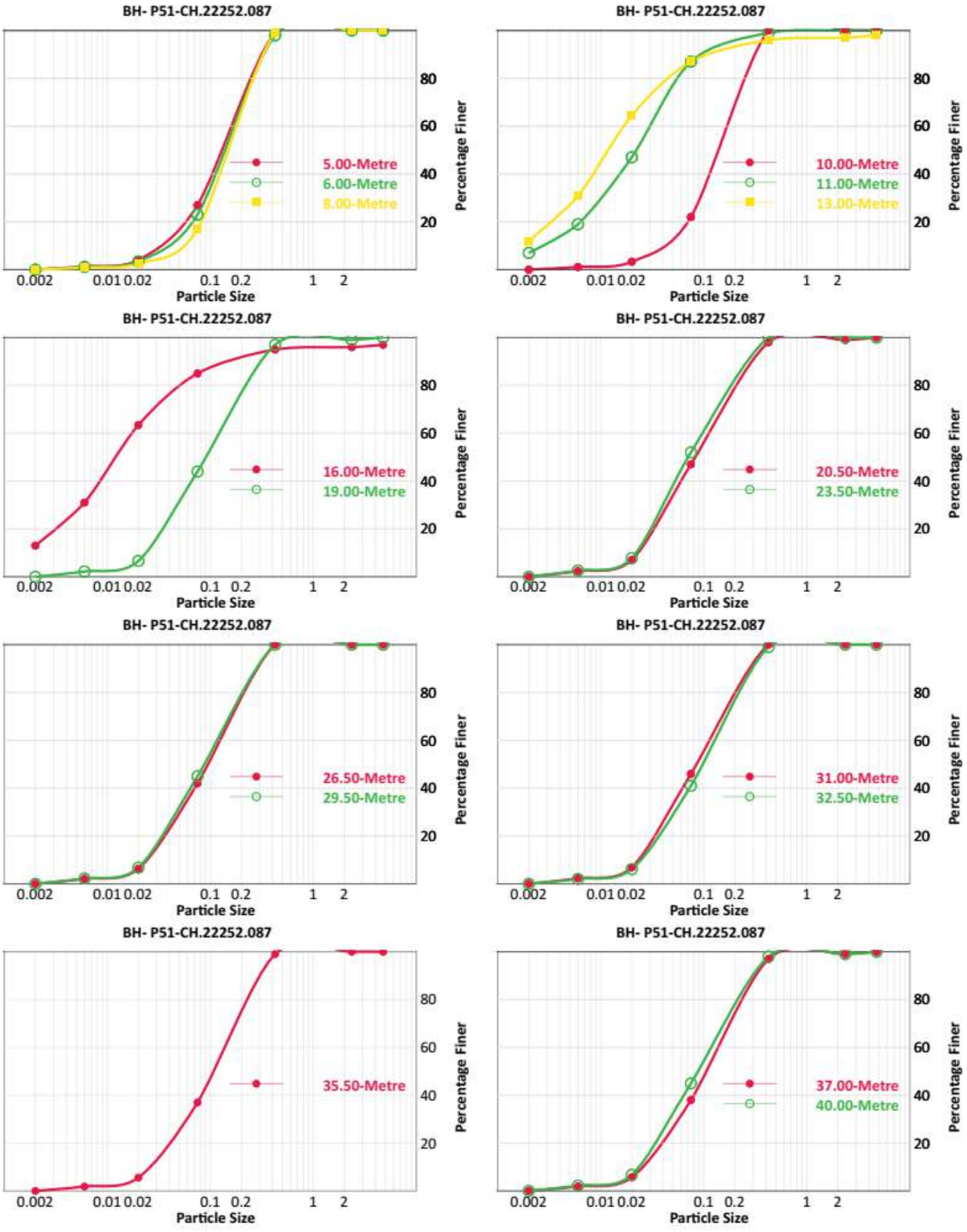
BH- P49-CH.22199.687



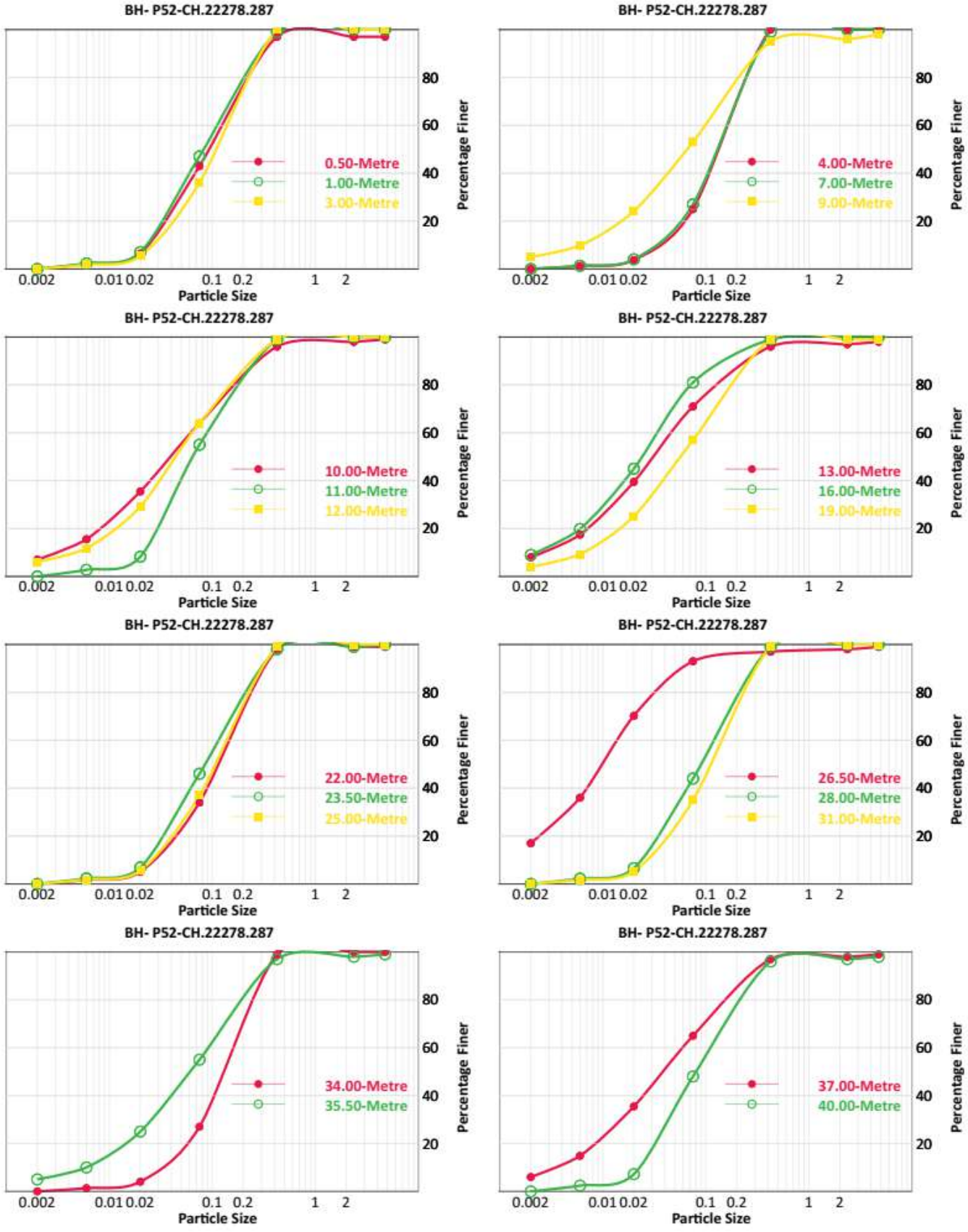
APPENDIX-D
PLOT 10: GRAIN SIZE DISTRIBUTION PLOTS



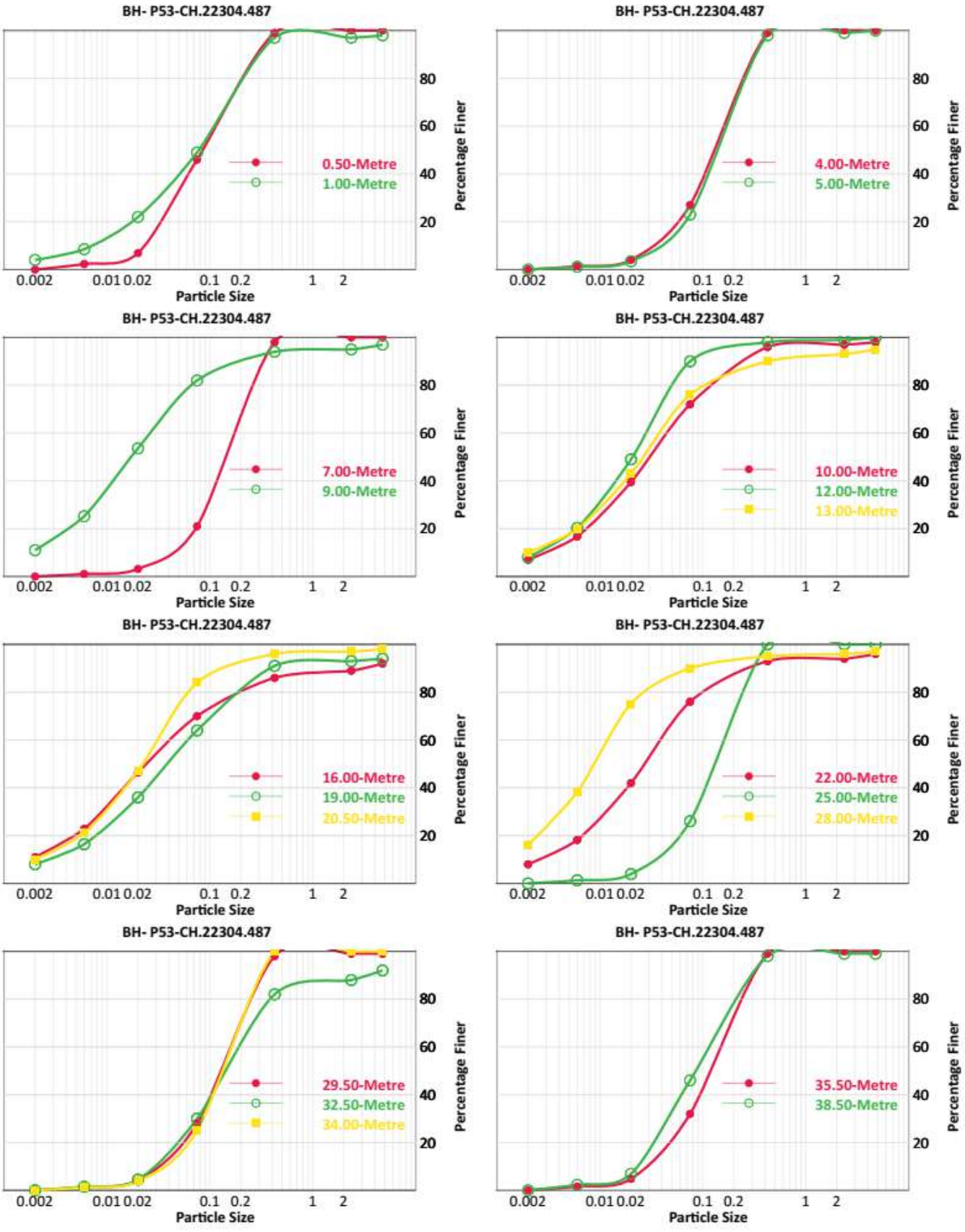
APPENDIX-D
PLOT 11: GRAIN SIZE DISTRIBUTION PLOTS



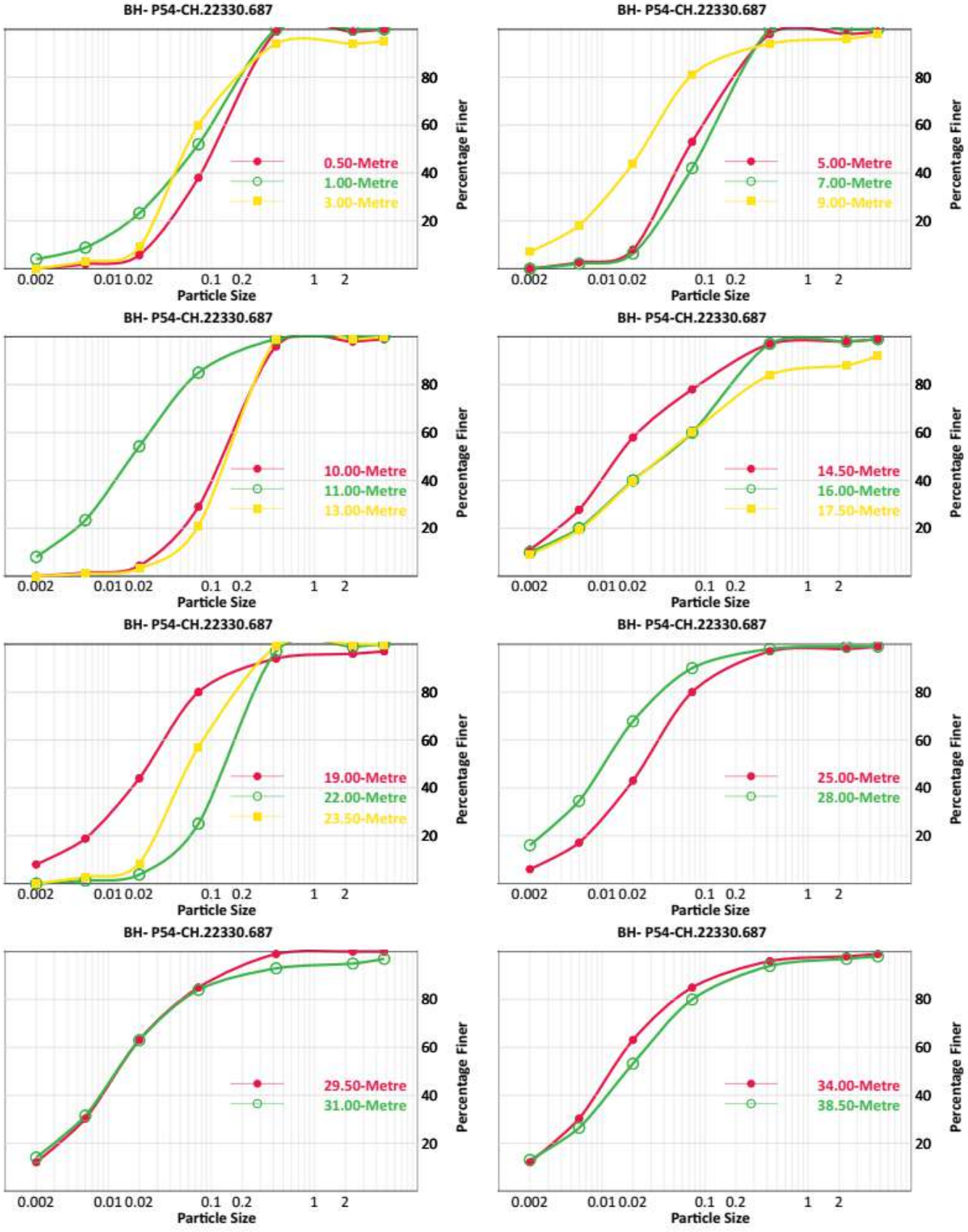
APPENDIX-D
PLOT 12: GRAIN SIZE DISTRIBUTION PLOTS



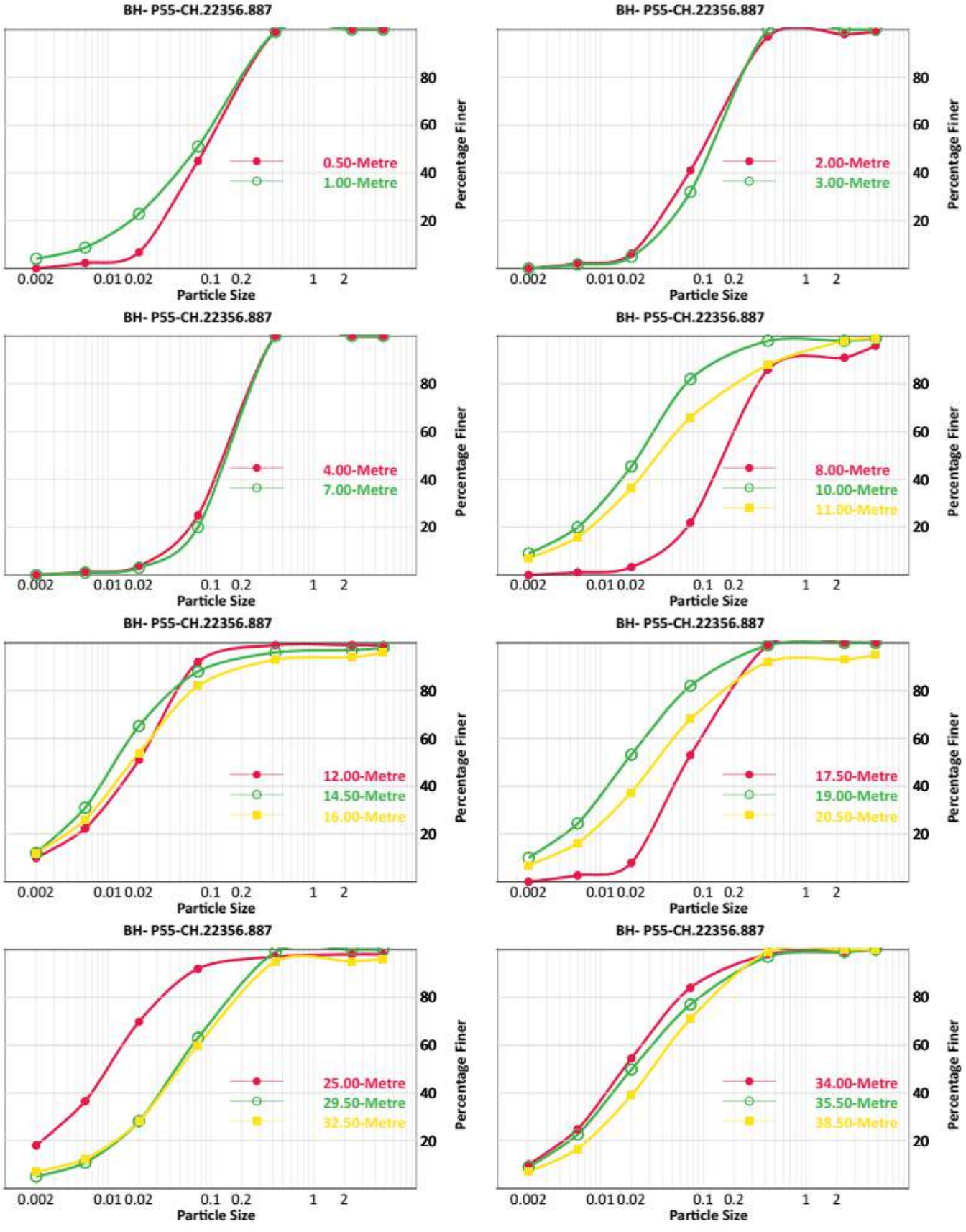
APPENDIX-D
PLOT 13: GRAIN SIZE DISTRIBUTION PLOTS



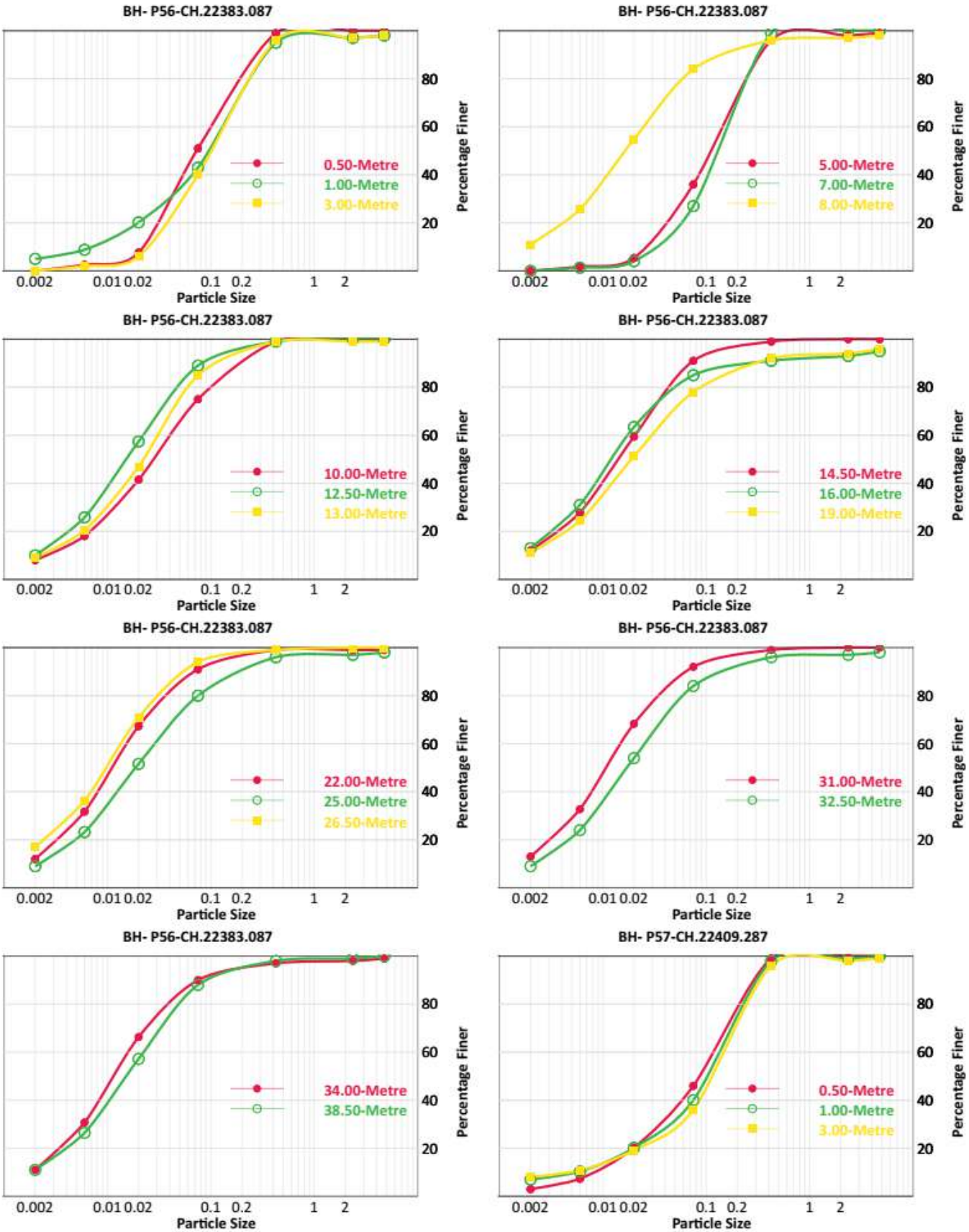
APPENDIX-D
PLOT 14: GRAIN SIZE DISTRIBUTION PLOTS



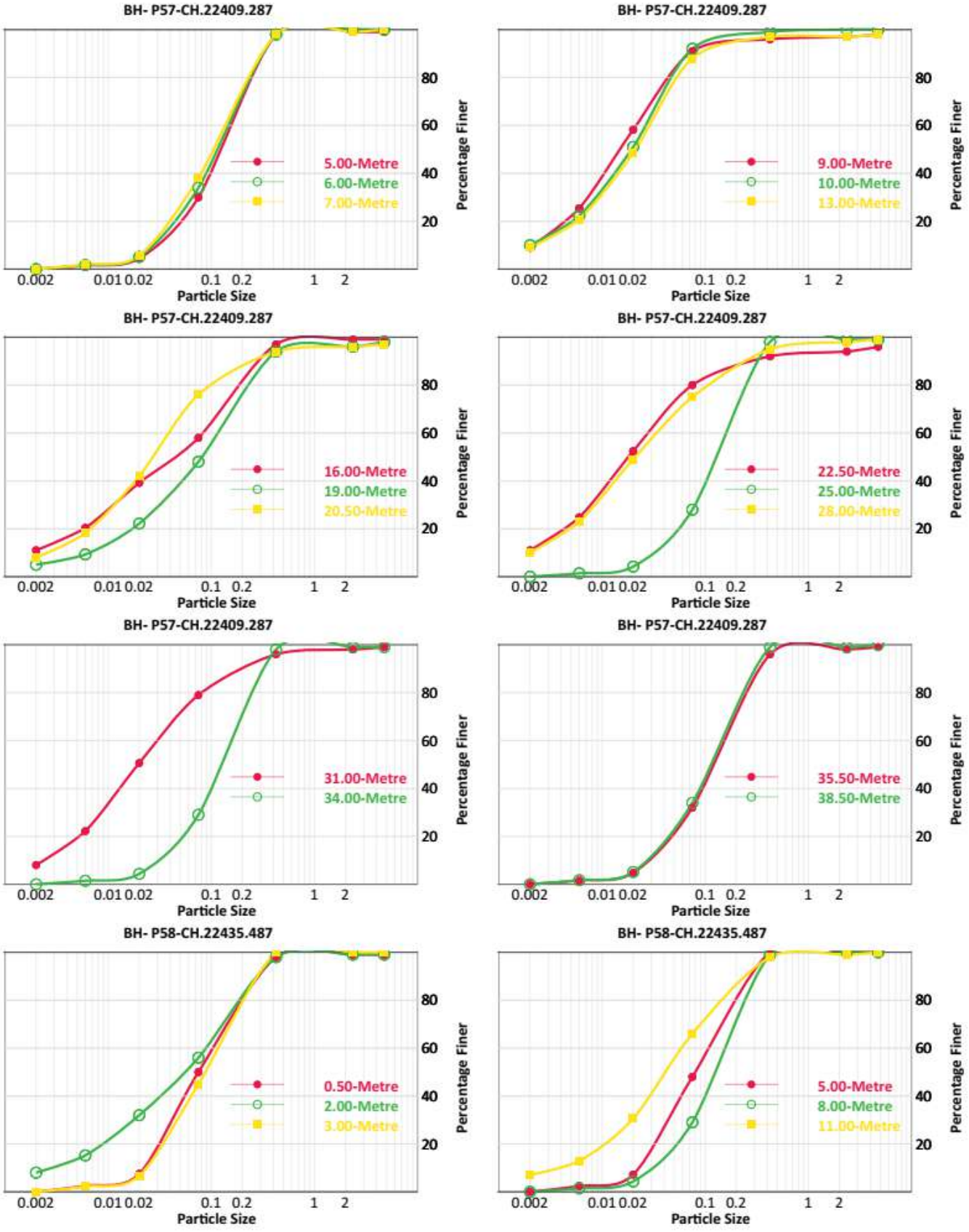
APPENDIX-D
PLOT 15: GRAIN SIZE DISTRIBUTION PLOTS



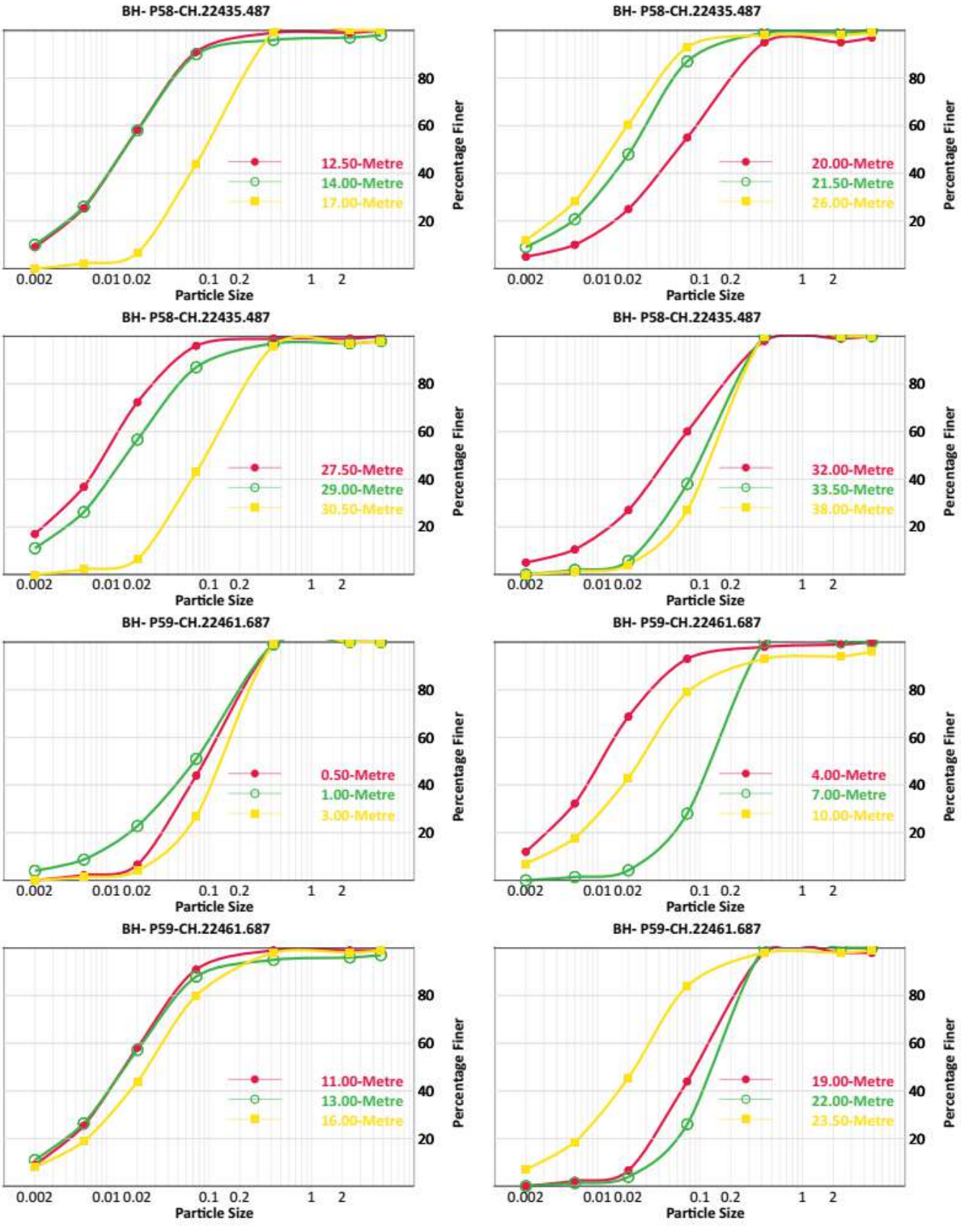
APPENDIX-D
PLOT 16: GRAIN SIZE DISTRIBUTION PLOTS



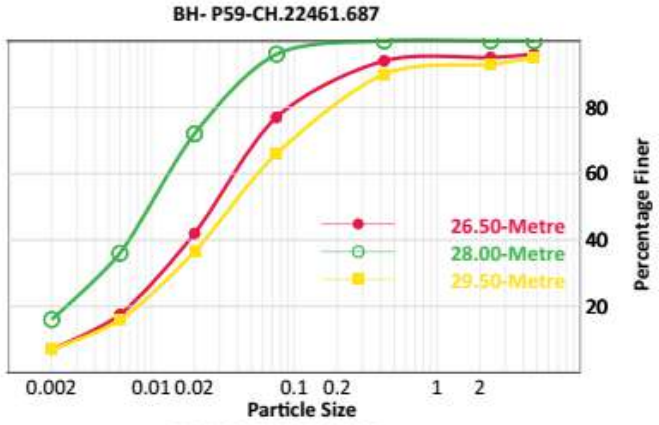
APPENDIX-D
PLOT 17: GRAIN SIZE DISTRIBUTION PLOTS

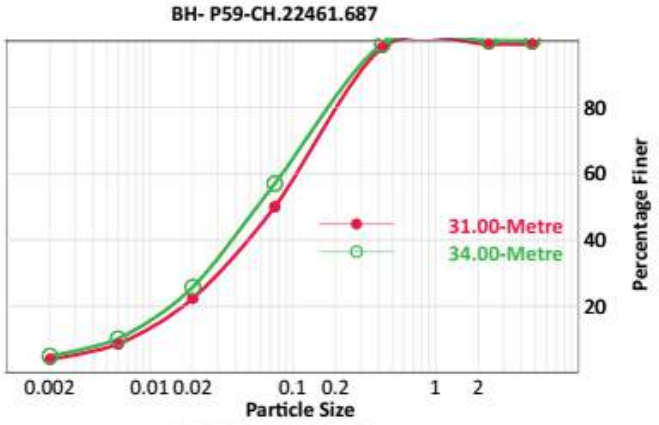


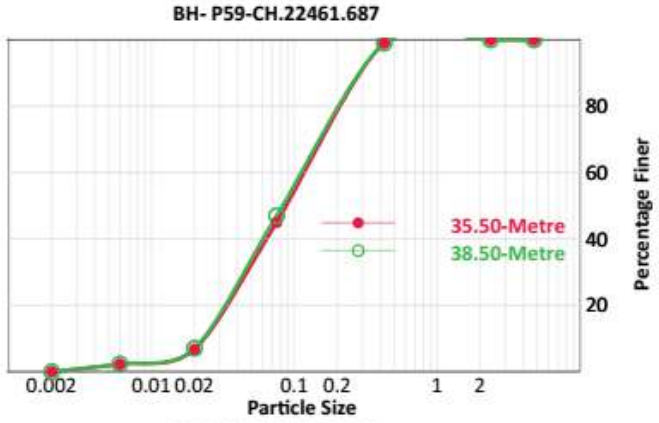
APPENDIX-D
PLOT 18: GRAIN SIZE DISTRIBUTION PLOTS

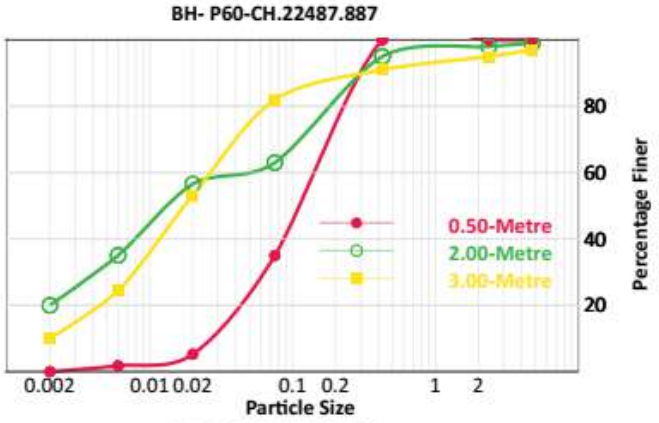


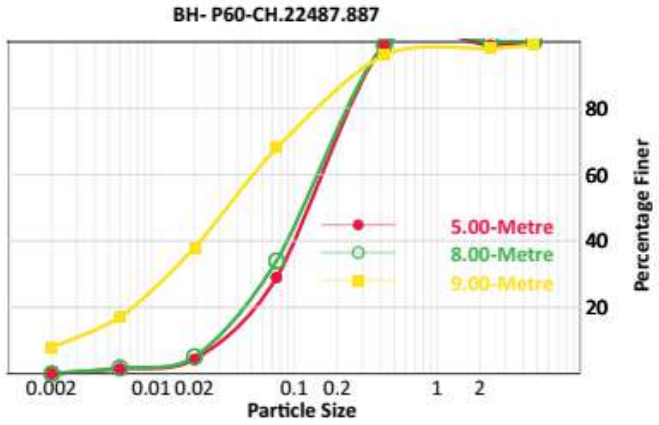
APPENDIX-D
PLOT 19: GRAIN SIZE DISTRIBUTION PLOTS

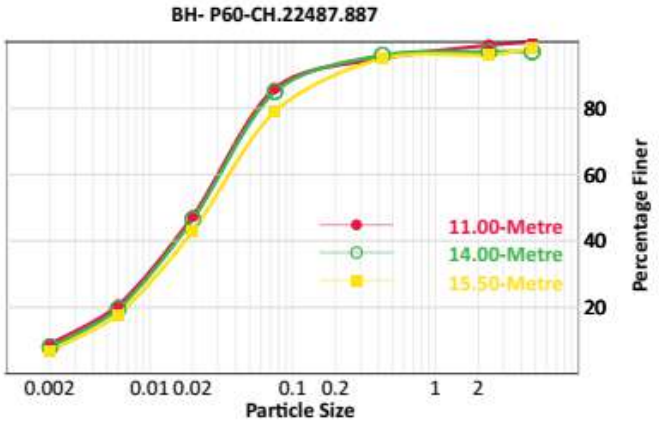


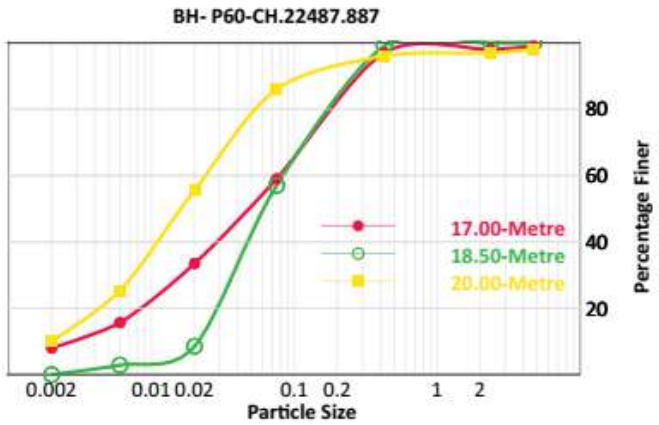


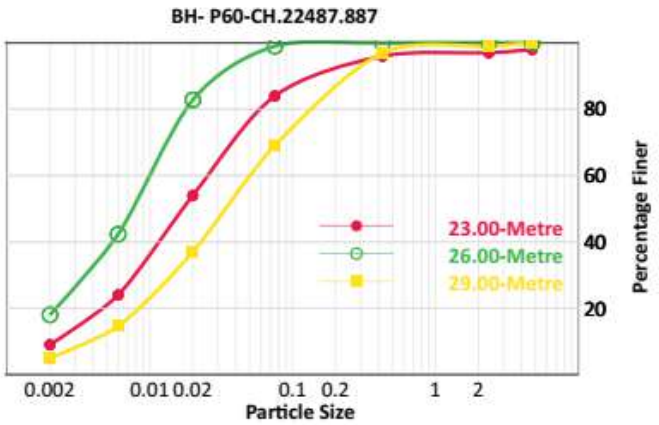




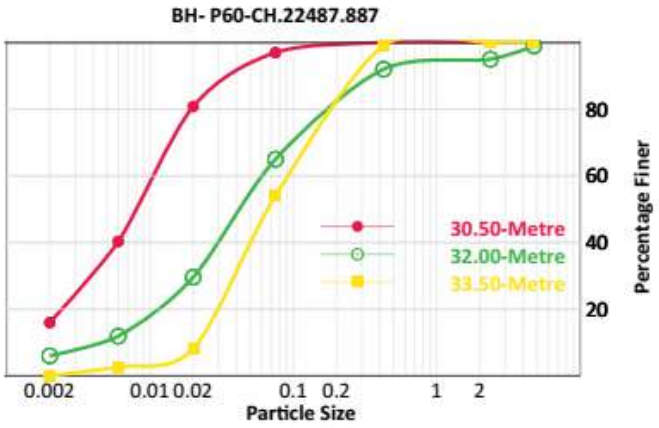


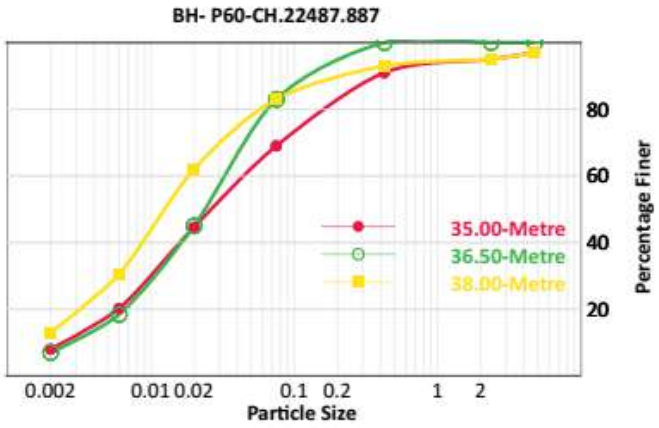






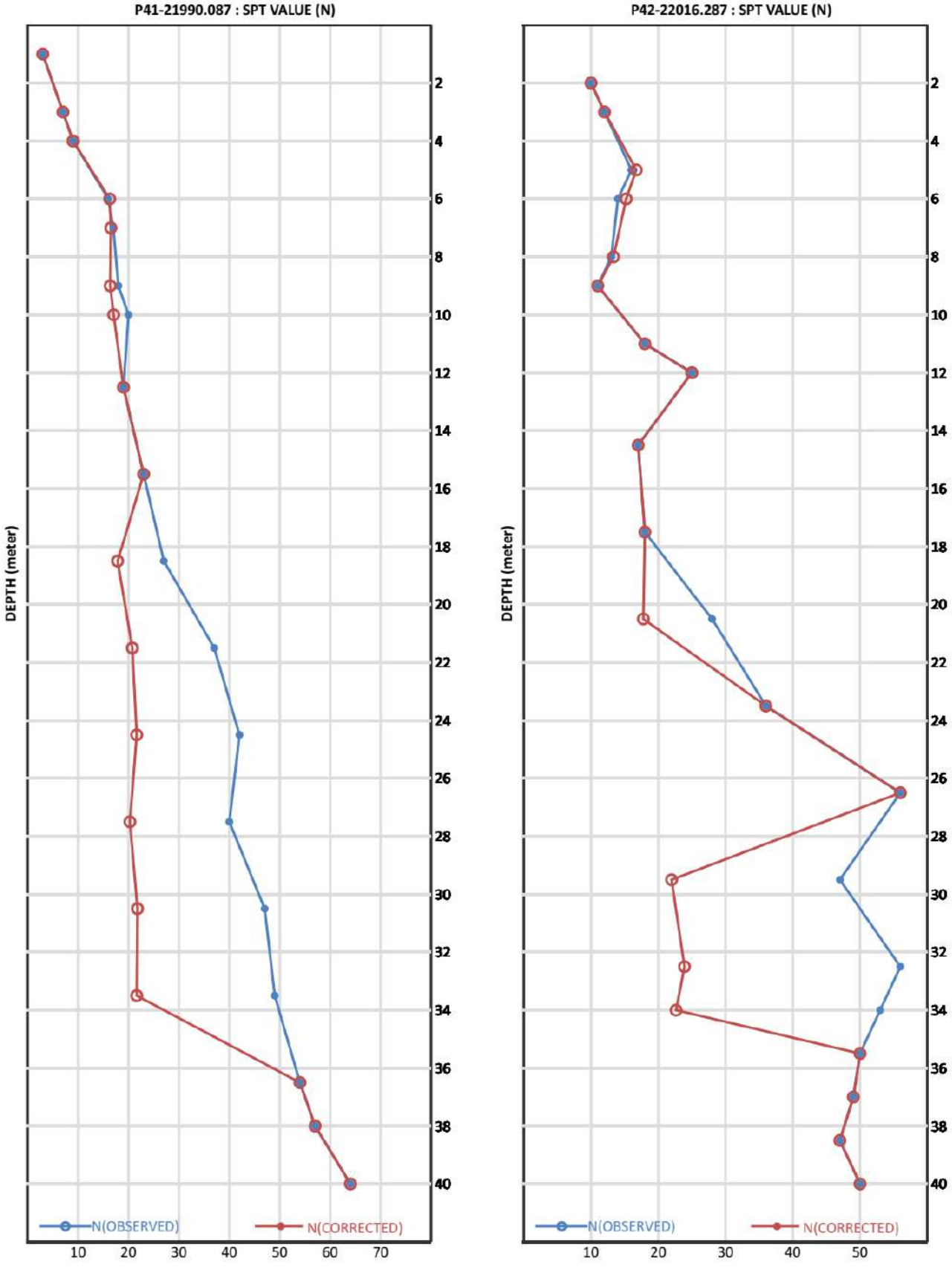
APPENDIX-D
PLOT 20: GRAIN SIZE DISTRIBUTION PLOTS



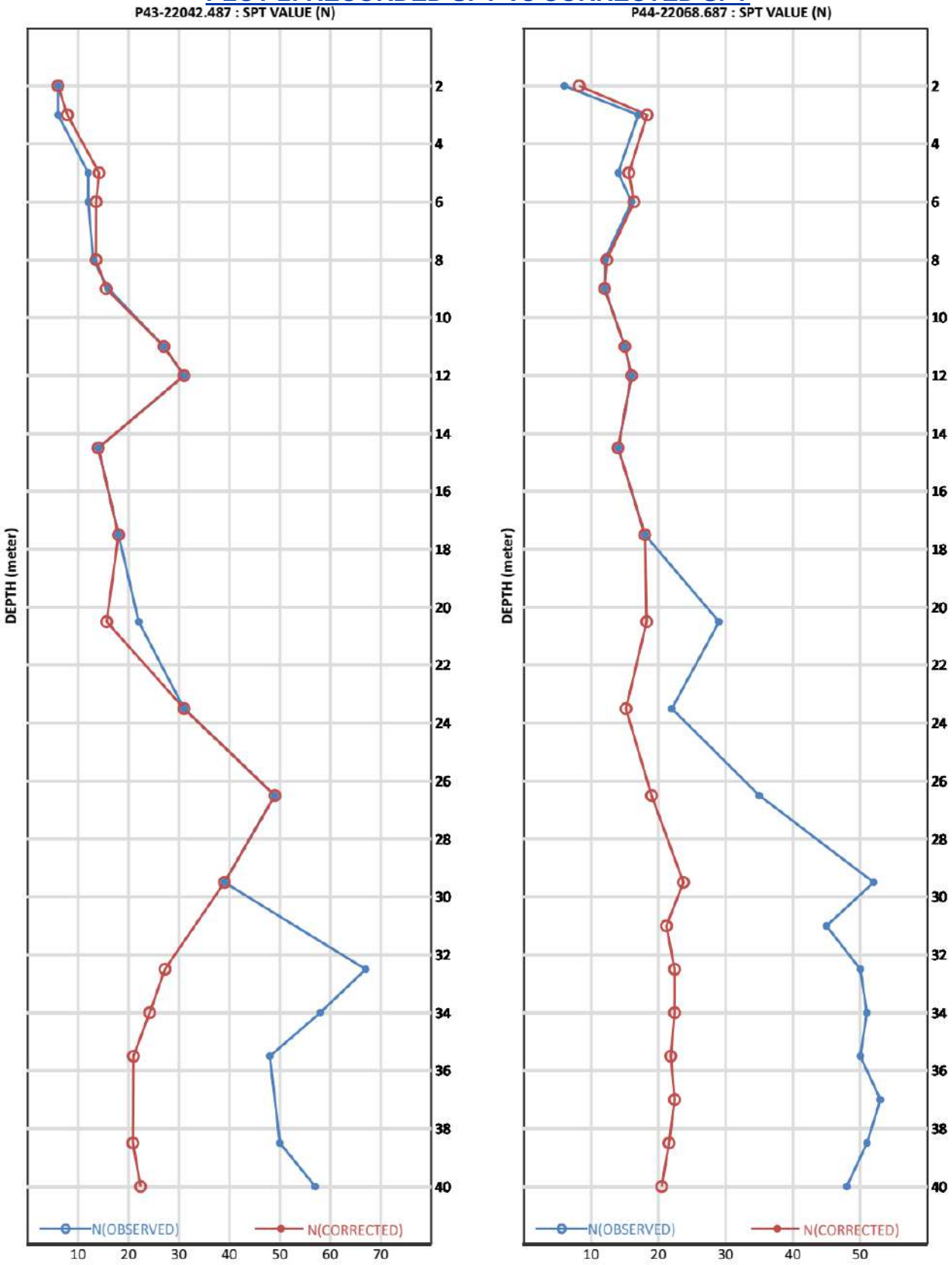


APPENDIX-E

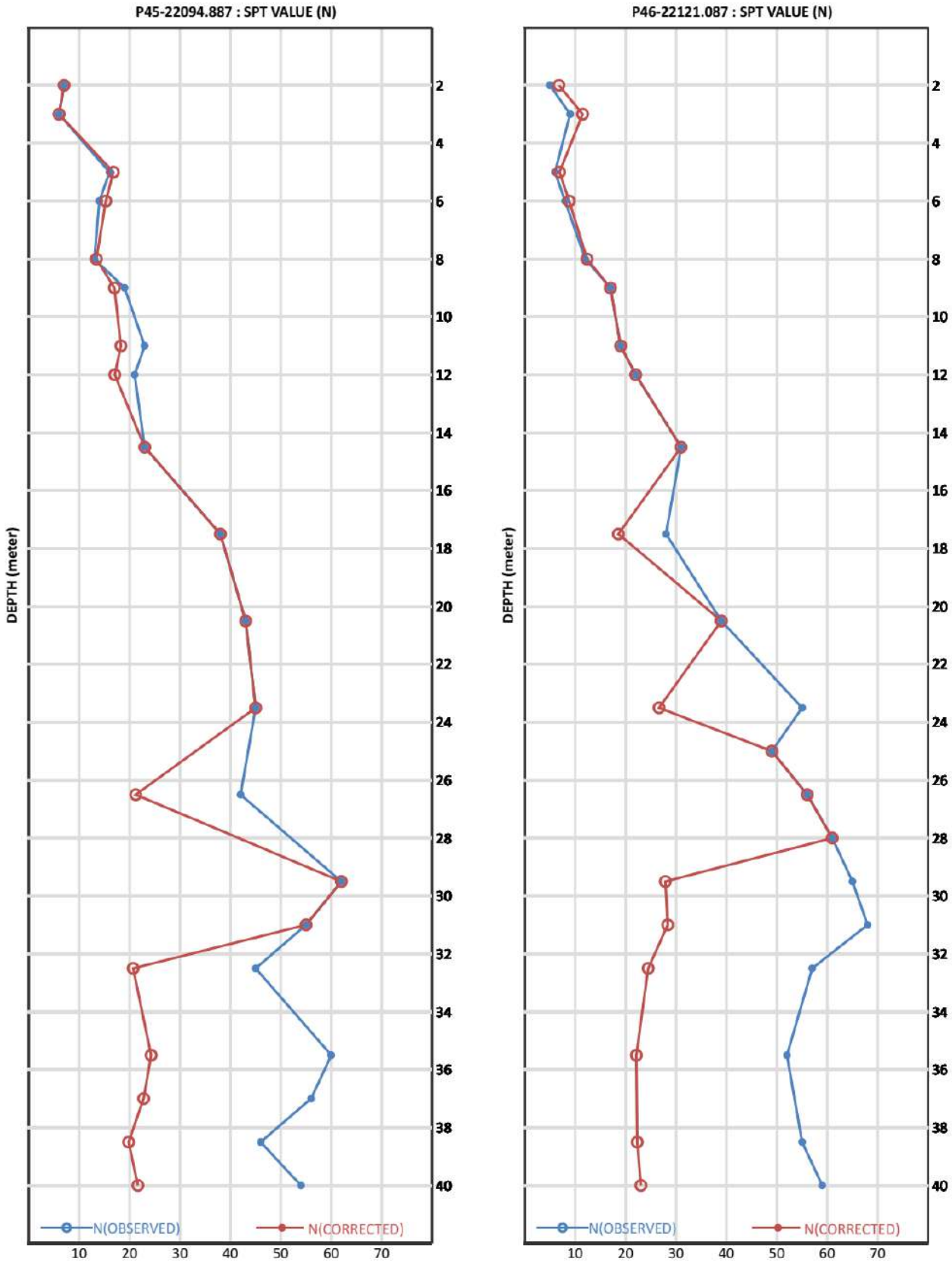
PLOT 1: RECORDED SPT Vs CORRECTED SPT



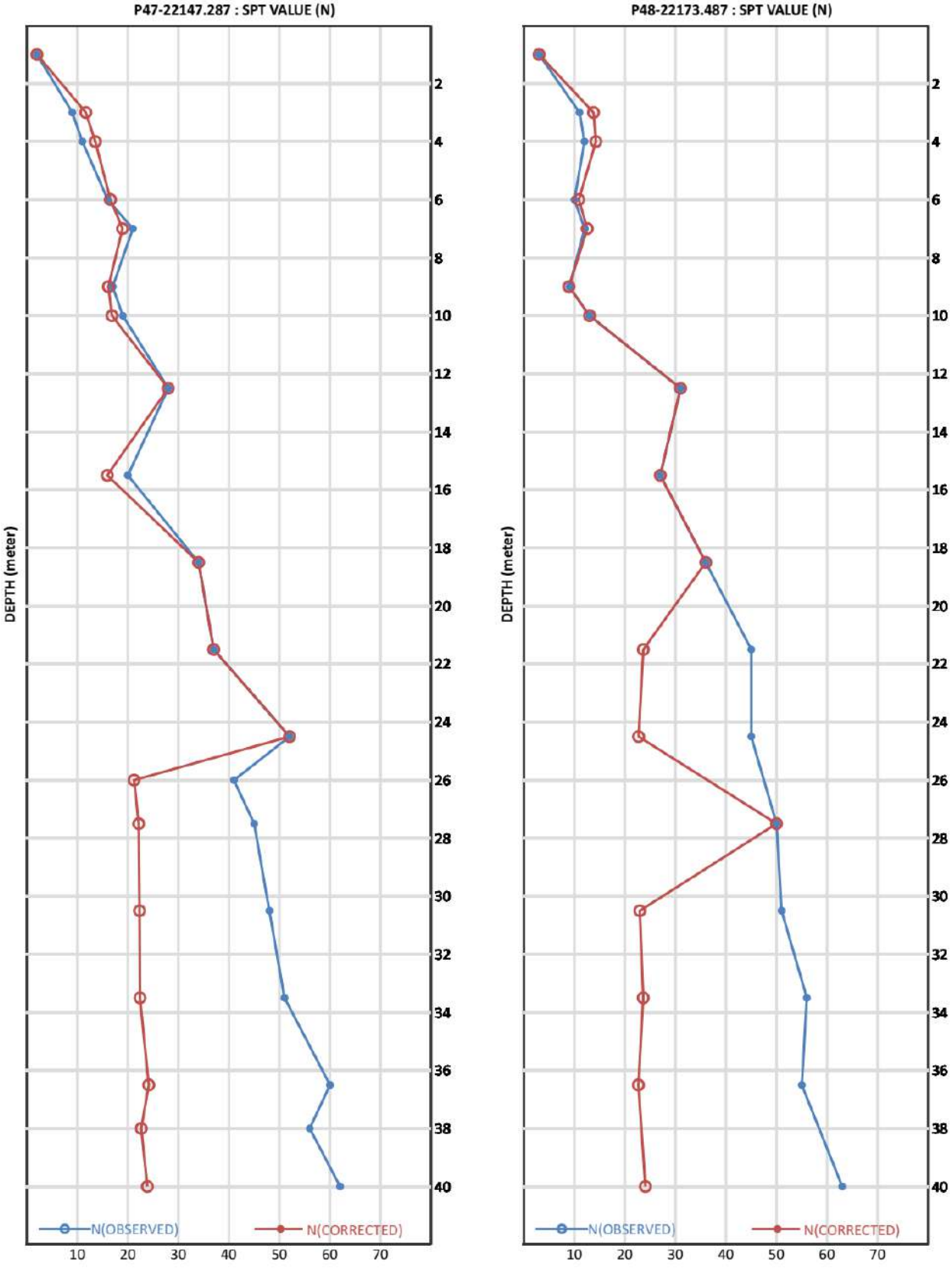
APPENDIX-E
PLOT 2: RECORDED SPT Vs CORRECTED SPT



APPENDIX-E
PLOT 3: RECORDED SPT Vs CORRECTED SPT

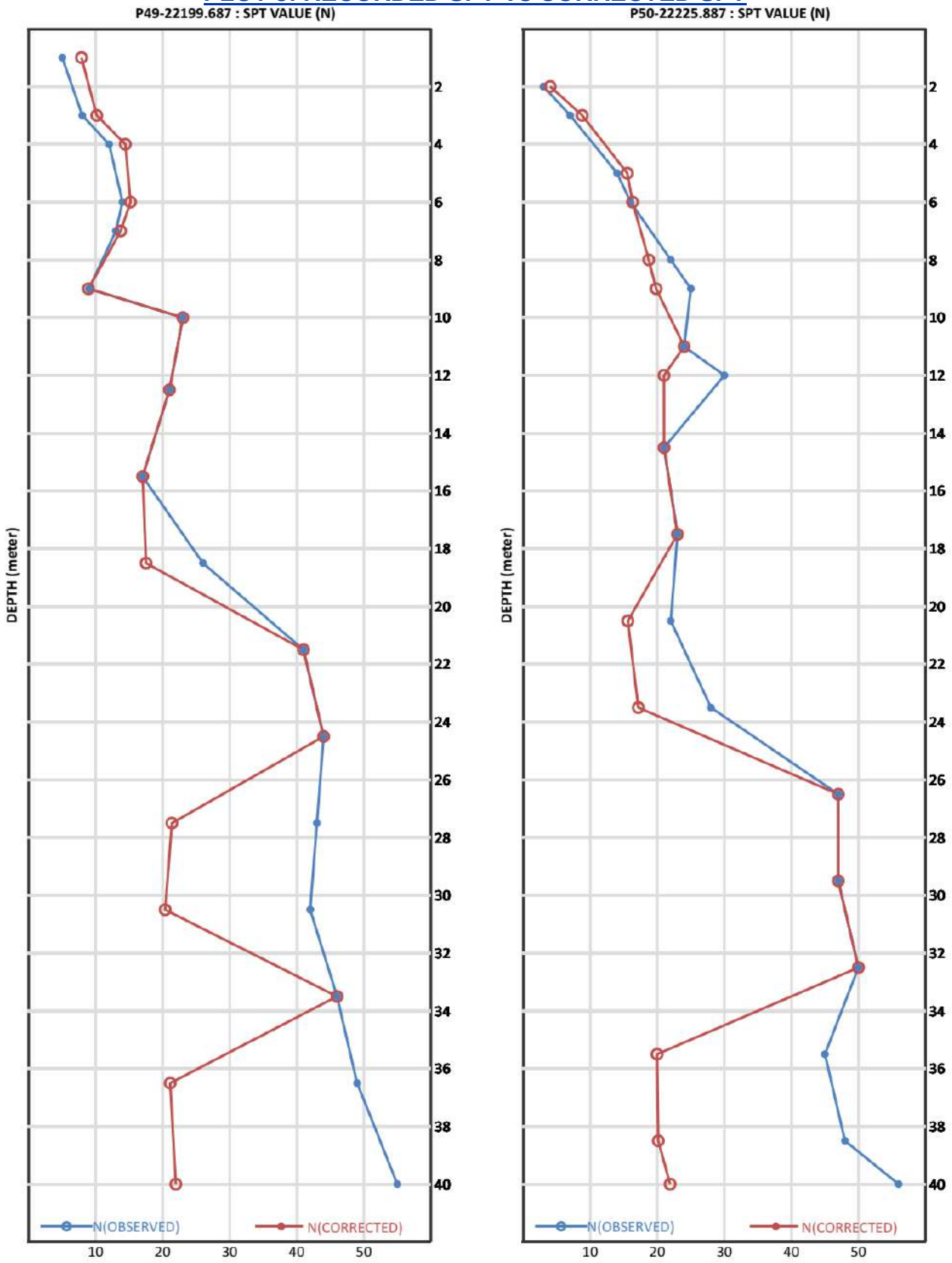


APPENDIX-E
PLOT 4: RECORDED SPT Vs CORRECTED SPT

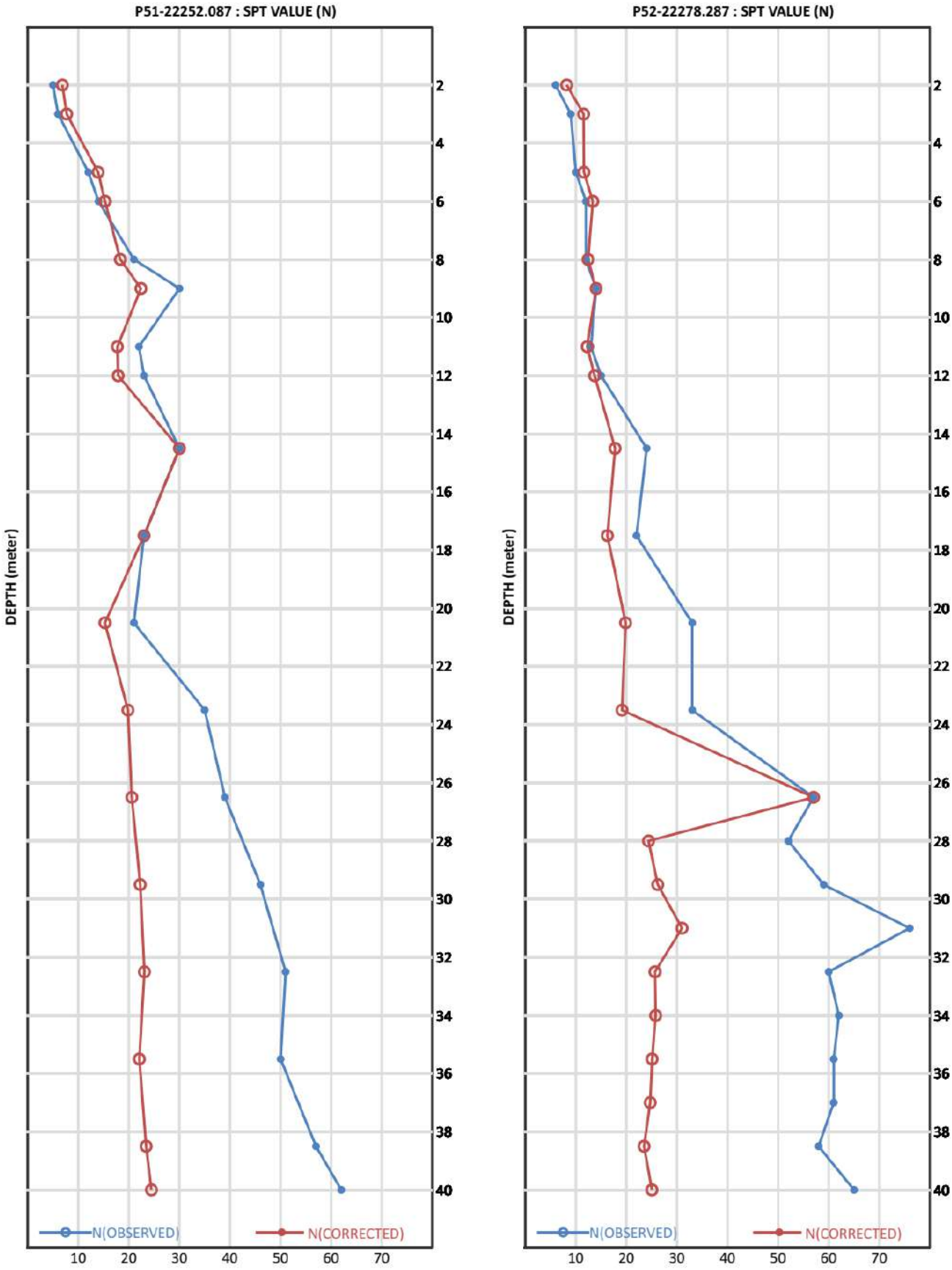


APPENDIX-E

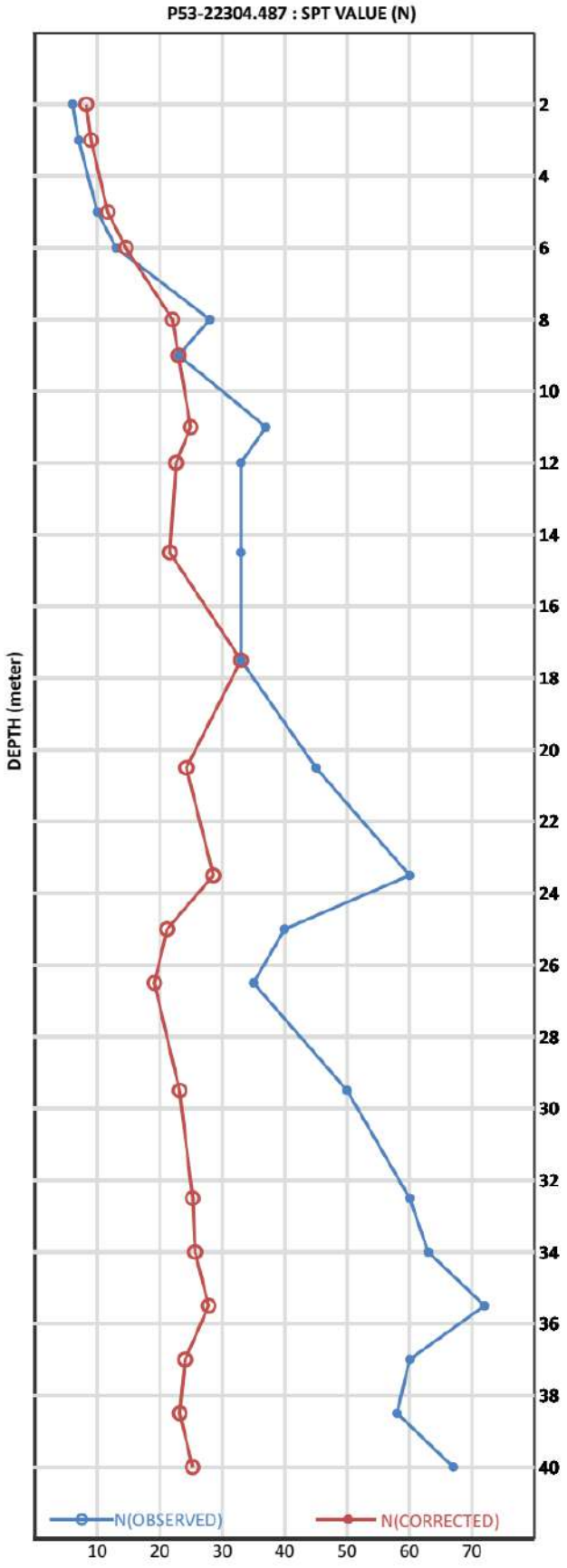
PLOT 5: RECORDED SPT Vs CORRECTED SPT

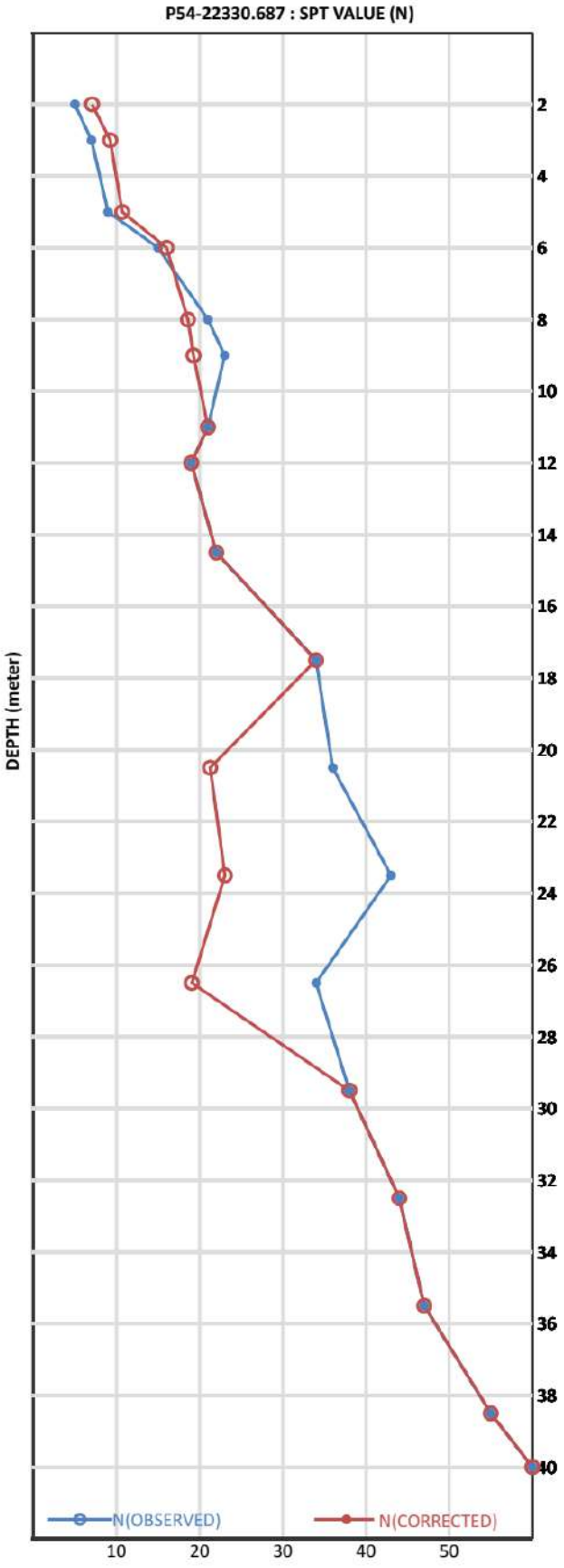


APPENDIX-E
PLOT 6: RECORDED SPT Vs CORRECTED SPT

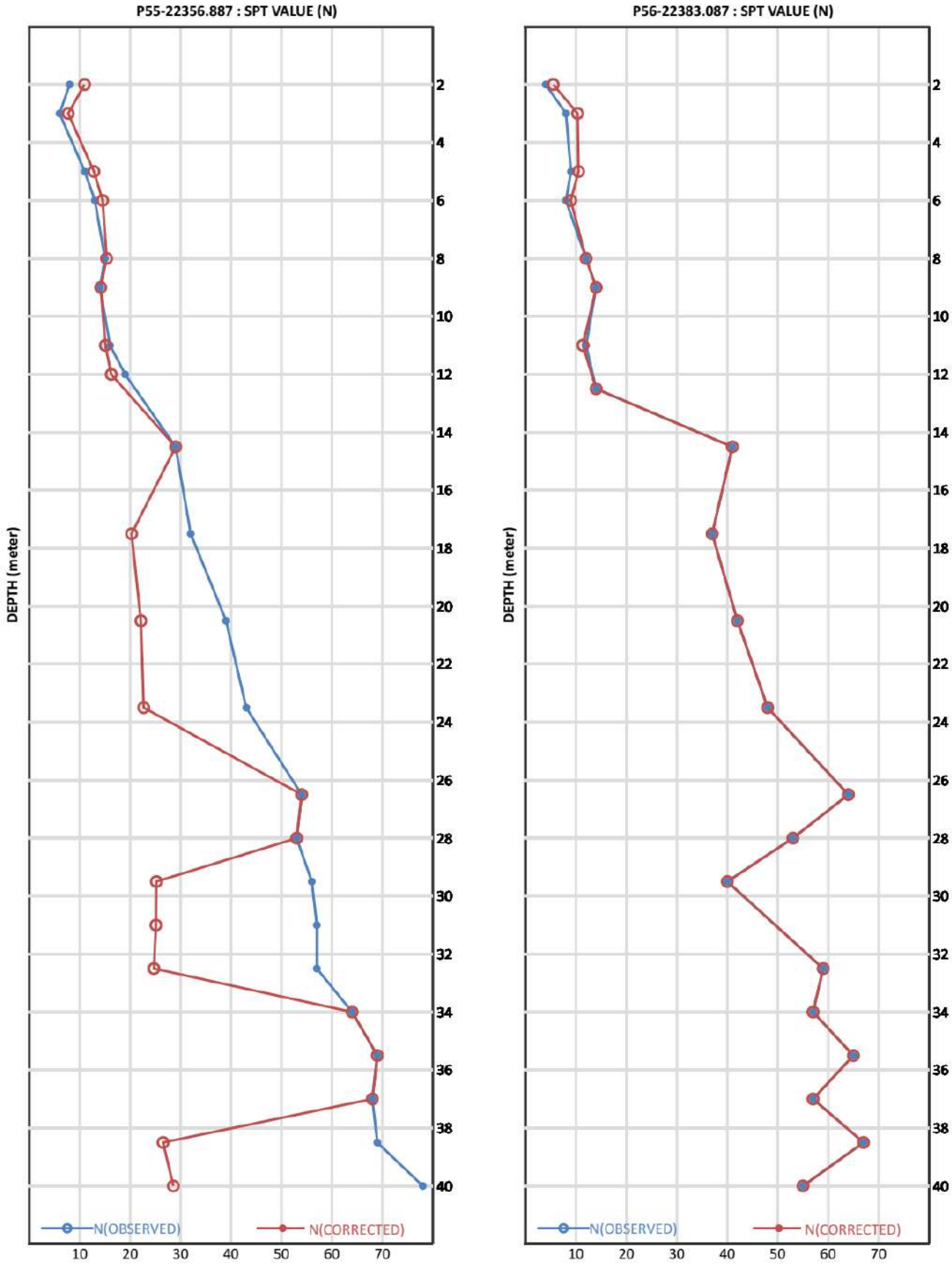


APPENDIX-E
PLOT 7: RECORDED SPT Vs CORRECTED SPT

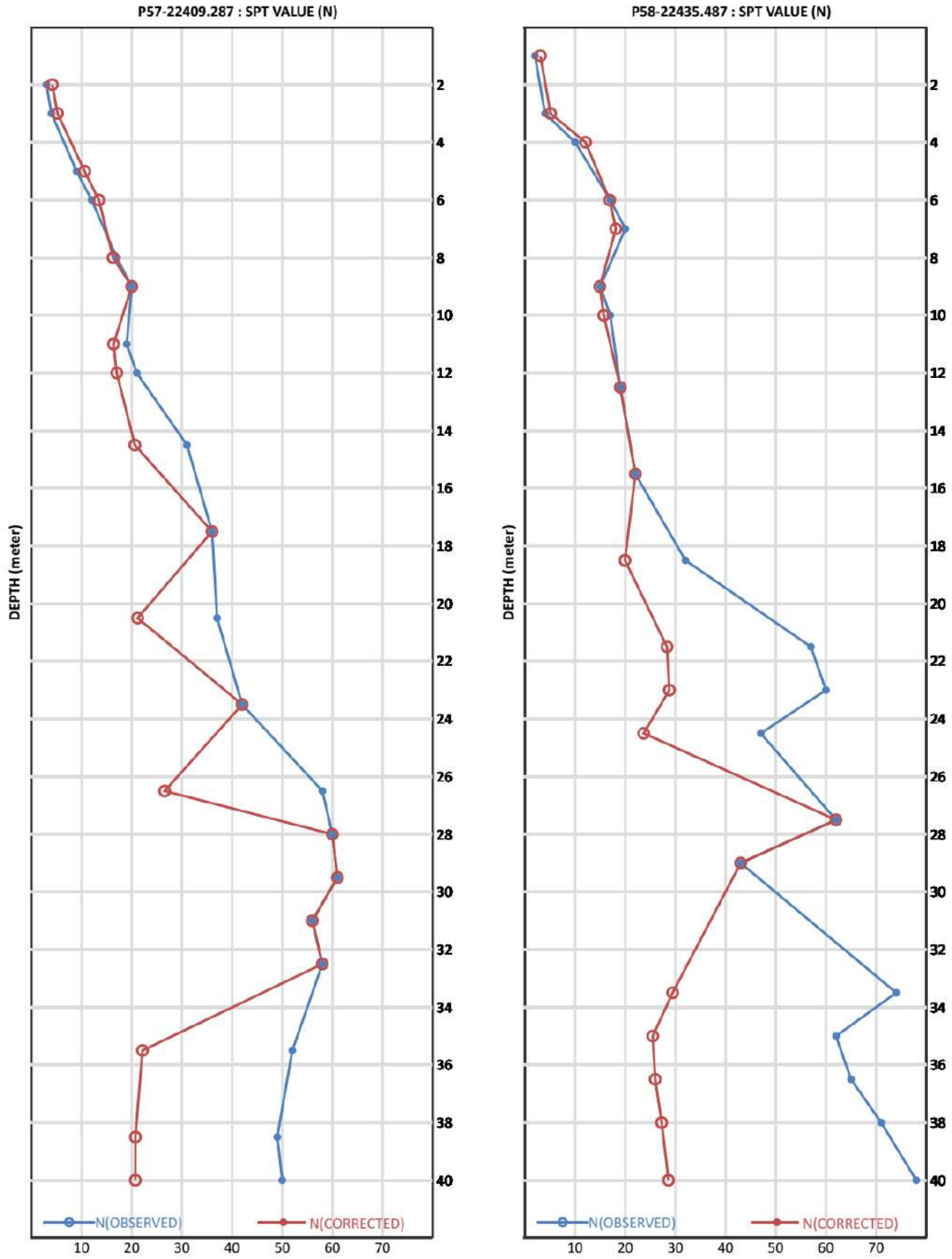




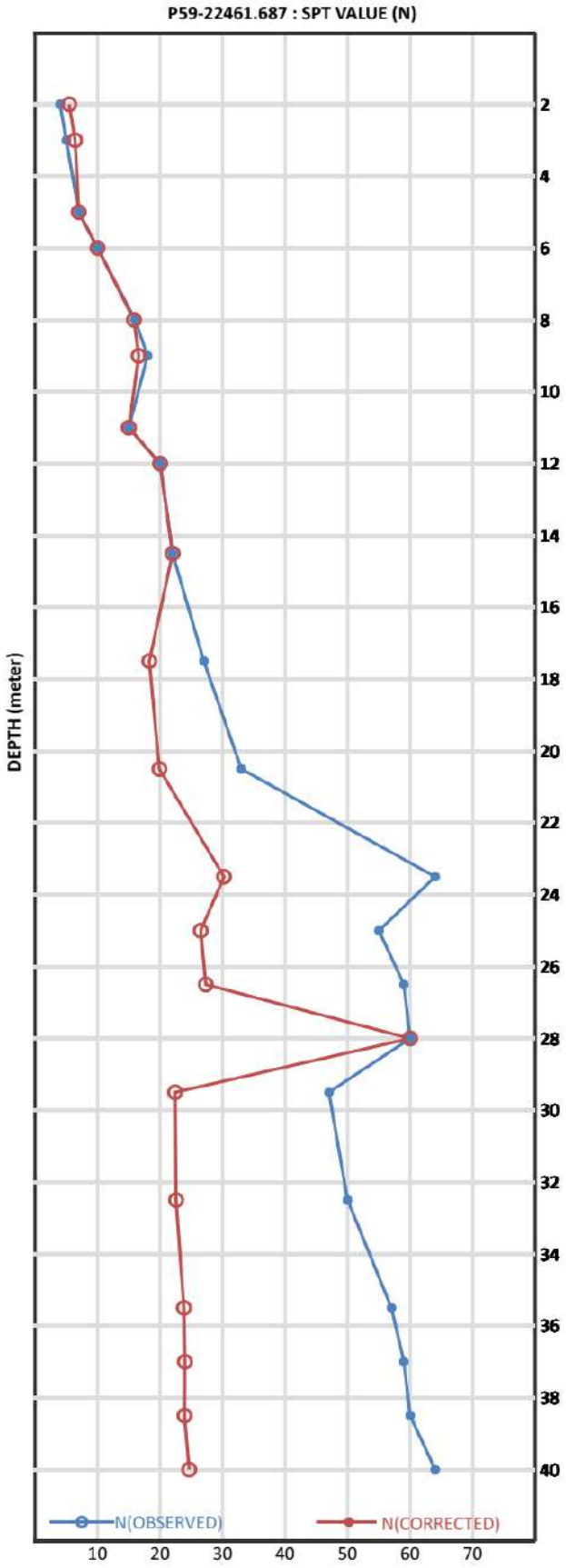
APPENDIX-E
PLOT 8: RECORDED SPT Vs CORRECTED SPT

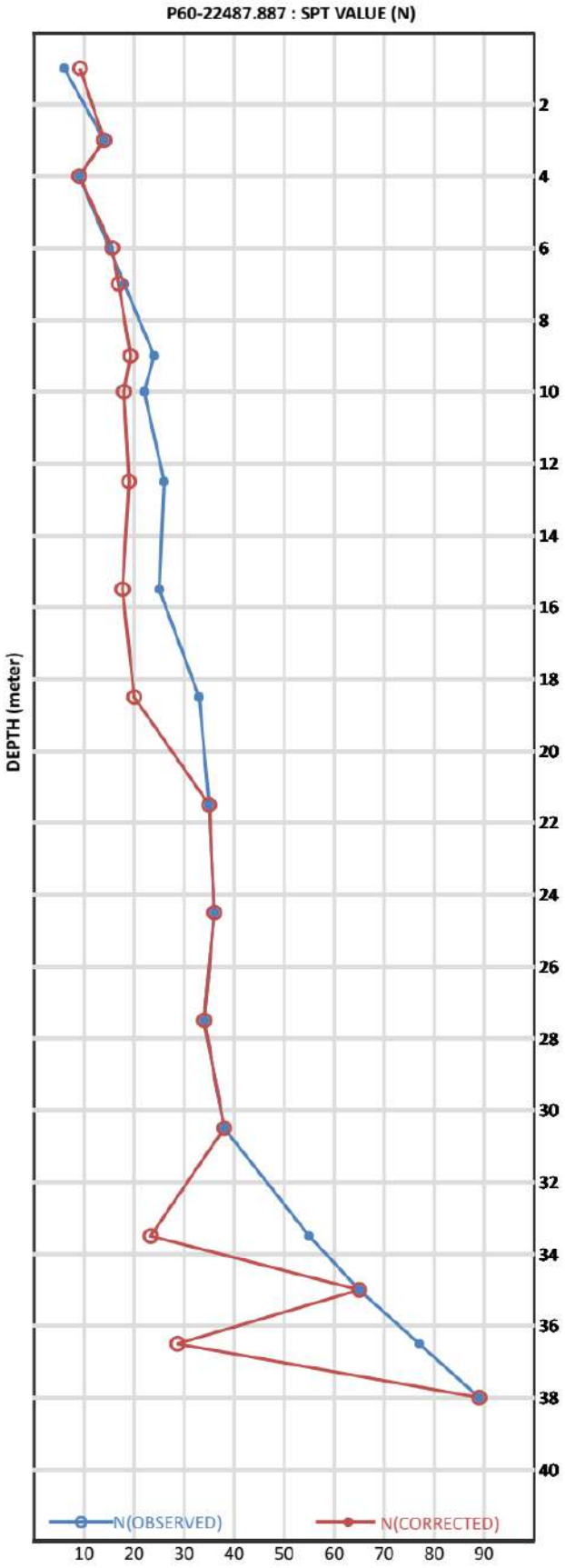


APPENDIX-E
PLOT 9: RECORDED SPT Vs CORRECTED SPT

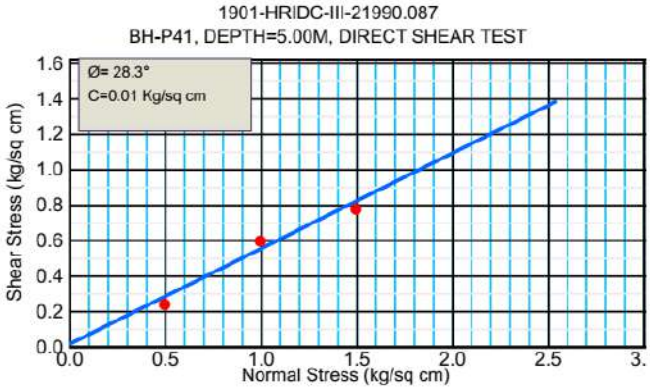


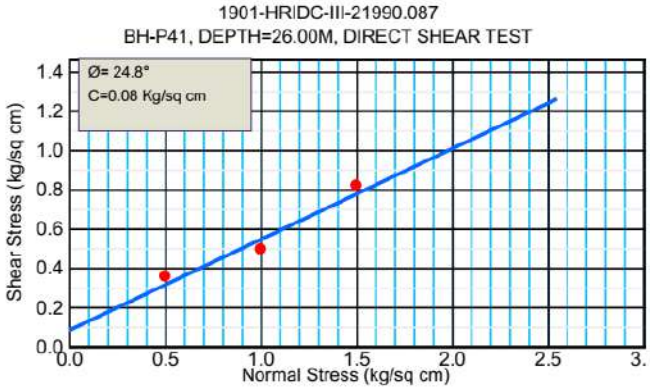
APPENDIX-E
PLOT 10: RECORDED SPT Vs CORRECTED SPT

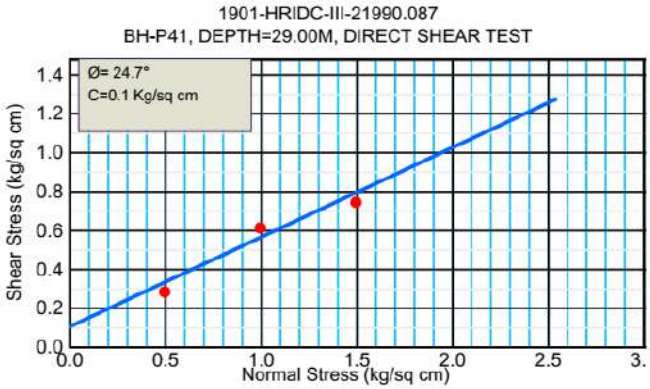


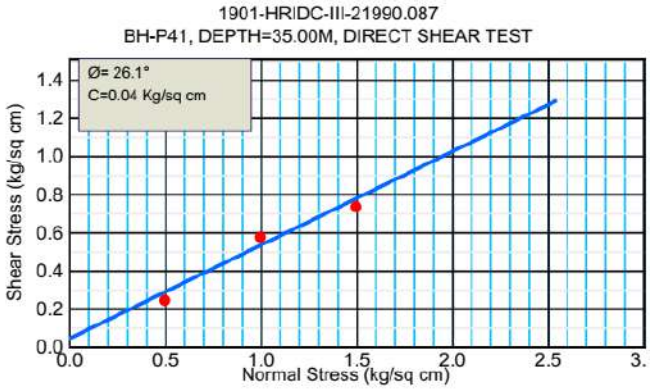


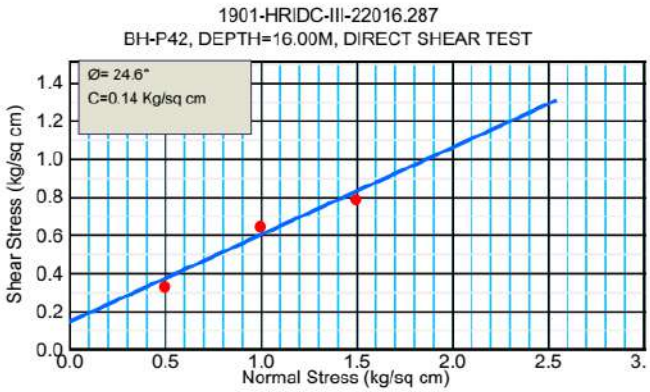
APPENDIX-F
GRAPH 1: DST GRAPH

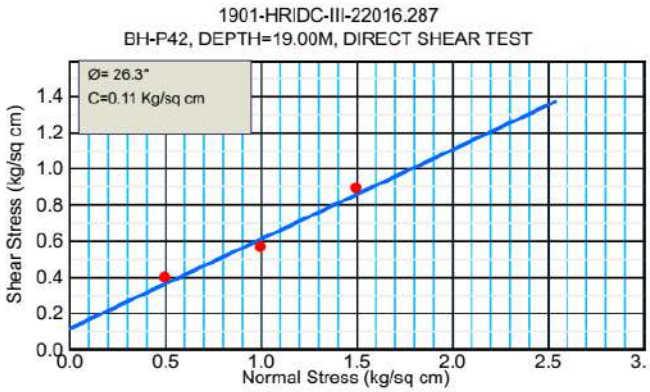


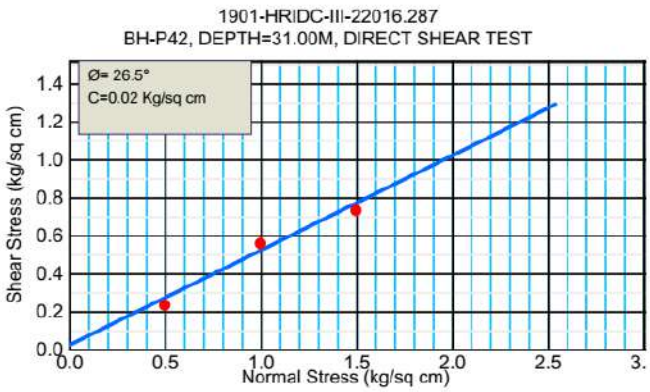


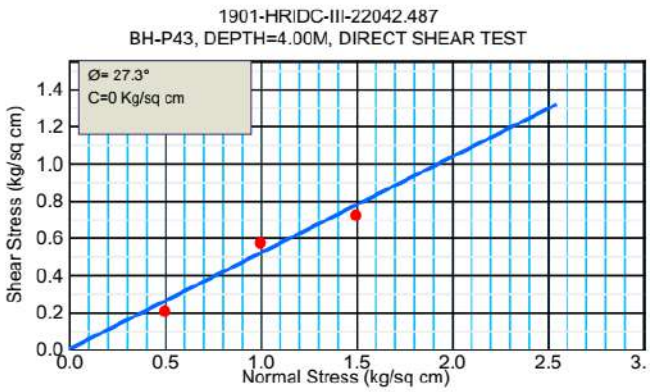






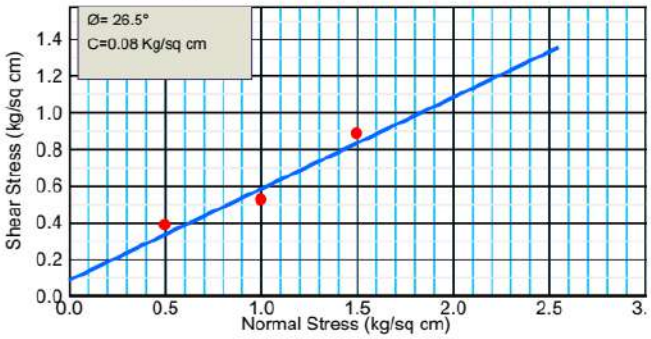




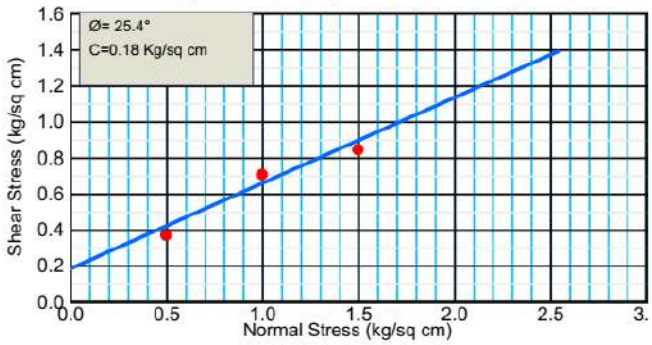


APPENDIX-F
GRAPH 2: DST GRAPH

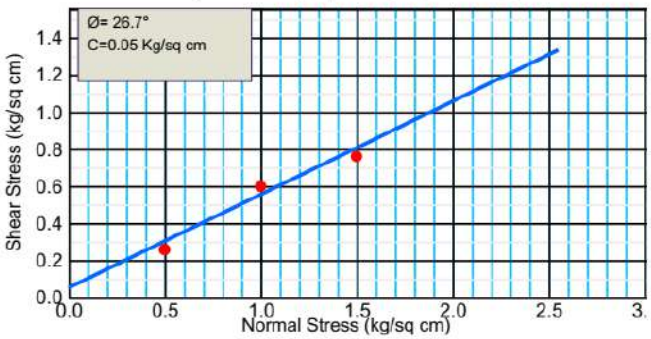
1901-HRIDC-III-22042.487
BH-P43, DEPTH=7.00M, DIRECT SHEAR TEST



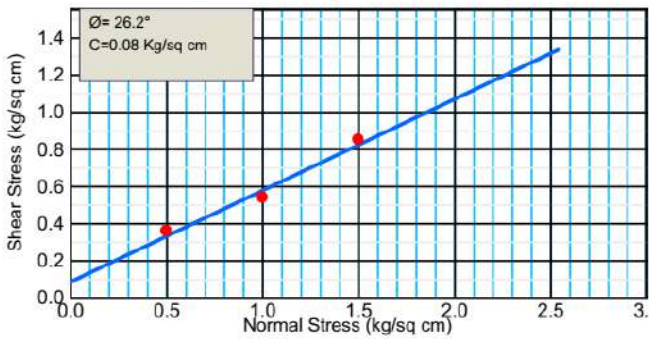
1901-HRIDC-III-22042.487
BH-P43, DEPTH=37.00M, DIRECT SHEAR TEST



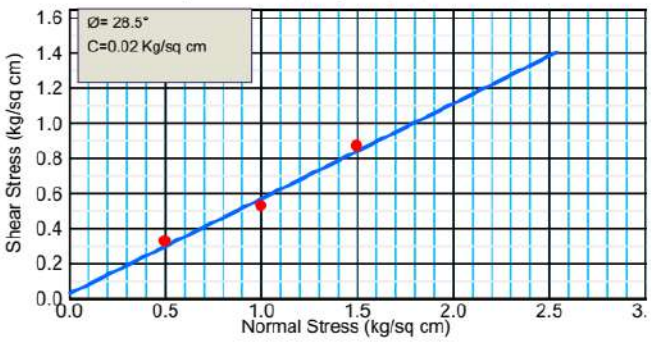
1901-HRIDC-III-22068.687
BH-P44, DEPTH=4.00M, DIRECT SHEAR TEST



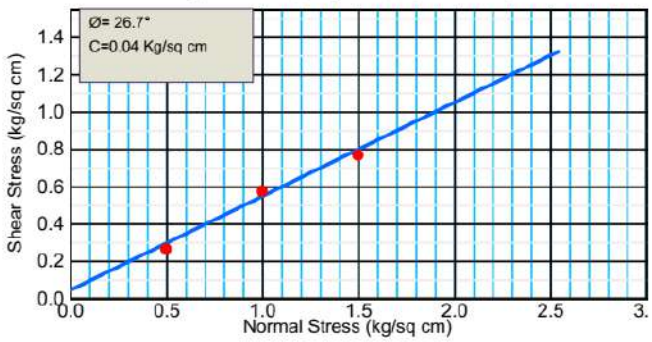
1901-HRIDC-III-22068.687
BH-P44, DEPTH=7.00M, DIRECT SHEAR TEST



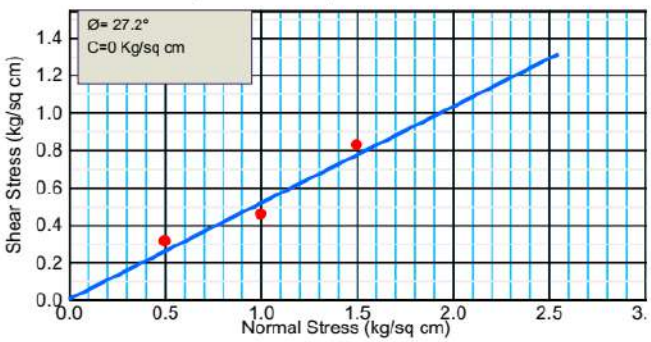
1901-HRIDC-III-22068.687
BH-P44, DEPTH=28.00M, DIRECT SHEAR TEST



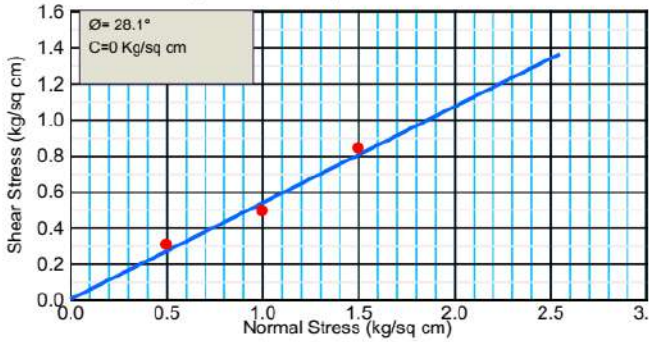
1901-HRIDC-III-22094.887
BH-P45, DEPTH=1.00M, DIRECT SHEAR TEST



1901-HRIDC-III-22094.887
BH-P45, DEPTH=4.00M, DIRECT SHEAR TEST

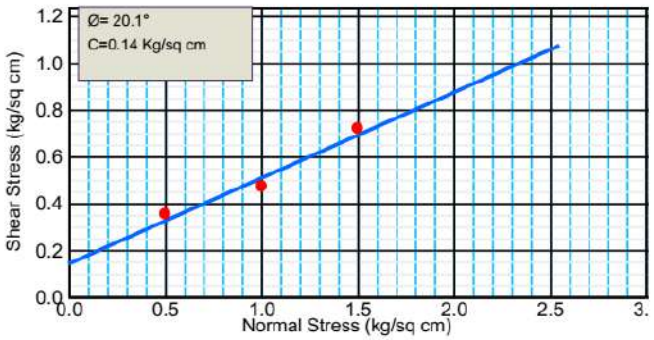


1901-HRIDC-III-22094.887
BH-P45, DEPTH=7.00M, DIRECT SHEAR TEST

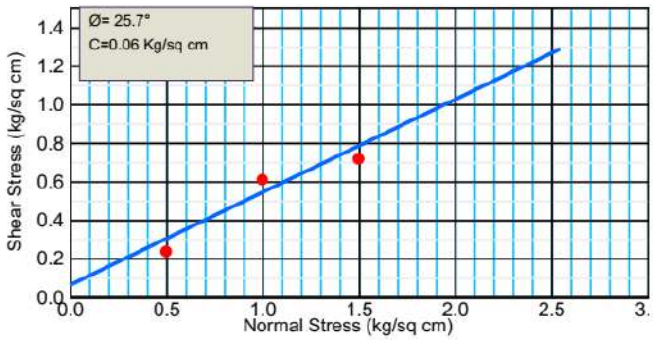


APPENDIX-F
GRAPH 3: DST GRAPH

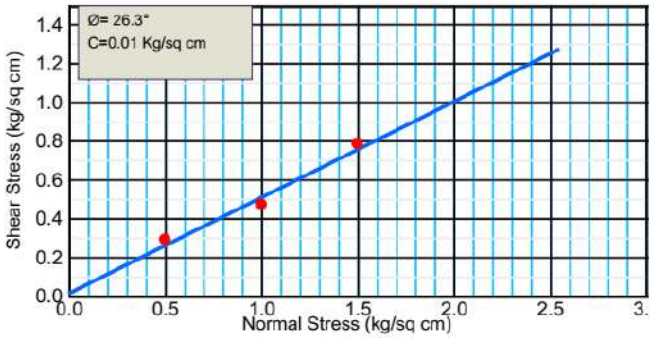
1901-HRIDC-III-22094.887
BH-P45, DEPTH=34.00M, DIRECT SHEAR TEST



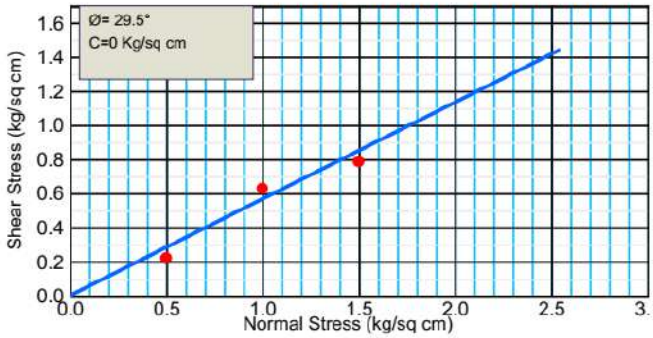
1901-HRIDC-III-22121.087
BH-P46, DEPTH=1.00M, DIRECT SHEAR TEST



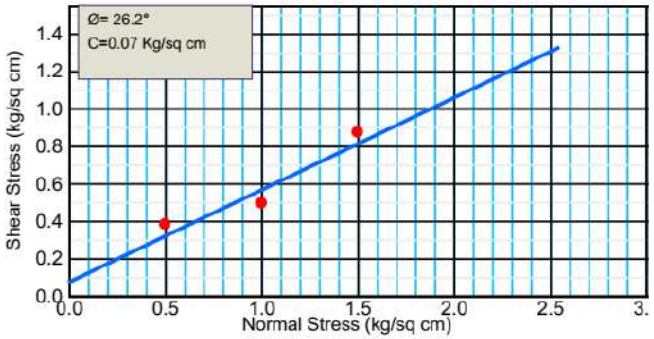
1901-HRIDC-III-22121.087
BH-P46, DEPTH=4.00M, DIRECT SHEAR TEST



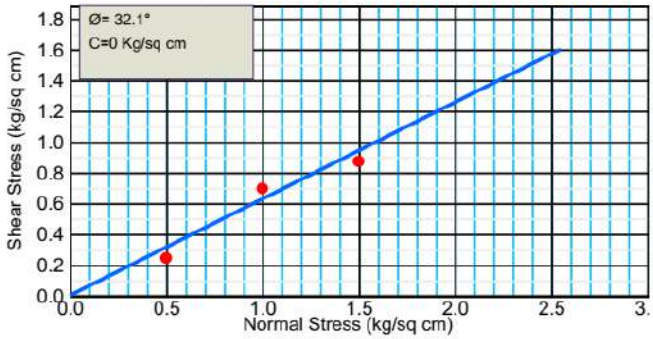
1901-HRIDC-III-22121.087
BH-P46, DEPTH=7.00M, DIRECT SHEAR TEST



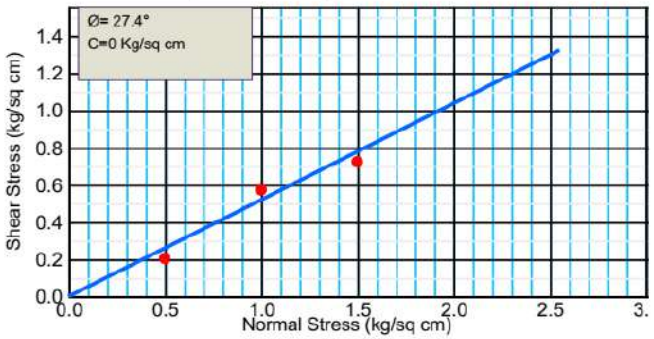
1901-HRIDC-III-22121.087
BH-P46, DEPTH=16.00M, DIRECT SHEAR TEST



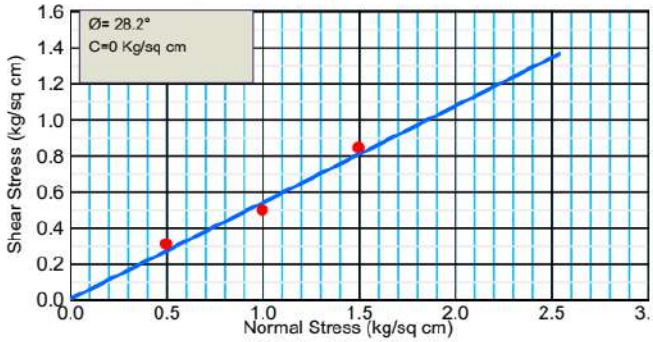
1901-HRIDC-III-22121.087
BH-P46, DEPTH=34.00M, DIRECT SHEAR TEST



1901-HRIDC-III-22147.287
BH-P47, DEPTH=5.00M, DIRECT SHEAR TEST

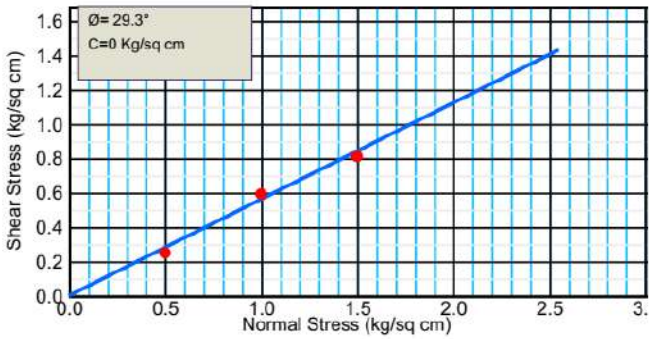


1901-HRIDC-III-22147.287
BH-P47, DEPTH=8.00M, DIRECT SHEAR TEST

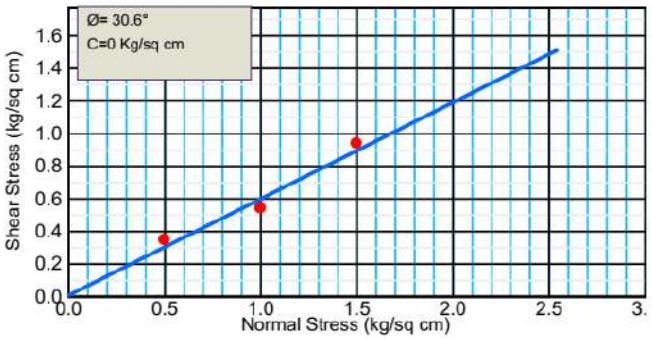


APPENDIX-F
GRAPH 4: DST GRAPH

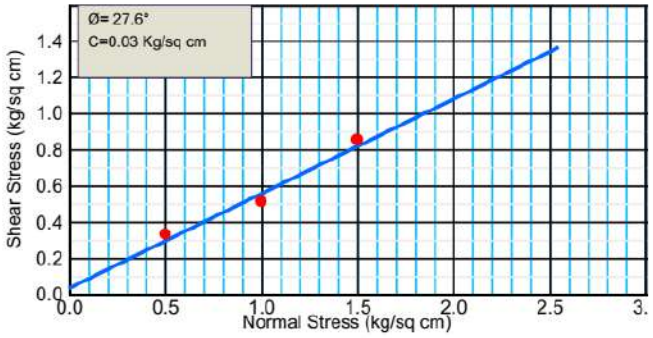
1901-HRIDC-III-22147.287
BH-P47, DEPTH=32.00M, DIRECT SHEAR TEST



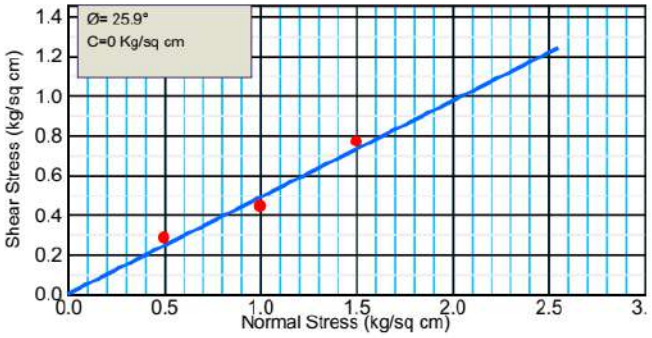
1901-HRIDC-III-22147.287
BH-P47, DEPTH=35.00M, DIRECT SHEAR TEST



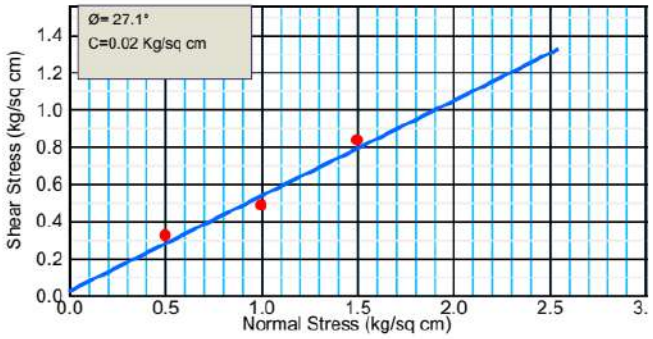
1901-HRIDC-III-22173.487
BH-P48, DEPTH=2.00M, DIRECT SHEAR TEST



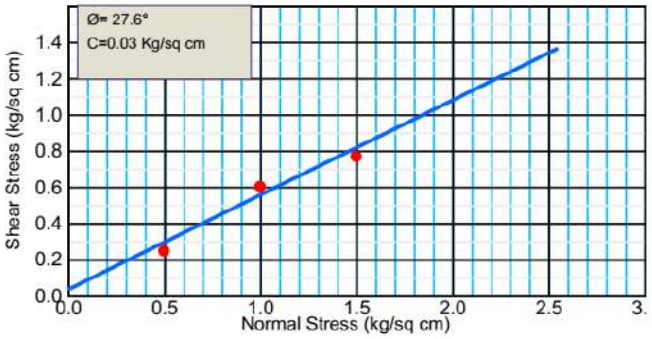
1901-HRIDC-III-22173.487
BH-P48, DEPTH=5.00M, DIRECT SHEAR TEST



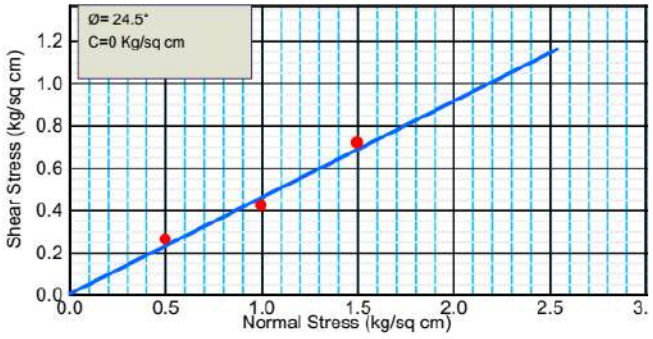
1901-HRIDC-III-22173.487
BH-P48, DEPTH=26.00M, DIRECT SHEAR TEST



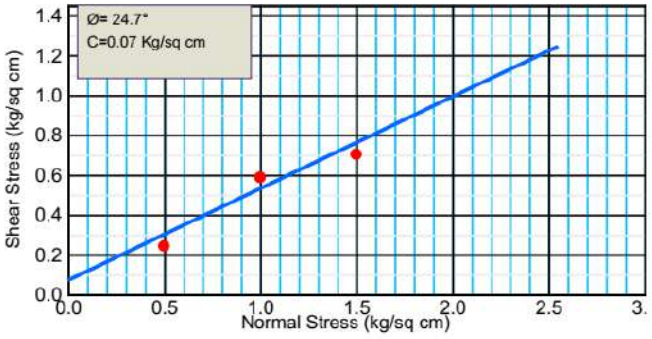
1901-HRIDC-III-22173.487
BH-P48, DEPTH=32.00M, DIRECT SHEAR TEST



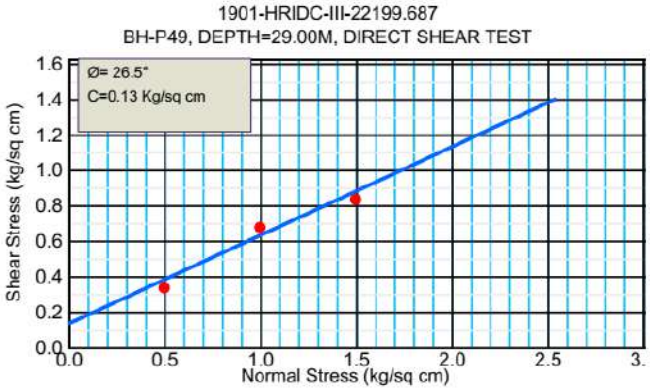
1901-HRIDC-III-22199.687
BH-P49, DEPTH=5.00M, DIRECT SHEAR TEST

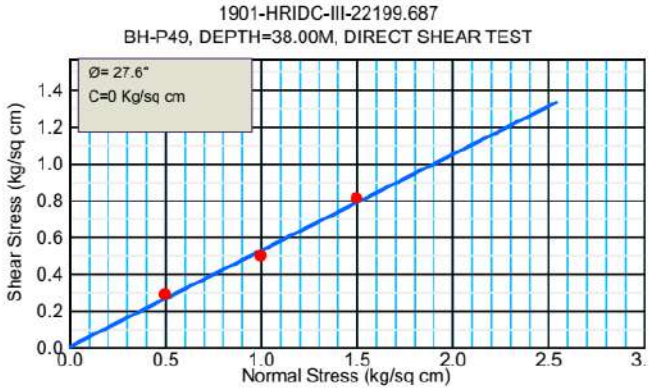


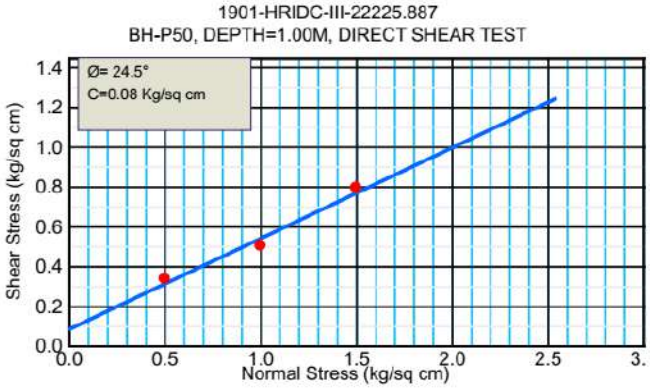
1901-HRIDC-III-22199.687
BH-P49, DEPTH=8.00M, DIRECT SHEAR TEST

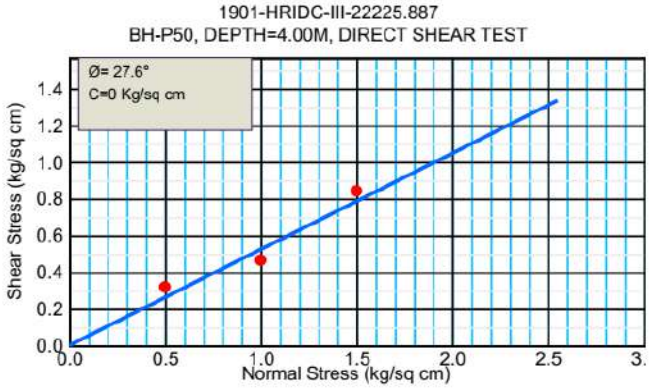


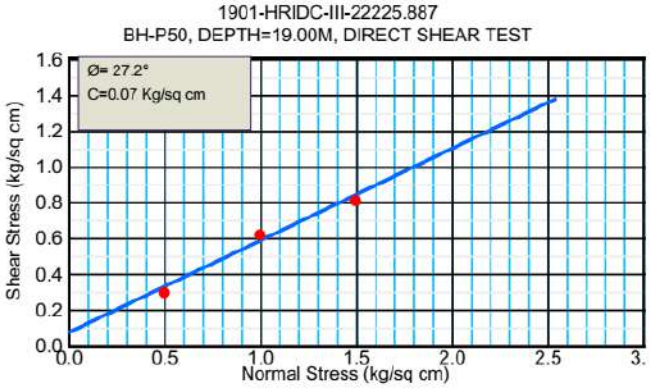
APPENDIX-F
GRAPH 5: DST GRAPH

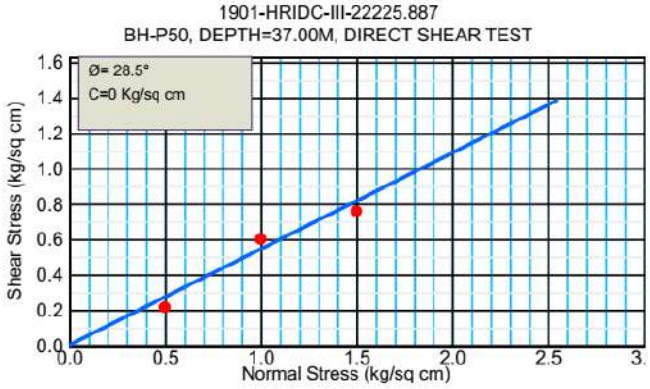


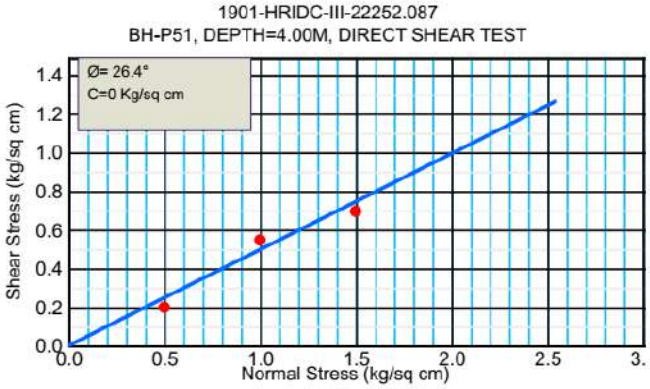


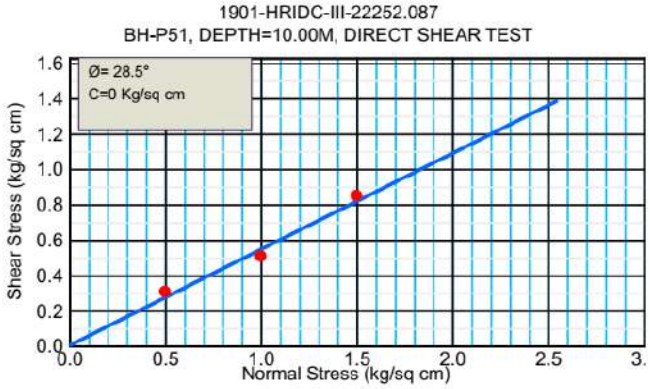




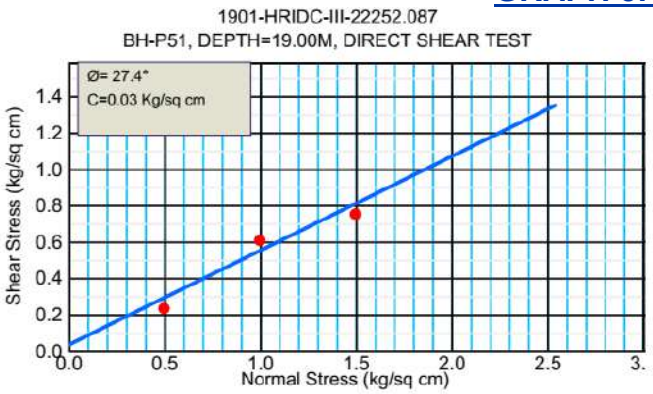


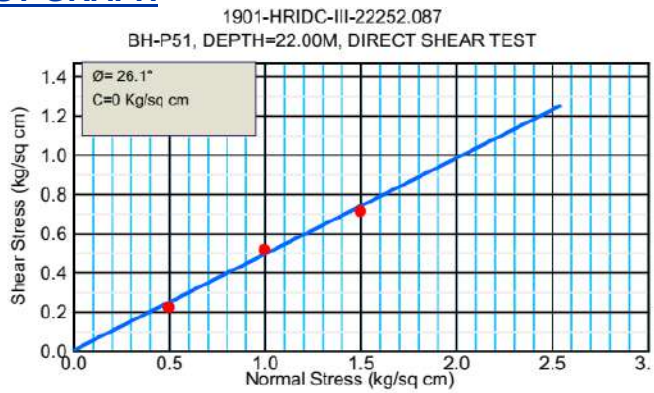


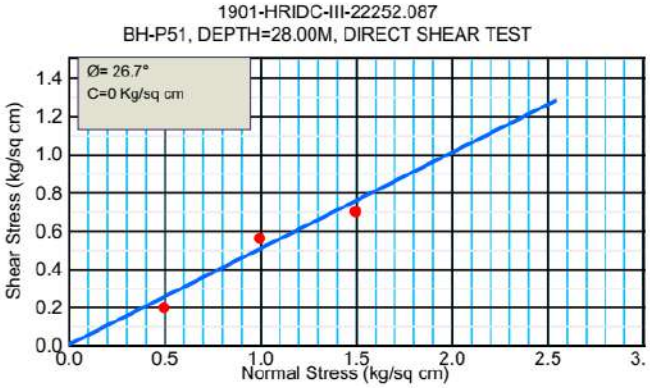


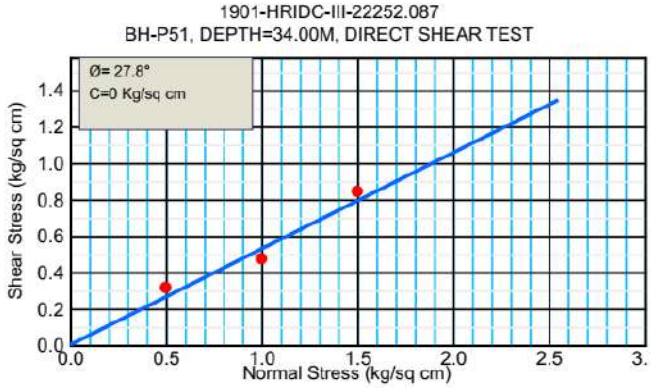


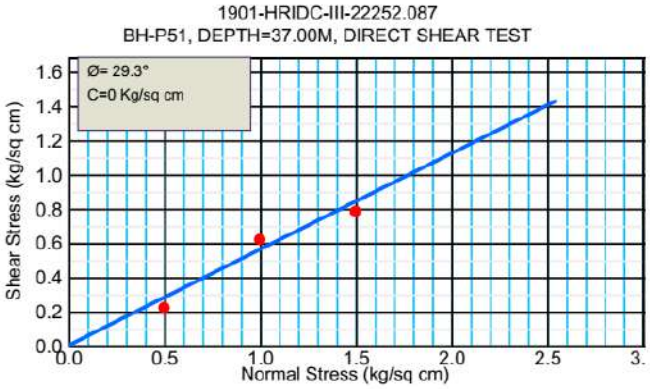
APPENDIX-F
GRAPH 6: DST GRAPH

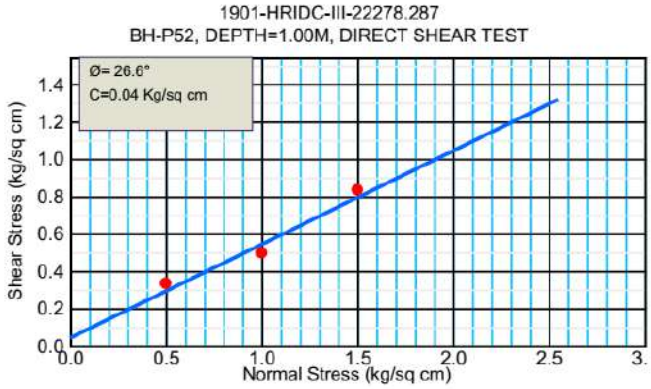


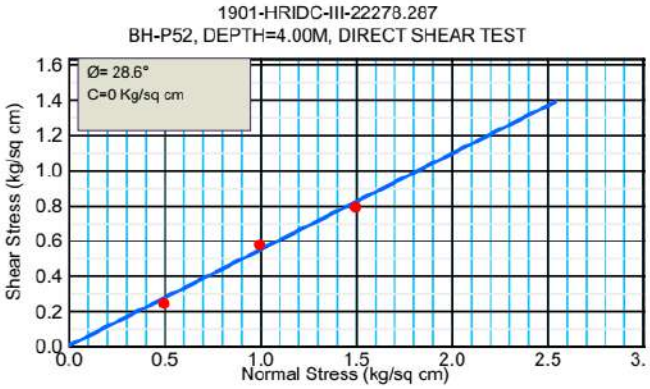


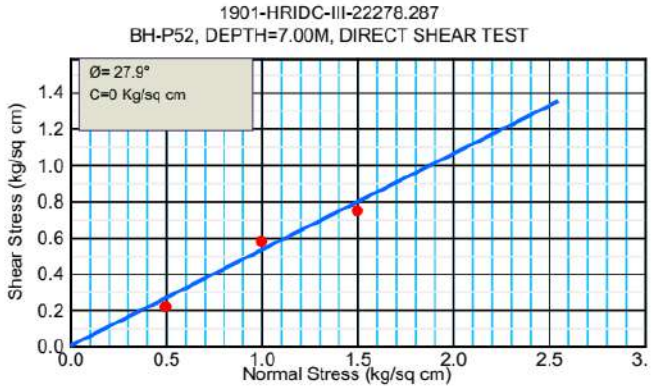






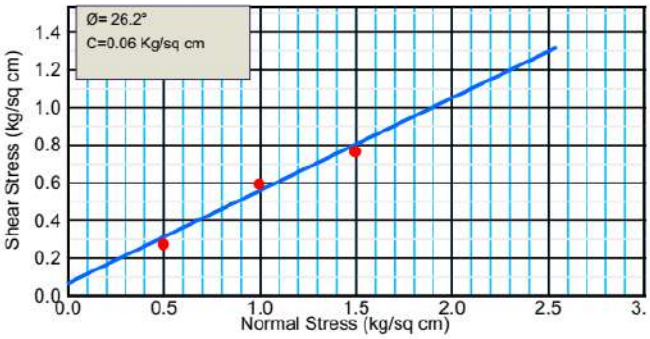




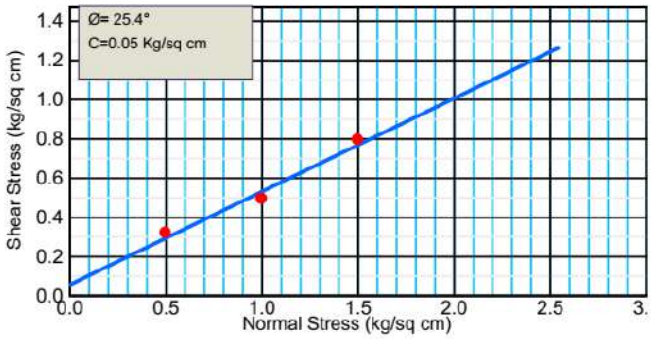


APPENDIX-F
GRAPH 7: DST GRAPH

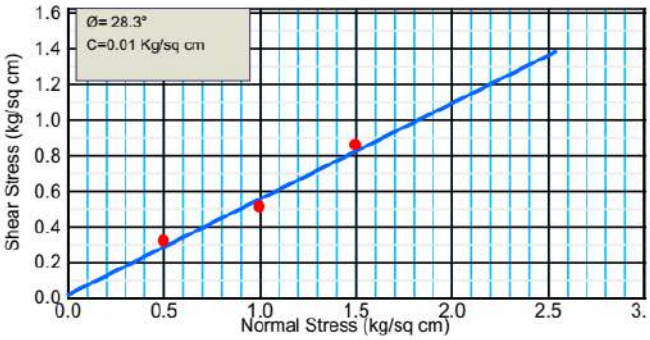
1901-HRIDC-III-22278.287
BH-P52, DEPTH=10.00M, DIRECT SHEAR TEST



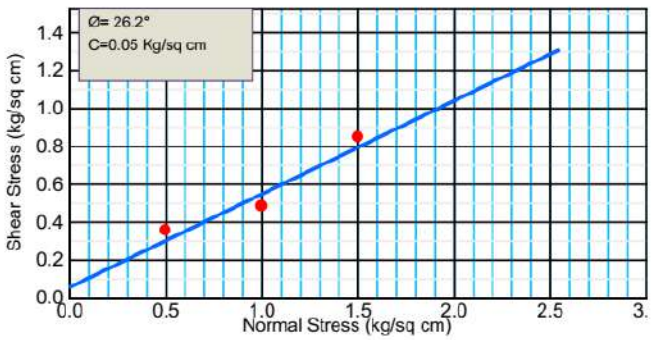
1901-HRIDC-III-22278.287
BH-P52, DEPTH=19.00M, DIRECT SHEAR TEST



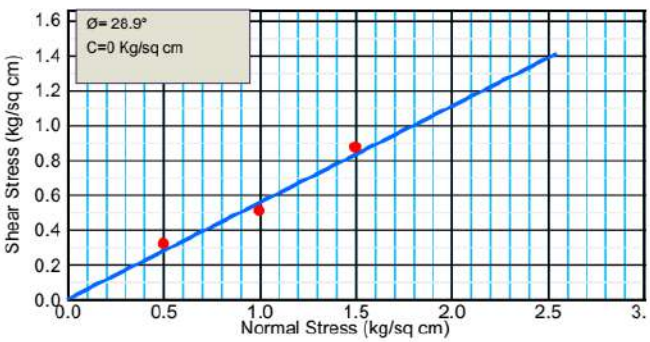
1901-HRIDC-III-22278.287
BH-P52, DEPTH=22.00M, DIRECT SHEAR TEST



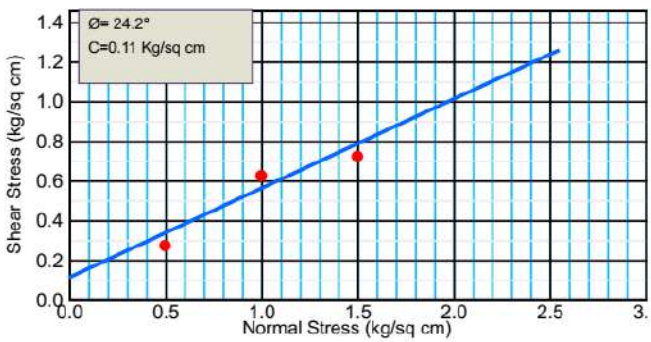
1901-HRIDC-III-22304.487
BH-P53, DEPTH=1.00M, DIRECT SHEAR TEST



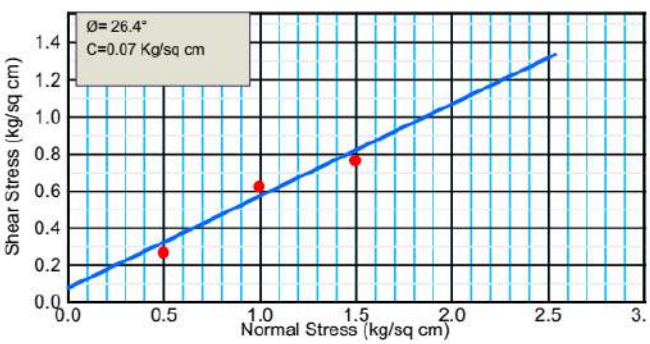
1901-HRIDC-III-22304.487
BH-P53, DEPTH=4.00M, DIRECT SHEAR TEST



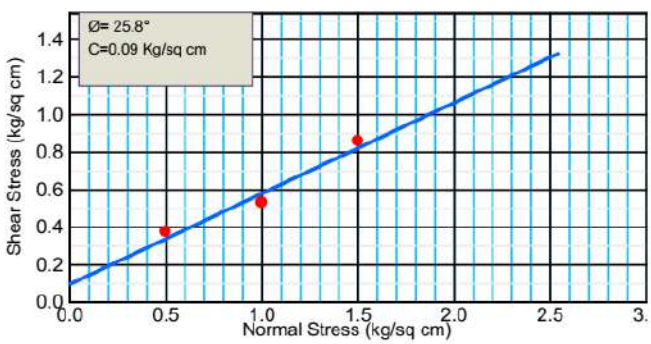
1901-HRIDC-III-22304.487
BH-P53, DEPTH=10.00M, DIRECT SHEAR TEST



1901-HRIDC-III-22304.487
BH-P53, DEPTH=19.00M, DIRECT SHEAR TEST

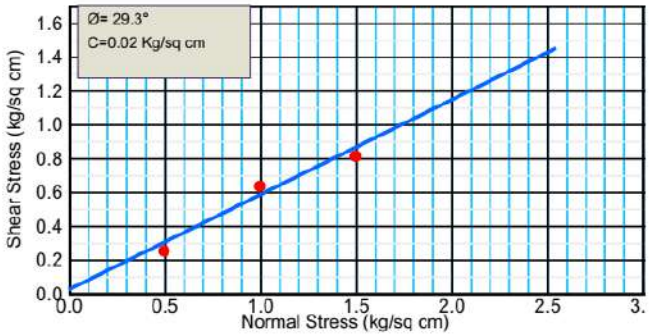


1901-HRIDC-III-22304.487
BH-P53, DEPTH=22.00M, DIRECT SHEAR TEST

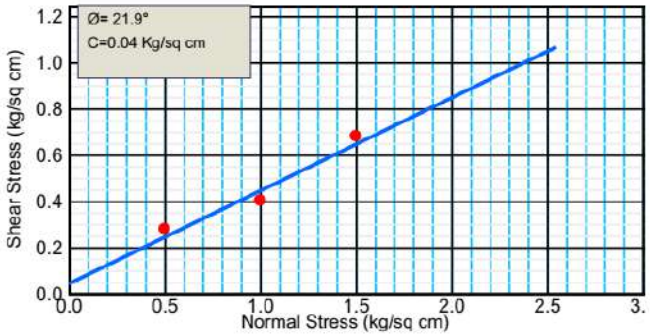


APPENDIX-F
GRAPH 8: DST GRAPH

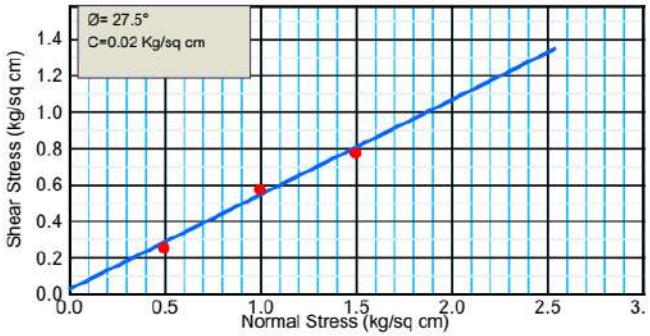
1901-HRIDC-III-22304.487
BH-P53, DEPTH=31.00M, DIRECT SHEAR TEST



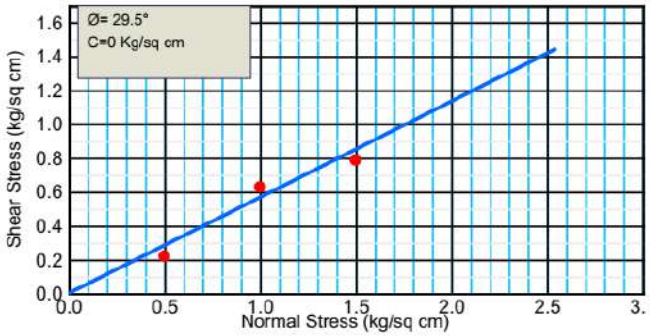
1901-HRIDC-III-22330.687
BH-P54, DEPTH=4.00M, DIRECT SHEAR TEST



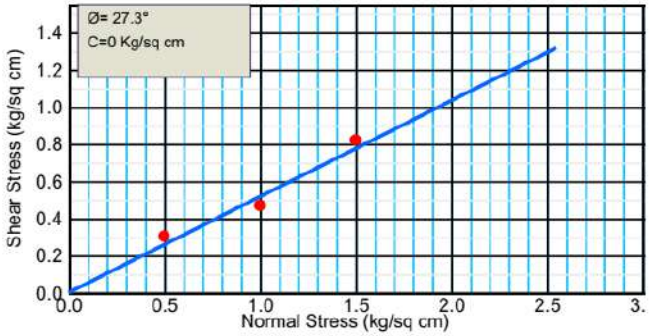
1901-HRIDC-III-22330.687
BH-P54, DEPTH=10.00M, DIRECT SHEAR TEST



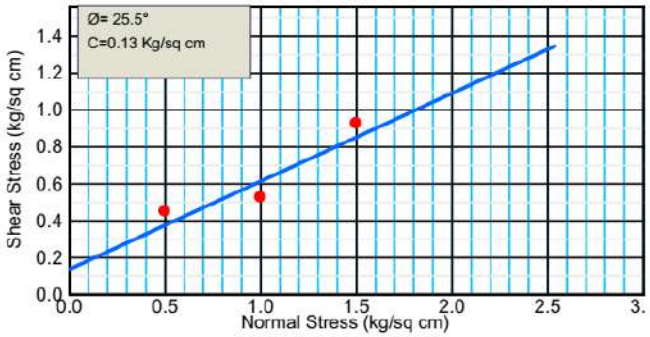
1901-HRIDC-III-22330.687
BH-P54, DEPTH=13.00M, DIRECT SHEAR TEST



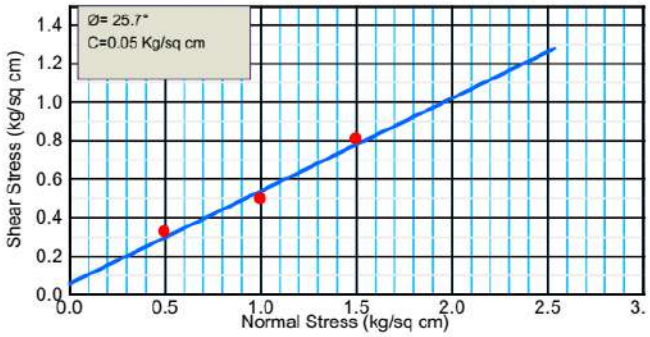
1901-HRIDC-III-22330.687
BH-P54, DEPTH=22.00M, DIRECT SHEAR TEST



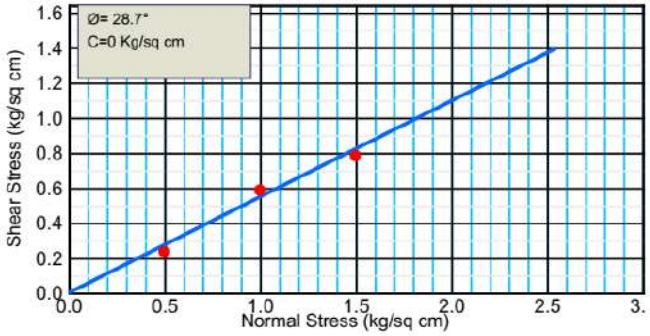
1901-HRIDC-III-22330.687
BH-P54, DEPTH=25.00M, DIRECT SHEAR TEST



1901-HRIDC-III-22356.887
BH-P55, DEPTH=1.00M, DIRECT SHEAR TEST

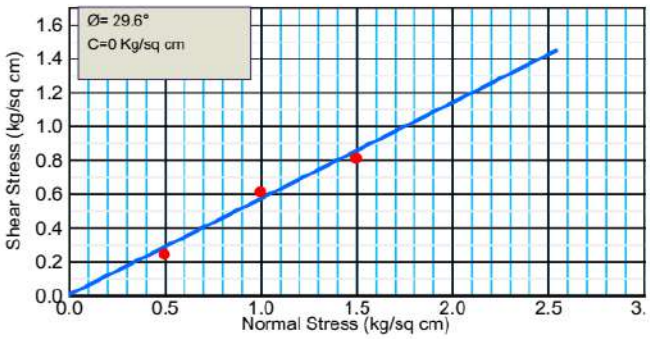


1901-HRIDC-III-22356.887
BH-P55, DEPTH=4.00M, DIRECT SHEAR TEST

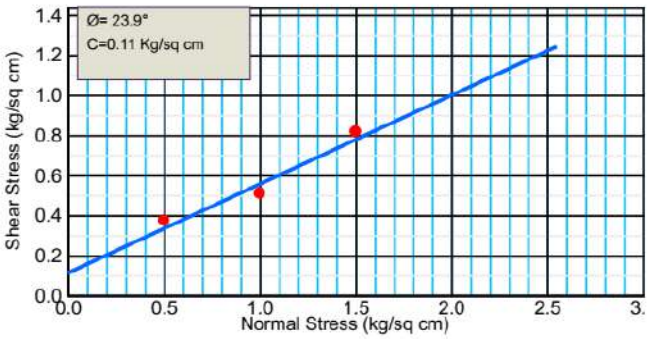


APPENDIX-F
GRAPH 9: DST GRAPH

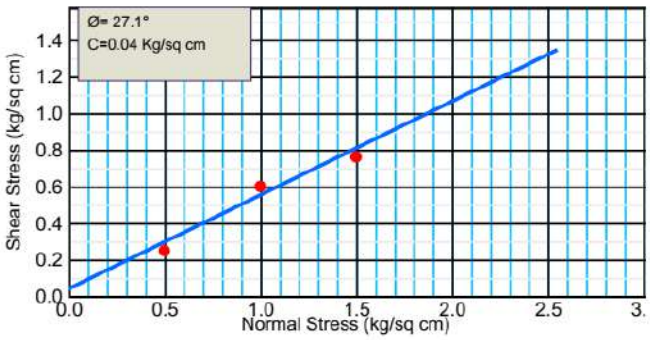
1901-HRIDC-III-22356.887
BH-P55, DEPTH=7.00M, DIRECT SHEAR TEST



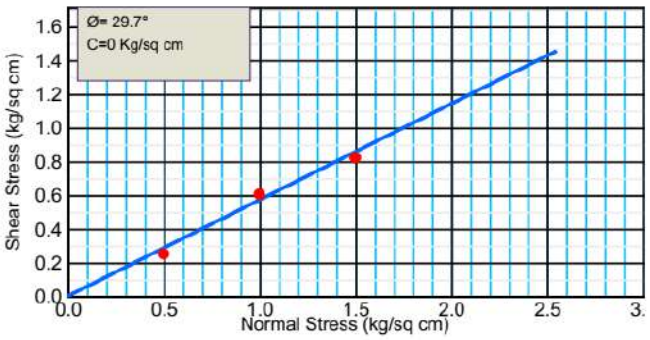
1901-HRIDC-III-22356.887
BH-P55, DEPTH=22.00M, DIRECT SHEAR TEST



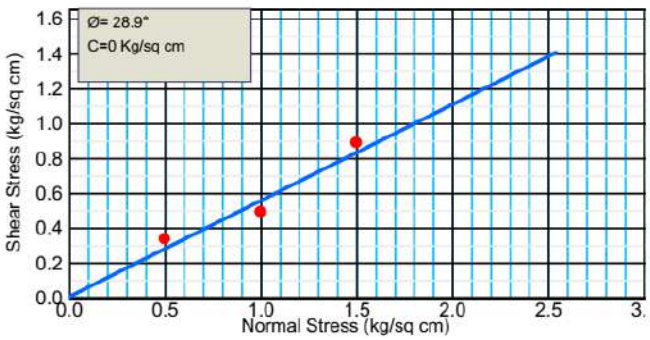
1901-HRIDC-III-22383.087
BH-P56, DEPTH=1.00M, DIRECT SHEAR TEST



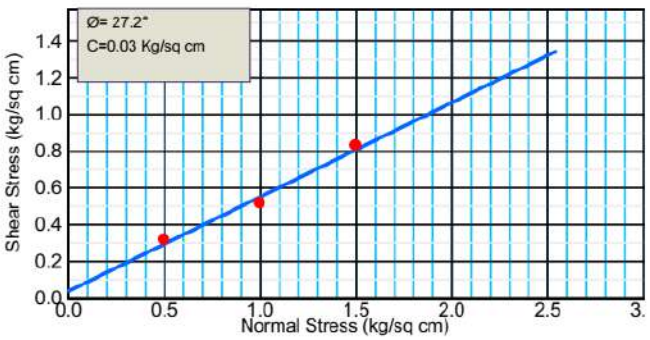
1901-HRIDC-III-22383.087
BH-P56, DEPTH=4.00M, DIRECT SHEAR TEST



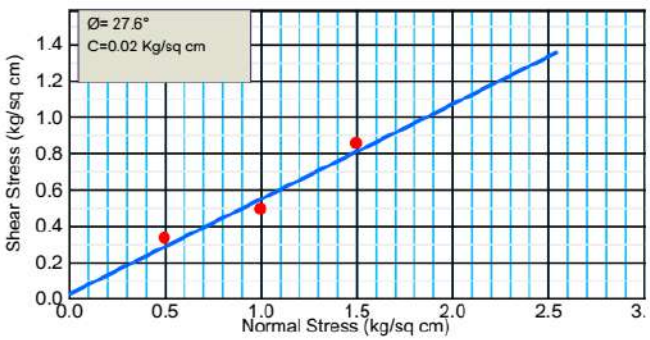
1901-HRIDC-III-22383.087
BH-P56, DEPTH=7.00M, DIRECT SHEAR TEST



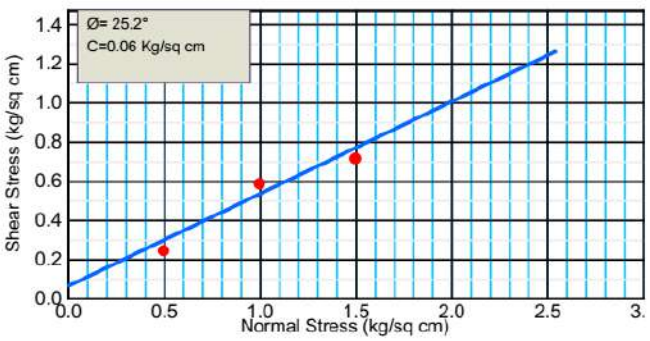
1901-HRIDC-III-22409.287
BH-P57, DEPTH=1.00M, DIRECT SHEAR TEST



1901-HRIDC-III-22409.287
BH-P57, DEPTH=7.00M, DIRECT SHEAR TEST

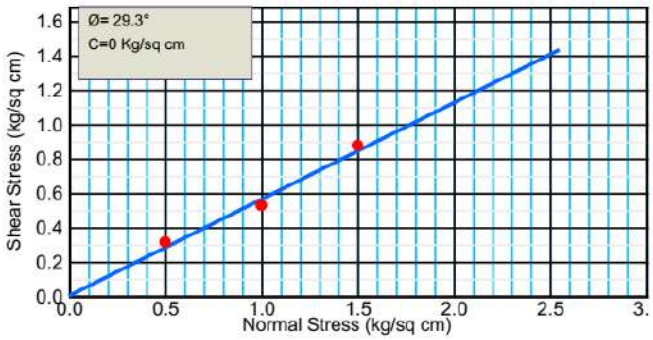


1901-HRIDC-III-22409.287
BH-P57, DEPTH=19.00M, DIRECT SHEAR TEST

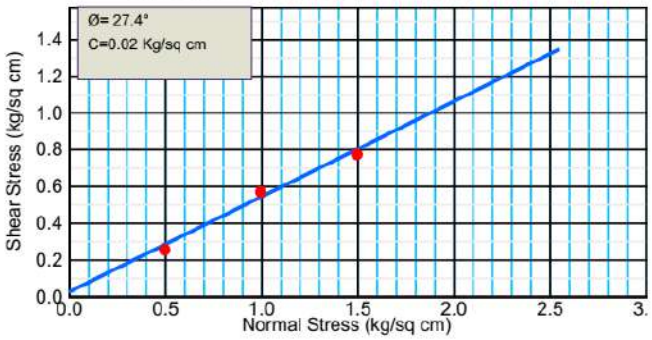


APPENDIX-F
GRAPH 10: DST GRAPH

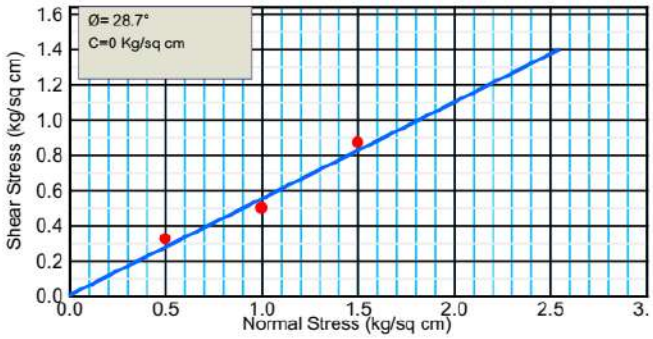
1901-HRIDC-III-22409.287
BH-P57, DEPTH=34.00M, DIRECT SHEAR TEST



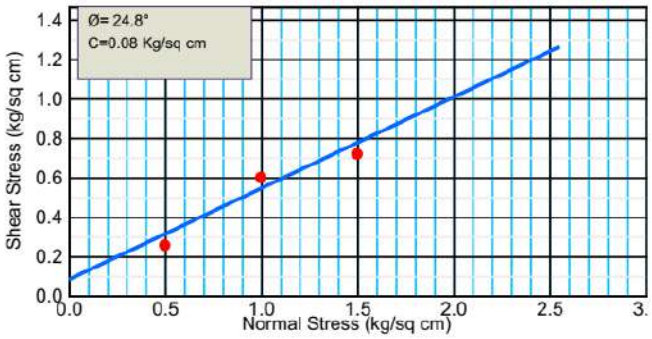
1901-HRIDC-III-22435.487
BH-P58, DEPTH=5.00M, DIRECT SHEAR TEST



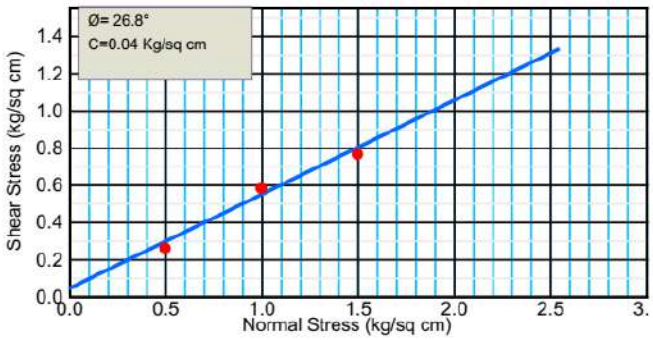
1901-HRIDC-III-22435.487
BH-P58, DEPTH=8.00M, DIRECT SHEAR TEST



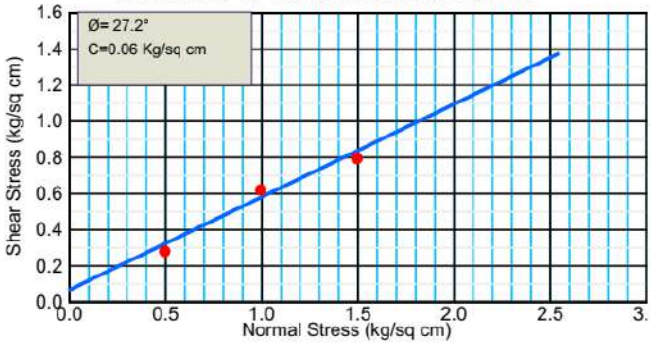
1901-HRIDC-III-22435.487
BH-P58, DEPTH=11.00M, DIRECT SHEAR TEST



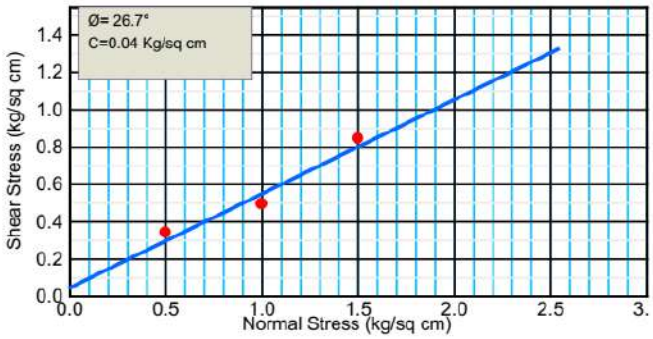
1901-HRIDC-III-22435.487
BH-P58, DEPTH=17.00M, DIRECT SHEAR TEST



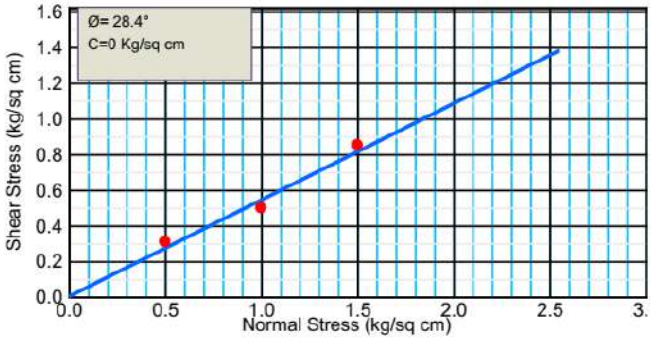
1901-HRIDC-III-22435.487
BH-P58, DEPTH=20.00M, DIRECT SHEAR TEST



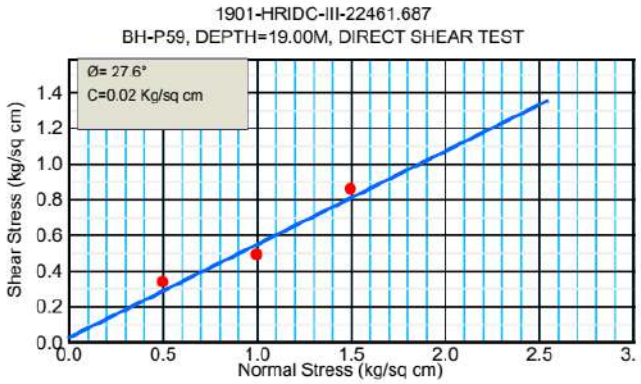
1901-HRIDC-III-22461.687
BH-P59, DEPTH=1.00M, DIRECT SHEAR TEST

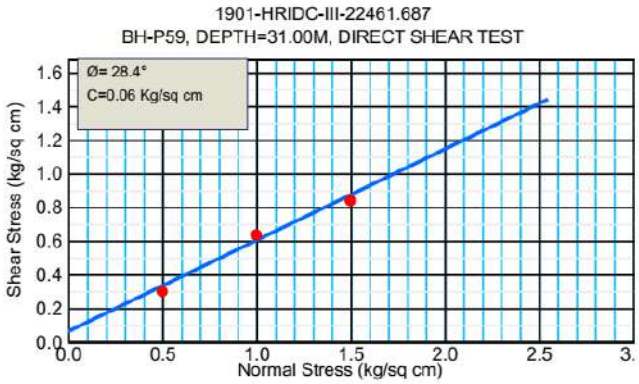


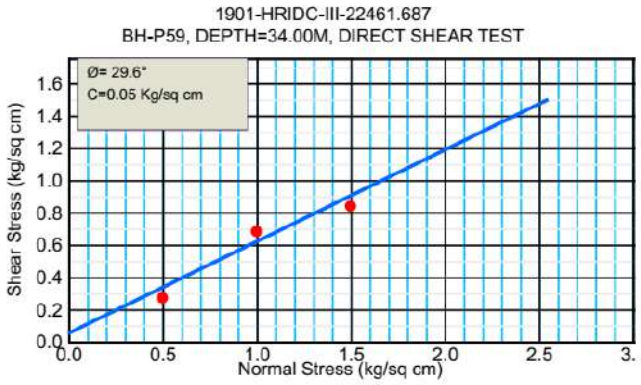
1901-HRIDC-III-22461.687
BH-P59, DEPTH=7.00M, DIRECT SHEAR TEST

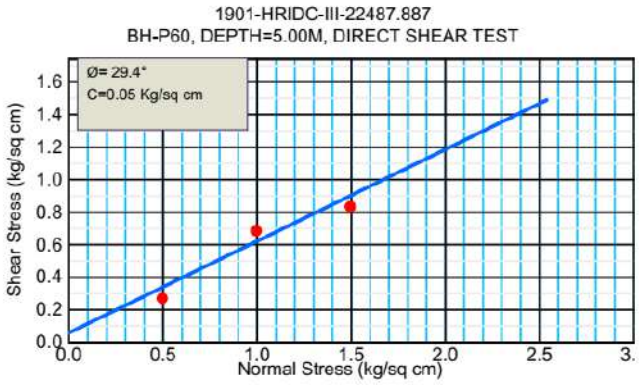


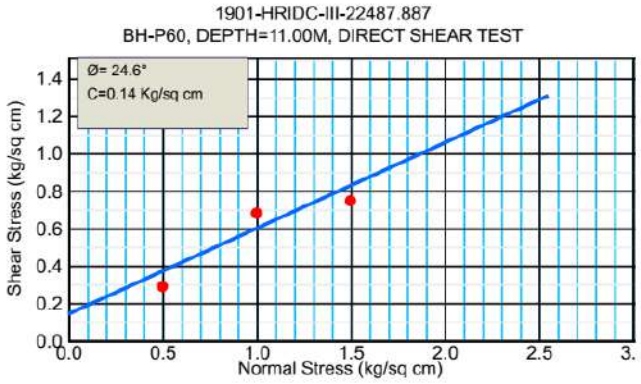
APPENDIX-F
GRAPH 11: DST GRAPH

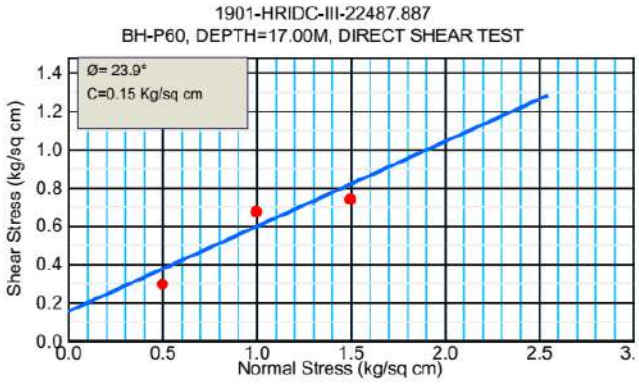


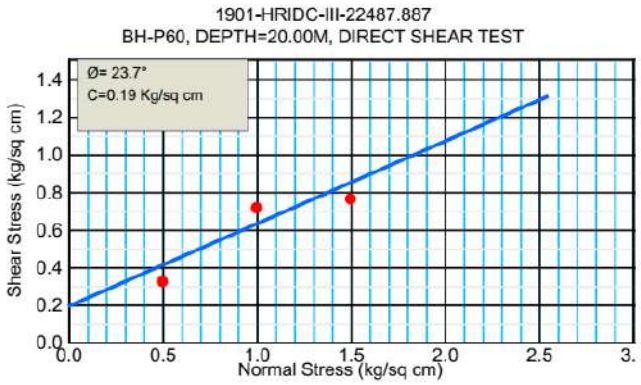






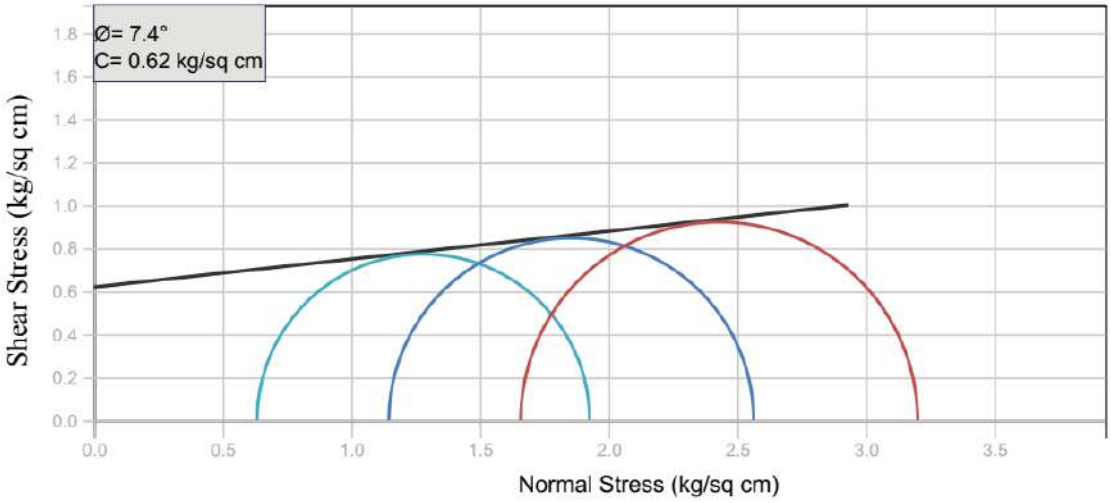




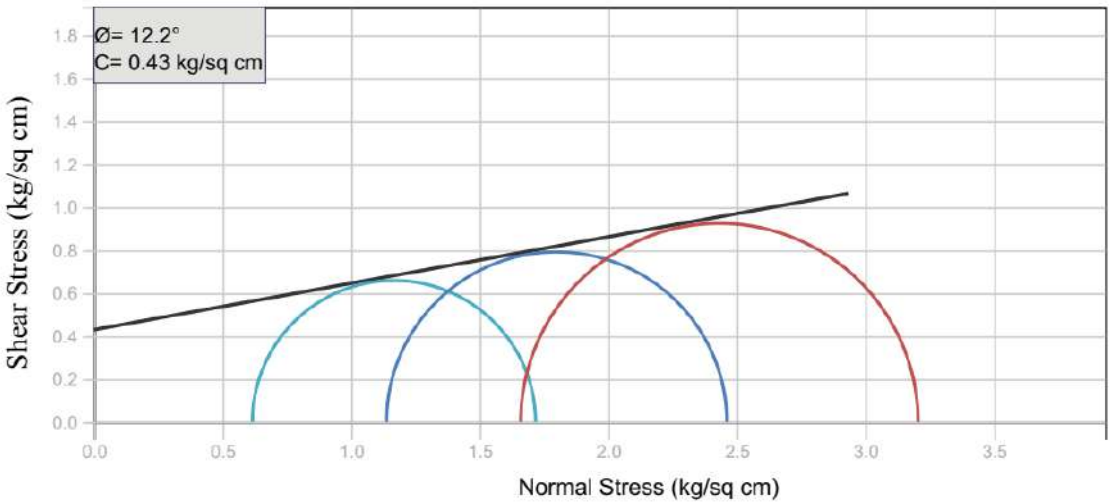


APPENDIX-G
GRAPH 1: UU GRAPH

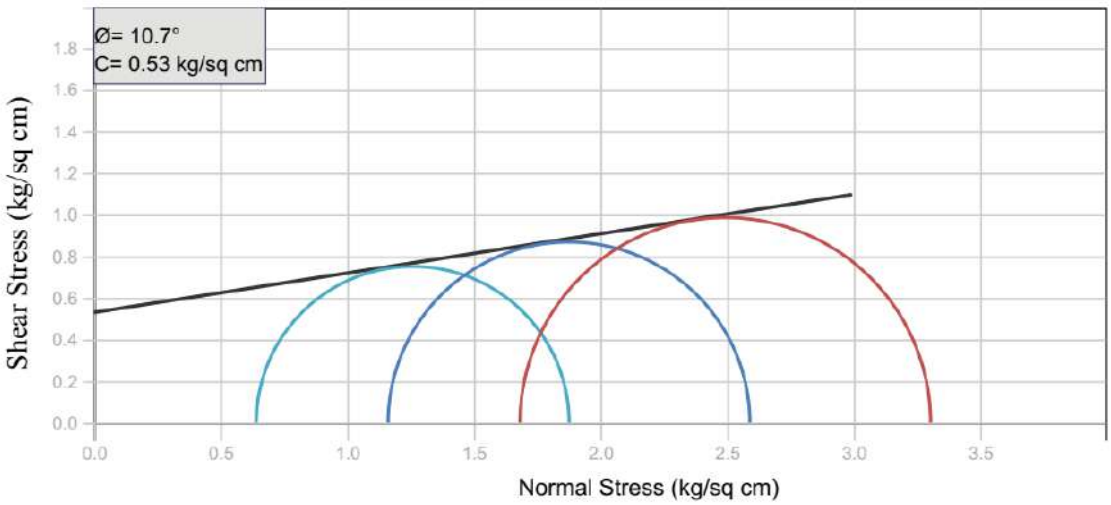
1901-HRIDC-III-21990.087
BH-NO.P41, DEPTH-2.00M, TRIAXIAL GRAPH



1901-HRIDC-III-21990.087
BH-NO.P41, DEPTH-8.00M, TRIAXIAL GRAPH

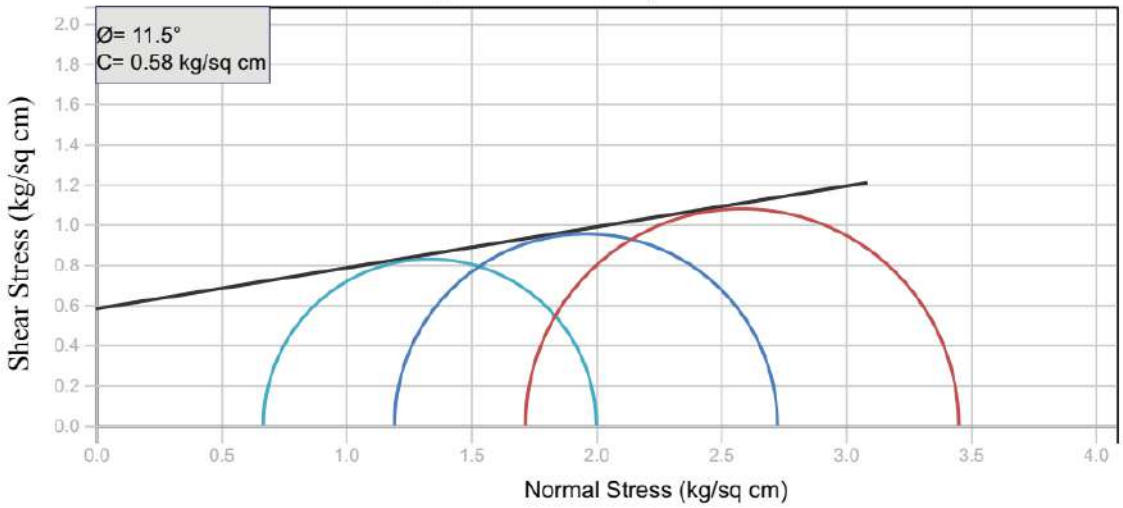


1901-HRIDC-III-21990.087
BH-NO.P41, DEPTH-11.00M, TRIAXIAL GRAPH

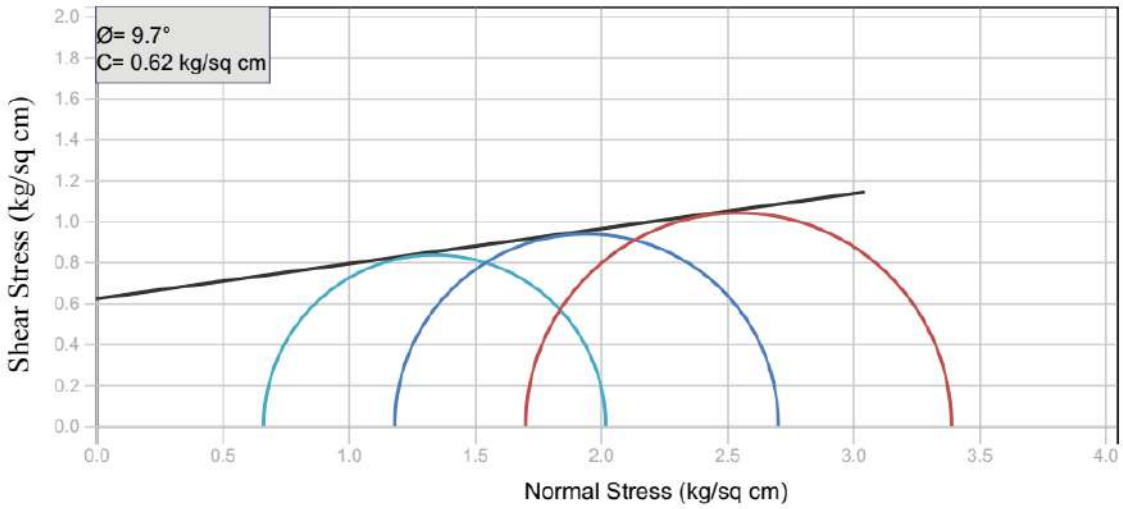


APPENDIX-G
GRAPH 2: UU GRAPH

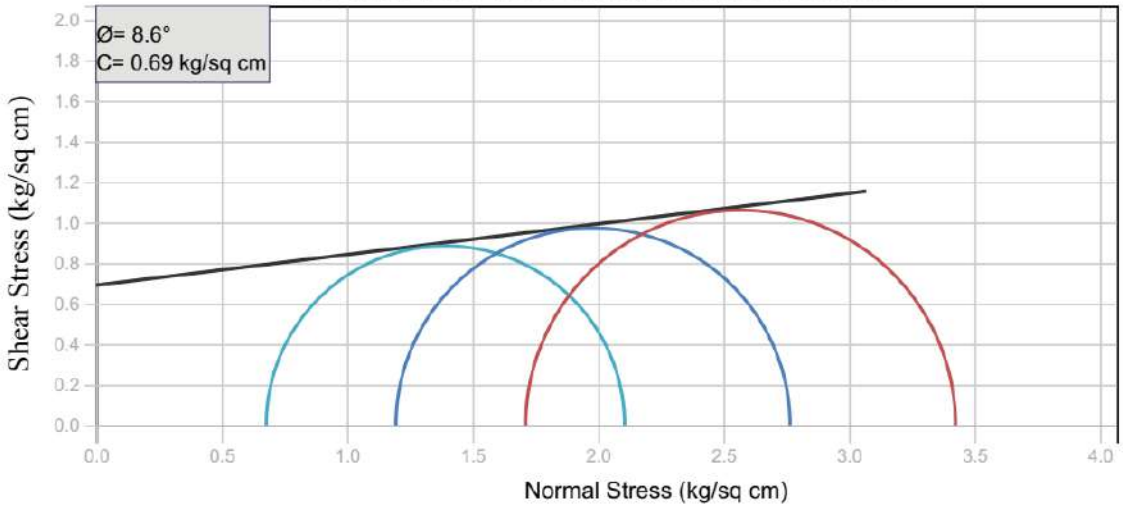
1901-HRIDC-III-21990.087
BH-NO.P41, DEPTH-14.00M, TRIAXIAL GRAPH



1901-HRIDC-III-21990.087
BH-NO.P41, DEPTH-17.00M, TRIAXIAL GRAPH

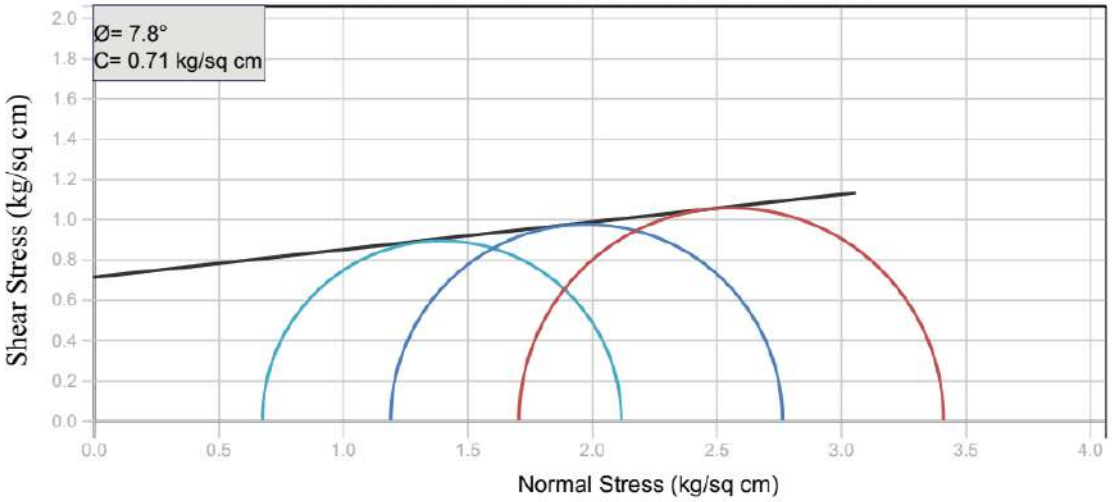


1901-HRIDC-III-22016.287
BH-NO.P42, DEPTH-1.00M, TRIAXIAL GRAPH

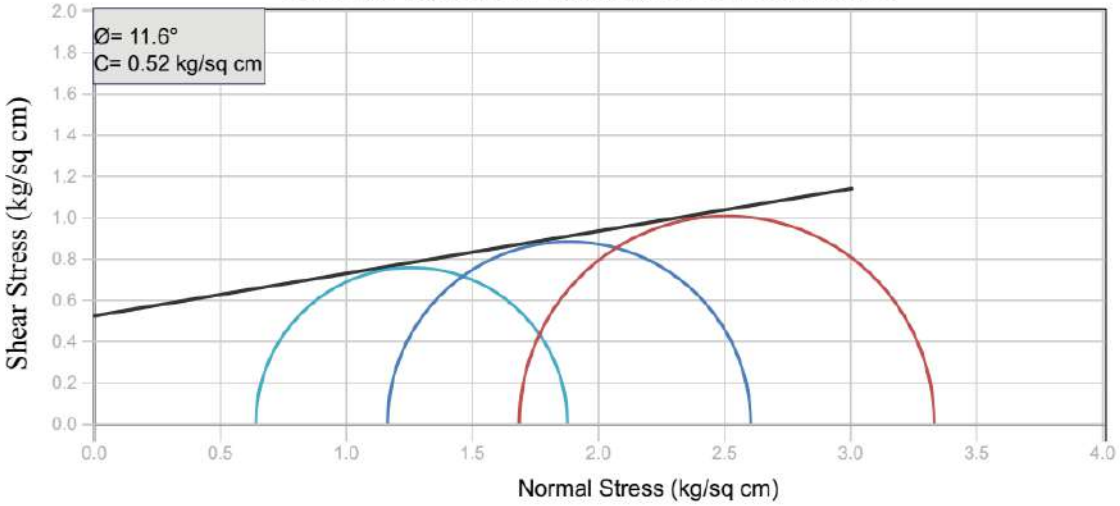


APPENDIX-G
GRAPH 3: UU GRAPH

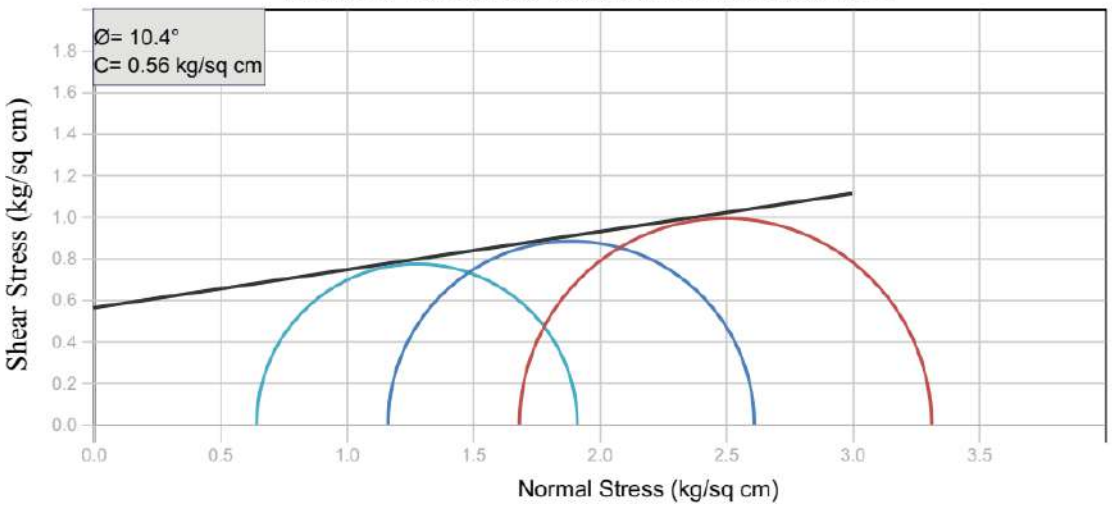
1901-HRIDC-III-22016.287
BH-NO.P42, DEPTH-4.00M, TRIAXIAL GRAPH



1901-HRIDC-III-22016.287
BH-NO.P42, DEPTH-10.00M, TRIAXIAL GRAPH

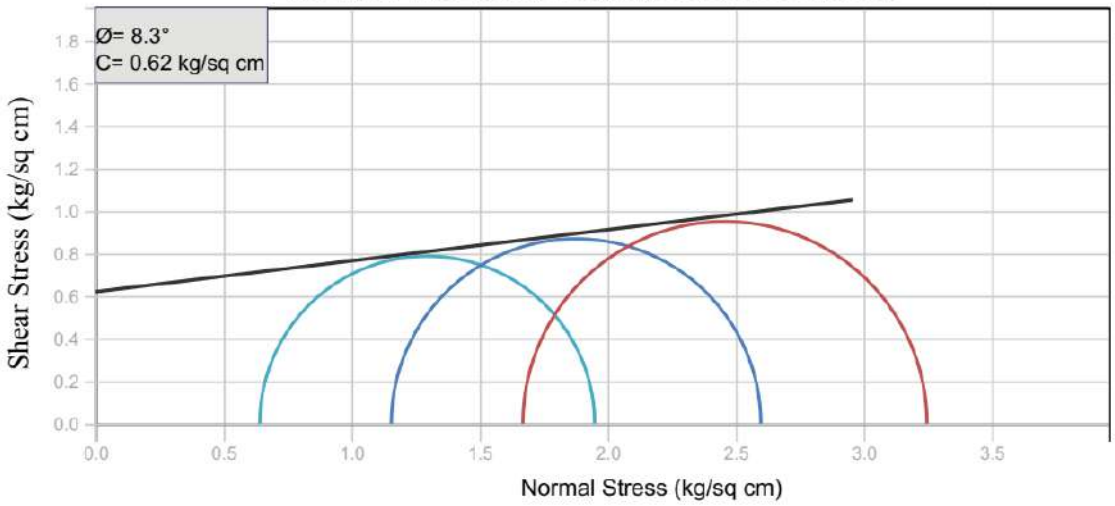


1901-HRIDC-III-22016.287
BH-NO.P42, DEPTH-13.00M, TRIAXIAL GRAPH

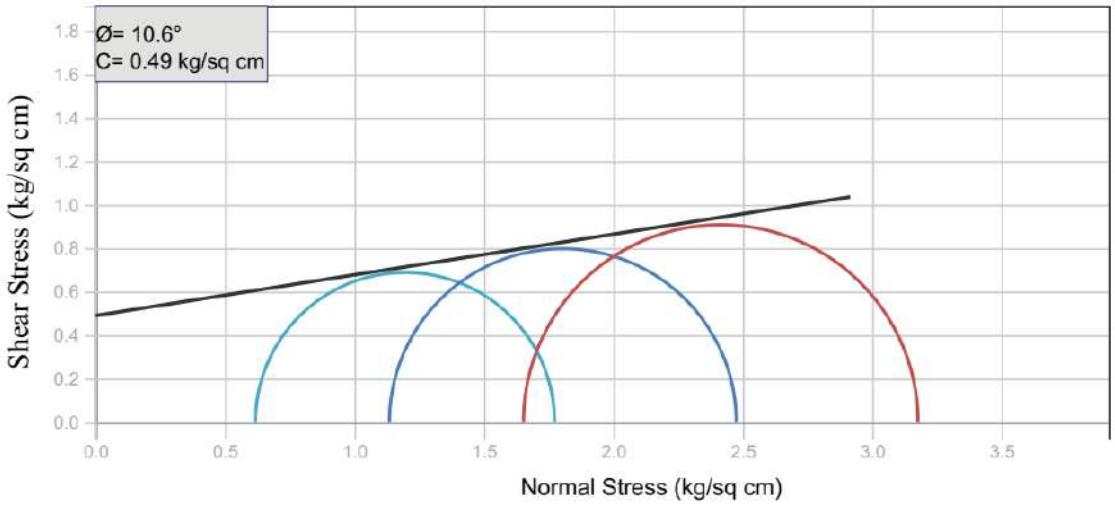


APPENDIX-G
GRAPH 4: UU GRAPH

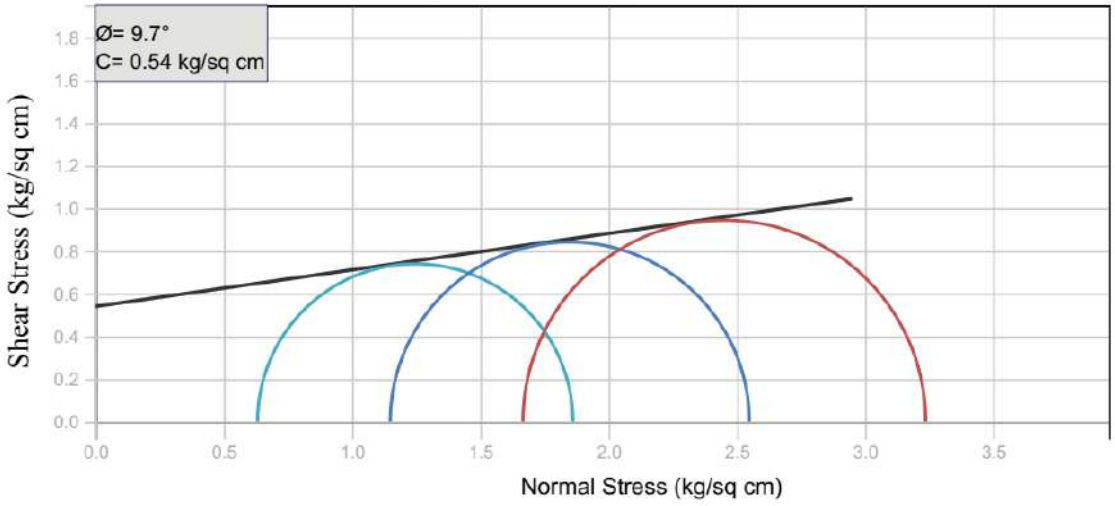
1901-HRIDC-III-22016.287
BH-NO.P42, DEPTH-22.00M, TRIAXIAL GRAPH



1901-HRIDC-III-22016.287
BH-NO.P42, DEPTH-25.00M, TRIAXIAL GRAPH

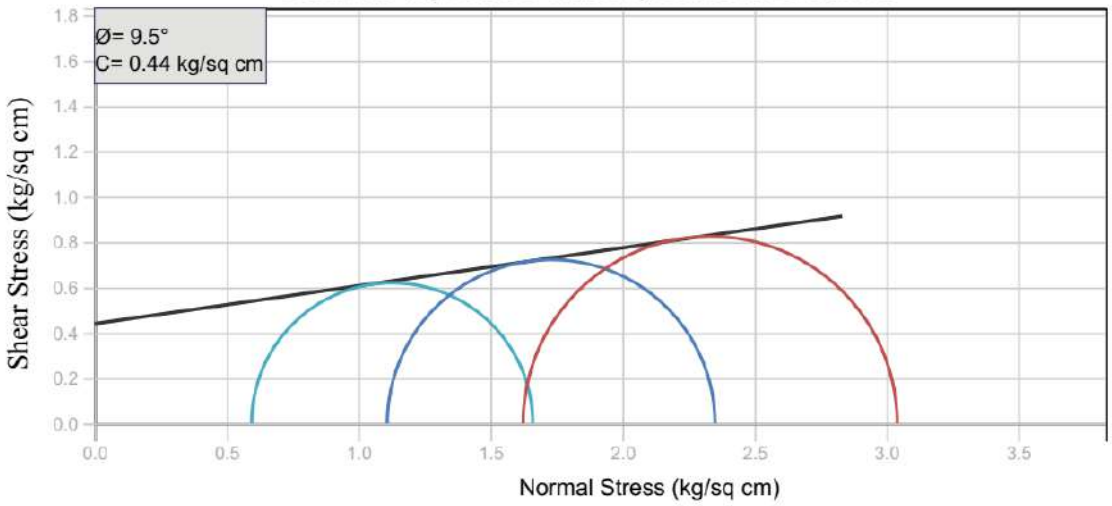


1901-HRIDC-III-22016.287
BH-NO.P42, DEPTH-28.00M, TRIAXIAL GRAPH

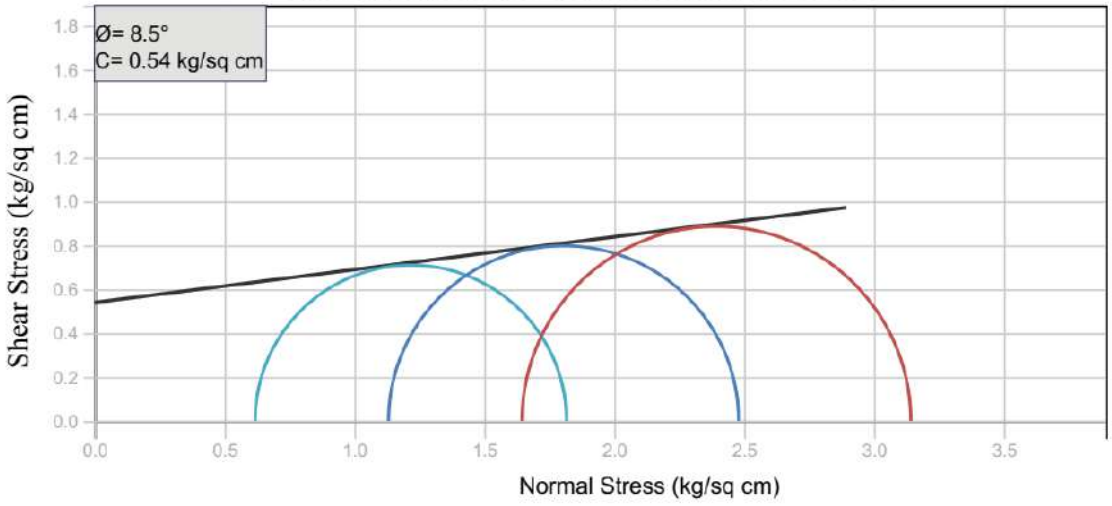


APPENDIX-G
GRAPH 5: UU GRAPH

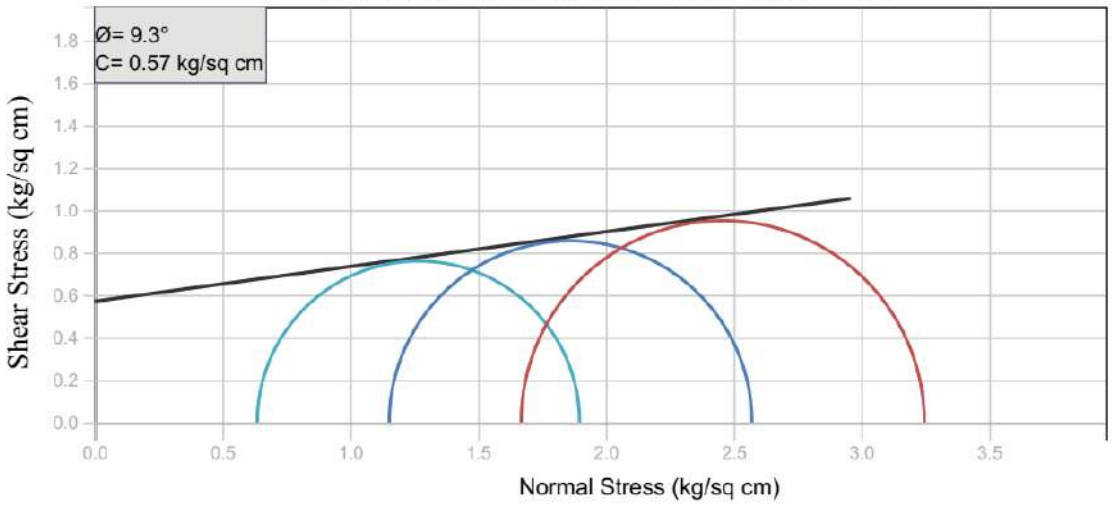
1901-HRIDC-III-22042.487
BH-NO.P43, DEPTH-10.00M, TRIAXIAL GRAPH



1901-HRIDC-III-22042.487
BH-NO.P43, DEPTH-13.00M, TRIAXIAL GRAPH

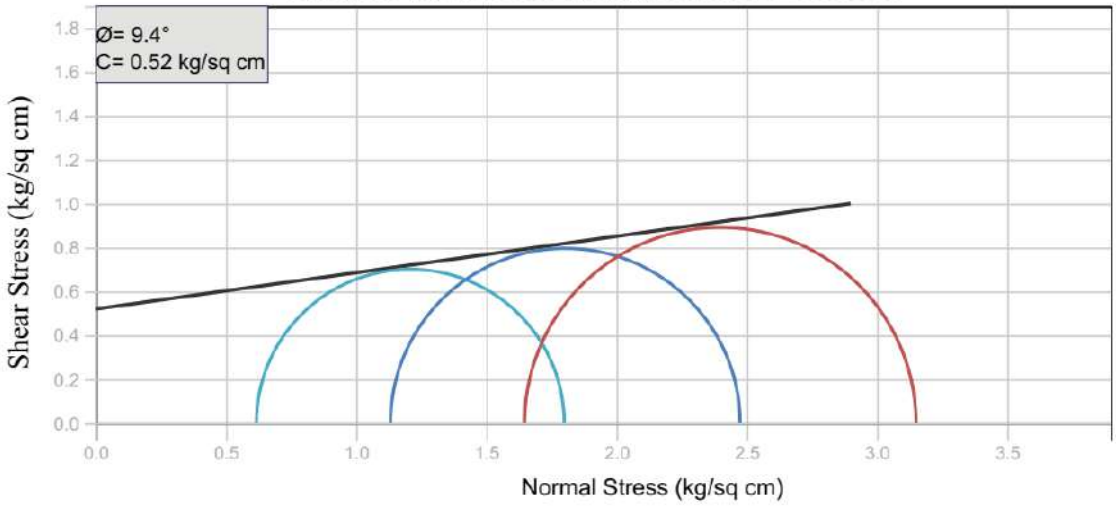


1901-HRIDC-III-22042.487
BH-NO.P43, DEPTH-16.00M, TRIAXIAL GRAPH

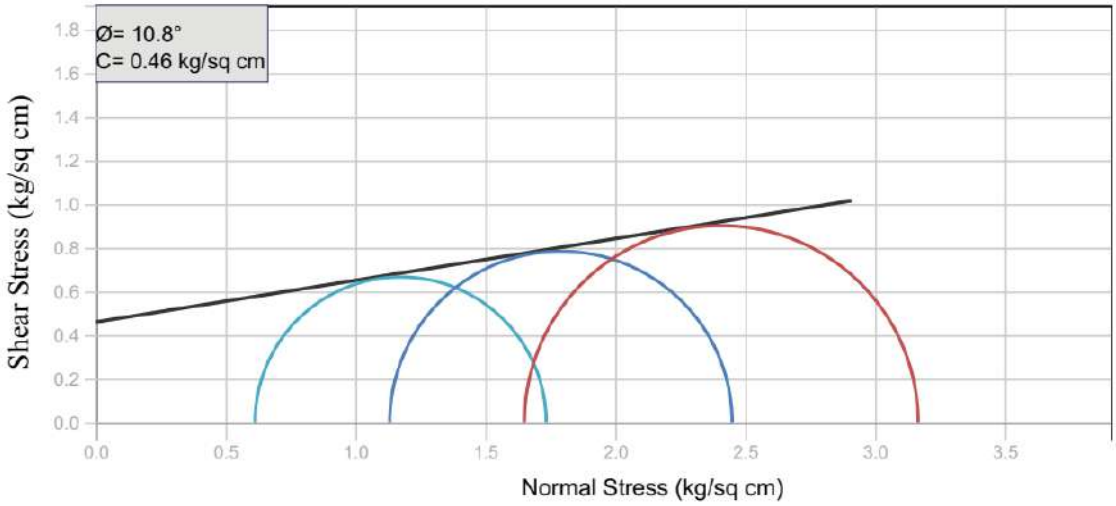


APPENDIX-G
GRAPH 6: UU GRAPH

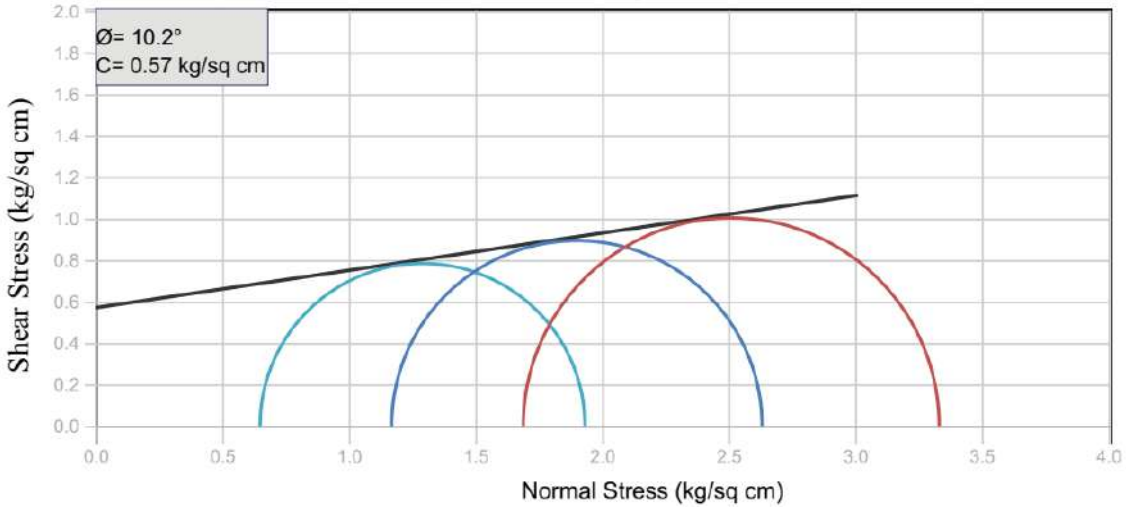
1901-HRIDC-III-22042.487
BH-NO.P43, DEPTH-22.00M, TRIAXIAL GRAPH



1901-HRIDC-III-22042.487
BH-NO.P43, DEPTH-31.00M, TRIAXIAL GRAPH

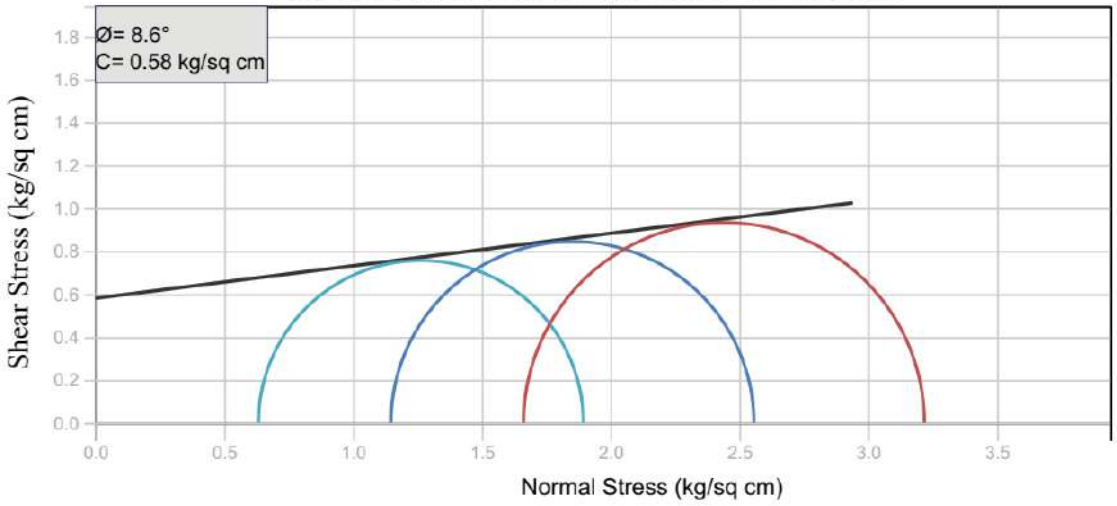


1901-HRIDC-III-22068.687
BH-NO.P44, DEPTH-1.00M, TRIAXIAL GRAPH

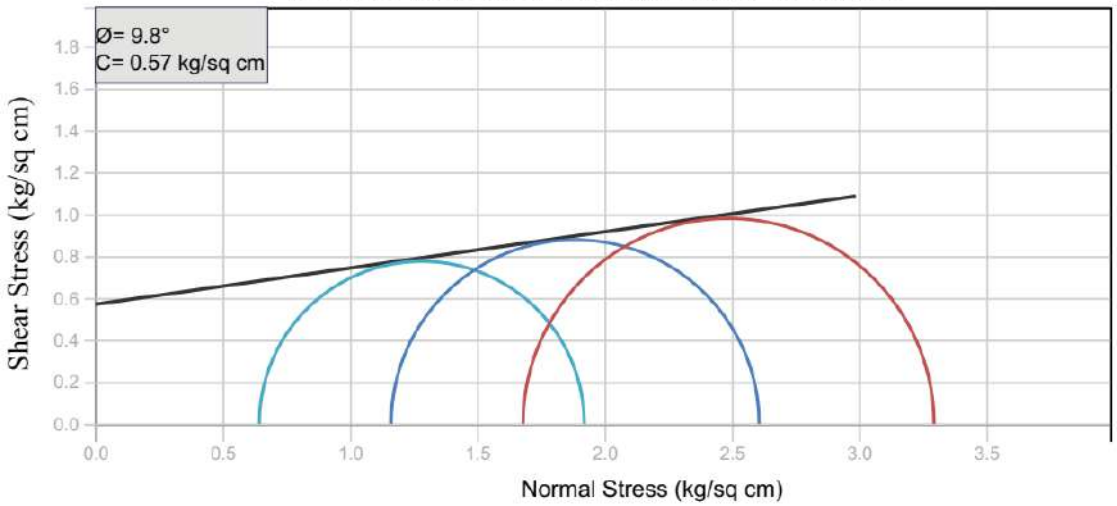


APPENDIX-G
GRAPH 7: UU GRAPH

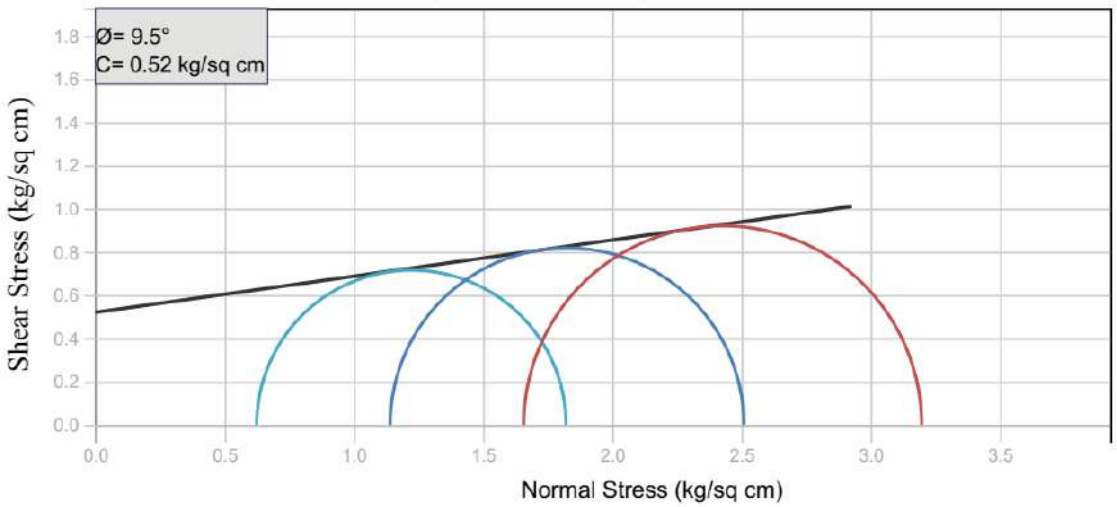
1901-HRIDC-III-22068.687
BH-NO.P44, DEPTH-10.00M, TRIAXIAL GRAPH



1901-HRIDC-III-22068.687
BH-NO.P44, DEPTH-13.00M, TRIAXIAL GRAPH

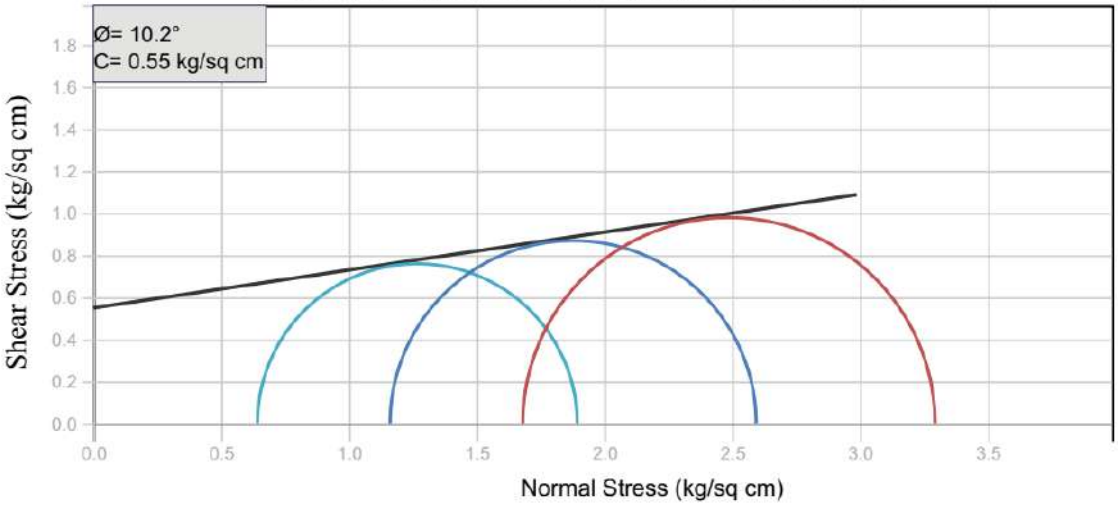


1901-HRIDC-III-22068.687
BH-NO.P44, DEPTH-19.00M, TRIAXIAL GRAPH

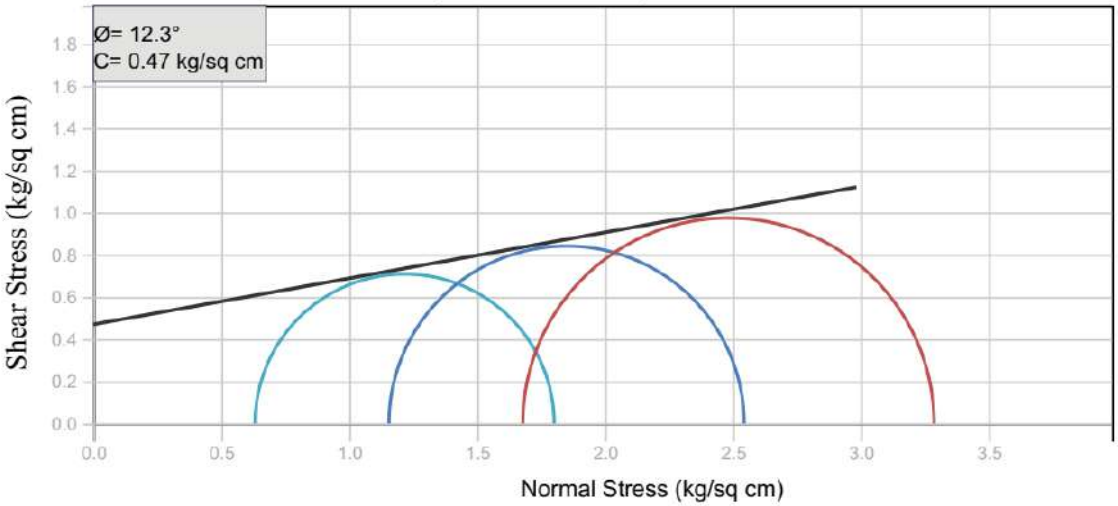


APPENDIX-G
GRAPH 8: UU GRAPH

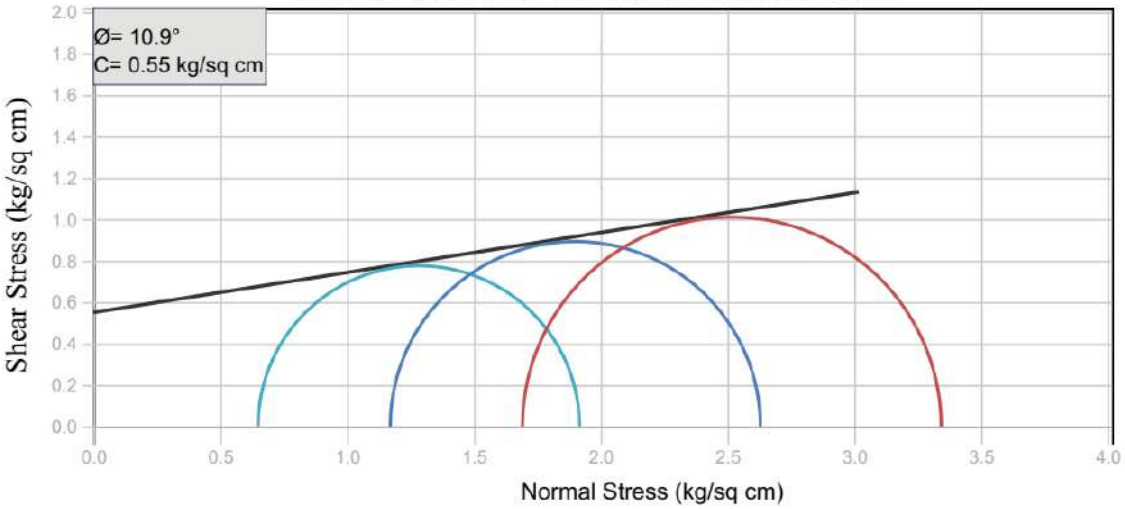
1901-HRIDC-III-22068.687
BH-NO.P44, DEPTH-25.00M, TRIAXIAL GRAPH



1901-HRIDC-III-22094.887
BH-NO.P45, DEPTH-10.00M, TRIAXIAL GRAPH

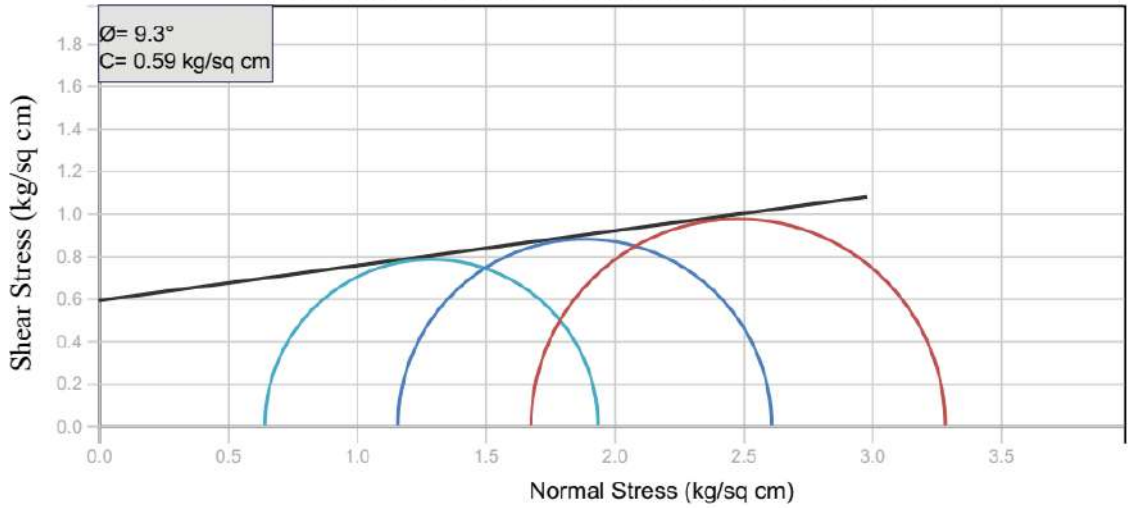


1901-HRIDC-III-22094.887
BH-NO.P45, DEPTH-13.00M, TRIAXIAL GRAPH

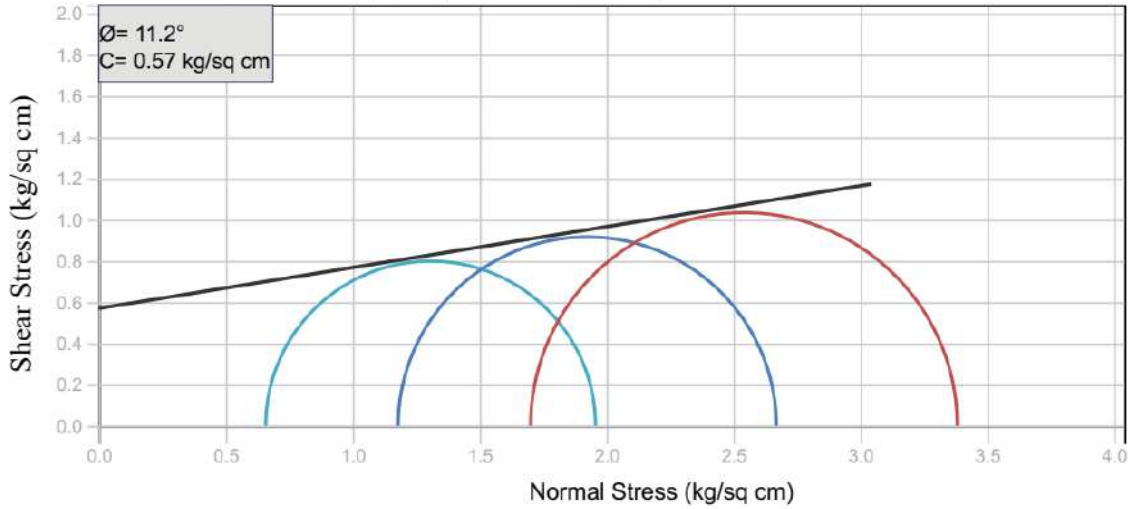


APPENDIX-G
GRAPH 9: UU GRAPH

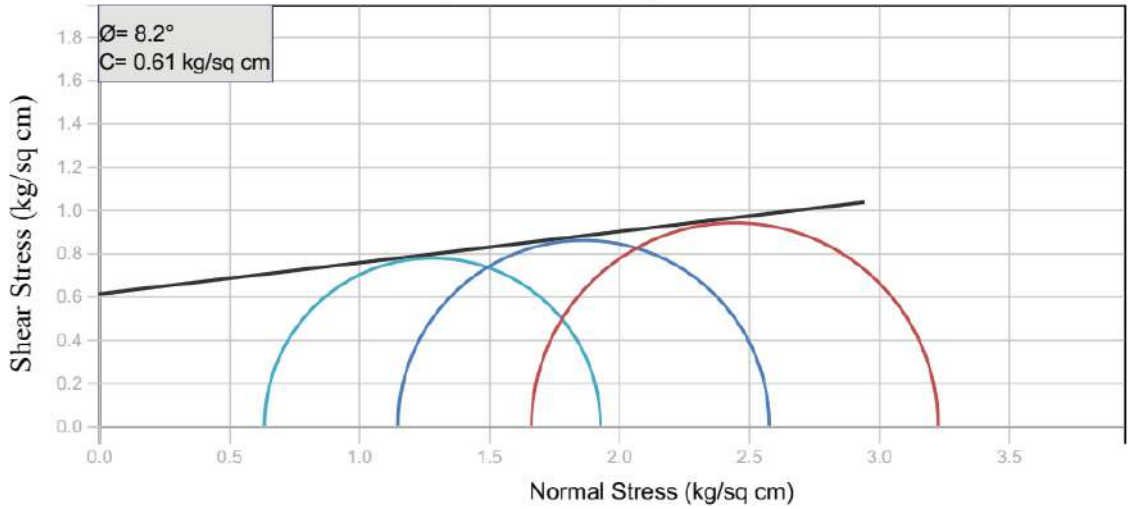
1901-HRIDC-III-22094.887
BH-NO.P45, DEPTH-16.00M, TRIAXIAL GRAPH



1901-HRIDC-III-22094.887
BH-NO.P45, DEPTH-19.00M, TRIAXIAL GRAPH

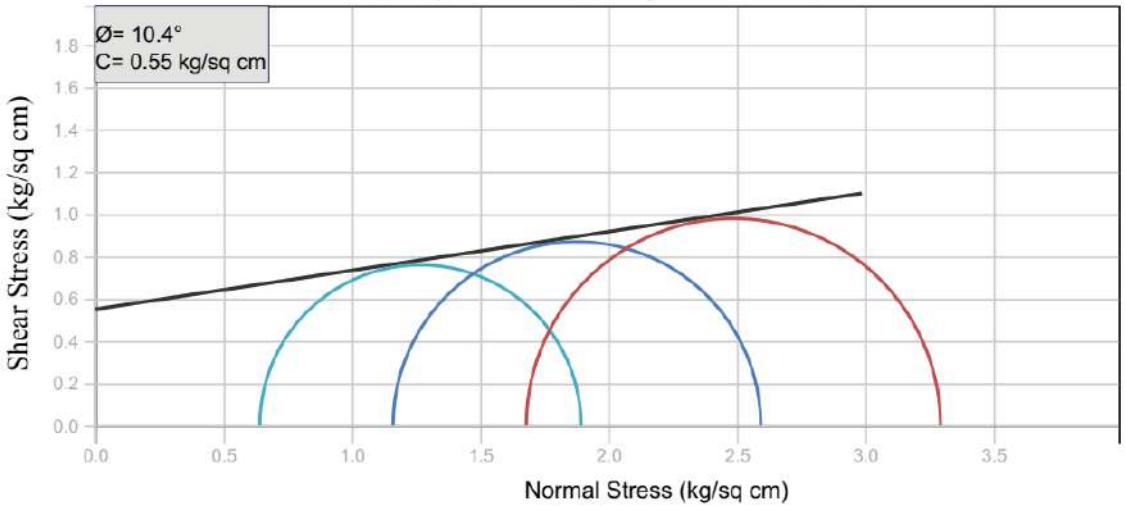


1901-HRIDC-III-22094.887
BH-NO.P45, DEPTH-22.00M, TRIAXIAL GRAPH

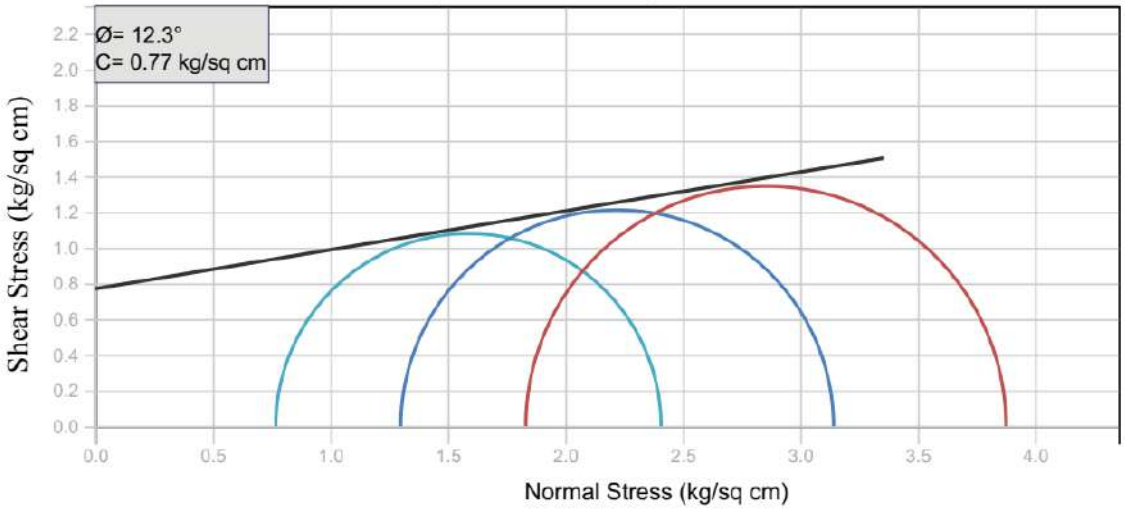


APPENDIX-G
GRAPH 10: UU GRAPH

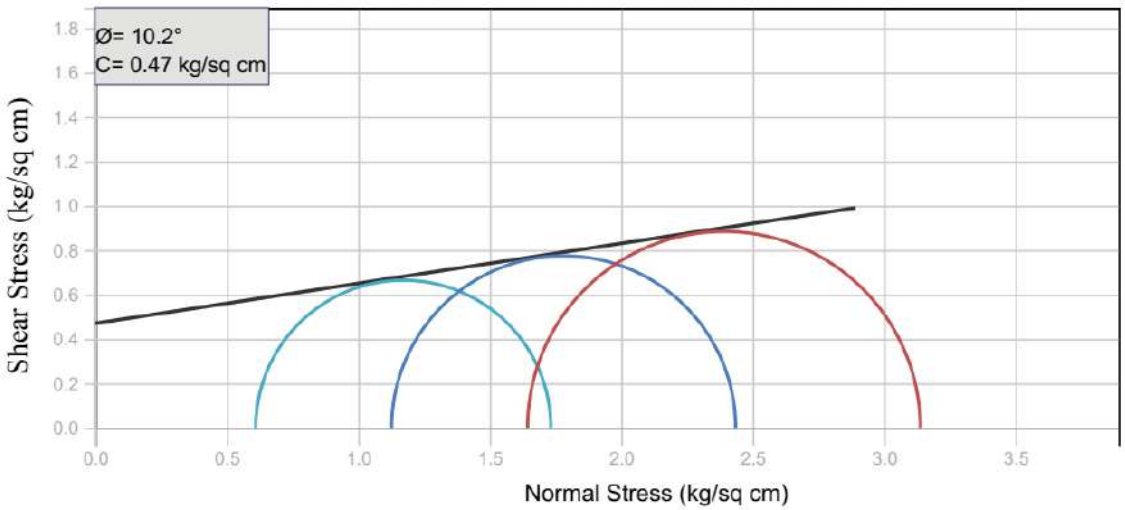
1901-HRIDC-III-22094.887
BH-NO.P45, DEPTH-25.00M, TRIAXIAL GRAPH



1901-HRIDC-III-22094.887
BH-NO.P45, DEPTH-28.00M, TRIAXIAL GRAPH

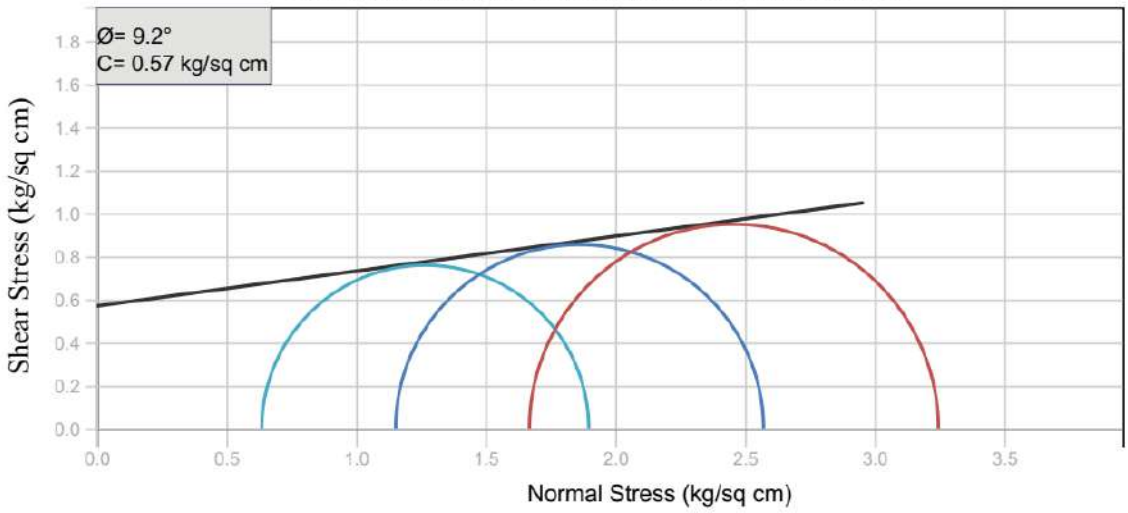


1901-HRIDC-III-22121.087
BH-NO.P46, DEPTH-10.00M, TRIAXIAL GRAPH

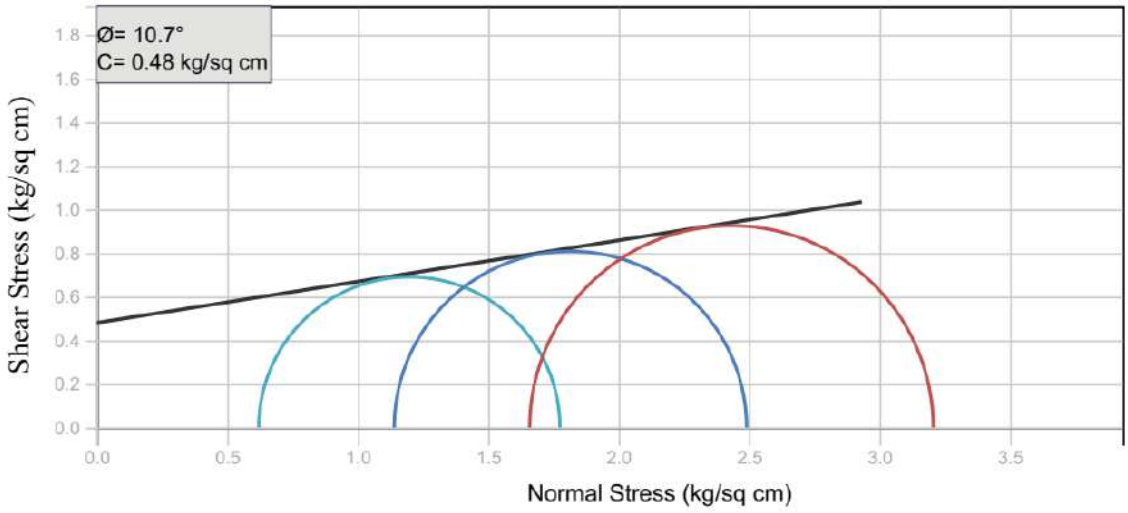


APPENDIX-G
GRAPH 11: UU GRAPH

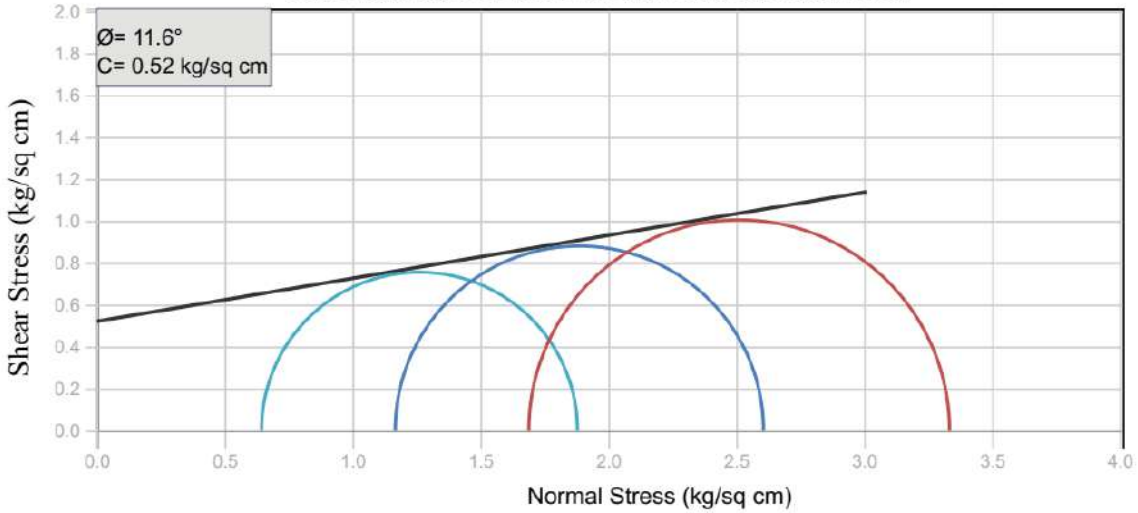
1901-HRIDC-III-22121.087
BH-NO.P46, DEPTH-13.00M, TRIAXIAL GRAPH



1901-HRIDC-III-22121.087
BH-NO.P46, DEPTH-19.00M, TRIAXIAL GRAPH

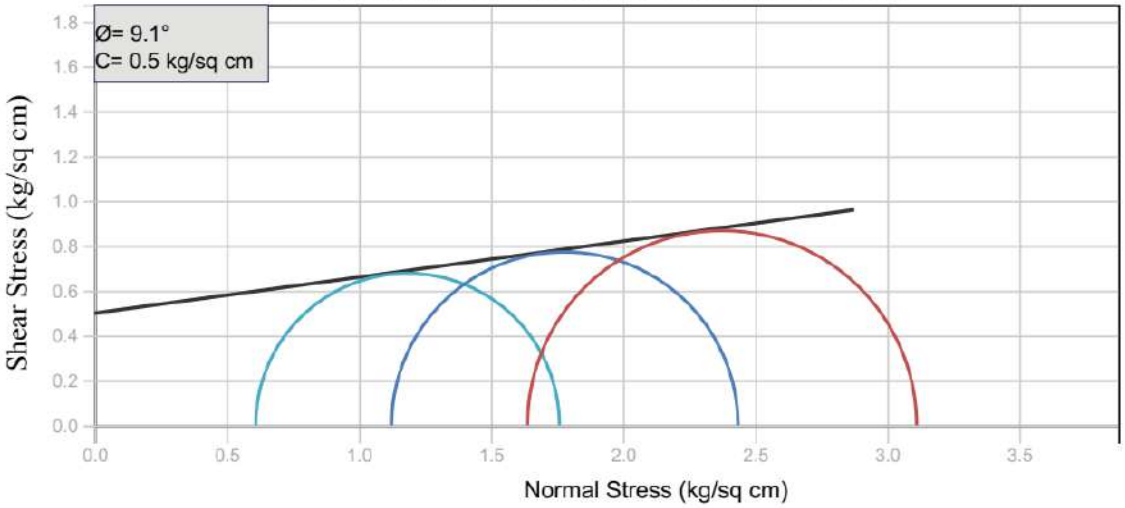


1901-HRIDC-III-22121.087
BH-NO.P46, DEPTH-22.00M, TRIAXIAL GRAPH

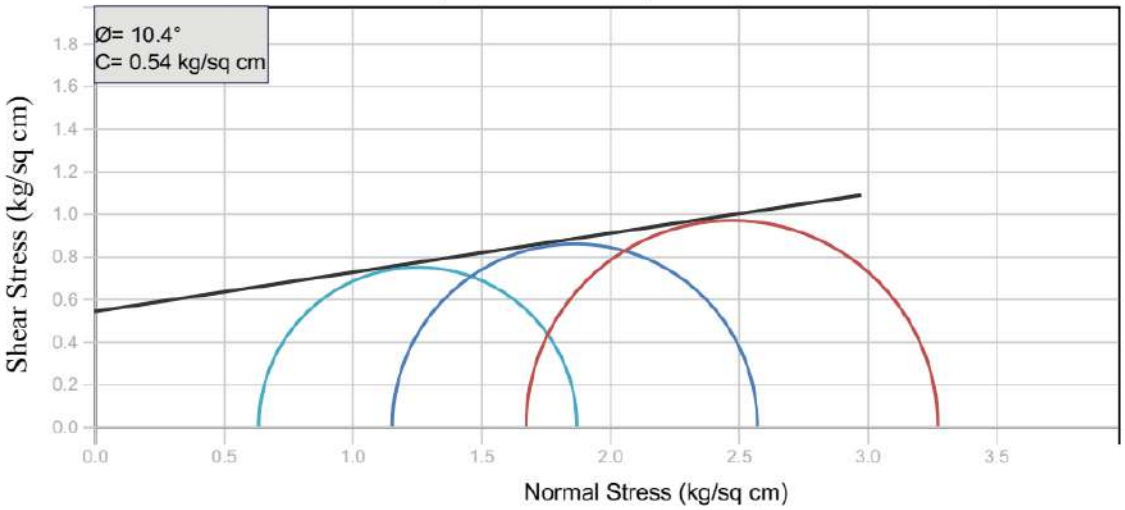


APPENDIX-G
GRAPH 12: UU GRAPH

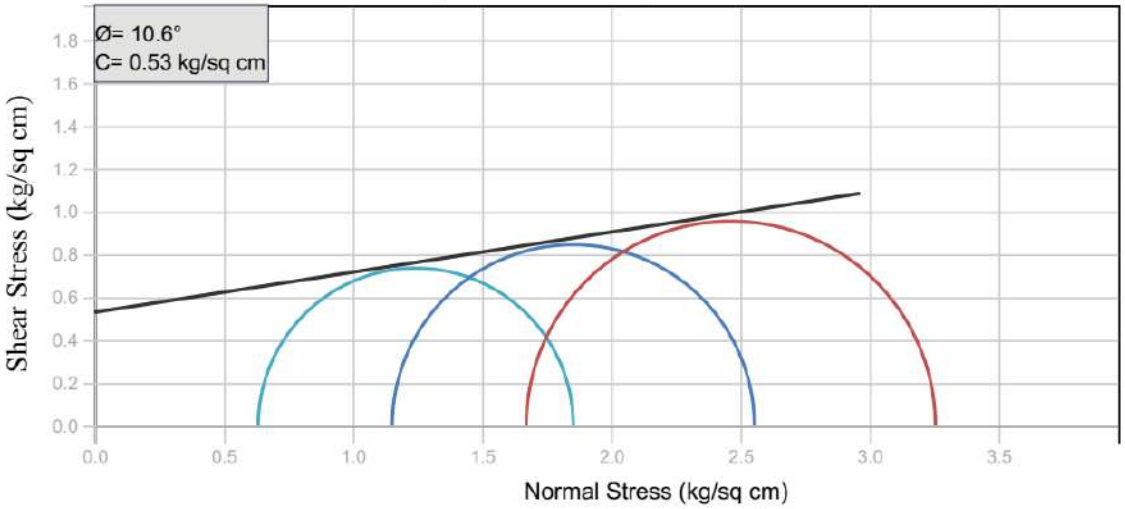
1901-HRIDC-III-22147.287
BH-NO.P47, DEPTH-11.00M, TRIAXIAL GRAPH



1901-HRIDC-III-22147.287
BH-NO.P47, DEPTH-17.00M, TRIAXIAL GRAPH

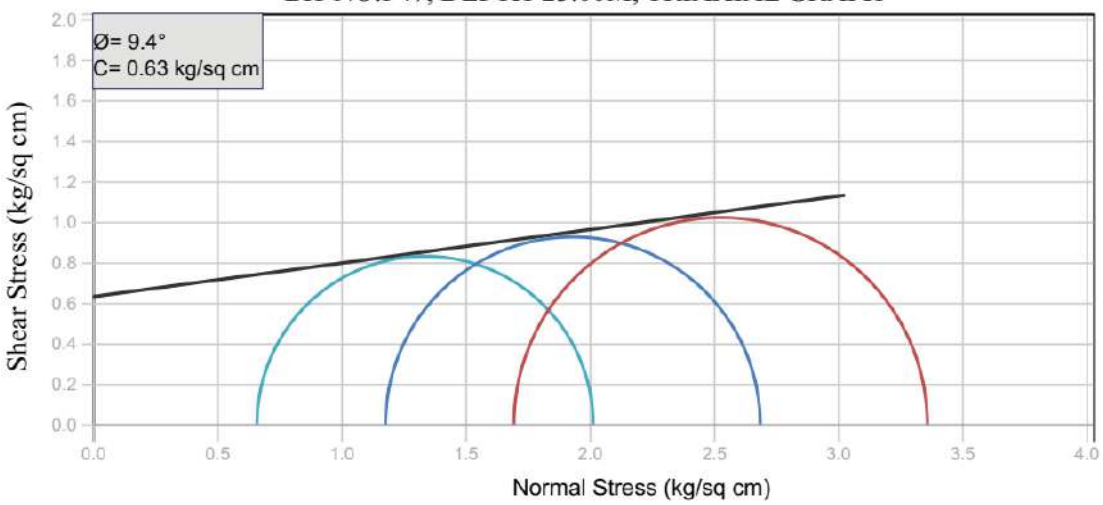


1901-HRIDC-III-22147.287
BH-NO.P47, DEPTH-20.00M, TRIAXIAL GRAPH

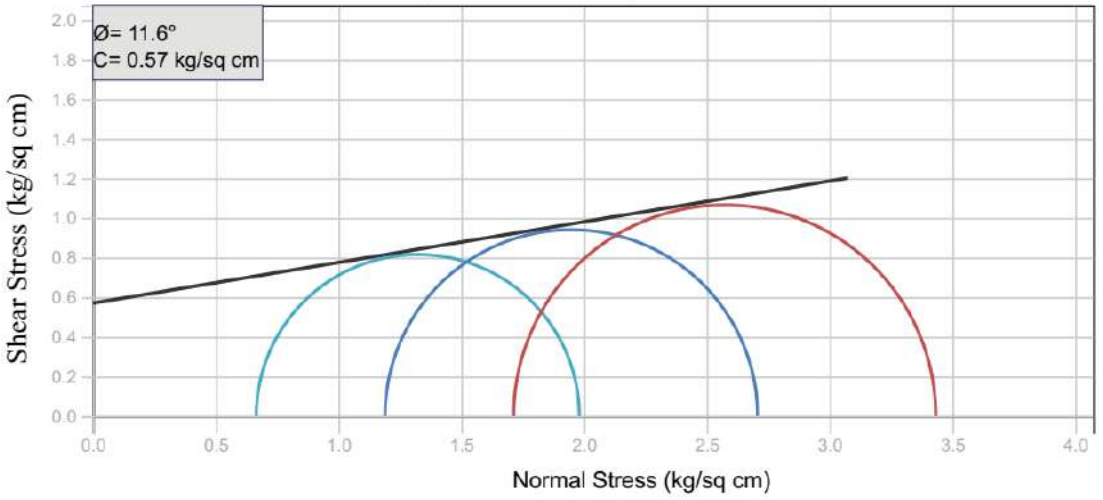


APPENDIX-G
GRAPH 13: UU GRAPH

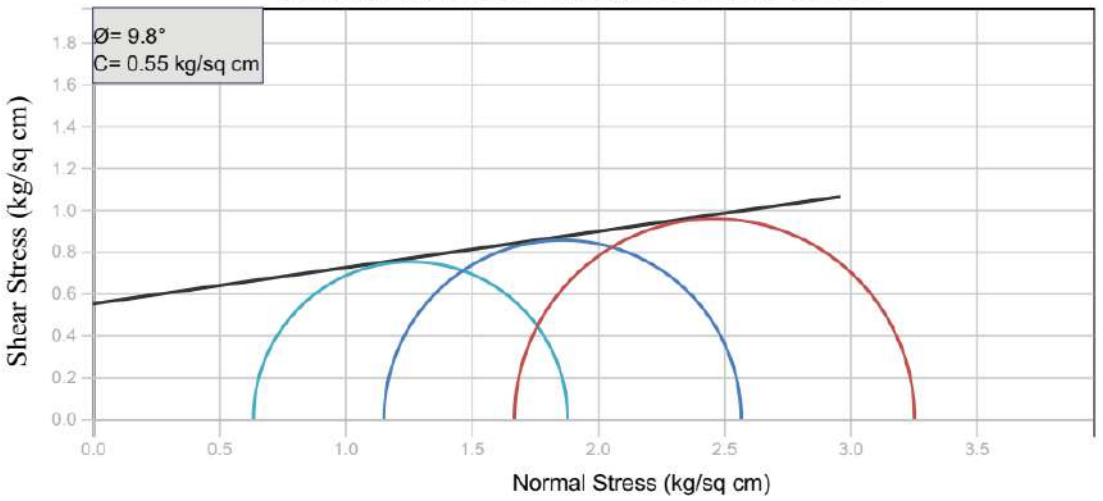
1901-HRIDC-III-22147.287
BH-NO.P47, DEPTH-23.00M, TRIAXIAL GRAPH



1901-HRIDC-III-22147.287
BH-NO.P47, DEPTH-29.00M, TRIAXIAL GRAPH

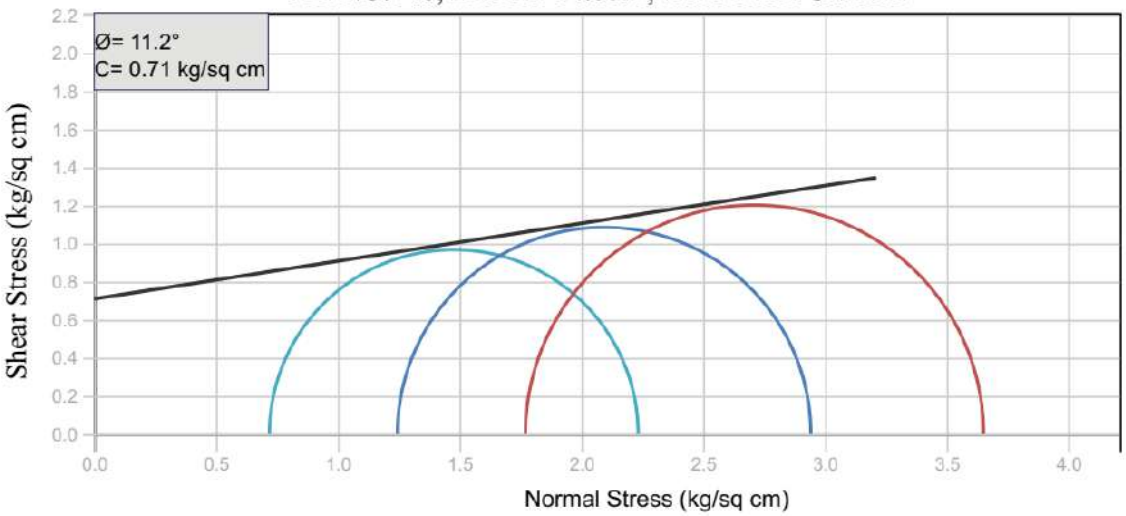


1901-HRIDC-III-22173.487
BH-NO.P48, DEPTH-11.00M, TRIAXIAL GRAPH

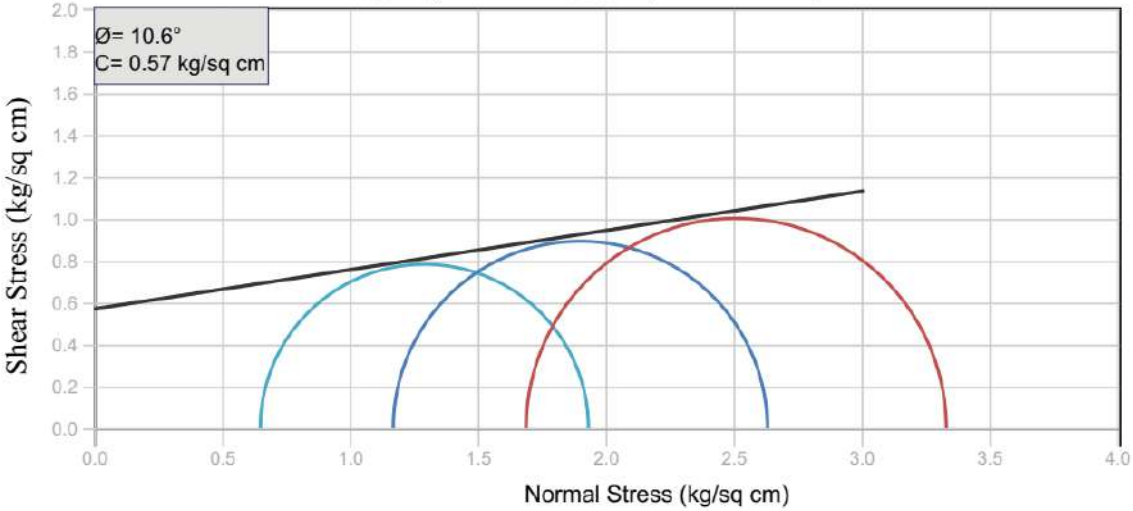


APPENDIX-G
GRAPH 14: UU GRAPH

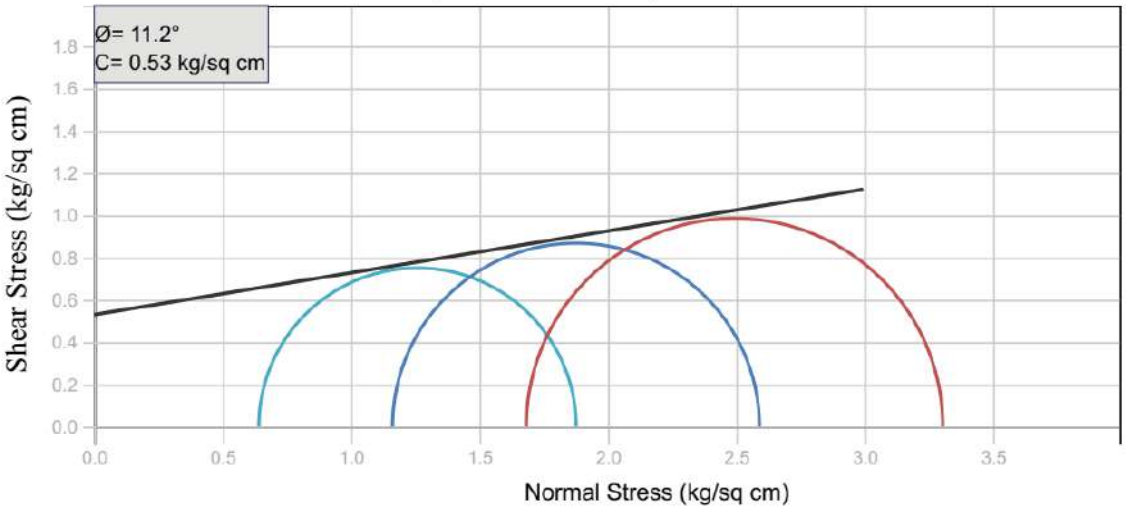
1901-HRIDC-III-22173.487
BH-NO.P48, DEPTH-14.00M, TRIAXIAL GRAPH



1901-HRIDC-III-22173.487
BH-NO.P48, DEPTH-17.00M, TRIAXIAL GRAPH

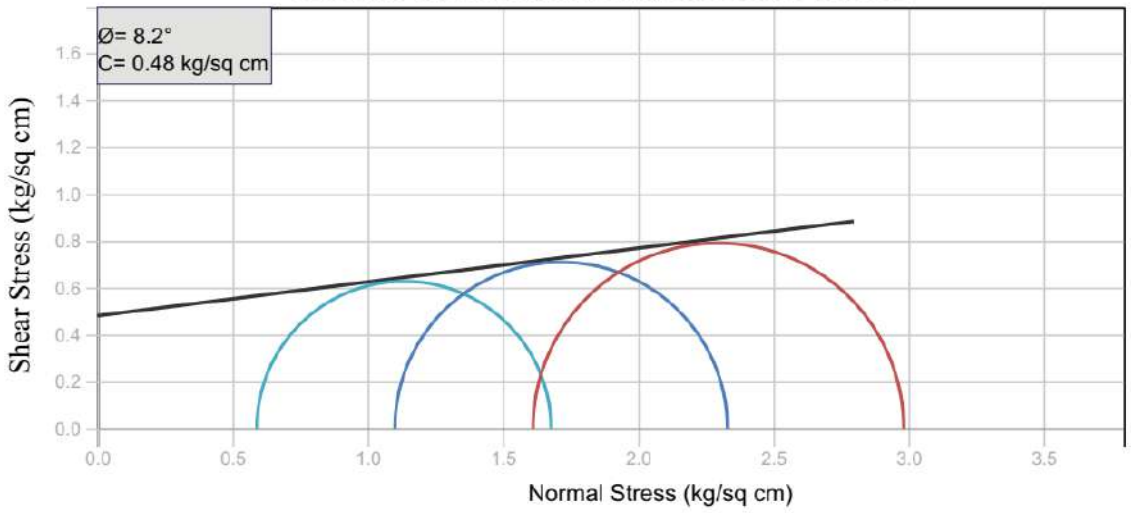


1901-HRIDC-III-22173.487
BH-NO.P48, DEPTH-20.00M, TRIAXIAL GRAPH

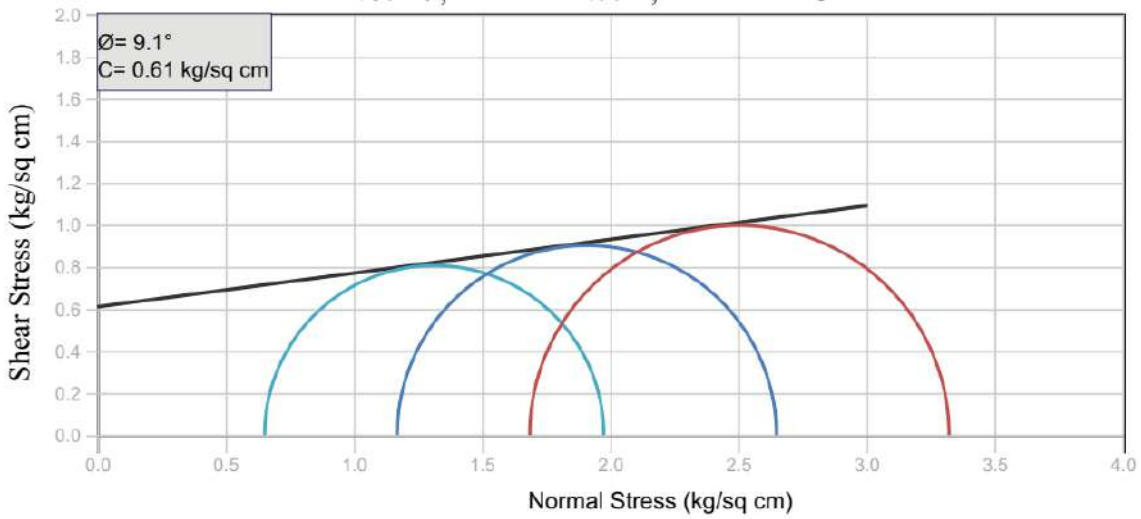


APPENDIX-G
GRAPH 15: UU GRAPH

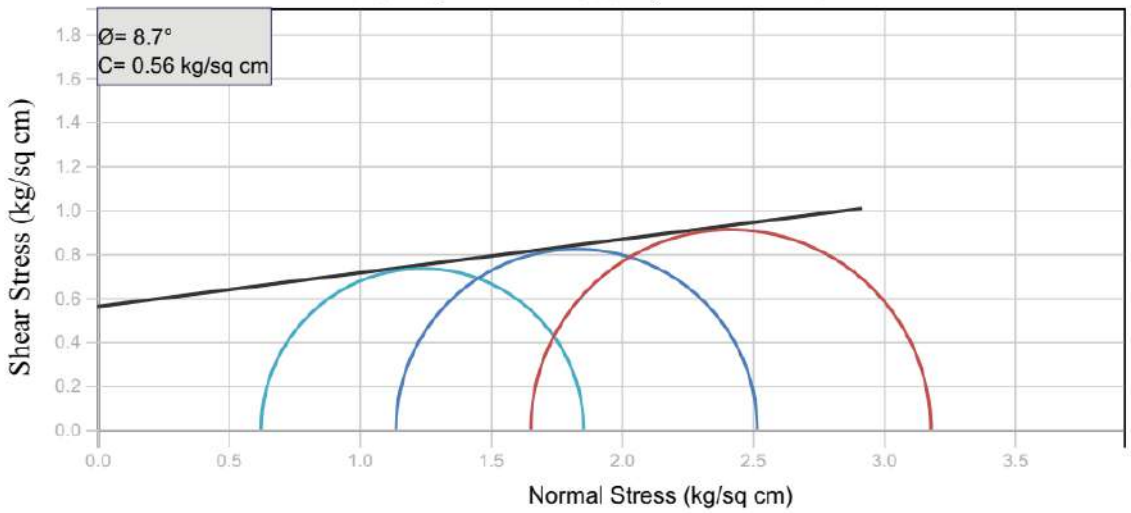
1901-HRIDC-III-22199.687
BH-NO.P49, DEPTH-11.00M, TRIAXIAL GRAPH



1901-HRIDC-III-22199.687
BH-NO.P49, DEPTH-14.00M, TRIAXIAL GRAPH

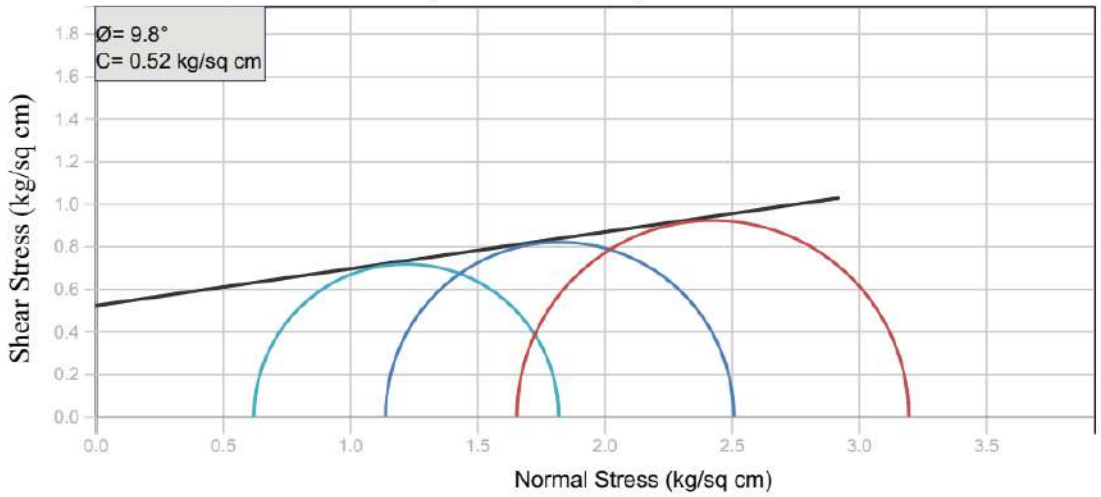


1901-HRIDC-III-22199.687
BH-NO.P49, DEPTH-17.00M, TRIAXIAL GRAPH

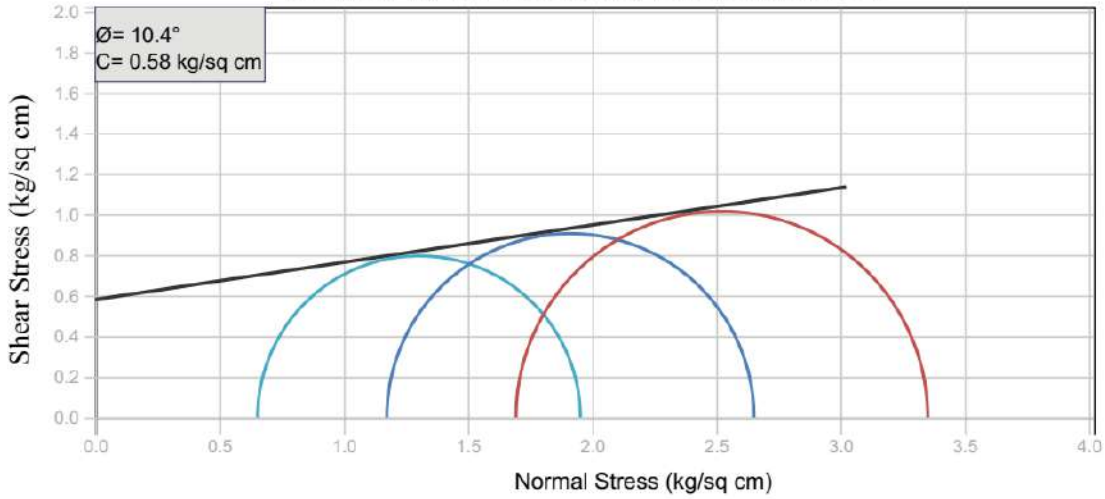


APPENDIX-G
GRAPH 16: UU GRAPH

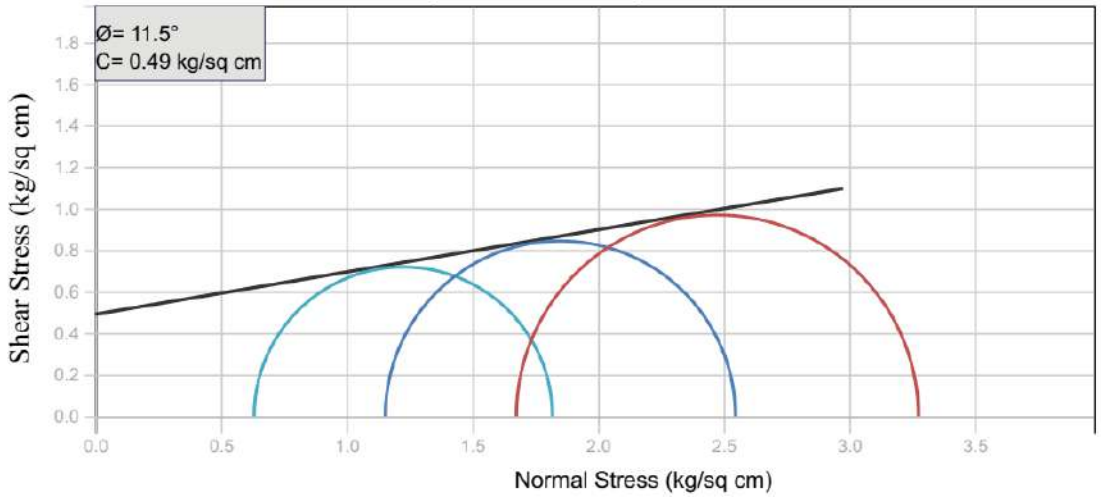
1901-HRIDC-III-22199.687
BH-NO.P49, DEPTH-20.00M, TRIAXIAL GRAPH



1901-HRIDC-III-22199.687
BH-NO.P49, DEPTH-23.00M, TRIAXIAL GRAPH

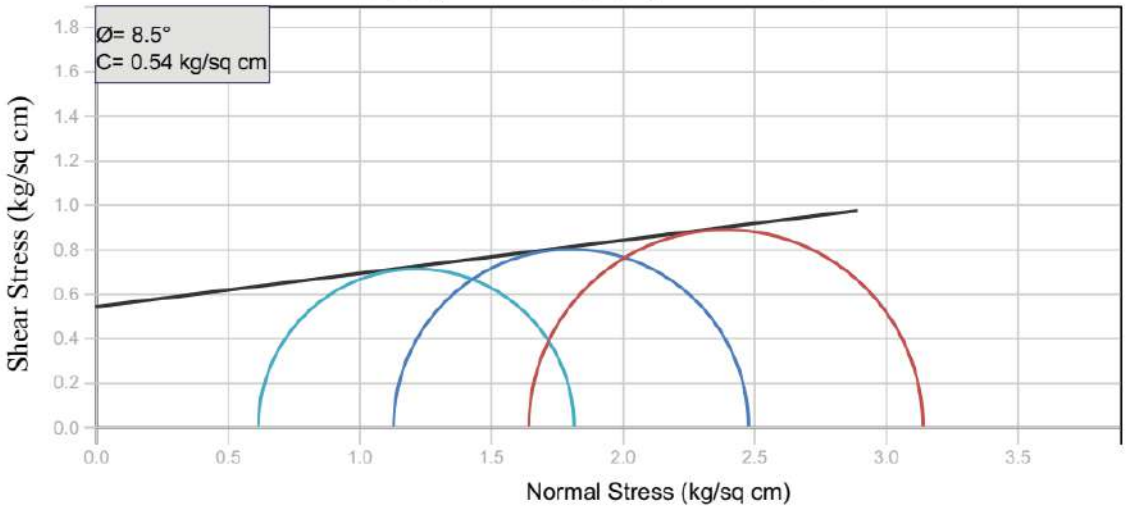


1901-HRIDC-III-22199.687
BH-NO.P49, DEPTH-32.00M, TRIAXIAL GRAPH

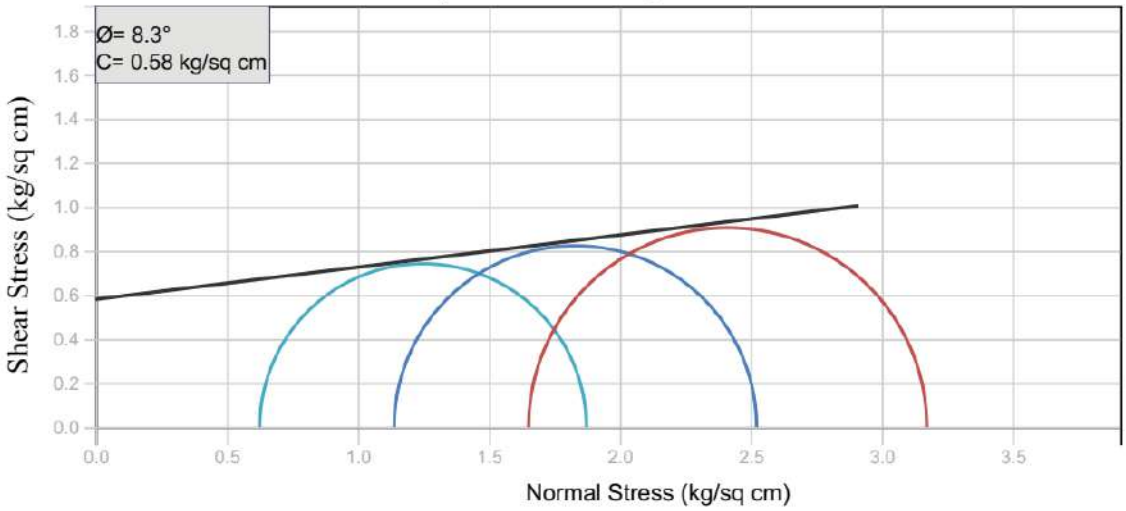


APPENDIX-G
GRAPH 17: UU GRAPH

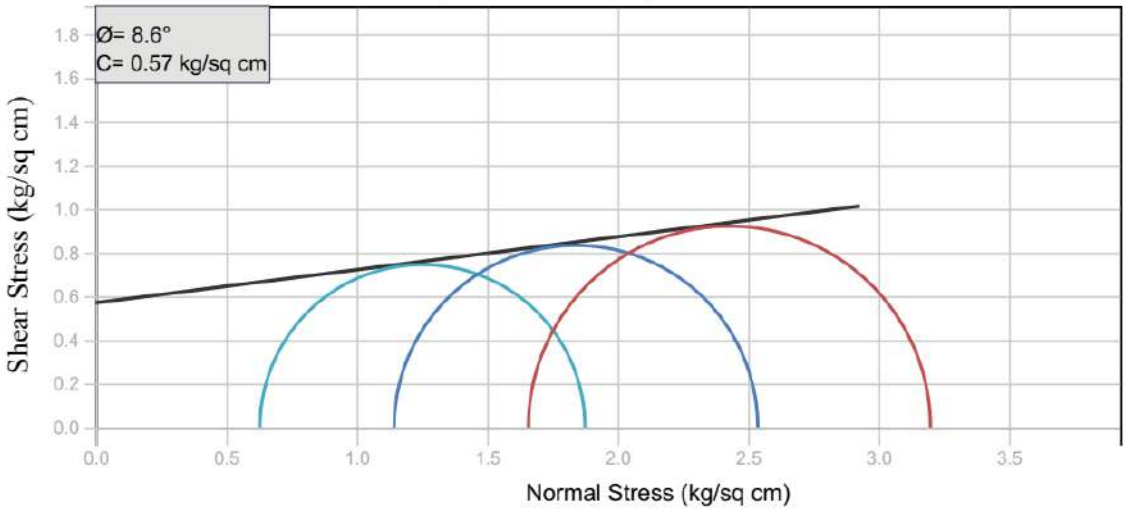
1901-HRIDC-III-22225.887
BH-NO.P50, DEPTH-10.00M, TRIAXIAL GRAPH



1901-HRIDC-III-22225.887
BH-NO.P50, DEPTH-13.00M, TRIAXIAL GRAPH

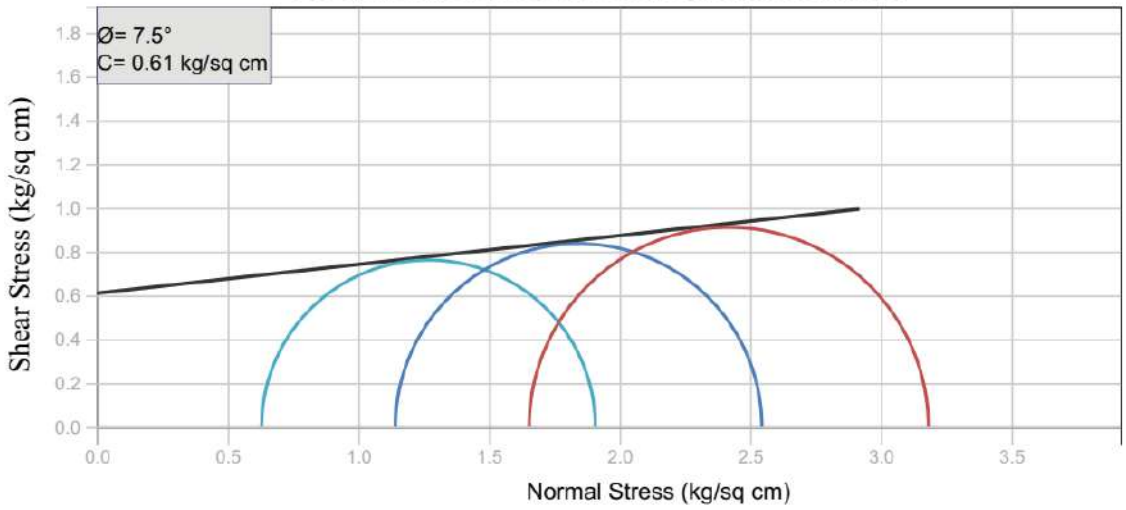


1901-HRIDC-III-22225.887
BH-NO.P50, DEPTH-16.00M, TRIAXIAL GRAPH

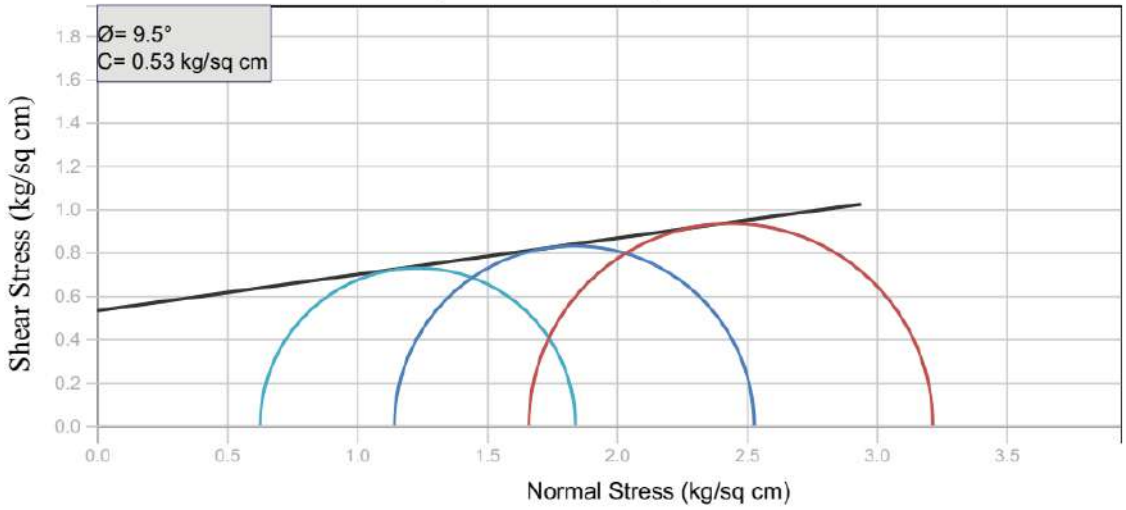


APPENDIX-G
GRAPH 18: UU GRAPH

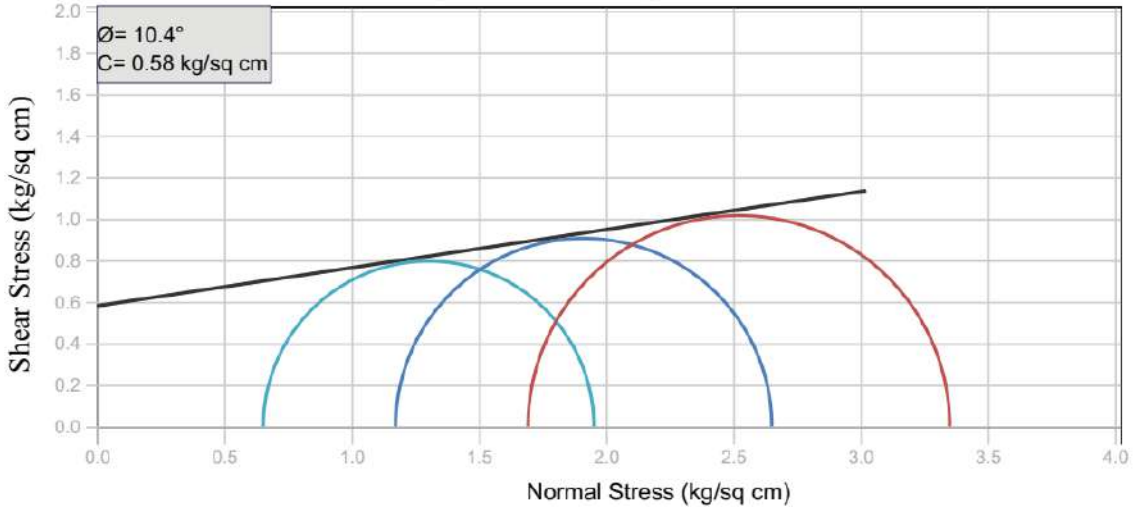
1901-HRIDC-III-22225.887
BH-NO.P50, DEPTH-31.00M, TRIAXIAL GRAPH



1901-HRIDC-III-22252.087
BH-NO.P51, DEPTH-13.00M, TRIAXIAL GRAPH

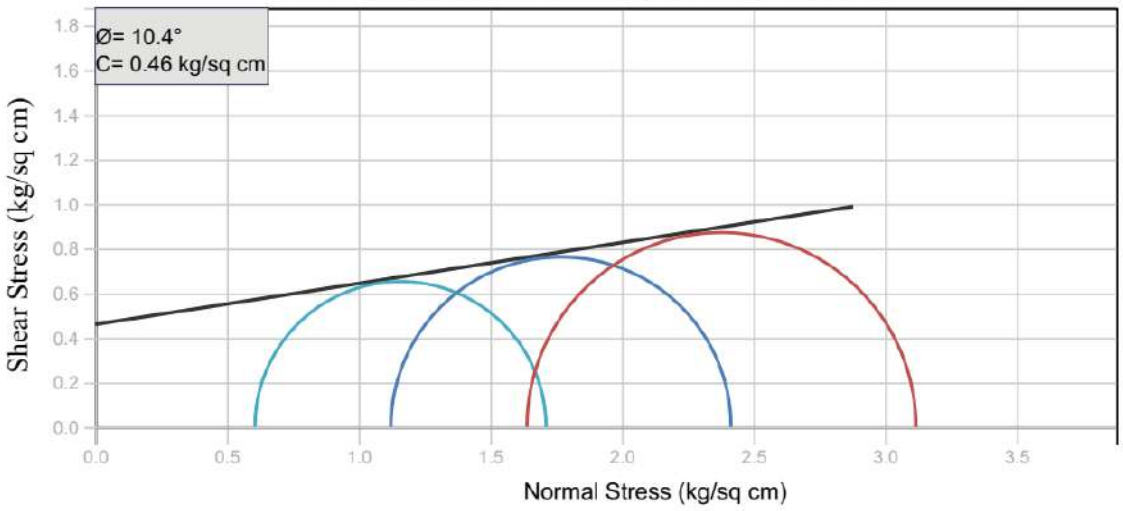


1901-HRIDC-III-22252.087
BH-NO.P51, DEPTH-16.00M, TRIAXIAL GRAPH

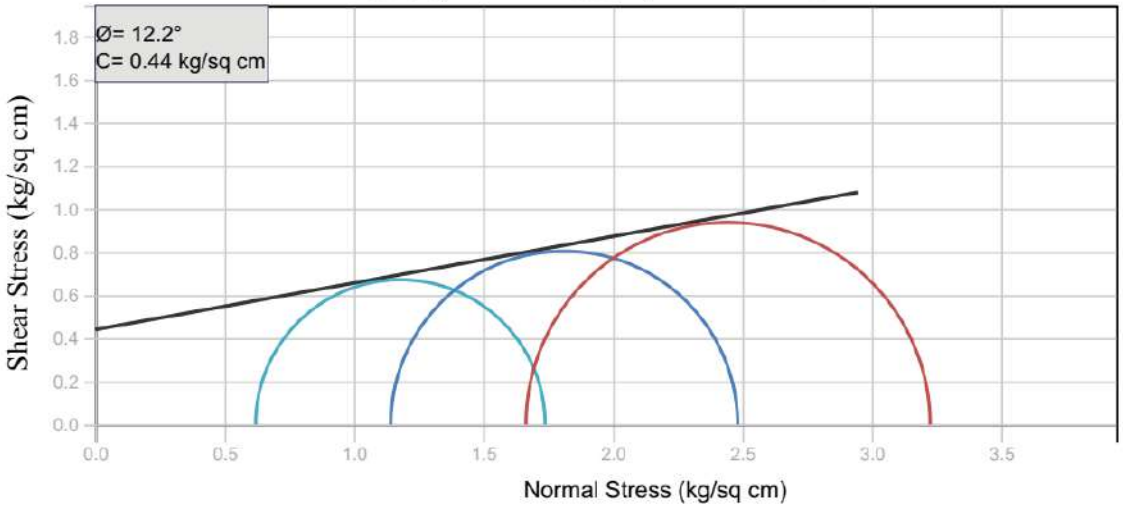


APPENDIX-G
GRAPH 19: UU GRAPH

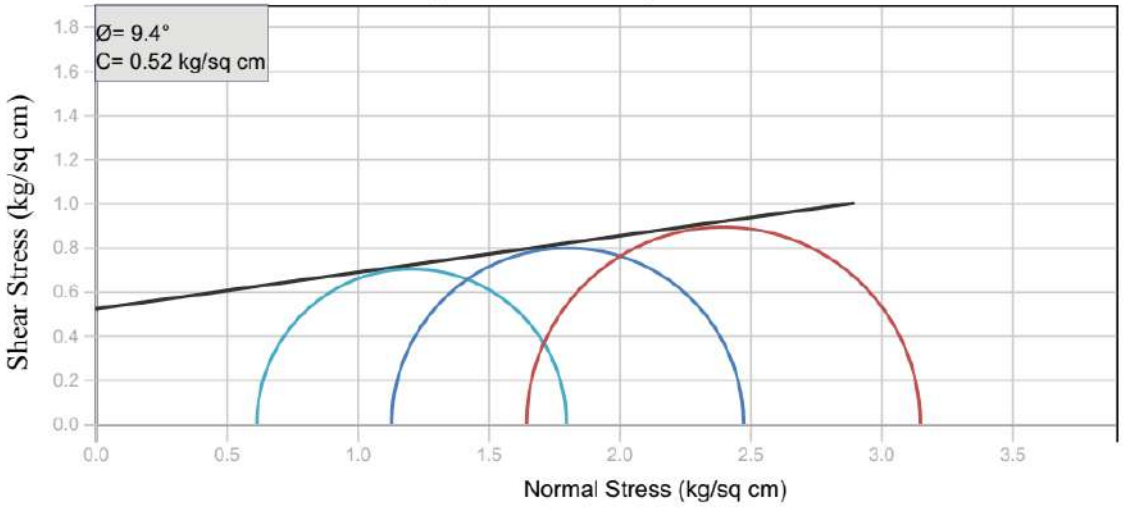
1901-HRIDC-III-22278.287
BH-NO.P52, DEPTH-13.00M, TRIAXIAL GRAPH



1901-HRIDC-III-22278.287
BH-NO.P52, DEPTH-16.00M, TRIAXIAL GRAPH

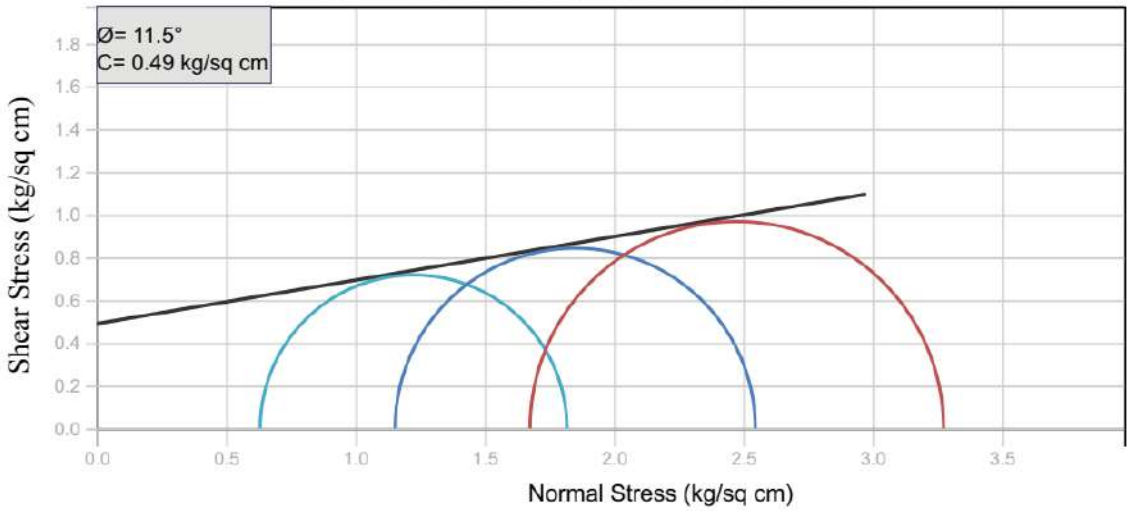


1901-HRIDC-III-22304.487
BH-NO.P53, DEPTH-13.00M, TRIAXIAL GRAPH

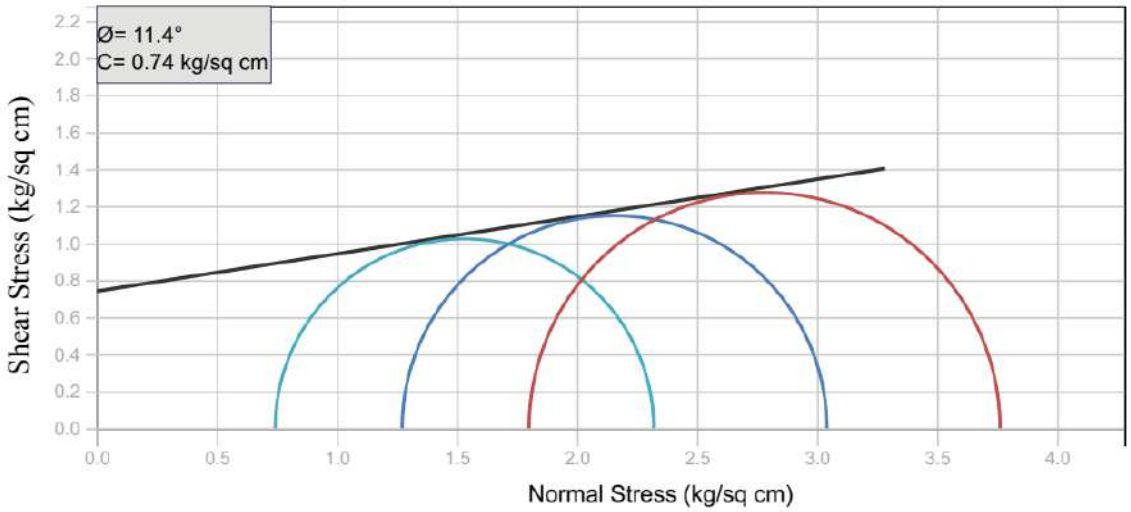


APPENDIX-G
GRAPH 20: UU GRAPH

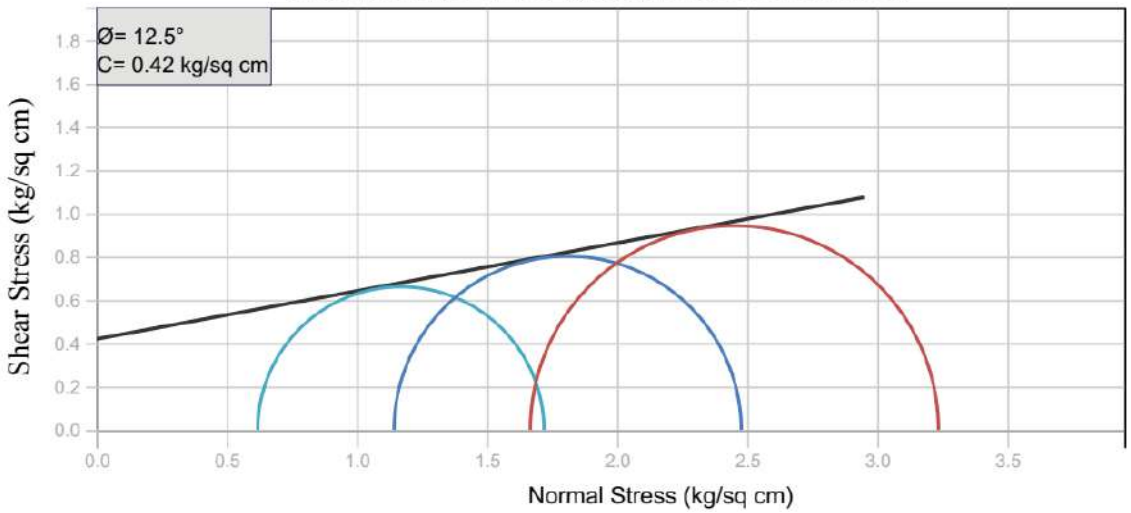
1901-HRIDC-III-22304.487
BH-NO.P53, DEPTH-16.00M, TRIAXIAL GRAPH



1901-HRIDC-III-22304.487
BH-NO.P53, DEPTH-28.00M, TRIAXIAL GRAPH

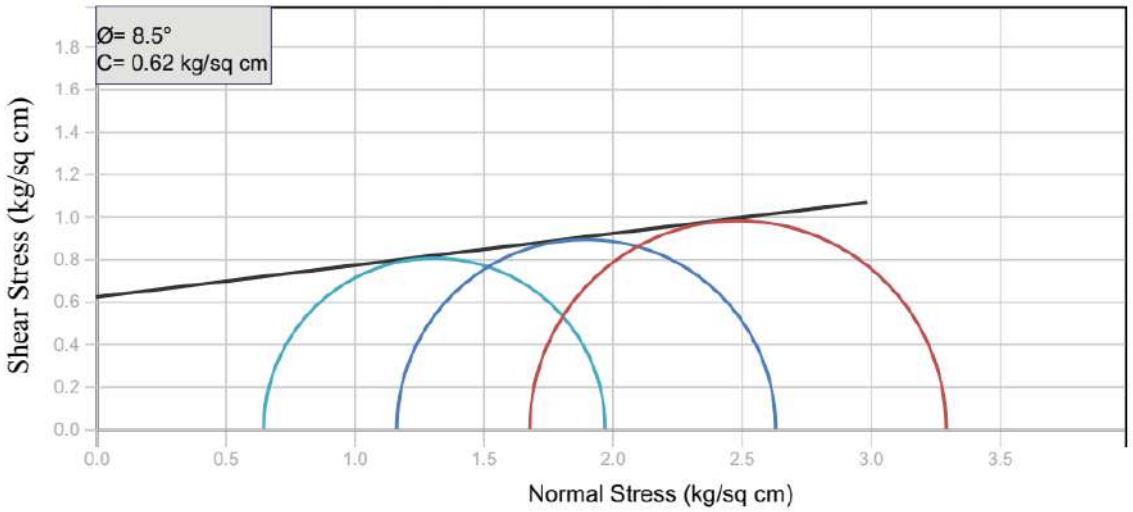


1901-HRIDC-III-22330.687
BH-NO.P54, DEPTH-16.00M, TRIAXIAL GRAPH

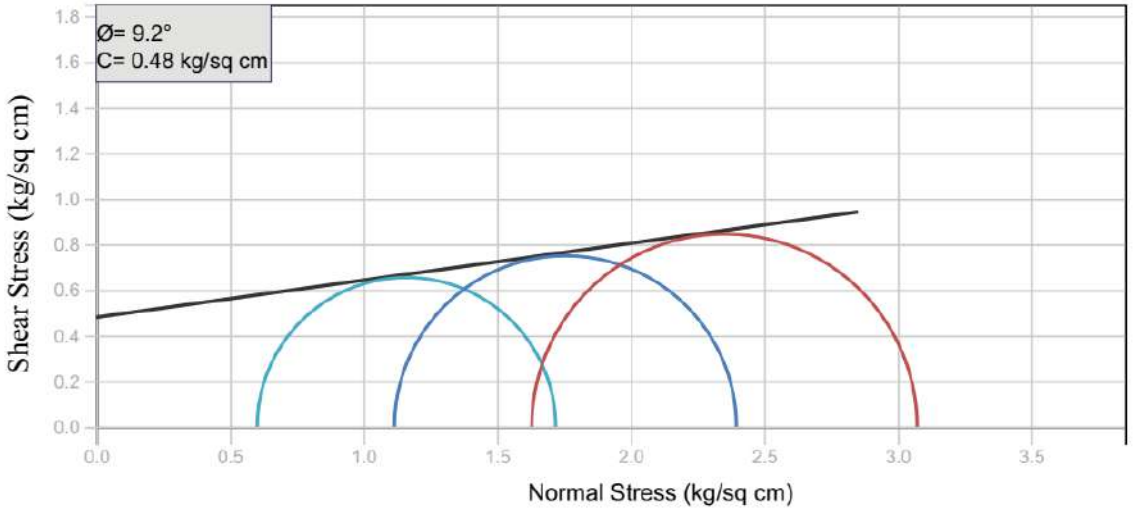


APPENDIX-G
GRAPH 21: UU GRAPH

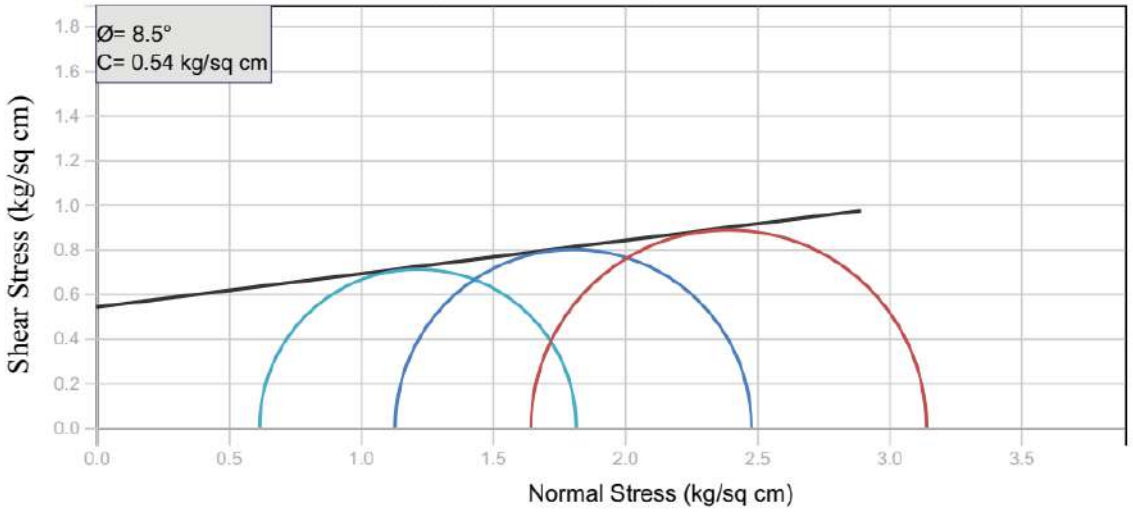
1901-HRIDC-III-22330.687
BH-NO.P54, DEPTH-28.00M, TRIAXIAL GRAPH



1901-HRIDC-III-22356.887
BH-NO.P55, DEPTH-10.00M, TRIAXIAL GRAPH

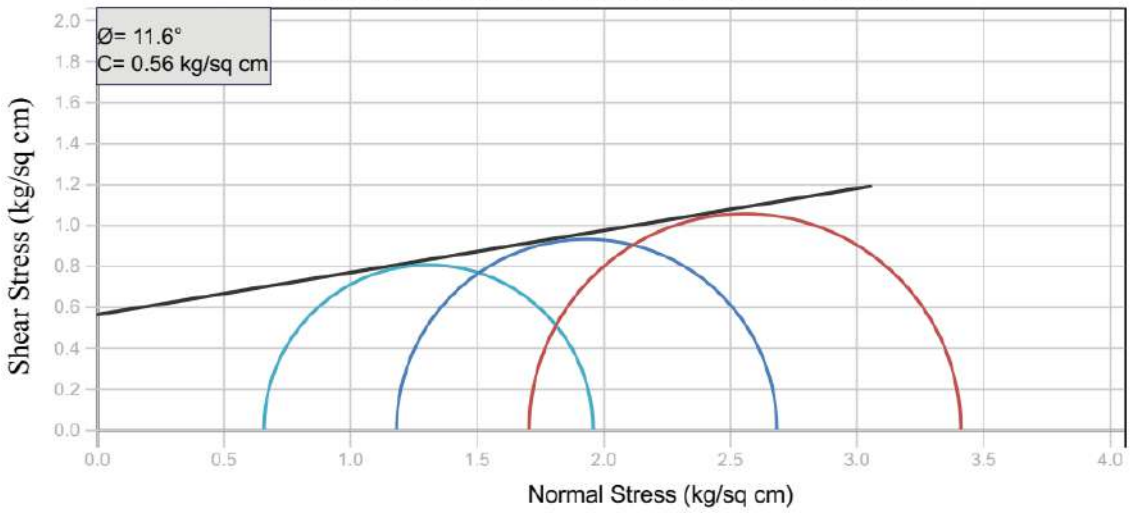


1901-HRIDC-III-22356.887
BH-NO.P55, DEPTH-13.00M, TRIAXIAL GRAPH

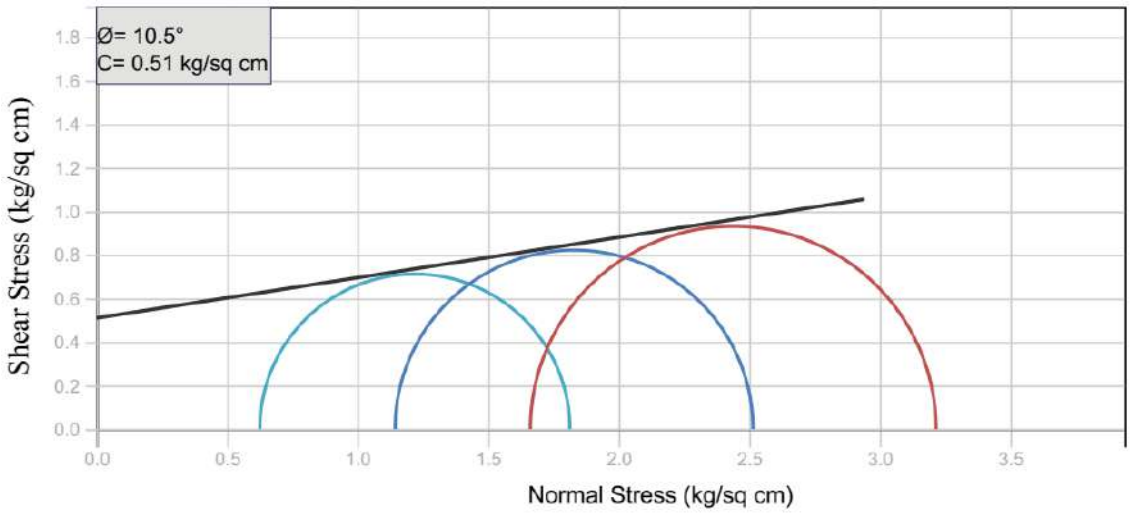


APPENDIX-G
GRAPH 22: UU GRAPH

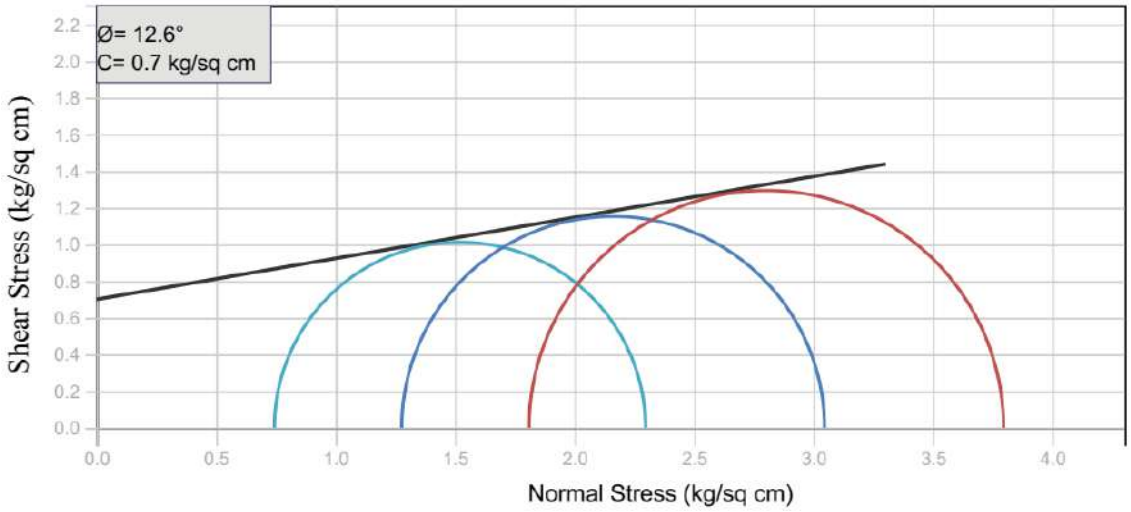
1901-HRIDC-III-22356.887
BH-NO.P55, DEPTH-16.00M, TRIAXIAL GRAPH



1901-HRIDC-III-22356.887
BH-NO.P55, DEPTH-19.00M, TRIAXIAL GRAPH

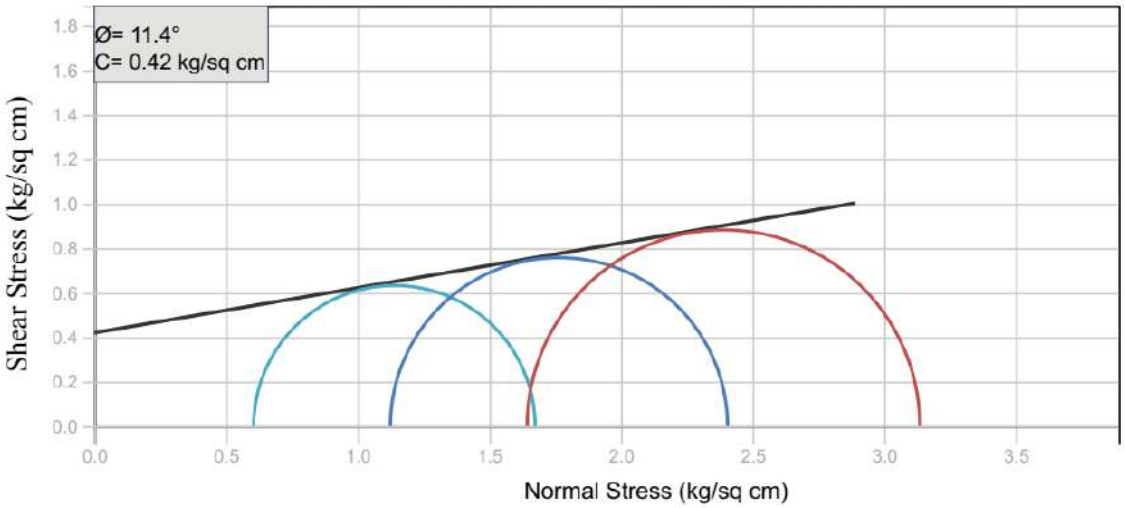


1901-HRIDC-III-22356.887
BH-NO.P55, DEPTH-25.00M, TRIAXIAL GRAPH

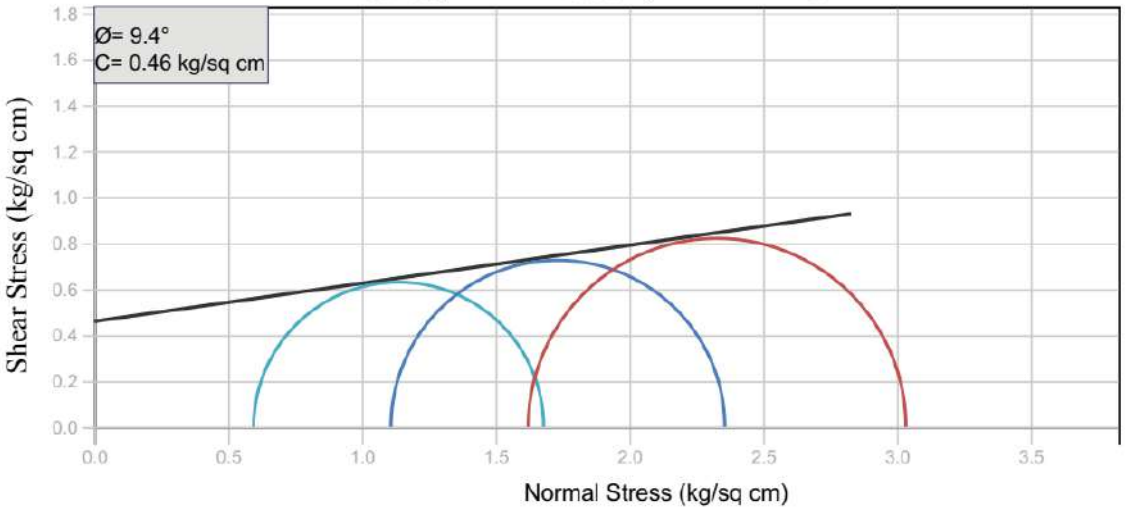


APPENDIX-G
GRAPH 23: UU GRAPH

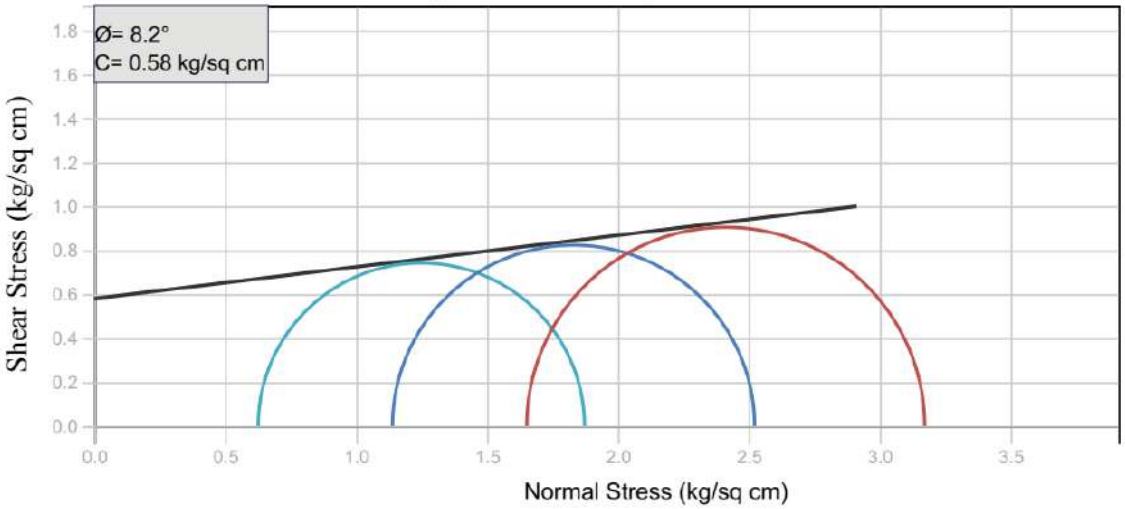
1901-HRIDC-III-22383.087
BH-NO.P56, DEPTH-10.00M, TRIAXIAL GRAPH



1901-HRIDC-III-22383.087
BH-NO.P56, DEPTH-13.00M, TRIAXIAL GRAPH

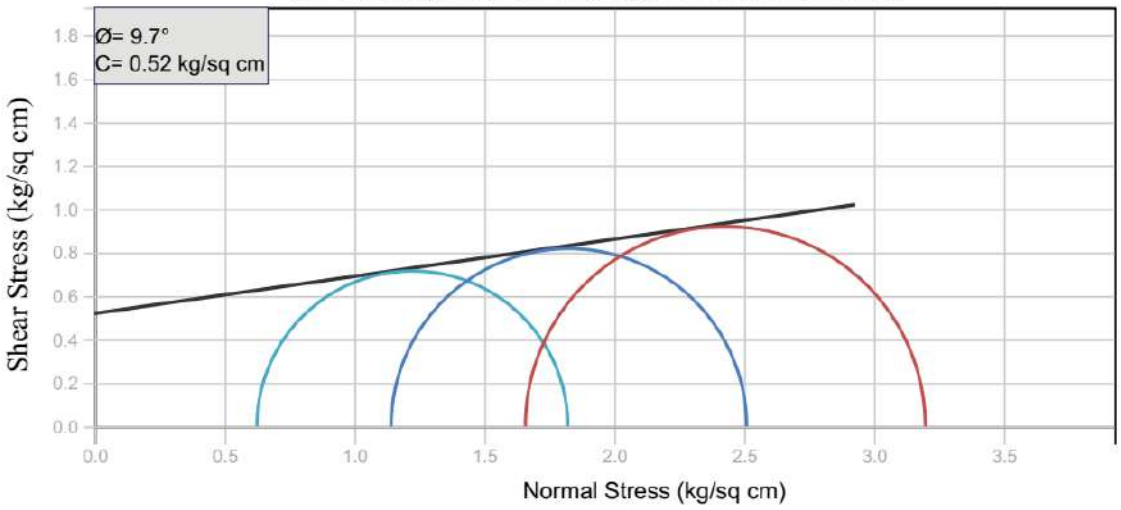


1901-HRIDC-III-22383.087
BH-NO.P56, DEPTH-16.00M, TRIAXIAL GRAPH

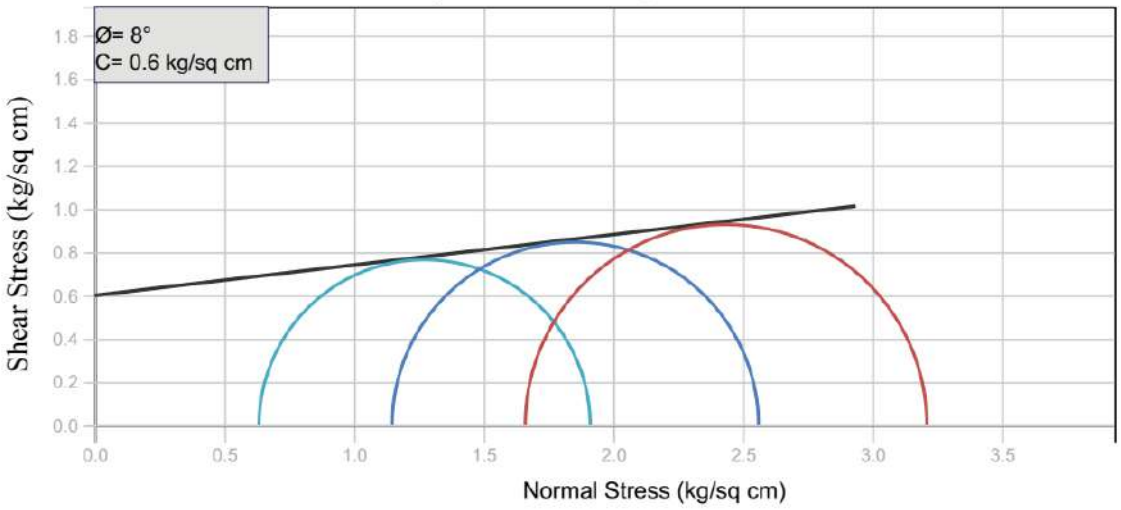


APPENDIX-G
GRAPH 24: UU GRAPH

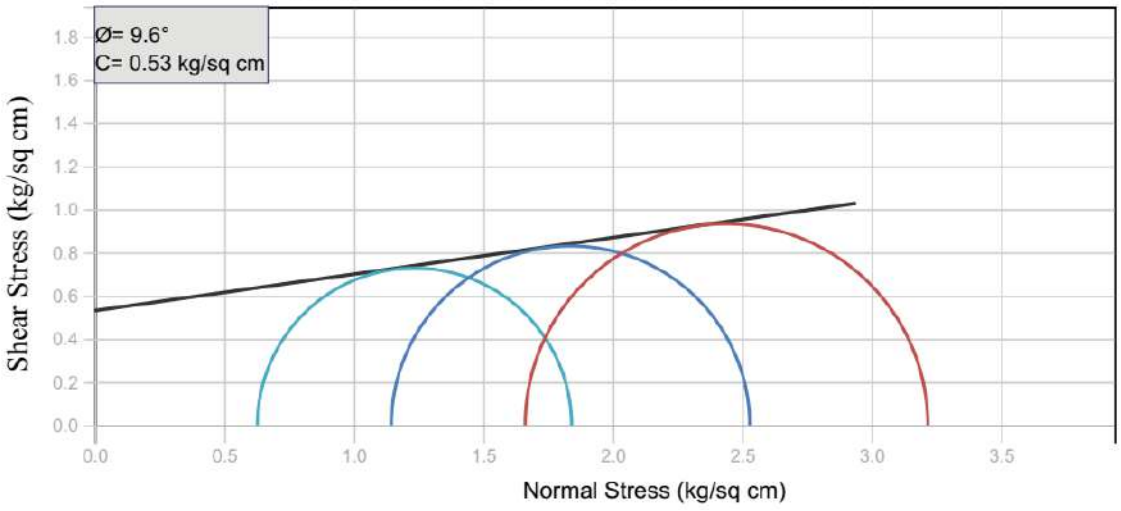
1901-HRIDC-III-22383.087
BH-NO.P56, DEPTH-19.00M, TRIAXIAL GRAPH



1901-HRIDC-III-22383.087
BH-NO.P56, DEPTH-22.00M, TRIAXIAL GRAPH

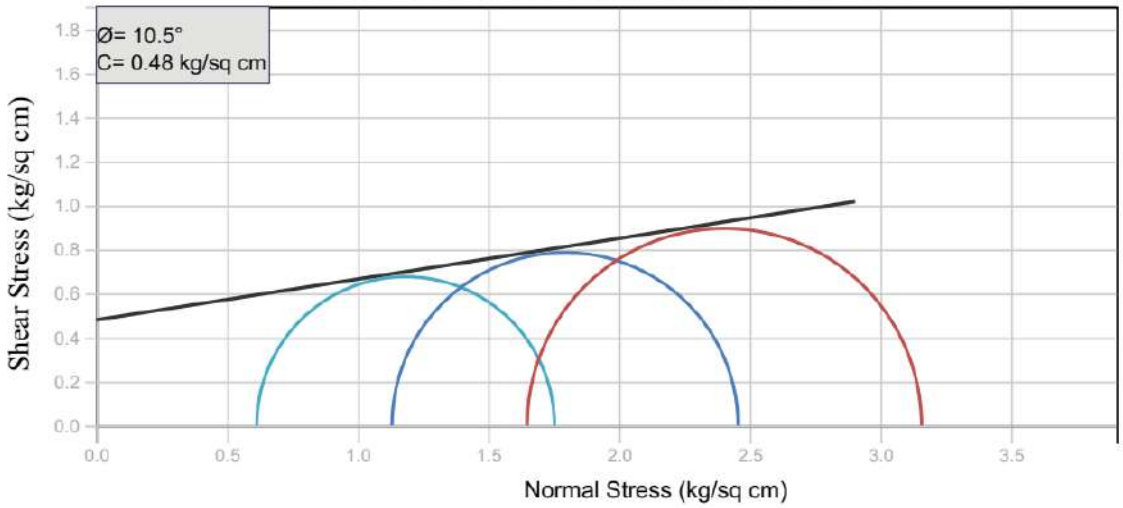


1901-HRIDC-III-22409.287
BH-NO.P57, DEPTH-10.00M, TRIAXIAL GRAPH

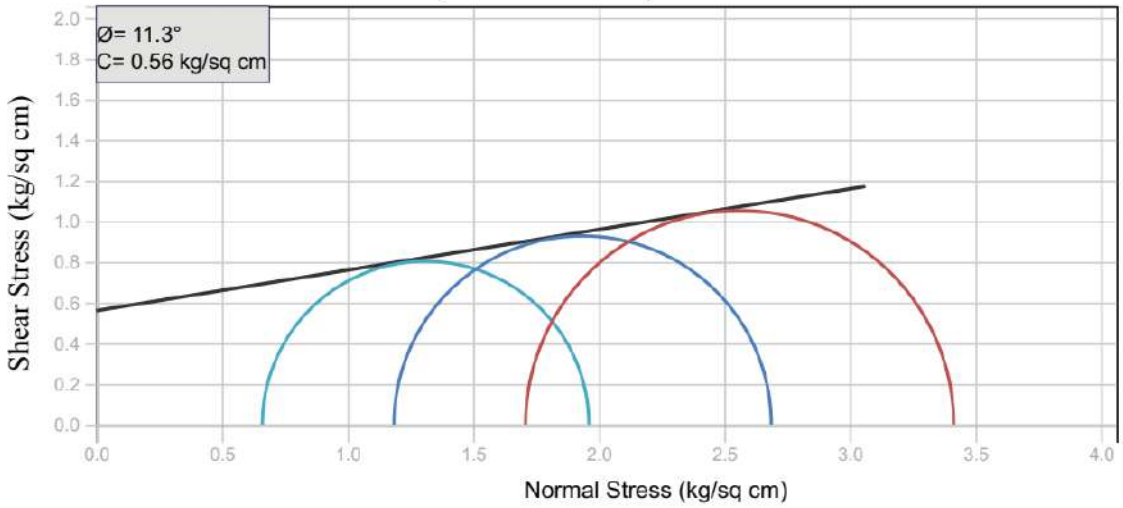


APPENDIX-G
GRAPH 25: UU GRAPH

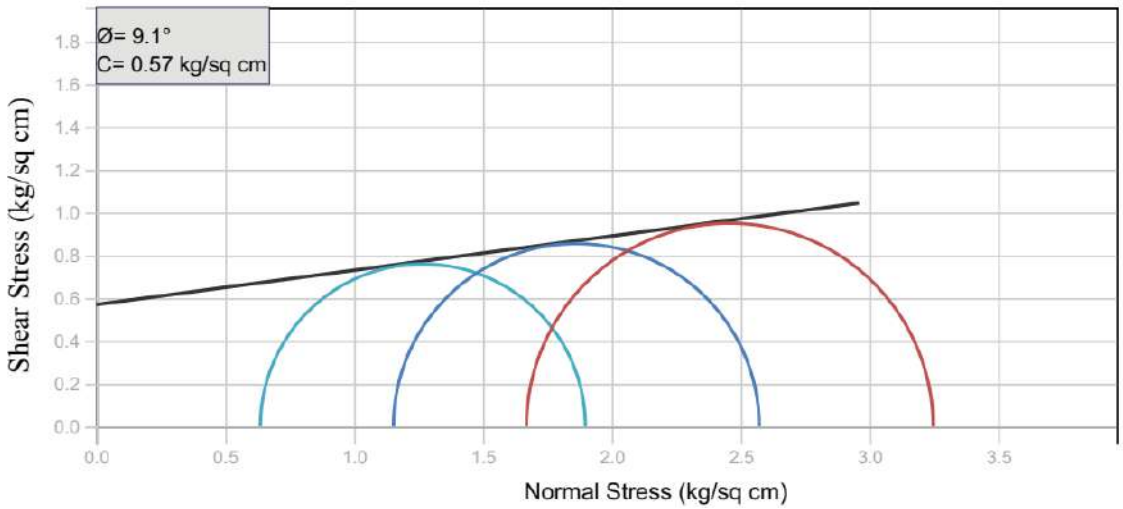
1901-HRIDC-III-22409.287
BH-NO.P57, DEPTH-13.00M, TRIAXIAL GRAPH



1901-HRIDC-III-22409.287
BH-NO.P57, DEPTH-16.00M, TRIAXIAL GRAPH

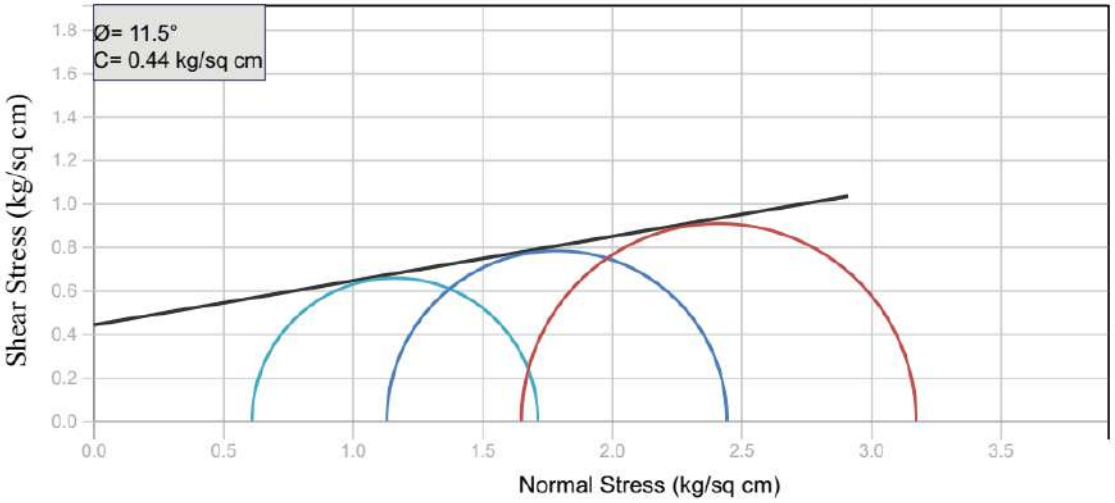


1901-HRIDC-III-22409.287
BH-NO.P57, DEPTH-22.50M, TRIAXIAL GRAPH

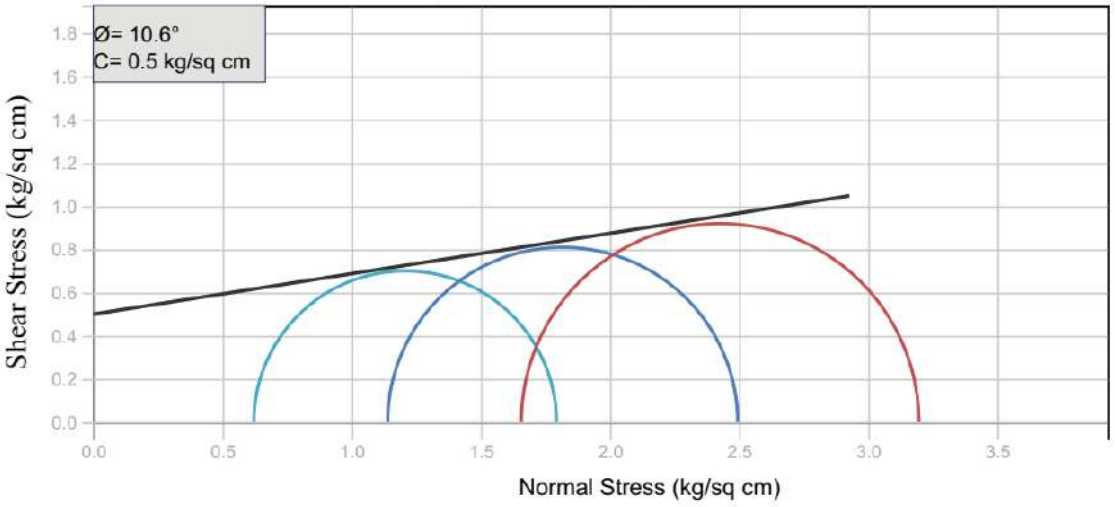


APPENDIX-G
GRAPH 26: UU GRAPH

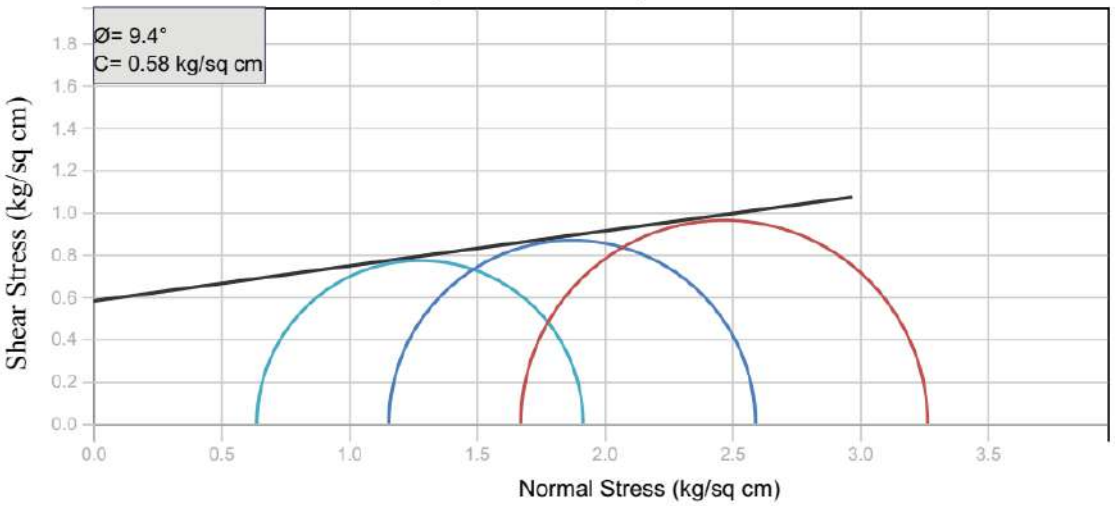
1901-HRIDC-III-22435.487
BH-NO.P58, DEPTH-2.00M, TRIAXIAL GRAPH



1901-HRIDC-III-22435.487
BH-NO.P58, DEPTH-14.00M, TRIAXIAL GRAPH

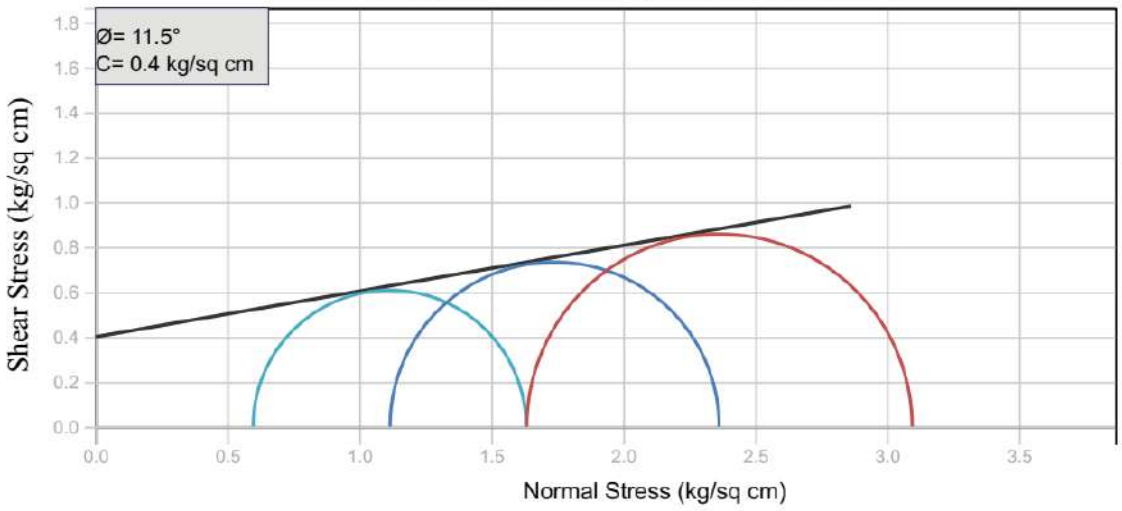


1901-HRIDC-III-22435.487
BH-NO.P58, DEPTH-26.00M, TRIAXIAL GRAPH

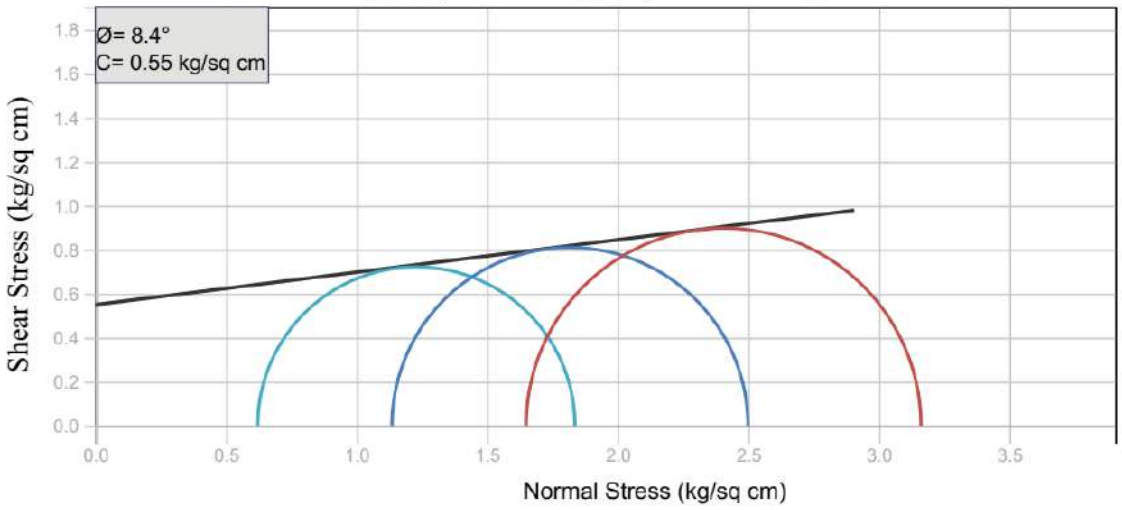


APPENDIX-G
GRAPH 27: UU GRAPH

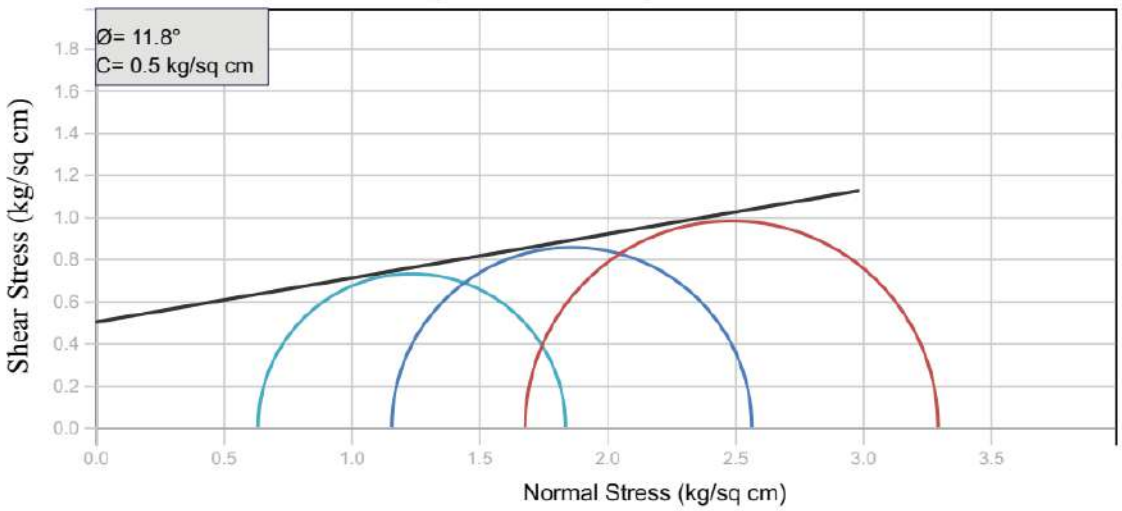
1901-HRIDC-III-22461.687
BH-NO.P59, DEPTH-10.00M, TRIAXIAL GRAPH



1901-HRIDC-III-22461.687
BH-NO.P59, DEPTH-13.00M, TRIAXIAL GRAPH

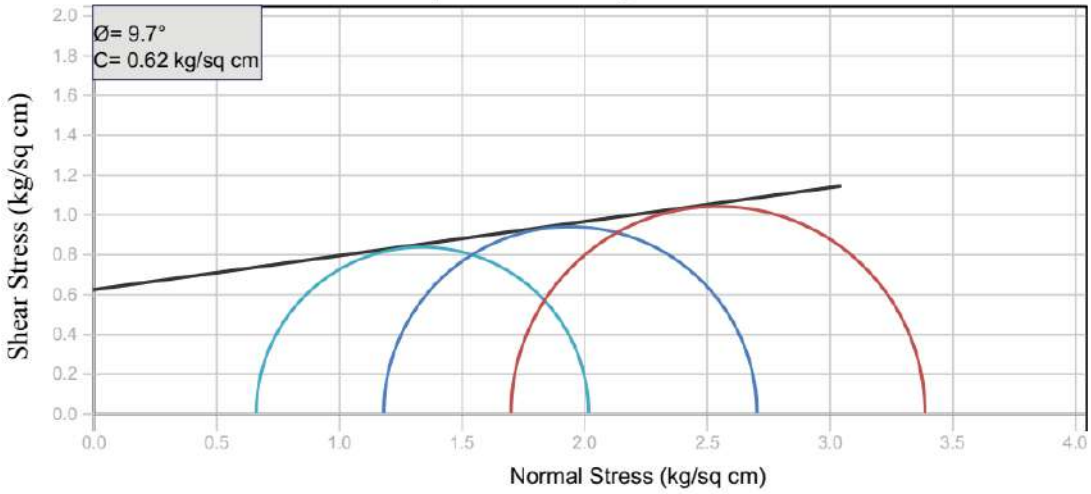


1901-HRIDC-III-22461.687
BH-NO.P59, DEPTH-16.00M, TRIAXIAL GRAPH

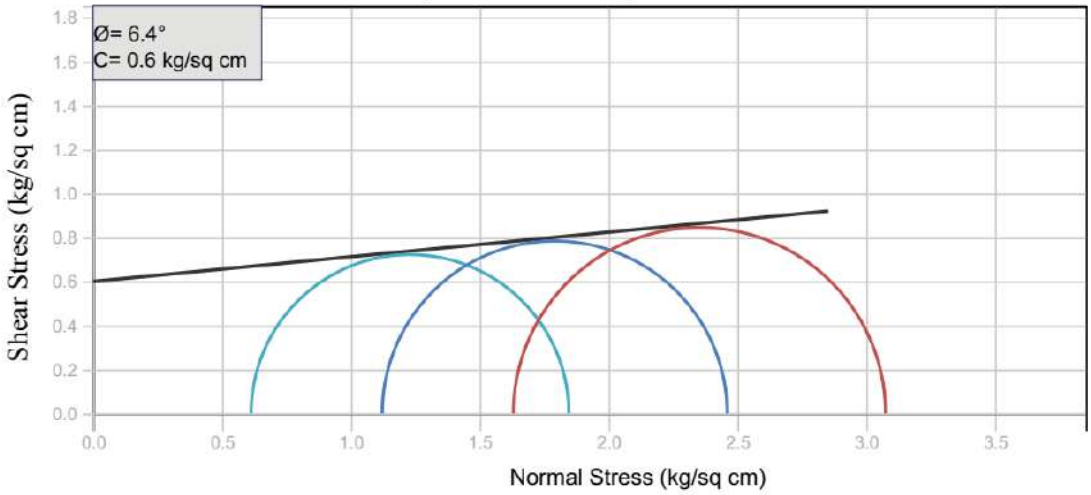


APPENDIX-G
GRAPH 28: UU GRAPH

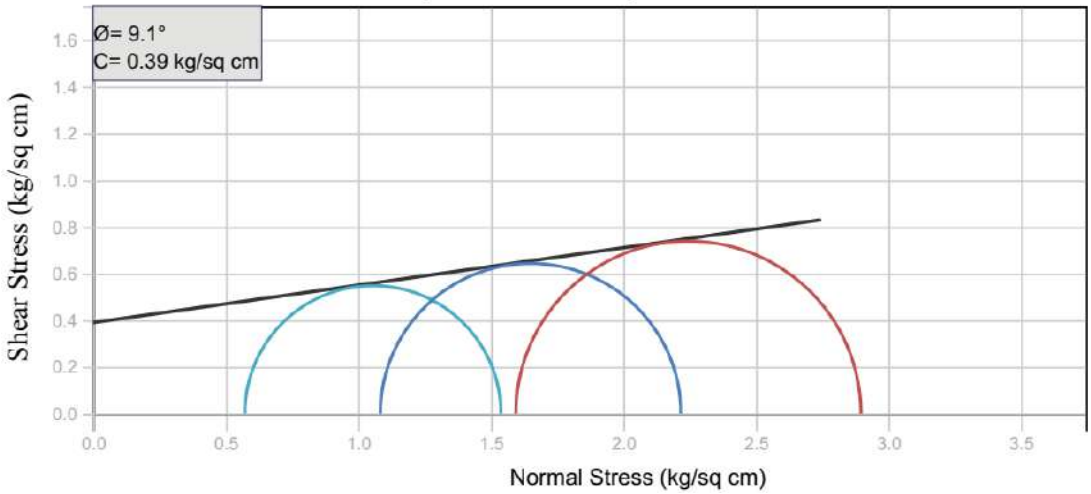
1901-HRIDC-III-22487.887
BH-NO.P60, DEPTH-2.00M, TRIAXIAL GRAPH



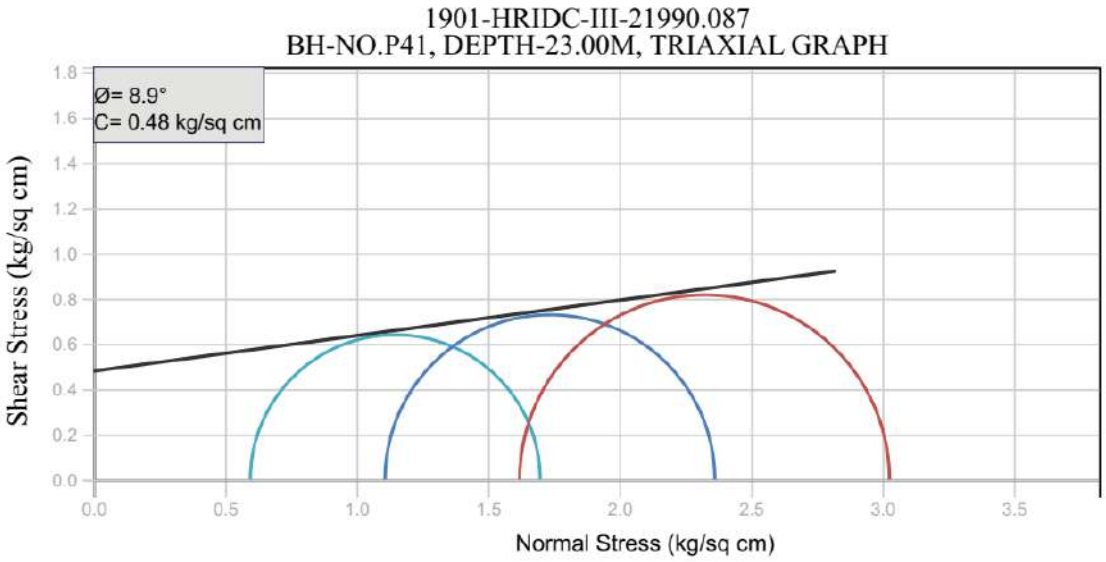
1901-HRIDC-III-22487.887
BH-NO.P60, DEPTH-26.00M, TRIAXIAL GRAPH

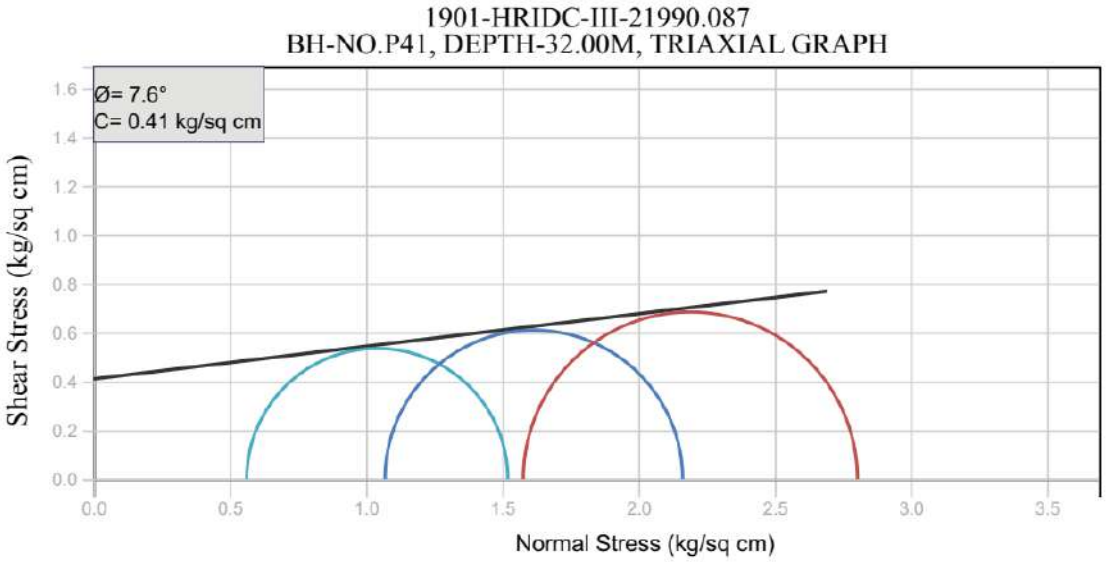


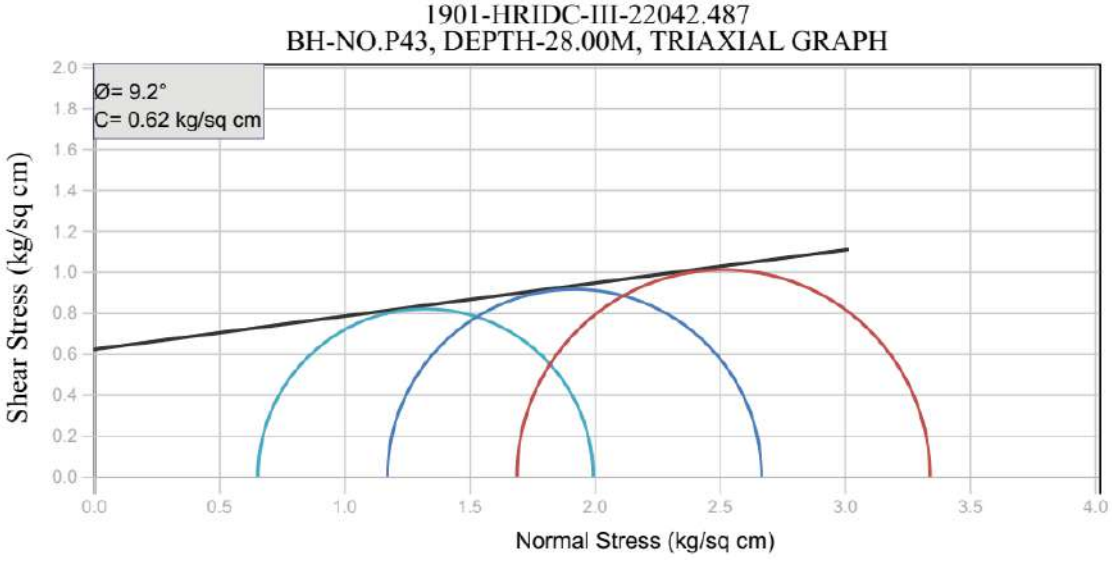
1901-HRIDC-III-22487.887
BH-NO.P60, DEPTH-29.00M, TRIAXIAL GRAPH



APPENDIX-G
GRAPH 29: RUU GRAPH

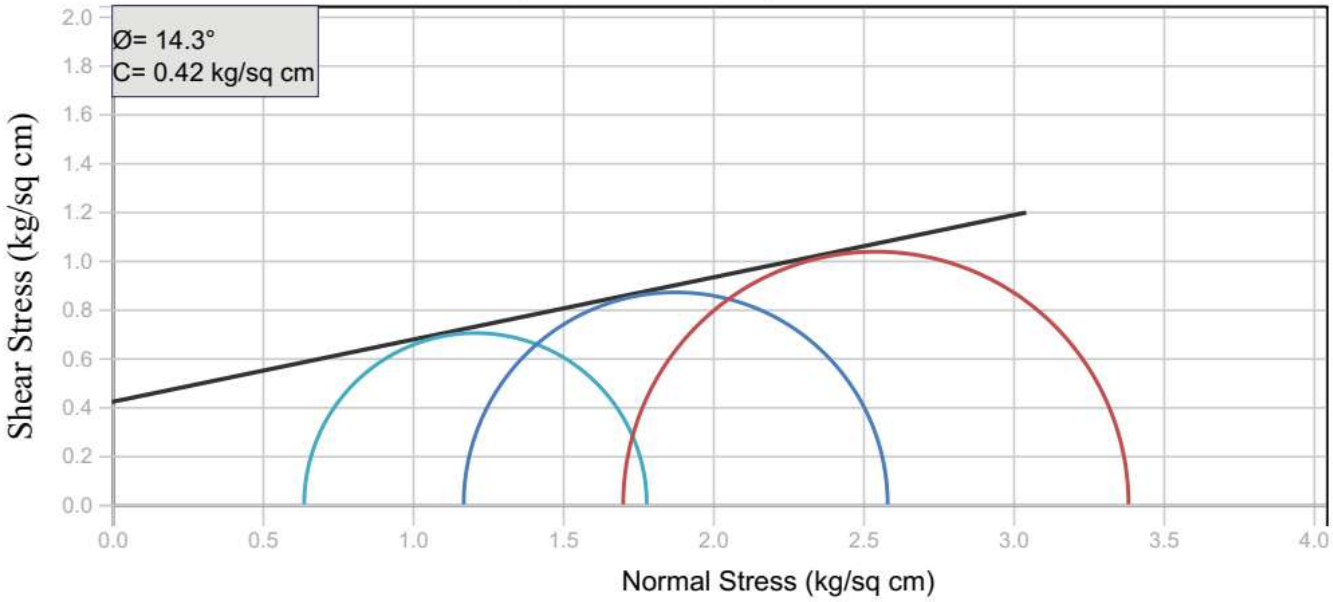




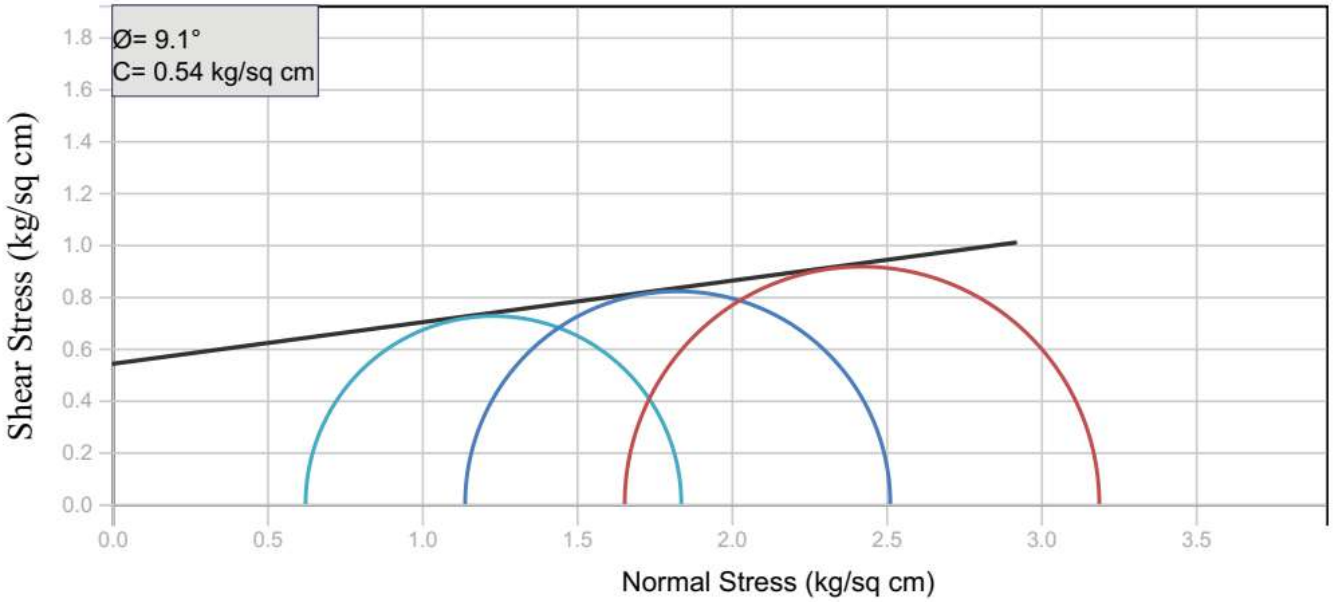


APPENDIX-G
GRAPH 30: RUU GRAPH

1901-HRIDC-III-22225.887
BH-NO.P50, DEPTH-25.00M, TRIAXIAL GRAPH

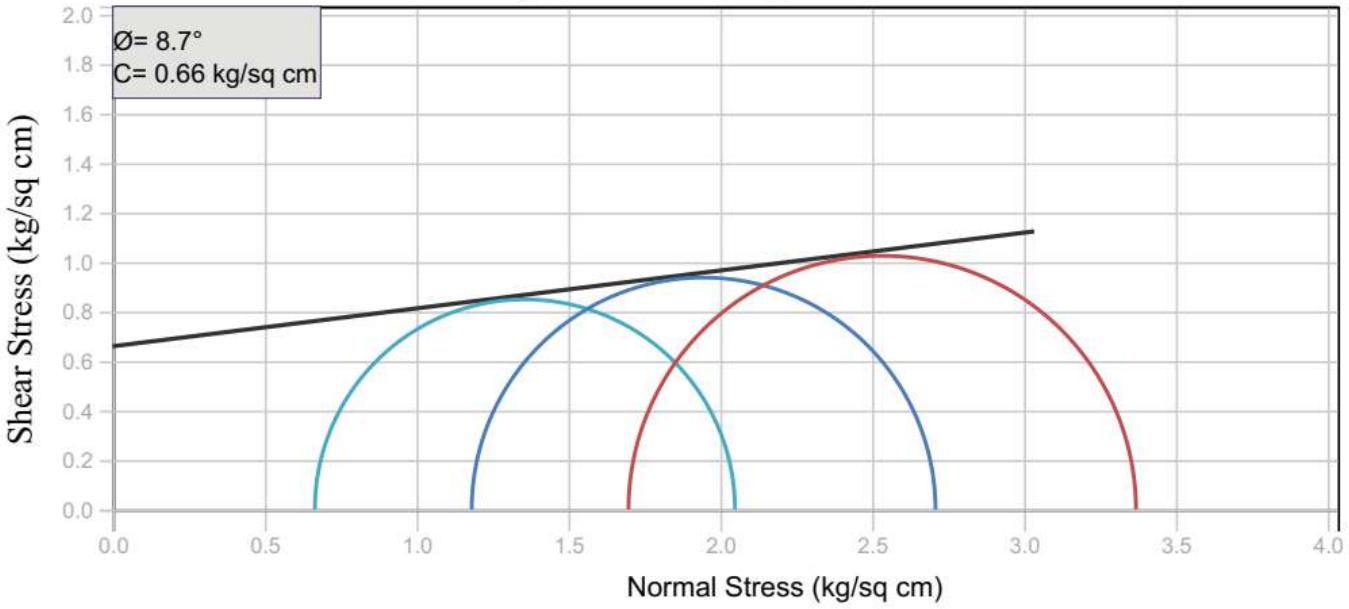


1901-HRIDC-III-22330.687
BH-NO.P54, DEPTH-34.00M, TRIAXIAL GRAPH

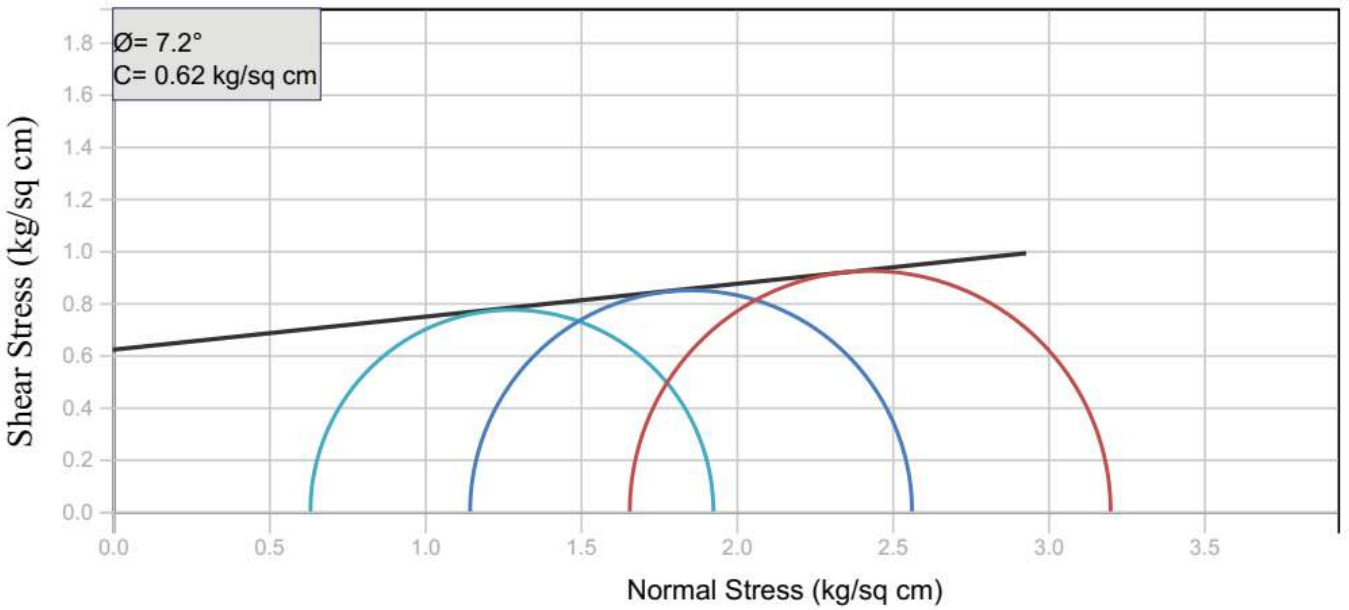


APPENDIX-G
GRAPH 31: RUU GRAPH

1901-HRIDC-III-22383.087
BH-NO.P56, DEPTH-31.00M, TRIAXIAL GRAPH



1901-HRIDC-III-22461.687
BH-NO.P59, DEPTH-4.00M, TRIAXIAL GRAPH



APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
BORE NO: P41, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	20.61	10.61	29.18	1.57	7.4	7.4	1.0	5.95	0	62	1.0	97.4	0	3.0	7.4	62	10.61	2.00	0.82	31.8	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.5	20.61	10.61	37.14	3.14	7.4	7.4	1.0	15.16	0	62	1.0	194.9	0	4.0	6.8	60	10.61	1.89	0.73	42.4	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	5.00	4.50	1.00	2.5	20.61	10.61	47.75	3.14	6.8	6.8	1.0	17.89	0	60	1.0	188.6	0	5.0	28.3	1	9.32	17.43	18.48	53.1	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.5	19.32	9.32	57.71	3.14	28.3	28.3	1.0	97.66	0	1	1.0	3.1	0	6.0	28.3	1	9.32	17.43	18.48	62.4	929.0	929.0	41.2	41.2	**371.59**	**13.74**
6.00	7.00	6.50	1.00	4.5	19.32	9.32	67.03	3.14	28.3	28.3	1.0	113.43	113.43	1	1.0	3.1	3.1	7.0	12.2	43	9.32	3.12	1.85	71.7	486.4	603.0	53.0	169.6	**241.18**	**56.53**
7.00	8.00	7.50	1.00	5.5	19.32	9.32	76.35	3.14	12.2	12.2	1.0	51.88	165.31	43	1.0	135.1	138.3	8.0	12.2	43	10.08	3.12	1.85	81.0	509.8	813.4	64.8	368.4	**325.34**	**122.80**
8.00	9.00	8.50	1.00	6.5	20.08	10.08	86.05	3.14	12.2	12.2	1.0	58.47	223.78	43	1.0	135.1	273.4	9.0	12.2	43	10.08	3.12	1.85	91.1	534.4	1031.6	76.6	573.8	**412.66**	**191.26**
9.00	10.00	9.50	1.00	7.5	20.08	10.08	96.13	3.14	12.2	12.2	1.0	65.32	289.11	43	1.0	135.1	408.6	10.0	10.7	53	10.08	2.68	1.42	101.2	593.1	1290.8	88.4	786.0	**516.32**	**262.01**
10.00	11.00	10.50	1.00	8.5	20.08	10.08	106.21	3.14	10.7	10.7	1.0	63.07	352.18	53	1.0	166.6	575.1	11.0	10.7	53	10.37	2.68	1.42	111.3	614.5	1541.8	100.1	1027.5	**616.71**	**342.49**
11.00	12.50	11.75	1.50	10.0	20.37	10.37	119.03	4.71	10.7	10.7	1.0	106.03	458.20	53	1.0	249.9	825.0	12.5	11.5	58	10.16	2.91	1.65	126.8	706.8	1990.0	117.8	1401.0	**795.98**	**467.00**
12.50	15.50	14.00	3.00	13.0	20.16	10.16	142.05	9.43	11.5	11.5	1.0	272.48	730.68	58	1.0	546.9	1371.9	15.5	9.7	62	10.40	2.42	1.17	126.8	683.9	2786.5	153.2	2255.7	**1114.59**	**751.90**
15.50	18.50	17.00	3.00	16.0	20.40	10.40	142.05	9.43	9.7	9.7	1.0	228.93	959.61	62	1.0	584.6	1956.4	18.5	14.8	31	10.40	3.88	2.59	126.8	616.6	3532.6	188.5	3104.5	**1413.05**	**1034.85**
18.50	20.00	19.25	1.50	17.5	20.40	10.40	142.05	4.71	14.8	14.8	1.0	176.93	1136.54	31	1.0	146.1	2102.6	20.0	8.3	60	10.40	2.16	0.96	126.8	643.8	3882.9	206.2	3445.3	**1553.17**	**1148.43**
20.00	21.50	20.75	1.50	19.0	20.40	10.40	142.05	4.71	8.3	8.3	1.0	97.69	1234.23	60	1.0	282.9	2385.4	21.5	8.9	48	10.86	2.27	1.05	126.8	570.3	4189.9	223.8	3843.5	**1675.97**	**1281.17**
21.50	24.50	23.00	3.00	22.0	20.86	10.86	142.05	9.43	8.9	8.9	1.0	209.73	1443.95	48	1.0	452.6	2838.0	24.5	8.9	48	10.86	2.27	1.05	126.8	570.3	4852.2	259.2	4541.1	**1940.89**	**1513.71**
24.50	26.00	25.25	1.50	23.5	20.86	10.86	142.05	4.71	8.9	8.9	1.0	104.86	1548.82	48	1.0	226.3	3064.3	26.0	24.8	8	9.49	9.86	10.66	126.8	1078.3	5691.4	276.9	4890.0	**2276.56**	**1629.99**
26.00	27.50	26.75	1.50	25.0	19.49	9.49	142.05	4.71	24.8	24.8	1.0	309.42	1858.24	8	1.0	37.7	3102.0	27.5	10.0	45	9.49	2.47	1.22	126.8	568.9	5529.1	294.5	5254.8	**2211.64**	**1751.59**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
27.50	29.00	28.25	1.50	26.5	19.49	9.49	142.05	4.71	10.0	10.0	1.0	118.08	1976.31	45	1.0	212.1	3314.1	29.0	24.7	10	9.76	9.78	10.55	126.8	1086.0	6376.4	312.2	5602.6	**2550.57**	**1867.55**
29.00	30.00	29.50	1.00	27.5	19.76	9.76	142.05	3.14	24.7	24.7	1.0	205.33	2181.64	10	1.0	31.4	3345.6	30.0	24.0	0	9.76	9.28	9.78	126.8	962.1	6489.3	324.0	5851.2	**2595.72**	**1950.40**
30.00	30.50	30.25	0.50	28.0	19.76	9.76	142.05	1.57	24.0	24.0	1.0	99.38	2281.03	0	1.0	0.0	3345.6	30.5	24.4	0	9.76	9.57	10.22	126.8	992.5	6619.1	329.9	5956.5	**2647.63**	**1985.49**
30.50	32.00	31.25	1.50	29.5	19.76	9.76	142.05	4.71	24.4	24.4	1.0	303.76	2584.79	0	1.0	0.0	3345.6	32.0	7.6	41	10.43	2.04	0.85	126.8	496.5	6426.8	347.5	6277.9	**2570.73**	**2092.63**
32.00	32.50	32.25	0.50	30.0	20.43	10.43	142.05	1.57	7.6	7.6	1.0	29.78	2614.57	41	1.0	64.4	3410.0	32.5	7.6	41	10.43	2.04	0.85	126.8	496.5	6521.0	353.4	6378.0	**2608.41**	**2126.00**
32.50	33.50	33.00	1.00	31.0	20.43	10.43	142.05	3.14	7.6	7.6	1.0	59.57	2674.14	41	1.0	128.9	3538.9	33.5	28.3	0	10.43	17.43	18.48	126.8	1812.5	8025.5	365.2	6578.2	**3210.18**	**2192.73**
33.50	35.00	34.25	1.50	32.5	20.43	10.43	142.05	4.71	28.3	28.3	1.0	360.56	3034.70	0	1.0	0.0	3538.9	35.0	26.1	4	10.84	12.48	13.41	126.8	1328.5	7902.1	382.9	6956.4	**3160.84**	**2318.81**
35.00	36.50	35.75	1.50	34.0	20.84	10.84	142.05	4.71	26.1	26.1	1.0	328.05	3362.76	4	1.0	18.9	3557.7	36.5	8.1	60	10.84	2.13	0.93	126.8	640.3	7560.7	400.6	7321.0	**3024.29**	**2440.34**
36.50	37.50	37.00	1.00	35.0	20.84	10.84	142.05	3.14	8.1	8.1	1.0	63.54	3426.29	60	1.0	188.6	3746.3	37.5	8.1	60	10.84	2.13	0.93	126.8	640.3	7812.8	412.3	7584.9	**3125.13**	**2528.30**
37.50	38.00	37.75	0.50	35.5	20.84	10.84	142.05	1.57	8.1	8.1	1.0	31.77	3458.06	60	1.0	94.3	3840.6	38.0	8.1	60	9.63	2.13	0.93	126.8	639.8	7938.4	418.2	7716.9	**3175.38**	**2572.29**
38.00	40.00	39.00	2.00	37.5	19.63	9.63	142.05	6.29	8.1	8.1	1.0	127.07	3585.13	60	1.0	377.1	4217.7	40.0	8.1	60	9.20	2.13	0.93	126.8	639.7	8442.5	441.8	8244.6	**3377.00**	**2748.21**
BORE NO: P42, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	20.28	10.28	28.27	1.57	8.6	8.6	1.0	6.72	0	47	1.0	73.9	0	3.0	14.4	36	10.28	3.77	2.48	30.8	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.5	20.28	10.28	35.98	3.14	14.4	14.4	1.0	29.03	0	36	1.0	113.1	0	4.0	7.8	71	10.08	2.07	0.88	41.1	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	5.00	4.50	1.00	2.5	20.08	10.08	46.16	3.14	7.8	7.8	1.0	19.87	0	71	1.0	223.1	0	5.0	28.8	0	10.08	18.56	19.64	51.2	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.5	20.08	10.08	56.24	3.14	28.8	28.8	1.0	97.17	0	0	1.0	0.0	0	6.0	29.0	0	10.08	19.01	20.10	61.3	0	0.0	41.2	41.2	**0.00**	**13.74**
6.00	8.00	7.00	2.00	5.5	20.08	10.08	71.36	6.29	29.0	29.0	1.0	248.63	0	0	1.0	0.0	0	8.0	28.5	0	10.76	17.88	18.94	81.4	0	0.0	64.8	64.8	**0.00**	**21.60**
8.00	9.00	8.50	1.00	6.5	20.76	10.76	86.82	3.14	28.5	28.5	1.0	148.15	0	0	1.0	0.0	0	9.0	11.6	52	10.76	2.94	1.68	92.2	587.8	587.8	76.6	76.6	**235.13**	**25.53**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
9.00	11.00	10.00	2.00	8.5	20.76	10.76	102.96	6.29	11.6	11.6	1.0	132.85	132.85	52	1.0	326.9	326.9	11.0	11.6	52	10.76	2.94	1.68	113.7	637.5	1097.2	100.1	559.8	**438.90**	**186.61**
11.00	12.00	11.50	1.00	9.5	20.76	10.76	119.10	3.14	11.6	11.6	1.0	76.84	209.68	52	1.0	163.4	490.3	12.0	10.0	50	10.39	2.47	1.22	124.5	600.1	1300.1	111.9	811.9	**520.04**	**270.63**
12.00	14.50	13.25	2.50	12.0	20.39	10.39	137.47	7.86	10.0	10.0	1.0	190.45	400.13	50	1.0	392.9	883.1	14.5	24.6	14	10.33	9.71	10.44	150.5	1289.5	2572.7	141.4	1424.6	**1029.10**	**474.88**
14.50	17.50	16.00	3.00	15.0	20.33	10.33	137.47	9.43	24.6	24.6	1.0	593.41	993.54	14	1.0	132.0	1015.1	17.5	26.3	11	10.03	12.93	13.88	150.5	1660.7	3669.4	176.7	2185.4	**1467.75**	**728.47**
17.50	20.50	19.00	3.00	18.0	20.03	10.03	137.47	9.43	26.3	26.3	1.0	640.58	1634.13	11	1.0	103.7	1118.9	20.5	12.4	62	10.03	3.17	1.91	150.5	821.2	3574.2	212.1	2965.0	**1429.69**	**988.35**
20.50	22.00	21.25	1.50	19.5	20.03	10.03	137.47	4.71	12.4	12.4	1.0	142.49	1776.61	62	1.0	292.3	1411.1	22.0	8.3	62	10.15	2.16	0.96	150.5	698.1	3885.8	229.7	3417.5	**1554.33**	**1139.16**
22.00	23.50	22.75	1.50	21.0	20.15	10.15	137.47	4.71	8.3	8.3	1.0	94.54	1871.16	62	1.0	292.3	1703.4	23.5	8.3	62	10.15	2.16	0.96	150.5	698.1	4272.6	247.4	3822.0	**1709.06**	**1273.99**
23.50	25.00	24.25	1.50	22.5	20.15	10.15	137.47	4.71	8.3	8.3	1.0	94.54	1965.70	62	1.0	292.3	1995.7	25.0	10.6	49	10.35	2.65	1.39	150.5	665.0	4626.4	265.1	4226.5	**1850.57**	**1408.83**
25.00	26.50	25.75	1.50	24.0	20.35	10.35	137.47	4.71	10.6	10.6	1.0	121.28	2086.98	49	1.0	231.0	2226.7	26.5	10.6	49	10.35	2.65	1.39	150.5	665.0	4978.7	282.7	4596.4	**1991.48**	**1532.15**
26.50	27.50	27.00	1.00	25.0	20.35	10.35	137.47	3.14	10.6	10.6	1.0	80.85	2167.83	49	1.0	154.0	2380.7	27.5	9.7	54	10.35	2.42	1.17	150.5	672.2	5220.8	294.5	4843.1	**2088.31**	**1614.36**
27.50	28.00	27.75	0.50	25.5	20.35	10.35	137.47	1.57	9.7	9.7	1.0	36.93	2204.76	54	1.0	84.9	2465.6	28.0	9.0	40	10.73	2.29	1.07	150.5	558.1	5228.4	300.4	4970.7	**2091.36**	**1656.91**
28.00	29.50	28.75	1.50	27.0	20.73	10.73	137.47	4.71	9.0	9.0	1.0	102.64	2307.40	40	1.0	188.6	2654.1	29.5	27.1	0	10.73	14.73	15.72	150.5	1807.4	6769.0	318.1	5279.6	**2707.59**	**1759.88**
29.50	30.00	29.75	0.50	27.5	20.73	10.73	137.47	1.57	27.1	27.1	1.0	110.54	2417.94	0	1.0	0.0	2654.1	30.0	27.1	0	10.73	14.73	15.72	150.5	1807.4	6879.5	324.0	5396.1	**2751.81**	**1798.69**
30.00	31.00	30.50	1.00	28.5	20.73	10.73	137.47	3.14	27.1	27.1	1.0	221.09	2639.03	0	1.0	0.0	2654.1	31.0	26.5	2	10.05	13.38	14.34	150.5	1652.2	6945.4	335.8	5628.9	**2778.15**	**1876.31**
31.00	32.50	31.75	1.50	30.0	20.05	10.05	137.47	4.71	26.5	26.5	1.0	323.11	2962.14	2	1.0	9.4	2663.6	32.5	12.0	46	10.05	3.06	1.79	150.5	693.9	6319.6	353.4	5979.1	**2527.83**	**1993.05**
32.50	34.00	33.25	1.50	31.5	20.05	10.05	137.47	4.71	12.0	12.0	1.0	137.75	3099.89	46	1.0	216.9	2880.4	34.0	9.5	46	10.05	2.38	1.14	150.5	611.1	6591.5	371.1	6351.4	**2636.59**	**2117.14**
34.00	35.00	34.50	1.00	32.5	20.05	10.05	137.47	3.14	9.5	9.5	1.0	72.30	3172.19	46	1.0	144.6	3025.0	35.0	9.5	48	8.75	2.38	1.14	150.5	624.7	6821.9	382.9	6580.1	**2728.76**	**2193.36**
35.00	35.50	35.25	0.50	33.0	18.75	8.75	137.47	1.57	9.5	9.5	1.0	36.15	3208.34	48	1.0	75.4	3100.4	35.5	13.0	57	9.00	3.35	2.08	150.5	806.4	7115.2	388.8	6697.5	**2846.08**	**2232.51**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
35.50	37.00	36.25	1.50	34.5	19.00	9.00	137.47	4.71	13.0	13.0	1.0	149.62	3357.96	57	1.0	268.7	3369.1	37.0	13.0	57	9.22	3.35	2.08	150.5	806.6	7533.7	406.4	7133.5	**3013.49**	**2377.85**
37.00	37.50	37.25	0.50	35.0	19.22	9.22	137.47	1.57	13.0	13.0	1.0	49.87	3407.83	57	1.0	89.6	3458.7	37.5	13.0	57	9.22	3.35	2.08	150.5	806.6	7673.2	412.3	7278.9	**3069.26**	**2426.29**
37.50	38.50	38.00	1.00	36.0	19.22	9.22	137.47	3.14	13.0	13.0	1.0	99.74	3507.57	57	1.0	179.1	3637.9	38.5	17.5	57	9.20	5.17	4.02	150.5	1028.8	8174.2	424.1	7569.5	**3269.68**	**2523.18**
38.50	40.00	39.25	1.50	37.5	19.20	9.20	137.47	4.71	17.5	17.5	1.0	204.33	3711.91	57	1.0	268.7	3906.6	40.0	17.5	57	9.20	5.17	4.02	150.5	1028.8	8647.2	441.8	8060.3	**3458.90**	**2686.75**
BORE NO: P43, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	19.38	9.38	25.80	1.57	11.2	11.2	1.0	8.03	0	31	1.0	48.7	0	3.0	27.3	0	9.38	15.18	16.18	28.1	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	5.00	4.00	2.00	2.5	19.38	9.38	37.52	6.29	27.3	27.3	1.0	121.73	0	0	1.0	0.0	0	5.0	27.3	0	9.38	15.18	16.18	46.9	619.0	619.0	29.5	29.5	**247.59**	**9.82**
5.00	6.00	5.50	1.00	3.5	19.38	9.38	51.59	3.14	27.3	27.3	1.0	83.69	83.69	0	1.0	0.0	0.0	6.0	26.3	0	9.38	12.93	13.88	56.3	622.8	706.5	41.2	124.9	**282.59**	**41.64**
6.00	7.00	6.50	1.00	4.5	19.38	9.38	60.97	3.14	26.3	26.3	1.0	94.70	178.39	0	1.0	0.0	0.0	7.0	26.5	8	10.36	13.38	14.34	65.7	805.1	983.5	53.0	231.4	**393.39**	**77.14**
7.00	8.00	7.50	1.00	5.5	20.36	10.36	70.84	3.14	26.5	26.5	1.0	111.00	289.40	8	1.0	25.1	25.1	8.0	9.0	48	10.36	2.29	1.07	76.0	480.5	795.1	64.8	379.3	**318.03**	**126.44**
8.00	9.00	8.50	1.00	6.5	20.36	10.36	81.20	3.14	9.0	9.0	1.0	40.42	329.82	48	1.0	150.9	176.0	9.0	9.5	44	10.15	2.38	1.14	86.4	477.2	983.0	76.6	582.4	**393.22**	**194.13**
9.00	11.00	10.00	2.00	8.5	20.15	10.15	96.53	6.29	9.5	9.5	1.0	101.54	431.35	44	1.0	276.6	452.6	11.0	9.5	44	10.15	2.38	1.14	106.7	515.2	1399.1	100.1	984.1	**559.65**	**328.02**
11.00	12.00	11.50	1.00	9.5	20.15	10.15	111.76	3.14	9.5	9.5	1.0	58.78	490.13	44	1.0	138.3	590.9	12.0	8.5	55	10.65	2.20	0.99	116.8	595.0	1676.0	111.9	1192.9	**670.40**	**397.63**
12.00	14.50	13.25	2.50	12.0	20.65	10.65	130.14	7.86	8.5	8.5	1.0	152.82	642.95	55	1.0	432.1	1023.0	14.5	8.5	57	10.27	2.20	0.99	143.5	655.0	2321.0	141.4	1807.3	**928.39**	**602.44**
14.50	17.50	16.00	3.00	15.0	20.27	10.27	130.14	9.43	8.5	8.5	1.0	183.39	826.33	57	1.0	537.4	1560.4	17.5	9.3	57	10.27	2.34	1.11	143.5	671.8	3058.5	176.7	2563.5	**1223.41**	**854.49**
17.50	20.50	19.00	3.00	18.0	20.27	10.27	130.14	9.43	9.3	9.3	1.0	200.94	1027.27	57	1.0	537.4	2097.9	20.5	14.3	39	10.41	3.74	2.45	143.5	707.0	3832.1	212.1	3337.2	**1532.86**	**1112.40**
20.50	22.00	21.25	1.50	19.5	20.41	10.41	130.14	4.71	14.3	14.3	1.0	156.39	1183.66	39	1.0	183.9	2281.7	22.0	9.4	52	10.41	2.36	1.13	143.5	638.6	4103.9	229.7	3695.1	**1641.57**	**1231.70**
22.00	23.50	22.75	1.50	21.0	20.41	10.41	130.14	4.71	9.4	9.4	1.0	101.57	1285.23	52	1.0	245.1	2526.9	23.5	9.4	52	10.41	2.36	1.13	143.5	638.6	4450.6	247.4	4059.5	**1780.26**	**1353.16**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
23.50	26.50	25.00	3.00	24.0	20.41	10.41	130.14	9.43	9.4	9.4	1.0	203.14	1488.37	52	1.0	490.3	3017.1	26.5	9.4	60	10.97	2.36	1.13	143.5	695.4	5200.9	282.7	4788.3	**2080.35**	**1596.08**
26.50	27.50	27.00	1.00	25.0	20.97	10.97	130.14	3.14	9.4	9.4	1.0	67.71	1556.08	60	1.0	188.6	3205.7	27.5	9.2	62	10.97	2.33	1.10	143.5	705.3	5467.1	294.5	5056.3	**2186.85**	**1685.44**
27.50	29.50	28.50	2.00	27.0	20.97	10.97	130.14	6.29	9.2	9.2	1.0	132.49	1688.57	62	1.0	389.7	3595.4	29.5	9.2	62	10.97	2.33	1.10	143.5	705.3	5989.3	318.1	5602.1	**2395.73**	**1867.36**
29.50	30.00	29.75	0.50	27.5	20.97	10.97	130.14	1.57	9.2	9.2	1.0	33.12	1721.70	62	1.0	97.4	3692.9	30.0	10.8	46	9.62	2.71	1.45	143.5	635.7	6050.2	324.0	5738.5	**2420.09**	**1912.84**
30.00	32.50	31.25	2.50	30.0	19.62	9.62	130.14	7.86	10.8	10.8	1.0	195.06	1916.76	46	1.0	361.4	4054.3	32.5	29.4	0	9.62	19.91	21.02	143.5	2323.4	8294.4	353.4	6324.5	**3317.78**	**2108.16**
32.50	34.00	33.25	1.50	31.5	19.62	9.62	130.14	4.71	29.4	29.4	1.0	345.71	2262.46	0	1.0	0.0	4054.3	34.0	29.4	0	9.62	19.91	21.02	143.5	2323.4	8640.1	371.1	6687.8	**3456.06**	**2229.28**
34.00	35.00	34.50	1.00	32.5	19.62	9.62	130.14	3.14	29.4	29.4	1.0	230.47	2492.93	0	1.0	0.0	4054.3	35.0	27.8	0	10.29	16.31	17.33	143.5	1907.9	8455.1	382.9	6930.1	**3382.05**	**2310.03**
35.00	35.50	35.25	0.50	33.0	20.29	10.29	130.14	1.57	27.8	27.8	1.0	107.83	2600.76	0	1.0	0.0	4054.3	35.5	27.8	0	10.29	16.31	17.33	143.5	1907.9	8563.0	388.8	7043.8	**3425.18**	**2347.94**
35.50	37.00	36.25	1.50	34.5	20.29	10.29	130.14	4.71	27.8	27.8	1.0	323.48	2924.24	0	1.0	0.0	4054.3	37.0	25.4	18	10.29	10.90	11.80	143.5	1403.7	8382.2	406.4	7385.0	**3352.88**	**2461.65**
37.00	37.50	37.25	0.50	35.0	20.29	10.29	130.14	1.57	25.4	25.4	1.0	97.11	3021.34	18	1.0	28.3	4082.6	37.5	25.4	18	10.29	10.90	11.80	143.5	1403.7	8507.6	412.3	7516.2	**3403.03**	**2505.42**
37.50	38.50	38.00	1.00	36.0	20.29	10.29	130.14	3.14	25.4	25.4	1.0	194.22	3215.56	18	1.0	56.6	4139.1	38.5	21.2	36	10.29	7.26	6.71	143.5	1100.4	8455.1	424.1	7778.8	**3382.06**	**2592.94**
38.50	40.00	39.25	1.50	37.5	20.29	10.29	130.14	4.71	21.2	21.2	1.0	237.97	3453.53	36	1.0	169.7	4308.9	40.0	21.2	36	10.29	7.26	6.71	143.5	1100.4	8862.8	441.8	8204.2	**3545.13**	**2734.73**
BORE NO: P44, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	20.75	10.75	29.56	1.57	18.0	18.0	1.0	15.09	0	33	1.0	51.9	0	3.0	26.7	5	9.39	13.83	14.80	32.3	440.3	440.3	5.9	5.9	**176.14**	**1.96**
3.00	5.00	4.00	2.00	2.5	19.39	9.39	41.64	6.29	26.7	26.7	1.0	131.64	131.64	5	1.0	31.4	31.4	5.0	26.7	5	9.39	13.83	14.80	51.0	644.4	807.5	29.5	192.5	**322.98**	**64.17**
5.00	6.00	5.50	1.00	3.5	19.39	9.39	55.73	3.14	26.7	26.7	1.0	88.08	219.72	5	1.0	15.7	47.1	6.0	25.8	0	9.39	11.80	12.72	60.4	607.2	874.1	41.2	308.1	**349.62**	**102.70**
6.00	7.00	6.50	1.00	4.5	19.39	9.39	65.12	3.14	25.8	25.8	1.0	98.93	318.65	0	1.0	0.0	47.1	7.0	26.2	8	10.09	12.70	13.64	69.8	807.4	1173.2	53.0	418.8	**469.27**	**139.60**
7.00	8.00	7.50	1.00	5.5	20.09	10.09	74.86	3.14	26.2	26.2	1.0	115.76	434.42	8	1.0	25.1	72.3	8.0	26.2	8	10.09	12.70	13.64	79.9	908.1	1414.8	64.8	571.5	**565.92**	**190.50**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
8.00	9.00	8.50	1.00	6.5	20.09	10.09	84.95	3.14	26.2	26.2	1.0	131.37	565.78	8	1.0	25.1	97.4	9.0	8.6	58	9.04	2.22	1.00	90.0	570.5	1233.7	76.6	739.8	**493.50**	**246.60**
9.00	11.00	10.00	2.00	8.5	19.04	9.04	99.03	6.29	8.6	8.6	1.0	94.14	659.92	58	1.0	364.6	462.0	11.0	8.6	58	9.04	2.22	1.00	108.1	602.0	1724.0	100.1	1222.1	**689.59**	**407.35**
11.00	12.00	11.50	1.00	9.5	19.04	9.04	112.59	3.14	8.6	8.6	1.0	53.52	713.44	58	1.0	182.3	644.3	12.0	9.8	57	10.61	2.43	1.19	117.1	632.0	1989.7	111.9	1469.6	**795.89**	**489.88**
12.00	14.50	13.25	2.50	12.0	20.61	10.61	130.37	7.86	9.8	9.8	1.0	176.94	890.37	57	1.0	447.9	1092.1	14.5	9.8	57	10.61	2.43	1.19	143.6	682.7	2665.2	141.4	2123.9	**1066.09**	**707.96**
14.50	17.50	16.00	3.00	15.0	20.61	10.61	130.37	9.43	9.8	9.8	1.0	212.32	1102.70	57	1.0	537.4	1629.6	17.5	9.5	52	10.18	2.38	1.14	143.6	640.9	3373.2	176.7	2909.0	**1349.26**	**969.66**
17.50	20.50	19.00	3.00	18.0	20.18	10.18	130.37	9.43	9.5	9.5	1.0	205.70	1308.40	52	1.0	490.3	2119.9	20.5	9.5	52	10.18	2.38	1.14	143.6	640.9	4069.1	212.1	3640.3	**1627.66**	**1213.44**
20.50	23.50	22.00	3.00	21.0	20.18	10.18	130.37	9.43	9.5	9.5	1.0	205.70	1514.10	52	1.0	490.3	2610.1	23.5	13.7	23	10.55	3.56	2.28	143.6	573.9	4698.1	247.4	4371.6	**1879.24**	**1457.22**
23.50	25.00	24.25	1.50	22.5	20.55	10.55	130.37	4.71	13.7	13.7	1.0	149.83	1663.93	23	1.0	108.4	2718.6	25.0	10.2	55	10.55	2.53	1.28	143.6	679.6	5062.1	265.1	4647.6	**2024.85**	**1549.19**
25.00	26.50	25.75	1.50	24.0	20.55	10.55	130.37	4.71	10.2	10.2	1.0	110.59	1774.52	55	1.0	259.3	2977.9	26.5	9.9	50	10.55	2.45	1.20	143.6	635.3	5387.7	282.7	5035.1	**2155.06**	**1678.37**
26.50	27.50	27.00	1.00	25.0	20.55	10.55	130.37	3.14	9.9	9.9	1.0	71.51	1846.03	50	1.0	157.1	3135.0	27.5	9.9	50	10.55	2.45	1.20	143.6	635.3	5616.3	294.5	5275.6	**2246.53**	**1758.52**
27.50	28.00	27.75	0.50	25.5	20.55	10.55	130.37	1.57	9.9	9.9	1.0	35.76	1881.78	50	1.0	78.6	3213.6	28.0	28.5	2	9.71	17.88	18.94	143.6	2104.5	7199.8	300.4	5395.8	**2879.93**	**1798.59**
28.00	29.50	28.75	1.50	27.0	19.71	9.71	130.37	4.71	28.5	28.5	1.0	333.71	2215.49	2	1.0	9.4	3223.0	29.5	24.5	20	9.71	9.64	10.33	143.6	1268.8	6707.3	318.1	5756.6	**2682.90**	**1918.86**
29.50	30.00	29.75	0.50	27.5	19.71	9.71	130.37	1.57	24.5	24.5	1.0	93.37	2308.86	20	1.0	31.4	3254.4	30.0	24.0	20	9.71	9.28	9.78	143.6	1226.0	6789.3	324.0	5887.3	**2715.73**	**1962.42**
30.00	31.00	30.50	1.00	28.5	19.71	9.71	130.37	3.14	24.0	24.0	1.0	182.43	2491.28	20	1.0	62.9	3317.3	31.0	28.2	0	9.71	17.21	18.25	143.6	2011.4	7820.0	335.8	6144.3	**3128.00**	**2048.11**
31.00	32.50	31.75	1.50	30.0	19.71	9.71	130.37	4.71	28.2	28.2	1.0	329.55	2820.84	0	1.0	0.0	3317.3	32.5	20.3	25	7.75	6.62	5.72	143.6	940.9	7079.0	353.4	6491.6	**2831.59**	**2163.85**
32.50	34.00	33.25	1.50	31.5	17.75	7.75	130.37	4.71	20.3	20.3	1.0	227.35	3048.19	25	1.0	117.9	3435.1	34.0	18.0	39	8.11	5.42	4.29	143.6	900.7	7384.0	371.1	6854.4	**2953.61**	**2284.81**
34.00	35.00	34.50	1.00	32.5	18.11	8.11	130.37	3.14	18.0	18.0	1.0	133.13	3181.32	39	1.0	122.6	3557.7	35.0	18.0	39	8.11	5.42	4.29	143.6	900.7	7639.7	382.9	7121.9	**3055.89**	**2373.97**
35.00	35.50	35.25	0.50	33.0	18.11	8.11	130.37	1.57	18.0	18.0	1.0	66.57	3247.89	39	1.0	61.3	3619.0	35.5	29.1	0	8.11	19.23	20.33	143.6	2235.3	9102.2	388.8	7255.7	**3640.88**	**2418.55**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
35.50	37.00	36.25	1.50	34.5	18.11	8.11	130.37	4.71	29.1	29.1	1.0	342.09	3589.98	0	1.0	0.0	3619.0	37.0	29.1	0	7.75	19.23	20.33	143.6	2232.4	9441.4	406.4	7615.4	**3776.56**	**2538.47**
37.00	37.50	37.25	0.50	35.0	17.75	7.75	130.37	1.57	29.1	29.1	1.0	114.03	3704.01	0	1.0	0.0	3619.0	37.5	28.9	0	7.75	18.78	19.87	143.6	2180.2	9503.2	412.3	7735.3	**3801.28**	**2578.45**
37.50	38.50	38.00	1.00	36.0	17.75	7.75	130.37	3.14	28.9	28.9	1.0	226.19	3930.20	0	1.0	0.0	3619.0	38.5	20.7	39	8.08	6.90	6.16	143.6	1074.5	8623.7	424.1	7973.3	**3449.48**	**2657.77**
38.50	40.00	39.25	1.50	37.5	18.08	8.08	130.37	4.71	20.7	20.7	1.0	232.24	4162.44	39	1.0	183.9	3802.9	40.0	20.7	39	8.08	6.90	6.16	143.6	1074.5	9039.8	441.8	8407.1	**3615.92**	**2802.36**
BORE NO: P45, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	19.47	9.47	26.04	1.57	9.2	9.2	1.0	6.63	0	50	1.0	78.6	0	3.0	9.2	50	9.47	2.33	1.10	28.4	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.5	19.47	9.47	33.15	3.14	9.2	9.2	1.0	16.87	0	50	1.0	157.1	0	4.0	27.2	0	9.60	14.95	15.95	37.9	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	5.00	4.50	1.00	2.5	19.60	9.60	42.68	3.14	27.2	27.2	1.0	68.94	0	0	1.0	0.0	0	5.0	28.1	0	9.60	16.98	18.02	47.5	701.5	701.5	29.5	29.5	**280.58**	**9.82**
5.00	6.00	5.50	1.00	3.5	19.60	9.60	52.28	3.14	28.1	28.1	1.0	87.73	87.73	0	1.0	0.0	0.0	6.0	28.1	0	9.70	16.98	18.02	57.1	830.2	918.0	41.2	129.0	**367.19**	**42.99**
6.00	8.00	7.00	2.00	5.5	19.70	9.70	66.78	6.29	28.1	28.1	1.0	224.13	311.86	0	1.0	0.0	0.0	8.0	28.1	0	9.70	16.98	18.02	76.5	1089.1	1400.9	64.8	376.7	**560.38**	**125.55**
8.00	9.00	8.50	1.00	6.5	19.70	9.70	81.33	3.14	28.1	28.1	1.0	136.48	448.35	0	1.0	0.0	0.0	9.0	27.4	0	9.70	15.40	16.41	86.2	1105.6	1554.0	76.6	524.9	**621.59**	**174.97**
9.00	10.00	9.50	1.00	7.5	19.70	9.70	91.03	3.14	27.4	27.4	1.0	148.30	596.64	0	1.0	0.0	0.0	10.0	12.3	47	10.17	3.15	1.88	95.9	576.8	1173.5	88.4	685.0	**469.39**	**228.33**
10.00	11.00	10.50	1.00	8.5	20.17	10.17	100.97	3.14	12.3	12.3	1.0	69.19	665.83	47	1.0	147.7	147.7	11.0	10.9	55	10.17	2.73	1.48	106.1	622.7	1436.2	100.1	913.7	**574.49**	**304.56**
11.00	12.00	11.50	1.00	9.5	20.17	10.17	111.14	3.14	10.9	10.9	1.0	67.26	733.09	55	1.0	172.9	320.6	12.0	12.0	69	10.42	3.06	1.79	116.2	774.5	1828.2	111.9	1165.6	**731.27**	**388.53**
12.00	14.50	13.25	2.50	12.0	20.42	10.42	129.25	7.86	12.0	12.0	1.0	215.85	948.94	69	1.0	542.1	862.7	14.5	9.3	59	10.57	2.34	1.11	142.3	683.9	2495.5	141.4	1953.0	**998.20**	**651.01**
14.50	17.50	16.00	3.00	15.0	20.57	10.57	129.25	9.43	9.3	9.3	1.0	199.55	1148.49	59	1.0	556.3	1419.0	17.5	11.2	57	10.50	2.82	1.56	142.3	725.1	3292.6	176.7	2744.2	**1317.02**	**914.74**
17.50	20.50	19.00	3.00	18.0	20.50	10.50	129.25	9.43	11.2	11.2	1.0	241.29	1389.78	57	1.0	537.4	1956.4	20.5	8.2	61	10.36	2.15	0.94	142.3	675.1	4021.3	212.1	3558.3	**1608.52**	**1186.09**
20.50	23.50	22.00	3.00	21.0	20.36	10.36	129.25	9.43	8.2	8.2	1.0	175.60	1565.38	61	1.0	575.1	2531.6	23.5	10.4	55	10.50	2.59	1.33	142.3	683.7	4780.6	247.4	4344.4	**1912.26**	**1448.12**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
23.50	26.50	25.00	3.00	24.0	20.50	10.50	129.25	9.43	10.4	10.4	1.0	223.65	1789.04	55	1.0	518.6	3050.1	26.5	13.3	41	10.50	3.44	2.16	142.3	683.4	5522.6	282.7	5121.9	**2209.03**	**1707.31**
26.50	27.50	27.00	1.00	25.0	20.50	10.50	129.25	3.14	13.3	13.3	1.0	96.02	1885.06	41	1.0	128.9	3179.0	27.5	13.3	41	10.50	3.44	2.16	142.3	683.4	5747.4	294.5	5358.6	**2298.98**	**1786.19**
27.50	28.00	27.75	0.50	25.5	20.50	10.50	129.25	1.57	13.3	13.3	1.0	48.01	1933.07	41	1.0	64.4	3243.4	28.0	12.3	77	10.40	3.15	1.88	142.3	903.8	6080.3	300.4	5476.9	**2432.12**	**1825.64**
28.00	29.50	28.75	1.50	27.0	20.40	10.40	129.25	4.71	12.3	12.3	1.0	132.85	2065.92	77	1.0	363.0	3606.4	29.5	12.3	77	10.40	3.15	1.88	142.3	903.8	6576.1	318.1	5990.4	**2630.46**	**1996.81**
29.50	30.00	29.75	0.50	27.5	20.40	10.40	129.25	1.57	12.3	12.3	1.0	44.28	2110.20	77	1.0	121.0	3727.4	30.0	12.3	77	10.40	3.15	1.88	142.3	903.8	6741.4	324.0	6161.6	**2696.57**	**2053.87**
30.00	31.00	30.50	1.00	28.5	20.40	10.40	129.25	3.14	12.3	12.3	1.0	88.57	2198.77	77	1.0	242.0	3969.4	31.0	12.3	77	10.40	3.15	1.88	142.3	903.8	7072.0	335.8	6504.0	**2828.80**	**2167.98**
31.00	32.50	31.75	1.50	30.0	20.40	10.40	129.25	4.71	12.3	12.3	1.0	132.85	2331.62	77	1.0	363.0	4332.4	32.5	12.0	30	10.07	3.06	1.79	142.3	561.1	7225.1	353.4	7017.5	**2890.04**	**2339.16**
32.50	35.00	33.75	2.50	32.5	20.07	10.07	129.25	7.86	12.0	12.0	1.0	215.85	2547.47	30	1.0	235.7	4568.1	35.0	20.1	14	10.07	6.47	5.50	142.3	844.2	7959.8	382.9	7498.5	**3183.93**	**2499.50**
35.00	35.50	35.25	0.50	33.0	20.07	10.07	129.25	1.57	20.1	20.1	1.0	74.32	2621.79	14	1.0	22.0	4590.1	35.5	20.0	14	10.07	6.40	5.39	142.3	835.7	8047.7	388.8	7600.7	**3219.07**	**2533.57**
35.50	37.00	36.25	1.50	34.5	20.07	10.07	129.25	4.71	20.0	20.0	1.0	221.77	2843.56	14	1.0	66.0	4656.1	37.0	23.0	10	10.07	8.56	8.68	142.3	1061.9	8561.6	406.4	7906.1	**3424.65**	**2635.38**
37.00	37.50	37.25	0.50	35.0	20.07	10.07	129.25	1.57	23.0	23.0	1.0	86.21	2929.77	10	1.0	15.7	4671.9	37.5	23.0	0	8.77	8.56	8.68	142.3	986.8	8588.4	412.3	8014.0	**3435.36**	**2671.32**
37.50	38.50	38.00	1.00	36.0	18.77	8.77	129.25	3.14	23.0	23.0	1.0	172.42	3102.19	0	1.0	0.0	4671.9	38.5	19.8	35	8.81	6.29	5.28	142.3	969.3	8743.3	424.1	8198.2	**3497.34**	**2732.72**
38.50	40.00	39.25	1.50	37.5	18.81	8.81	129.25	4.71	19.8	19.8	1.0	219.36	3321.55	35	1.0	165.0	4836.9	40.0	19.8	35	8.81	6.29	5.28	142.3	969.3	9127.7	441.8	8600.2	**3651.08**	**2866.73**
BORE NO: P46, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	19.42	9.42	25.91	1.57	26.3	26.3	1.0	20.12	0	1	1.0	1.6	0	3.0	26.3	1	9.42	12.93	13.88	28.3	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.5	19.42	9.42	32.97	3.14	26.3	26.3	1.0	51.21	0	1	1.0	3.1	0	4.0	26.3	1	10.02	12.93	13.88	37.7	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	5.00	4.50	1.00	2.5	20.02	10.02	42.69	3.14	26.3	26.3	1.0	66.31	0	1	1.0	3.1	0	5.0	29.5	0	10.02	20.13	21.25	47.7	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.5	20.02	10.02	52.71	3.14	29.5	29.5	1.0	93.73	0	0	1.0	0.0	0	6.0	29.5	0	8.96	20.13	21.25	57.7	0	0.0	41.2	41.2	**0.00**	**13.74**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
6.00	8.00	7.00	2.00	5.5	18.96	8.96	66.68	6.29	29.5	29.5	1.0	237.13	0	0	1.0	0.0	0	8.0	29.5	0	8.96	20.13	21.25	75.6	0	0.0	64.8	64.8	**0.00**	**21.60**
8.00	9.00	8.50	1.00	6.5	18.96	8.96	80.12	3.14	29.5	29.5	1.0	142.46	0	0	1.0	0.0	0	9.0	10.2	47	10.24	2.53	1.28	84.6	505.6	505.6	76.6	76.6	**202.24**	**25.53**
9.00	11.00	10.00	2.00	8.5	20.24	10.24	94.84	6.29	10.2	10.2	1.0	107.26	107.26	47	1.0	295.4	295.4	11.0	10.2	47	10.24	2.53	1.28	105.1	546.3	949.0	100.1	502.8	**379.59**	**167.61**
11.00	12.00	11.50	1.00	9.5	20.24	10.24	110.20	3.14	10.2	10.2	1.0	62.32	169.58	47	1.0	147.7	443.1	12.0	9.2	57	10.43	2.33	1.10	115.3	618.3	1231.0	111.9	724.6	**492.42**	**241.55**
12.00	14.50	13.25	2.50	12.0	20.43	10.43	128.36	7.86	9.2	9.2	1.0	163.35	332.92	57	1.0	447.9	891.0	14.5	9.2	57	10.43	2.33	1.10	141.4	666.0	1889.9	141.4	1365.3	**755.96**	**455.10**
14.50	16.00	15.25	1.50	13.5	20.43	10.43	128.36	4.71	9.2	9.2	1.0	98.01	430.93	57	1.0	268.7	1159.7	16.0	26.2	7	10.15	12.70	13.64	141.4	1515.1	3105.7	159.0	1749.7	**1242.29**	**583.23**
16.00	17.50	16.75	1.50	15.0	20.15	10.15	128.36	4.71	26.2	26.2	1.0	297.75	728.68	7	1.0	33.0	1192.7	17.5	26.2	7	10.15	12.70	13.64	141.4	1515.1	3436.5	176.7	2098.1	**1374.59**	**699.37**
17.50	19.00	18.25	1.50	16.5	20.15	10.15	128.36	4.71	26.2	26.2	1.0	297.75	1026.44	7	1.0	33.0	1225.7	19.0	10.7	48	10.17	2.68	1.42	141.4	642.4	2894.5	194.4	2446.5	**1157.81**	**815.51**
19.00	20.50	19.75	1.50	18.0	20.17	10.17	128.36	4.71	10.7	10.7	1.0	114.34	1140.77	48	1.0	226.3	1452.0	20.5	10.0	52	10.34	2.47	1.22	141.4	647.1	3239.9	212.1	2804.8	**1295.94**	**934.94**
20.50	23.50	22.00	3.00	21.0	20.34	10.34	128.36	9.43	10.0	10.0	1.0	213.40	1354.17	52	1.0	490.3	1942.3	23.5	16.5	30	10.34	4.68	3.47	141.4	746.0	4042.4	247.4	3543.9	**1616.96**	**1181.29**
23.50	25.00	24.25	1.50	22.5	20.34	10.34	128.36	4.71	16.5	16.5	1.0	179.24	1533.41	30	1.0	141.4	2083.7	25.0	9.5	50	10.34	2.38	1.14	141.4	622.6	4239.8	265.1	3882.2	**1695.90**	**1294.07**
25.00	26.50	25.75	1.50	24.0	20.34	10.34	128.36	4.71	9.5	9.5	1.0	101.26	1634.67	50	1.0	235.7	2319.4	26.5	9.5	50	9.38	2.38	1.14	141.4	622.2	4576.3	282.7	4236.8	**1830.52**	**1412.28**
26.50	27.50	27.00	1.00	25.0	19.38	9.38	128.36	3.14	9.5	9.5	1.0	67.51	1702.18	50	1.0	157.1	2476.6	27.5	9.5	50	9.38	2.38	1.14	141.4	622.2	4800.9	294.5	4473.3	**1920.38**	**1491.09**
27.50	28.00	27.75	0.50	25.5	19.38	9.38	128.36	1.57	9.5	9.5	1.0	33.75	1735.94	50	1.0	78.6	2555.1	28.0	7.3	72	9.86	1.98	0.80	141.4	732.7	5023.8	300.4	4591.5	**2009.50**	**1530.50**
28.00	29.50	28.75	1.50	27.0	19.86	9.86	128.36	4.71	7.3	7.3	1.0	77.52	1813.45	72	1.0	339.4	2894.6	29.5	30.0	0	8.36	21.26	22.40	141.4	2435.4	7143.4	318.1	5026.1	**2857.38**	**1675.37**
29.50	30.00	29.75	0.50	27.5	18.36	8.36	128.36	1.57	30.0	30.0	1.0	116.45	1929.91	0	1.0	0.0	2894.6	30.0	30.0	0	11.65	21.26	22.40	141.4	2464.4	7288.8	324.0	5148.5	**2915.54**	**1716.15**
30.00	31.00	30.50	1.00	28.5	21.65	11.65	128.36	3.14	30.0	30.0	1.0	232.91	2162.82	0	1.0	0.0	2894.6	31.0	28.7	0	11.65	18.33	19.40	141.4	2125.4	7182.8	335.8	5393.1	**2873.13**	**1797.71**
31.00	32.50	31.75	1.50	30.0	21.65	11.65	128.36	4.71	28.7	28.7	1.0	331.29	2494.11	0	1.0	0.0	2894.6	32.5	34.2	0	11.65	42.42	43.93	141.4	4913.4	10302.1	353.4	5742.1	**4120.83**	**1914.04**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
32.50	35.00	33.75	2.50	32.5	21.65	11.65	128.36	7.86	34.2	34.2	1.2	829.32	3323.43	0	1.0	0.0	2894.6	35.0	33.4	0	11.65	38.39	39.83	141.4	4446.9	10664.9	382.9	6600.9	**4265.96**	**2200.29**
35.00	35.50	35.25	0.50	33.0	21.65	11.65	128.36	1.57	33.4	33.4	1.2	155.61	3479.04	0	1.0	0.0	2894.6	35.5	33.4	0	11.65	38.39	39.83	141.4	4446.9	10820.5	388.8	6762.4	**4328.21**	**2254.13**
35.50	37.50	36.50	2.00	35.0	21.65	11.65	128.36	6.29	33.4	33.4	1.2	622.44	4101.48	0	1.0	0.0	2894.6	37.5	33.6	0	9.47	39.39	40.85	141.4	4528.5	11524.6	412.3	7408.4	**4609.84**	**2469.46**
37.50	38.50	38.00	1.00	36.0	19.47	9.47	128.36	3.14	33.6	33.6	1.2	316.27	4417.75	0	1.0	0.0	2894.6	38.5	34.1	0	9.44	41.91	43.42	141.4	4817.4	12129.7	424.1	7736.4	**4851.88**	**2578.81**
38.50	40.00	39.25	1.50	37.5	19.44	9.44	128.36	4.71	34.1	34.1	1.2	493.68	4911.43	0	1.0	0.0	2894.6	40.0	34.1	0	9.44	41.91	43.42	141.4	4817.4	12623.4	441.8	8247.8	**5049.35**	**2749.26**
BORE NO: P47, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	18.89	8.89	24.45	1.57	13.5	13.5	1.0	9.22	0	18	1.0	28.3	0	3.0	9.0	41	8.89	2.29	1.07	26.7	341.6	341.6	5.9	5.9	**136.66**	**1.96**
3.00	4.00	3.50	1.00	1.5	18.89	8.89	31.12	3.14	9.0	9.0	1.0	15.49	15.49	41	1.0	128.9	128.9	4.0	27.4	0	8.89	15.40	16.41	35.6	487.7	632.1	17.7	162.0	**252.82**	**54.01**
4.00	6.00	5.00	2.00	3.5	18.89	8.89	44.45	6.29	27.4	27.4	1.0	144.83	160.32	0	1.0	0.0	128.9	6.0	28.2	0	8.89	17.21	18.25	53.3	784.9	1074.0	41.2	330.4	**429.61**	**110.14**
6.00	7.00	6.50	1.00	4.5	18.89	8.89	57.79	3.14	28.2	28.2	1.0	97.38	257.69	0	1.0	0.0	128.9	7.0	28.2	0	9.35	17.21	18.25	62.2	908.3	1294.9	53.0	439.6	**517.96**	**146.52**
7.00	9.00	8.00	2.00	6.5	19.35	9.35	71.58	6.29	28.2	28.2	1.0	241.25	498.95	0	1.0	0.0	128.9	9.0	28.2	0	9.35	17.21	18.25	80.9	1161.1	1788.9	76.6	704.4	**715.58**	**234.79**
9.00	10.00	9.50	1.00	7.5	19.35	9.35	85.61	3.14	28.2	28.2	1.0	144.26	643.21	0	1.0	0.0	128.9	10.0	27.4	0	9.35	15.40	16.41	90.3	1153.0	1925.1	88.4	860.4	**770.02**	**286.81**
10.00	11.00	10.50	1.00	8.5	19.35	9.35	94.96	3.14	27.4	27.4	1.0	154.69	797.90	0	1.0	0.0	128.9	11.0	9.1	50	10.17	2.31	1.08	99.6	538.6	1465.3	100.1	1026.9	**586.13**	**342.30**
11.00	12.50	11.75	1.50	10.0	20.17	10.17	107.26	4.71	9.1	9.1	1.0	80.99	878.89	50	1.0	235.7	364.6	12.5	9.1	50	10.17	2.31	1.08	114.9	566.2	1809.7	117.8	1361.3	**723.87**	**453.76**
12.50	14.00	13.25	1.50	11.5	20.17	10.17	122.51	4.71	9.1	9.1	1.0	92.51	971.40	50	1.0	235.7	600.3	14.0	27.2	0	10.17	14.95	15.95	130.1	1592.8	3164.5	135.5	1707.2	**1265.81**	**569.05**
14.00	15.50	14.75	1.50	13.0	20.17	10.17	137.77	4.71	27.2	27.2	1.0	333.78	1305.18	0	1.0	0.0	600.3	15.5	9.0	51	10.32	2.29	1.07	130.1	599.1	2504.6	153.2	2058.6	**1001.84**	**686.21**
15.50	17.00	16.25	1.50	14.5	20.32	10.32	137.77	4.71	9.0	9.0	1.0	102.87	1408.05	51	1.0	240.4	840.7	17.0	10.4	54	10.32	2.59	1.33	130.1	651.9	2900.6	170.8	2419.6	**1160.25**	**806.53**
17.00	18.50	17.75	1.50	16.0	20.32	10.32	137.77	4.71	10.4	10.4	1.0	119.20	1527.25	54	1.0	254.6	1095.3	18.5	10.4	54	10.19	2.59	1.33	130.1	651.8	3274.3	188.5	2811.0	**1309.73**	**937.01**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
18.50	21.50	20.00	3.00	19.0	20.19	10.19	137.77	9.43	10.4	10.4	1.0	238.40	1765.65	54	1.0	509.1	1604.4	21.5	10.6	53	10.49	2.65	1.39	130.1	651.1	4021.2	223.8	3593.9	**1608.48**	**1197.97**
21.50	24.50	23.00	3.00	22.0	20.49	10.49	137.77	9.43	10.6	10.6	1.0	243.09	2008.74	53	1.0	499.7	2104.1	24.5	9.4	63	10.49	2.36	1.13	130.1	691.7	4804.6	259.2	4372.1	**1921.82**	**1457.36**
24.50	26.00	25.25	1.50	23.5	20.49	10.49	137.77	4.71	9.4	9.4	1.0	107.52	2116.26	63	1.0	297.0	2401.1	26.0	17.6	20	10.49	5.22	4.07	130.1	691.9	5209.3	276.9	4794.3	**2083.72**	**1598.09**
26.00	27.50	26.75	1.50	25.0	20.49	10.49	137.77	4.71	17.6	17.6	1.0	206.03	2322.29	20	1.0	94.3	2495.4	27.5	17.6	20	10.16	5.22	4.07	130.1	691.4	5509.1	294.5	5112.2	**2203.64**	**1704.08**
27.50	29.00	28.25	1.50	26.5	20.16	10.16	137.77	4.71	17.6	17.6	1.0	206.03	2528.32	20	1.0	94.3	2589.7	29.0	11.6	57	10.16	2.94	1.68	130.1	710.4	5828.5	312.2	5430.2	**2331.38**	**1810.08**
29.00	30.00	29.50	1.00	27.5	20.16	10.16	137.77	3.14	11.6	11.6	1.0	88.88	2617.19	57	1.0	179.1	2768.9	30.0	12.0	50	10.16	3.06	1.79	130.1	673.4	6059.5	324.0	5710.0	**2423.79**	**1903.34**
30.00	30.50	30.25	0.50	28.0	20.16	10.16	137.77	1.57	12.0	12.0	1.0	46.02	2663.21	50	1.0	78.6	2847.4	30.5	31.6	0	10.16	29.32	30.60	130.1	3120.1	8630.8	329.9	5840.5	**3452.31**	**1946.84**
30.50	32.50	31.50	2.00	30.0	20.16	10.16	137.77	6.29	31.6	31.6	1.1	575.37	3238.58	0	1.0	0.0	2847.4	32.5	30.9	0	10.86	25.79	27.01	130.1	2752.7	8838.7	353.4	6439.4	**3535.47**	**2146.48**
32.50	33.50	33.00	1.00	31.0	20.86	10.86	137.77	3.14	30.9	30.9	1.0	270.80	3509.37	0	1.0	0.0	2847.4	33.5	30.9	0	10.86	25.79	27.01	130.1	2752.7	9109.5	365.2	6722.0	**3643.79**	**2240.67**
33.50	35.00	34.25	1.50	32.5	20.86	10.86	137.77	4.71	30.9	30.9	1.0	406.19	3915.57	0	1.0	0.0	2847.4	35.0	30.6	0	10.76	24.28	25.48	130.1	2590.6	9353.6	382.9	7145.9	**3741.44**	**2381.96**
35.00	36.50	35.75	1.50	34.0	20.76	10.76	137.77	4.71	30.6	30.6	1.0	395.62	4311.19	0	1.0	0.0	2847.4	36.5	30.6	0	10.76	24.28	25.48	130.1	2590.6	9749.2	400.6	7559.2	**3899.68**	**2519.72**
36.50	37.50	37.00	1.00	35.0	20.76	10.76	137.77	3.14	30.6	30.6	1.0	263.75	4574.94	0	1.0	0.0	2847.4	37.5	30.1	0	10.76	21.76	22.91	130.1	2322.2	9744.6	412.3	7834.7	**3897.83**	**2611.57**
37.50	38.00	37.75	0.50	35.5	20.76	10.76	137.77	1.57	30.1	30.1	1.0	126.12	4701.06	0	1.0	0.0	2847.4	38.0	30.1	0	9.83	21.76	22.91	130.1	2313.8	9862.3	418.2	7966.7	**3944.93**	**2655.57**
38.00	40.00	39.00	2.00	37.5	19.83	9.83	137.77	6.29	30.1	30.1	1.0	504.49	5205.55	0	1.0	0.0	2847.4	40.0	30.1	0	9.83	21.76	22.91	130.1	2313.8	10366.8	441.8	8494.8	**4146.73**	**2831.59**
BORE NO: P48, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	20.10	10.10	27.78	1.57	27.6	27.6	1.0	22.82	0	3	1.0	4.7	0	3.0	7.2	43	10.10	1.97	0.79	30.3	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.5	20.10	10.10	35.35	3.14	7.2	7.2	1.0	14.04	0	43	1.0	135.1	0	4.0	25.9	0	10.00	12.03	12.95	40.4	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	6.00	5.00	2.00	3.5	20.00	10.00	50.40	6.29	25.9	25.9	1.0	153.83	0	0	1.0	0.0	0	6.0	25.9	0	10.00	12.03	12.95	60.4	0	0.0	41.2	41.2	**0.00**	**13.74**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
6.00	7.00	6.50	1.00	4.5	20.00	10.00	65.40	3.14	25.9	25.9	1.0	99.81	0	0	1.0	0.0	0	7.0	24.9	0	10.00	9.93	10.77	70.4	0	0.0	53.0	53.0	**0.00**	**17.67**
7.00	9.00	8.00	2.00	6.5	20.00	10.00	80.40	6.29	24.9	24.9	1.0	234.59	0	0	1.0	0.0	0	9.0	14.3	20	10.21	3.74	2.45	90.4	0	0.0	76.6	76.6	**0.00**	**25.53**
9.00	10.00	9.50	1.00	7.5	20.21	10.21	95.51	3.14	14.3	14.3	1.0	76.51	0	20	1.0	62.9	0	10.0	11.0	55	10.21	2.76	1.51	100.6	613.5	613.5	88.4	88.4	**245.39**	**29.45**
10.00	12.50	11.25	2.50	10.0	20.21	10.21	113.37	7.86	11.0	11.0	1.0	173.15	173.15	55	1.0	432.1	432.1	12.5	9.8	55	10.21	2.43	1.19	126.1	634.9	1240.2	117.8	723.1	**496.09**	**241.03**
12.50	14.00	13.25	1.50	11.5	20.21	10.21	133.79	4.71	9.8	9.8	1.0	108.95	282.10	55	1.0	259.3	691.4	14.0	11.2	71	10.64	2.82	1.56	141.5	822.3	1795.9	135.5	1109.0	**718.34**	**369.67**
14.00	15.50	14.75	1.50	13.0	20.64	10.64	149.43	4.71	11.2	11.2	1.0	139.49	421.58	71	1.0	334.7	1026.1	15.5	11.2	71	10.64	2.82	1.56	141.5	822.3	2270.1	153.2	1600.9	**908.02**	**533.63**
15.50	17.00	16.25	1.50	14.5	20.64	10.64	149.43	4.71	11.2	11.2	1.0	139.49	561.07	71	1.0	334.7	1360.9	17.0	10.6	57	10.22	2.65	1.39	141.5	702.8	2624.7	170.8	2092.8	**1049.88**	**697.58**
17.00	18.50	17.75	1.50	16.0	20.22	10.22	149.43	4.71	10.6	10.6	1.0	131.84	692.91	57	1.0	268.7	1629.6	18.5	11.2	53	10.74	2.82	1.56	141.5	695.1	3017.6	188.5	2511.0	**1207.03**	**836.99**
18.50	21.50	20.00	3.00	19.0	20.74	10.74	149.43	9.43	11.2	11.2	1.0	278.97	971.88	53	1.0	499.7	2129.3	21.5	12.5	48	10.74	3.20	1.94	141.5	703.7	3804.8	223.8	3325.0	**1521.94**	**1108.33**
21.50	23.00	22.25	1.50	20.5	20.74	10.74	149.43	4.71	12.5	12.5	1.0	156.17	1128.05	48	1.0	226.3	2355.6	23.0	29.0	0	10.74	19.01	20.10	141.5	2197.3	5680.9	241.5	3725.1	**2272.36**	**1241.71**
23.00	24.50	23.75	1.50	22.0	20.74	10.74	149.43	4.71	29.0	29.0	1.0	390.49	1518.54	0	1.0	0.0	2355.6	24.5	28.3	0	10.41	17.43	18.48	141.5	2012.9	5887.0	259.2	4133.3	**2354.80**	**1377.76**
24.50	26.00	25.25	1.50	23.5	20.41	10.41	149.43	4.71	28.3	28.3	1.0	379.31	1897.85	0	1.0	0.0	2355.6	26.0	27.1	2	10.41	14.73	15.72	141.5	1715.4	5968.8	276.9	4530.3	**2387.53**	**1510.09**
26.00	27.50	26.75	1.50	25.0	20.41	10.41	149.43	4.71	27.1	27.1	1.0	360.49	2258.34	2	1.0	9.4	2365.0	27.5	9.0	70	10.41	2.29	1.07	141.5	753.9	5377.2	294.5	4917.9	**2150.88**	**1639.29**
27.50	29.00	28.25	1.50	26.5	20.41	10.41	149.43	4.71	9.0	9.0	1.0	111.57	2369.91	70	1.0	330.0	2695.0	29.0	9.0	40	10.41	2.29	1.07	141.5	541.7	5606.6	312.2	5377.1	**2242.65**	**1792.37**
29.00	30.00	29.50	1.00	27.5	20.41	10.41	149.43	3.14	9.0	9.0	1.0	74.38	2444.29	40	1.0	125.7	2820.7	30.0	9.0	40	10.20	2.29	1.07	141.5	541.6	5806.6	324.0	5589.0	**2322.66**	**1862.99**
30.00	30.50	30.25	0.50	28.0	20.20	10.20	149.43	1.57	9.0	9.0	1.0	37.19	2481.49	40	1.0	62.9	2883.6	30.5	25.2	0	10.20	10.45	11.34	141.5	1206.9	6571.9	329.9	5694.9	**2628.78**	**1898.31**
30.50	32.50	31.50	2.00	30.0	20.20	10.20	149.43	6.29	25.2	25.2	1.0	441.99	2923.47	0	1.0	0.0	2883.6	32.5	26.0	0	10.20	12.25	13.18	141.5	1414.5	7221.5	353.4	6160.5	**2888.62**	**2053.49**
32.50	33.50	33.00	1.00	31.0	20.20	10.20	149.43	3.14	27.6	27.6	1.0	245.52	3168.99	0	1.0	0.0	2883.6	33.5	18.0	28	10.20	5.42	4.29	141.5	817.1	6869.7	365.2	6417.8	**2747.88**	**2139.26**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
33.50	35.00	34.25	1.50	32.5	20.20	10.20	149.43	4.71	18.0	18.0	1.0	228.89	3397.89	28	1.0	132.0	3015.6	35.0	18.0	28	10.20	5.42	4.29	141.5	817.1	7230.6	382.9	6796.3	**2892.24**	**2265.45**
35.00	36.50	35.75	1.50	34.0	20.20	10.20	149.43	4.71	18.0	18.0	1.0	228.89	3626.78	28	1.0	132.0	3147.6	36.5	18.0	30	8.98	5.42	4.29	141.5	829.2	7603.6	400.6	7174.9	**3041.43**	**2391.63**
36.50	37.50	37.00	1.00	35.0	18.98	8.98	149.43	3.14	18.0	18.0	1.0	152.59	3779.37	30	1.0	94.3	3241.9	37.5	13.5	48	8.98	3.50	2.22	141.5	736.3	7757.5	412.3	7433.6	**3102.99**	**2477.85**
37.50	40.00	38.75	2.50	37.5	18.98	8.98	149.43	7.86	13.5	13.5	1.0	281.87	4061.25	48	1.0	377.1	3619.0	40.0	13.5	48	8.98	3.50	2.22	141.5	736.3	8416.5	441.8	8122.0	**3366.60**	**2707.34**
BORE NO: P49, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	19.98	9.98	27.45	1.57	14.1	14.1	1.0	10.83	0	31	1.0	48.7	0	3.0	26.1	0	9.98	12.48	13.41	29.9	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.5	19.98	9.98	34.93	3.14	26.1	26.1	1.0	53.78	0	0	1.0	0.0	0	4.0	24.5	0	9.98	9.64	10.33	39.9	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	6.00	5.00	2.00	3.5	19.98	9.98	49.90	6.29	24.5	24.5	1.0	142.94	0	0	1.0	0.0	0	6.0	28.3	0	9.98	17.43	18.48	59.9	0	0.0	41.2	41.2	**0.00**	**13.74**
6.00	7.00	6.50	1.00	4.5	19.98	9.98	64.87	3.14	28.3	28.3	1.0	109.78	0	0	1.0	0.0	0	7.0	28.3	0	9.98	17.43	18.48	69.9	0	0.0	53.0	53.0	**0.00**	**17.67**
7.00	8.00	7.50	1.00	5.5	19.98	9.98	74.85	3.14	28.3	28.3	1.0	126.67	0	0	1.0	0.0	0	8.0	24.7	7	9.19	9.78	10.55	79.8	0	0.0	64.8	64.8	**0.00**	**21.60**
8.00	9.00	8.50	1.00	6.5	19.19	9.19	84.44	3.14	24.7	24.7	1.0	122.06	0	7	1.0	22.0	0	9.0	24.7	7	9.19	9.78	10.55	89.0	0	0.0	76.6	76.6	**0.00**	**25.53**
9.00	10.00	9.50	1.00	7.5	19.19	9.19	93.63	3.14	24.7	24.7	1.0	135.34	0	7	1.0	22.0	0	10.0	8.2	48	10.48	2.15	0.94	98.2	508.9	508.9	88.4	88.4	**203.57**	**29.45**
10.00	12.50	11.25	2.50	10.0	20.48	10.48	111.32	7.86	8.2	8.2	1.0	126.04	126.04	48	1.0	377.1	377.1	12.5	9.1	61	10.32	2.31	1.08	124.4	661.4	1164.6	117.8	621.0	**465.82**	**207.00**
12.50	15.50	14.00	3.00	13.0	20.32	10.32	139.90	9.43	9.1	9.1	1.0	211.28	337.32	61	1.0	575.1	952.3	15.5	8.7	56	10.05	2.24	1.02	124.4	618.6	1908.2	153.2	1442.8	**763.29**	**480.92**
15.50	18.50	17.00	3.00	16.0	20.05	10.05	139.90	9.43	8.7	8.7	1.0	201.84	539.16	56	1.0	528.0	1480.3	18.5	18.8	40	10.05	5.78	4.73	124.4	866.4	2885.8	188.5	2207.9	**1154.32**	**735.98**
18.50	20.00	19.25	1.50	17.5	20.05	10.05	139.90	4.71	18.8	18.8	1.0	224.52	763.68	40	1.0	188.6	1668.9	20.0	9.8	52	9.64	2.43	1.19	124.4	610.2	3042.7	206.2	2638.7	**1217.08**	**879.57**
20.00	21.50	20.75	1.50	19.0	19.64	9.64	139.90	4.71	9.8	9.8	1.0	113.92	877.61	52	1.0	245.1	1914.0	21.5	9.5	52	10.56	2.38	1.14	124.4	605.1	3396.7	223.8	3015.4	**1358.69**	**1005.15**
21.50	24.50	23.00	3.00	22.0	20.56	10.56	139.90	9.43	9.5	9.5	1.0	220.73	1098.34	52	1.0	490.3	2404.3	24.5	10.4	58	10.56	2.59	1.33	124.4	668.6	4171.3	259.2	3761.8	**1668.51**	**1253.94**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
24.50	27.50	26.00	3.00	25.0	20.56	10.56	139.90	9.43	10.4	10.4	1.0	242.09	1340.43	58	1.0	546.9	2951.1	27.5	27.9	0	9.98	16.53	17.56	124.4	1684.9	5976.4	294.5	4586.1	**2390.57**	**1528.70**
27.50	29.00	28.25	1.50	26.5	19.98	9.98	139.90	4.71	27.9	27.9	1.0	349.20	1689.63	0	1.0	0.0	2951.1	29.0	26.5	13	9.98	13.38	14.34	124.4	1455.9	6096.7	312.2	4953.0	**2438.69**	**1650.99**
29.00	30.00	29.50	1.00	27.5	19.98	9.98	139.90	3.14	26.5	26.5	1.0	219.22	1908.85	13	1.0	40.9	2992.0	30.0	27.3	0	9.98	15.18	16.18	124.4	1547.3	6448.2	324.0	5224.8	**2579.28**	**1741.61**
30.00	30.50	30.25	0.50	28.0	19.98	9.98	139.90	1.57	27.3	27.3	1.0	113.47	2022.32	0	1.0	0.0	2992.0	30.5	27.3	0	9.98	15.18	16.18	124.4	1547.3	6561.7	329.9	5344.2	**2624.67**	**1781.40**
30.50	32.00	31.25	1.50	29.5	19.98	9.98	139.90	4.71	27.3	27.3	1.0	340.41	2362.73	0	1.0	0.0	2992.0	32.0	11.5	49	9.57	2.91	1.65	124.4	637.3	5992.0	347.5	5702.3	**2396.80**	**1900.76**
32.00	32.50	32.25	0.50	30.0	19.57	9.57	139.90	1.57	11.5	11.5	1.0	44.73	2407.46	49	1.0	77.0	3069.0	32.5	11.5	49	9.57	2.91	1.65	124.4	637.3	6113.7	353.4	5829.9	**2445.49**	**1943.30**
32.50	33.50	33.00	1.00	31.0	19.57	9.57	139.90	3.14	11.5	11.5	1.0	89.46	2496.91	49	1.0	154.0	3223.0	33.5	11.5	49	9.57	2.91	1.65	124.4	637.3	6357.2	365.2	6085.1	**2542.88**	**2028.37**
33.50	35.00	34.25	1.50	32.5	19.57	9.57	139.90	4.71	11.5	11.5	1.0	134.18	2631.10	49	1.0	231.0	3454.0	35.0	11.5	49	9.57	2.91	1.65	124.4	637.3	6722.4	382.9	6468.0	**2688.95**	**2155.99**
35.00	36.50	35.75	1.50	34.0	19.57	9.57	139.90	4.71	11.5	11.5	1.0	134.18	2765.28	49	1.0	231.0	3685.0	36.5	15.8	38	10.24	4.33	3.09	124.4	704.8	7155.1	400.6	6850.8	**2862.03**	**2283.61**
36.50	37.50	37.00	1.00	35.0	20.24	10.24	139.90	3.14	15.8	15.8	1.0	124.42	2889.70	38	1.0	119.4	3804.4	37.5	15.8	38	10.24	4.33	3.09	124.4	704.8	7398.9	412.3	7106.5	**2959.56**	**2368.82**
37.50	38.00	37.75	0.50	35.5	20.24	10.24	139.90	1.57	15.8	15.8	1.0	62.21	2951.91	38	1.0	59.7	3864.1	38.0	28.0	0	10.24	16.76	17.79	124.4	1709.6	8525.6	418.2	7234.3	**3410.26**	**2411.42**
38.00	40.00	39.00	2.00	37.5	20.24	10.24	139.90	6.29	28.0	28.0	1.0	467.57	3419.48	0	1.0	0.0	3864.1	40.0	28.0	0	10.24	16.76	17.79	124.4	1709.6	8993.2	441.8	7725.4	**3597.28**	**2575.14**
BORE NO: P50, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	20.30	10.30	28.33	1.57	24.5	24.5	1.0	20.28	0	8	1.0	12.6	0	3.0	24.5	8	10.30	9.64	10.33	30.9	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.5	20.30	10.30	36.05	3.14	24.5	24.5	1.0	51.63	0	8	1.0	25.1	0	4.0	27.6	0	9.23	15.85	16.87	41.2	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	5.00	4.50	1.00	2.5	19.23	9.23	45.82	3.14	27.6	27.6	1.0	75.28	0	0	1.0	0.0	0	5.0	27.6	0	9.23	15.85	16.87	50.4	689.4	689.4	29.5	29.5	**275.76**	**9.82**
5.00	6.00	5.50	1.00	3.5	19.23	9.23	55.05	3.14	27.6	27.6	1.0	90.44	90.44	0	1.0	0.0	0.0	6.0	28.7	0	9.23	18.33	19.40	59.7	929.7	1020.1	41.2	131.7	**408.05**	**43.89**
6.00	8.00	7.00	2.00	5.5	19.23	9.23	68.89	6.29	28.7	28.7	1.0	237.07	327.51	0	1.0	0.0	0.0	8.0	29.6	0	10.30	20.36	21.48	78.1	1336.5	1664.0	64.8	392.3	**665.62**	**130.77**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
8.00	9.00	8.50	1.00	6.5	20.30	10.30	83.27	3.14	29.6	29.6	1.0	148.67	476.18	0	1.0	0.0	0.0	9.0	29.6	0	10.30	20.36	21.48	88.4	1501.3	1977.5	76.6	552.8	**790.99**	**184.25**
9.00	10.00	9.50	1.00	7.5	20.30	10.30	93.57	3.14	29.6	29.6	1.0	167.06	643.24	0	1.0	0.0	0.0	10.0	8.5	54	10.30	2.20	0.99	98.7	556.5	1199.7	88.4	731.6	**479.90**	**243.87**
10.00	11.00	10.50	1.00	8.5	20.30	10.30	103.87	3.14	8.5	8.5	1.0	48.79	692.03	54	1.0	169.7	169.7	11.0	8.5	54	10.30	2.20	0.99	109.0	574.3	1436.1	100.1	961.9	**574.42**	**320.63**
11.00	12.00	11.50	1.00	9.5	20.30	10.30	114.17	3.14	8.5	8.5	1.0	53.63	745.66	54	1.0	169.7	339.4	12.0	29.1	0	10.30	19.23	20.33	119.3	1885.4	2970.4	111.9	1197.0	**1188.18**	**399.00**
12.00	13.00	12.50	1.00	10.5	20.30	10.30	124.47	3.14	29.1	29.1	1.0	217.73	963.39	0	1.0	0.0	339.4	13.0	8.3	58	10.30	2.16	0.96	129.6	634.4	1937.2	123.7	1426.5	**774.89**	**475.51**
13.00	14.50	13.75	1.50	12.0	20.30	10.30	137.35	4.71	8.3	8.3	1.0	94.46	1057.85	58	1.0	273.4	612.9	14.5	8.6	57	10.15	2.22	1.00	145.1	659.9	2330.6	141.4	1812.1	**932.24**	**604.03**
14.50	17.50	16.00	3.00	15.0	20.15	10.15	137.35	9.43	8.6	8.6	1.0	195.85	1253.69	57	1.0	537.4	1150.3	17.5	8.6	57	10.15	2.22	1.00	145.1	659.9	3063.9	176.7	2580.7	**1225.55**	**860.23**
17.50	19.00	18.25	1.50	16.5	20.15	10.15	137.35	4.71	8.6	8.6	1.0	97.92	1351.62	57	1.0	268.7	1419.0	19.0	27.2	7	9.78	14.95	15.95	145.1	1815.3	4585.9	194.4	2965.0	**1834.37**	**988.33**
19.00	20.50	19.75	1.50	18.0	19.78	9.78	137.35	4.71	27.2	27.2	1.0	332.76	1684.38	7	1.0	33.0	1452.0	20.5	12.3	58	9.78	3.15	1.88	145.1	775.9	3912.3	212.1	3348.4	**1564.91**	**1116.15**
20.50	23.50	22.00	3.00	21.0	19.78	9.78	137.35	9.43	12.3	12.3	1.0	282.35	1966.73	58	1.0	546.9	1998.9	23.5	12.3	58	10.91	3.15	1.88	145.1	776.7	4742.3	247.4	4213.0	**1896.93**	**1404.33**
23.50	25.00	24.25	1.50	22.5	20.91	10.91	137.35	4.71	12.3	12.3	1.0	141.17	2107.90	58	1.0	273.4	2272.3	25.0	14.3	42	10.91	3.74	2.45	145.1	733.5	5113.6	265.1	4645.3	**2045.46**	**1548.42**
25.00	26.50	25.75	1.50	24.0	20.91	10.91	137.35	4.71	14.3	14.3	1.0	165.04	2272.94	42	1.0	198.0	2470.3	26.5	10.5	58	10.91	2.62	1.36	145.1	714.3	5457.5	282.7	5026.0	**2183.00**	**1675.32**
26.50	27.50	27.00	1.00	25.0	20.91	10.91	137.35	3.14	10.5	10.5	1.0	80.00	2352.95	58	1.0	182.3	2652.6	27.5	10.5	58	10.91	2.62	1.36	145.1	714.3	5719.8	294.5	5300.0	**2287.92**	**1766.68**
27.50	29.50	28.50	2.00	27.0	20.91	10.91	137.35	6.29	10.5	10.5	1.0	160.01	2512.95	58	1.0	364.6	3017.1	29.5	7.5	61	10.56	2.02	0.84	145.1	665.1	6195.2	318.1	5848.2	**2478.06**	**1949.39**
29.50	30.00	29.75	0.50	27.5	20.56	10.56	137.35	1.57	7.5	7.5	1.0	28.41	2541.37	61	1.0	95.9	3113.0	30.0	7.5	61	10.56	2.02	0.84	145.1	665.1	6319.4	324.0	5978.3	**2527.77**	**1992.78**
30.00	32.50	31.25	2.50	30.0	20.56	10.56	137.35	7.86	7.5	7.5	1.0	142.07	2683.44	61	1.0	479.3	3592.3	32.5	8.6	60	10.56	2.22	1.00	145.1	681.3	6957.0	353.4	6629.2	**2782.80**	**2209.72**
32.50	35.00	33.75	2.50	32.5	20.56	10.56	137.35	7.86	8.6	8.6	1.0	163.20	2846.64	60	1.0	471.4	4063.7	35.0	19.6	30	10.60	6.19	5.17	145.1	938.9	7849.3	382.9	7293.2	**3139.71**	**2431.08**
35.00	35.50	35.25	0.50	33.0	20.60	10.60	137.35	1.57	19.6	19.6	1.0	76.85	2923.49	30	1.0	47.1	4110.9	35.5	26.4	0	10.60	13.15	14.11	145.1	1557.9	8592.3	388.8	7423.1	**3436.91**	**2474.37**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
35.50	37.50	36.50	2.00	35.0	20.60	10.60	137.35	6.29	26.4	26.4	1.0	428.55	3352.05	0	1.0	0.0	4110.9	37.5	28.5	0	10.60	17.88	18.94	145.1	2117.1	9580.0	412.3	7875.2	**3832.00**	**2625.08**
37.50	38.50	38.00	1.00	36.0	20.60	10.60	137.35	3.14	28.5	28.5	1.0	234.37	3586.42	0	1.0	0.0	4110.9	38.5	28.0	0	10.60	16.76	17.79	145.1	1984.0	9681.2	424.1	8121.4	**3872.50**	**2707.13**
38.50	40.00	39.25	1.50	37.5	20.60	10.60	137.35	4.71	28.0	28.0	1.0	344.27	3930.69	0	1.0	0.0	4110.9	40.0	28.0	0	10.60	16.76	17.79	145.1	1984.0	10025.5	441.8	8483.3	**4010.21**	**2827.78**
BORE NO: P51, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	19.69	9.69	26.65	1.57	23.9	23.9	1.0	18.56	0	0	1.0	0.0	0	3.0	26.4	0	9.69	13.15	14.11	29.1	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	5.00	4.00	2.00	2.5	19.69	9.69	38.76	6.29	26.4	26.4	1.0	120.94	0	0	1.0	0.0	0	5.0	26.4	0	9.69	13.15	14.11	48.5	554.4	554.4	29.5	29.5	**221.76**	**9.82**
5.00	6.00	5.50	1.00	3.5	19.69	9.69	53.30	3.14	26.4	26.4	1.0	83.15	83.15	0	1.0	0.0	0.0	6.0	30.3	0	9.69	22.77	23.94	58.1	1131.3	1214.5	41.2	124.4	**485.79**	**41.46**
6.00	8.00	7.00	2.00	5.5	19.69	9.69	67.83	6.29	30.3	30.3	1.0	252.88	336.03	0	1.0	0.0	0.0	8.0	28.5	0	10.66	17.88	18.94	77.5	1168.5	1504.5	64.8	400.8	**601.80**	**133.61**
8.00	9.00	8.50	1.00	6.5	20.66	10.66	82.85	3.14	28.5	28.5	1.0	141.38	477.41	0	1.0	0.0	0.0	9.0	28.5	0	10.66	17.88	18.94	88.2	1318.3	1795.7	76.6	554.0	**718.26**	**184.66**
9.00	11.00	10.00	2.00	8.5	20.66	10.66	98.84	6.29	28.5	28.5	1.0	337.33	814.73	0	1.0	0.0	0.0	11.0	10.4	40	10.66	2.59	1.33	109.5	511.1	1325.8	100.1	914.9	**530.32**	**304.96**
11.00	12.00	11.50	1.00	9.5	20.66	10.66	114.83	3.14	10.4	10.4	1.0	66.24	880.97	40	1.0	125.7	125.7	12.0	10.4	40	10.66	2.59	1.33	120.2	532.7	1539.4	111.9	1118.6	**615.77**	**372.87**
12.00	13.00	12.50	1.00	10.5	20.66	10.66	125.49	3.14	10.4	10.4	1.0	72.39	953.36	40	1.0	125.7	251.4	13.0	9.5	53	10.49	2.38	1.14	130.8	624.1	1828.9	123.7	1328.5	**731.57**	**442.83**
13.00	14.50	13.75	1.50	12.0	20.49	10.49	138.69	4.71	9.5	9.5	1.0	109.41	1062.77	53	1.0	249.9	501.3	14.5	10.4	58	10.60	2.59	1.33	146.6	713.7	2277.7	141.4	1705.4	**911.09**	**568.47**
14.50	17.50	16.00	3.00	15.0	20.60	10.60	138.69	9.43	10.4	10.4	1.0	239.99	1302.76	58	1.0	546.9	1048.1	17.5	10.4	58	10.60	2.59	1.33	146.6	713.7	3064.6	176.7	2527.6	**1225.83**	**842.54**
17.50	19.00	18.25	1.50	16.5	20.60	10.60	138.69	4.71	10.4	10.4	1.0	120.00	1422.76	58	1.0	273.4	1321.6	19.0	27.4	0	8.71	15.40	16.41	146.6	1830.0	4574.3	194.4	2938.7	**1829.73**	**979.57**
19.00	20.50	19.75	1.50	18.0	18.71	8.71	138.69	4.71	27.4	27.4	1.0	338.90	1761.66	0	1.0	0.0	1321.6	20.5	26.1	0	8.25	12.48	13.41	146.6	1480.2	4563.5	212.1	3295.3	**1825.38**	**1098.43**
20.50	23.50	22.00	3.00	21.0	18.25	8.25	138.69	9.43	26.1	26.1	1.0	640.60	2402.26	0	1.0	0.0	1321.6	23.5	26.0	0	8.25	12.25	13.18	146.6	1453.5	5177.4	247.4	3971.2	**2070.95**	**1323.74**
23.50	26.50	25.00	3.00	24.0	18.25	8.25	138.69	9.43	26.0	26.0	1.0	637.77	3040.03	0	1.0	0.0	1321.6	26.5	26.7	0	8.37	13.83	14.80	146.6	1641.0	6002.6	282.7	4644.3	**2401.03**	**1548.12**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
26.50	27.50	27.00	1.00	25.0	18.37	8.37	138.69	3.14	26.7	26.7	1.0	219.22	3259.25	0	1.0	0.0	1321.6	27.5	26.7	0	8.37	13.83	14.80	146.6	1641.0	6221.8	294.5	4875.4	**2488.72**	**1625.12**
27.50	29.50	28.50	2.00	27.0	18.37	8.37	138.69	6.29	26.7	26.7	1.0	438.44	3697.70	0	1.0	0.0	1321.6	29.5	27.5	0	8.37	15.63	16.64	146.6	1854.5	6873.8	318.1	5337.4	**2749.50**	**1779.12**
29.50	30.00	29.75	0.50	27.5	18.37	8.37	138.69	1.57	27.5	27.5	1.0	113.45	3811.15	0	1.0	0.0	1321.6	30.0	27.8	0	8.37	16.31	17.33	146.6	1934.6	7067.3	324.0	5456.7	**2826.91**	**1818.90**
30.00	32.50	31.25	2.50	30.0	18.37	8.37	138.69	7.86	27.8	27.8	1.0	574.53	4385.68	0	1.0	0.0	1321.6	32.5	27.8	0	9.29	16.31	17.33	146.6	1940.8	7648.1	353.4	6060.7	**3059.23**	**2020.23**
32.50	35.00	33.75	2.50	32.5	19.29	9.29	138.69	7.86	27.8	27.8	1.0	574.53	4960.20	0	1.0	0.0	1321.6	35.0	29.3	0	9.29	19.68	20.79	146.6	2342.4	8624.2	382.9	6664.7	**3449.67**	**2221.55**
35.00	35.50	35.25	0.50	33.0	19.29	9.29	138.69	1.57	29.3	29.3	1.0	122.30	5082.51	0	1.0	0.0	1321.6	35.5	29.3	0	9.29	19.68	20.79	146.6	2342.4	8746.5	388.8	6792.8	**3498.59**	**2264.28**
35.50	37.50	36.50	2.00	35.0	19.29	9.29	138.69	6.29	29.3	29.3	1.0	489.20	5571.71	0	1.0	0.0	1321.6	37.5	29.3	0	8.91	19.68	20.79	146.6	2339.3	9232.6	412.3	7305.6	**3693.03**	**2435.20**
37.50	38.50	38.00	1.00	36.0	18.91	8.91	138.69	3.14	29.3	29.3	1.0	244.60	5816.31	0	1.0	0.0	1321.6	38.5	29.0	0	8.91	19.01	20.10	146.6	2259.1	9397.0	424.1	7562.0	**3758.78**	**2520.67**
38.50	40.00	39.25	1.50	37.5	18.91	8.91	138.69	4.71	29.0	29.0	1.0	362.41	6178.72	0	1.0	0.0	1321.6	40.0	29.0	0	8.91	19.01	20.10	146.6	2259.1	9759.4	441.8	7942.1	**3903.75**	**2647.36**
BORE NO: P52, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	19.45	9.45	25.99	1.57	28.6	28.6	1.0	22.27	0	0	1.0	0.0	0	3.0	28.6	0	9.44	18.11	19.17	28.4	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	5.00	4.00	2.00	2.5	19.44	9.44	37.79	6.29	28.6	28.6	1.0	129.51	0	0	1.0	0.0	0	5.0	27.9	0	9.44	16.53	17.56	47.2	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.5	19.44	9.44	51.95	3.14	27.9	27.9	1.0	86.45	0	0	1.0	0.0	0	6.0	27.9	0	9.55	16.53	17.56	56.7	0	0.0	41.2	41.2	**0.00**	**13.74**
6.00	8.00	7.00	2.00	5.5	19.55	9.55	66.22	6.29	27.9	27.9	1.0	220.39	0	0	1.0	0.0	0	8.0	27.9	0	9.55	16.53	17.56	75.8	0	0.0	64.8	64.8	**0.00**	**21.60**
8.00	9.00	8.50	1.00	6.5	19.55	9.55	80.55	3.14	27.9	27.9	1.0	134.03	0	0	1.0	0.0	0	9.0	26.2	6	9.84	12.70	13.64	85.3	0	0.0	76.6	76.6	**0.00**	**25.53**
9.00	11.00	10.00	2.00	8.5	19.84	9.84	95.16	6.29	26.2	26.2	1.0	294.33	0	6	1.0	37.7	0	11.0	24.0	0	9.84	9.28	9.78	105.0	0	0.0	100.1	100.1	**0.00**	**33.38**
11.00	12.00	11.50	1.00	9.5	19.84	9.84	109.92	3.14	24.0	24.0	1.0	153.81	0	0	1.0	0.0	0	12.0	13.5	21	9.84	3.50	2.22	114.8	472.9	472.9	111.9	111.9	**189.16**	**37.31**
12.00	13.00	12.50	1.00	10.5	19.84	9.84	119.76	3.14	13.5	13.5	1.0	90.36	90.36	21	1.0	66.0	66.0	13.0	10.4	46	10.14	2.59	1.33	124.7	584.1	740.5	123.7	280.1	**296.18**	**93.35**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
13.00	14.50	13.75	1.50	12.0	20.14	10.14	132.29	4.71	10.4	10.4	1.0	114.46	204.82	46	1.0	216.9	282.9	14.5	10.4	46	10.14	2.59	1.33	139.9	615.0	1102.7	141.4	629.0	**441.08**	**209.68**
14.50	16.00	15.25	1.50	13.5	20.14	10.14	132.29	4.71	10.4	10.4	1.0	114.46	319.28	46	1.0	216.9	499.7	16.0	12.2	44	10.24	3.12	1.85	139.9	661.1	1480.1	159.0	978.0	**592.04**	**326.01**
16.00	17.50	16.75	1.50	15.0	20.24	10.24	132.29	4.71	12.2	12.2	1.0	134.83	454.11	44	1.0	207.4	707.1	17.5	12.2	44	10.24	3.12	1.85	139.9	661.1	1822.4	176.7	1338.0	**728.95**	**445.99**
17.50	19.00	18.25	1.50	16.5	20.24	10.24	132.29	4.71	12.2	12.2	1.0	134.83	588.94	44	1.0	207.4	914.6	19.0	25.4	5	9.38	10.90	11.80	139.9	1277.0	2780.5	194.4	1697.9	**1112.20**	**565.97**
19.00	20.50	19.75	1.50	18.0	19.38	9.38	132.29	4.71	25.4	25.4	1.0	296.12	885.07	5	1.0	23.6	938.1	20.5	25.4	5	9.38	10.90	11.80	139.9	1277.0	3100.2	212.1	2035.3	**1240.08**	**678.42**
20.50	22.00	21.25	1.50	19.5	19.38	9.38	132.29	4.71	25.4	25.4	1.0	296.12	1181.19	5	1.0	23.6	961.7	22.0	28.3	0	9.64	17.43	18.48	139.9	1985.9	4128.8	229.7	2372.6	**1651.53**	**790.88**
22.00	23.50	22.75	1.50	21.0	19.64	9.64	132.29	4.71	28.3	28.3	1.0	335.79	1516.98	0	1.0	0.0	961.7	23.5	28.3	0	9.64	17.43	18.48	139.9	1985.9	4464.6	247.4	2726.1	**1785.85**	**908.70**
23.50	26.50	25.00	3.00	24.0	19.64	9.64	132.29	9.43	28.3	28.3	1.0	671.58	2188.56	0	1.0	0.0	961.7	26.5	6.2	70	10.28	1.79	0.63	139.9	693.9	3844.1	282.7	3433.0	**1537.66**	**1144.34**
26.50	27.50	27.00	1.00	25.0	20.28	10.28	132.29	3.14	6.2	6.2	1.0	45.17	2233.72	70	1.0	220.0	1181.7	27.5	6.2	70	10.28	1.79	0.63	139.9	693.9	4109.3	294.5	3710.0	**1643.72**	**1236.65**
27.50	28.00	27.75	0.50	25.5	20.28	10.28	132.29	1.57	6.2	6.2	1.0	22.58	2256.30	70	1.0	110.0	1291.7	28.0	30.4	0	8.98	23.27	24.45	139.9	2644.4	6192.5	300.4	3848.4	**2476.98**	**1282.81**
28.00	29.50	28.75	1.50	27.0	18.98	8.98	132.29	4.71	30.4	30.4	1.0	373.20	2629.50	0	1.0	0.0	1291.7	29.5	30.4	0	9.07	23.27	24.45	139.9	2645.3	6566.5	318.1	4239.3	**2626.61**	**1413.10**
29.50	30.00	29.75	0.50	27.5	19.07	9.07	132.29	1.57	30.4	30.4	1.0	124.40	2753.90	0	1.0	0.0	1291.7	30.0	31.0	0	9.07	26.30	27.53	139.9	2988.5	7034.1	324.0	4369.6	**2813.64**	**1456.53**
30.00	31.00	30.50	1.00	28.5	19.07	9.07	132.29	3.14	31.0	31.0	1.1	262.30	3016.20	0	1.0	0.0	1291.7	31.0	31.9	0	9.18	30.83	32.14	139.9	3504.6	7812.5	335.8	4643.7	**3125.01**	**1547.89**
31.00	32.50	31.75	1.50	30.0	19.18	9.18	132.29	4.71	31.9	31.9	1.1	425.05	3441.25	0	1.0	0.0	1291.7	32.5	31.9	0	8.92	30.83	32.14	139.9	3501.3	8234.3	353.4	5086.4	**3293.72**	**1695.47**
32.50	34.00	33.25	1.50	31.5	18.92	8.92	132.29	4.71	31.9	31.9	1.1	425.05	3866.31	0	1.0	0.0	1291.7	34.0	33.4	0	10.23	38.39	39.83	139.9	4379.3	9537.3	371.1	5529.1	**3814.93**	**1843.04**
34.00	35.00	34.50	1.00	32.5	20.23	10.23	132.29	3.14	33.4	33.4	1.2	320.74	4187.05	0	1.0	0.0	1291.7	35.0	33.2	0	10.23	37.38	38.80	139.9	4264.4	9743.2	382.9	5861.6	**3897.28**	**1953.88**
35.00	35.50	35.25	0.50	33.0	20.23	10.23	132.29	1.57	33.2	33.2	1.2	157.80	4344.84	0	1.0	0.0	1291.7	35.5	22.5	28	9.00	8.20	8.14	139.9	1128.1	6764.6	388.8	6025.3	**2705.84**	**2008.44**
35.50	37.00	36.25	1.50	34.5	19.00	9.00	132.29	4.71	22.5	22.5	1.0	258.32	4603.16	28	1.0	132.0	1423.7	37.0	20.5	34	9.12	6.76	5.94	139.9	1004.7	7031.6	406.4	6433.3	**2812.64**	**2144.44**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
37.00	37.50	37.25	0.50	35.0	19.12	9.12	132.29	1.57	20.5	20.5	1.0	77.72	4680.88	34	1.0	53.4	1477.1	37.5	20.5	34	9.12	6.76	5.94	139.9	1004.7	7162.7	412.3	6570.4	**2865.10**	**2190.12**
37.50	38.50	38.00	1.00	36.0	19.12	9.12	132.29	3.14	20.5	20.5	1.0	155.44	4836.32	34	1.0	106.9	1584.0	38.5	20.5	34	9.37	6.76	5.94	139.9	1005.3	7425.6	424.1	6844.4	**2970.25**	**2281.48**
38.50	40.00	39.25	1.50	37.5	19.37	9.37	132.29	4.71	20.5	20.5	1.0	233.17	5069.49	34	1.0	160.3	1744.3	40.0	28.0	0	9.37	16.76	17.79	139.9	1907.2	8720.9	441.8	7255.6	**3488.38**	**2418.52**
BORE NO: P53, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	19.63	9.63	26.48	1.57	28.9	28.9	1.0	22.97	0	0	1.0	0.0	0	3.0	28.9	0	9.63	18.78	19.87	28.9	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.5	19.63	9.63	33.71	3.14	28.9	28.9	1.0	58.48	0	0	1.0	0.0	0	4.0	28.9	0	9.21	18.78	19.87	38.5	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	5.00	4.50	1.00	2.5	19.21	9.21	43.13	3.14	28.9	28.9	1.0	74.82	0	0	1.0	0.0	0	5.0	28.4	0	9.21	17.66	18.71	47.7	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.5	19.21	9.21	52.34	3.14	28.4	28.4	1.0	88.93	0	0	1.0	0.0	0	6.0	32.8	0	9.21	35.36	36.75	56.9	1715.1	1715.1	41.2	41.2	**686.05**	**13.74**
6.00	8.00	7.00	2.00	5.5	19.21	9.21	66.15	6.29	32.8	32.8	1.1	305.48	305.48	0	1.0	0.0	0.0	8.0	31.2	0	9.80	27.30	28.55	75.4	1726.7	2032.1	64.8	370.3	**812.85**	**123.43**
8.00	9.00	8.50	1.00	6.5	19.80	9.80	80.26	3.14	31.2	31.2	1.1	161.93	467.41	0	1.0	0.0	0.0	9.0	24.2	11	9.80	9.42	10.00	85.2	746.9	1214.3	76.6	544.0	**485.71**	**181.33**
9.00	10.00	9.50	1.00	7.5	19.80	9.80	90.06	3.14	24.2	24.2	1.0	127.21	594.62	11	1.0	34.6	34.6	10.0	24.2	11	9.80	9.42	10.00	95.0	819.4	1448.6	88.4	717.5	**579.45**	**239.18**
10.00	11.00	10.50	1.00	8.5	19.80	9.80	99.86	3.14	24.2	24.2	1.0	141.05	735.66	11	1.0	34.6	69.1	11.0	24.2	11	9.80	9.42	10.00	104.8	892.0	1696.8	100.1	904.9	**678.72**	**301.65**
11.00	12.00	11.50	1.00	9.5	19.80	9.80	109.66	3.14	24.2	24.2	1.0	154.89	890.55	11	1.0	34.6	103.7	12.0	9.4	52	9.80	2.36	1.13	114.6	584.7	1578.9	111.9	1106.2	**631.57**	**368.73**
12.00	13.00	12.50	1.00	10.5	19.80	9.80	119.46	3.14	9.4	9.4	1.0	62.15	952.71	52	1.0	163.4	267.1	13.0	9.4	52	10.40	2.36	1.13	124.4	603.1	1823.0	123.7	1343.6	**729.19**	**447.85**
13.00	14.50	13.75	1.50	12.0	20.40	10.40	132.16	4.71	9.4	9.4	1.0	103.14	1055.85	52	1.0	245.1	512.3	14.5	11.5	49	10.23	2.91	1.65	140.0	673.2	2241.4	141.4	1709.5	**896.55**	**569.84**
14.50	17.50	16.00	3.00	15.0	20.23	10.23	132.16	9.43	11.5	11.5	1.0	253.52	1309.37	49	1.0	462.0	974.3	17.5	11.5	49	10.23	2.91	1.65	140.0	673.2	2956.9	176.7	2460.4	**1182.76**	**820.12**
17.50	19.00	18.25	1.50	16.5	20.23	10.23	132.16	4.71	11.5	11.5	1.0	126.76	1436.13	49	1.0	231.0	1205.3	19.0	26.4	7	9.95	13.15	14.11	140.0	1551.0	4192.4	194.4	2835.8	**1676.97**	**945.27**
19.00	20.50	19.75	1.50	18.0	19.95	9.95	132.16	4.71	26.4	26.4	1.0	309.28	1745.41	7	1.0	33.0	1238.3	20.5	25.8	9	9.95	11.80	12.72	140.0	1411.2	4394.9	212.1	3195.8	**1757.95**	**1065.25**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
20.50	22.00	21.25	1.50	19.5	19.95	9.95	132.16	4.71	25.8	25.8	1.0	301.19	2046.60	9	1.0	42.4	1280.7	22.0	25.8	9	9.59	11.80	12.72	140.0	1409.4	4736.7	229.7	3557.0	**1894.67**	**1185.68**
22.00	23.50	22.75	1.50	21.0	19.59	9.59	132.16	4.71	25.8	25.8	1.0	301.19	2347.79	9	1.0	42.4	1323.1	23.5	25.9	9	9.59	12.03	12.95	140.0	1435.0	5105.9	247.4	3918.3	**2042.37**	**1306.11**
23.50	25.00	24.25	1.50	22.5	19.59	9.59	132.16	4.71	25.9	25.9	1.0	302.53	2650.32	9	1.0	42.4	1365.6	25.0	30.3	0	9.59	22.77	23.94	140.0	2594.3	6610.1	265.1	4281.0	**2644.06**	**1426.99**
25.00	26.50	25.75	1.50	24.0	19.59	9.59	132.16	4.71	30.3	30.3	1.0	369.54	3019.86	0	1.0	0.0	1365.6	26.5	30.3	0	10.66	22.77	23.94	140.0	2604.3	6989.7	282.7	4668.2	**2795.90**	**1556.06**
26.50	27.50	27.00	1.00	25.0	20.66	10.66	132.16	3.14	30.3	30.3	1.0	246.36	3266.21	0	1.0	0.0	1365.6	27.5	30.3	0	10.66	22.77	23.94	140.0	2604.3	7236.1	294.5	4926.3	**2894.44**	**1642.10**
27.50	28.00	27.75	0.50	25.5	20.66	10.66	132.16	1.57	30.3	30.3	1.0	123.18	3389.39	0	1.0	0.0	1365.6	28.0	11.4	74	10.66	2.88	1.62	140.0	847.0	5601.9	300.4	5055.4	**2240.77**	**1685.13**
28.00	29.50	28.75	1.50	27.0	20.66	10.66	132.16	4.71	11.4	11.4	1.0	125.63	3515.02	74	1.0	348.9	1714.4	29.5	32.1	0	10.66	31.84	33.16	140.0	3640.1	8869.5	318.1	5547.5	**3547.81**	**1849.18**
29.50	30.00	29.75	0.50	27.5	20.66	10.66	132.16	1.57	32.1	32.1	1.1	143.96	3658.98	0	1.0	0.0	1714.4	30.0	29.3	2	11.07	19.68	20.79	140.0	2269.1	7642.5	324.0	5697.4	**3056.99**	**1899.13**
30.00	32.50	31.25	2.50	30.0	21.07	11.07	132.16	7.86	29.3	29.3	1.0	582.72	4241.70	2	1.0	15.7	1730.1	32.5	32.8	0	11.07	35.36	36.75	140.0	4048.8	10020.6	353.4	6325.3	**4008.26**	**2108.42**
32.50	34.00	33.25	1.50	31.5	21.07	11.07	132.16	4.71	32.8	32.8	1.1	457.73	4699.43	0	1.0	0.0	1730.1	34.0	33.8	0	11.07	40.40	41.88	140.0	4625.1	11054.6	371.1	6800.7	**4421.85**	**2266.89**
34.00	35.00	34.50	1.00	32.5	21.07	11.07	132.16	3.14	33.8	33.8	1.2	330.89	5030.32	0	1.0	0.0	1730.1	35.0	34.7	0	8.83	44.94	46.49	140.0	5102.8	11863.2	382.9	7143.3	**4745.29**	**2381.12**
35.00	35.50	35.25	0.50	33.0	18.83	8.83	132.16	1.57	34.7	34.7	1.2	177.60	5207.92	0	1.0	0.0	1730.1	35.5	31.8	0	8.91	30.33	31.63	140.0	3445.7	10383.8	388.8	7326.8	**4153.51**	**2442.28**
35.50	37.00	36.25	1.50	34.5	18.91	8.91	132.16	4.71	31.8	31.8	1.1	421.07	5628.99	0	1.0	0.0	1730.1	37.0	31.8	0	8.90	30.33	31.63	140.0	3445.6	10804.7	406.4	7765.6	**4321.89**	**2588.53**
37.00	37.50	37.25	0.50	35.0	18.90	8.90	132.16	1.57	31.8	31.8	1.1	140.36	5769.35	0	1.0	0.0	1730.1	37.5	31.4	0	8.90	28.31	29.58	140.0	3216.8	10716.3	412.3	7911.8	**4286.53**	**2637.27**
37.50	38.50	38.00	1.00	36.0	18.90	8.90	132.16	3.14	31.4	31.4	1.1	271.28	6040.63	0	1.0	0.0	1730.1	38.5	29.6	0	8.77	20.36	21.48	140.0	2312.8	10083.6	424.1	8194.9	**4033.44**	**2731.63**
38.50	40.00	39.25	1.50	37.5	18.77	8.77	132.16	4.71	29.6	29.6	1.0	353.94	6394.57	0	1.0	0.0	1730.1	40.0	29.6	0	8.77	20.36	21.48	140.0	2312.8	10437.5	441.8	8566.5	**4175.01**	**2855.50**
BORE NO: P54, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	19.37	9.37	25.77	1.57	21.9	21.9	1.0	16.28	0	4	1.0	6.3	0	3.0	21.9	4	9.37	7.77	7.48	28.1	0	0.0	5.9	5.9	**0.00**	**1.96**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
3.00	5.00	4.00	2.00	2.5	19.37	9.37	37.48	6.29	21.9	21.9	1.0	94.71	0	4	1.0	25.1	0	5.0	21.9	4	9.37	7.77	7.48	46.9	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.5	19.37	9.37	51.54	3.14	21.9	21.9	1.0	65.11	0	4	1.0	12.6	0	6.0	15.3	26	9.37	4.09	2.81	56.2	374.8	374.8	41.2	41.2	**149.91**	**13.74**
6.00	7.00	6.50	1.00	4.5	19.37	9.37	60.91	3.14	15.3	15.3	1.0	52.37	52.37	26	1.0	81.7	81.7	7.0	27.4	0	9.37	15.40	16.41	65.6	854.3	988.4	53.0	187.1	**395.34**	**62.36**
7.00	8.00	7.50	1.00	5.5	19.37	9.37	70.28	3.14	27.4	27.4	1.0	114.49	166.85	0	1.0	0.0	81.7	8.0	27.6	0	9.00	15.85	16.87	75.0	993.5	1242.0	64.8	313.4	**496.81**	**104.45**
8.00	9.00	8.50	1.00	6.5	19.00	9.00	79.46	3.14	27.6	27.6	1.0	130.56	297.41	0	1.0	0.0	81.7	9.0	9.0	38	9.00	2.29	1.07	84.0	423.6	802.7	76.6	455.7	**321.07**	**151.90**
9.00	10.00	9.50	1.00	7.5	19.00	9.00	88.46	3.14	9.0	9.0	1.0	44.03	341.44	38	1.0	119.4	201.1	10.0	27.5	2	9.00	15.63	16.64	93.0	1214.6	1757.2	88.4	630.9	**702.86**	**210.31**
10.00	11.00	10.50	1.00	8.5	19.00	9.00	97.46	3.14	27.5	27.5	1.0	159.45	500.89	2	1.0	6.3	207.4	11.0	7.1	57	9.00	1.95	0.77	102.0	561.9	1270.2	100.1	808.5	**508.07**	**269.49**
11.00	12.00	11.50	1.00	9.5	19.00	9.00	106.46	3.14	7.1	7.1	1.0	41.68	542.57	57	1.0	179.1	386.6	12.0	7.1	57	9.00	1.95	0.77	111.0	575.6	1504.8	111.9	1041.1	**601.91**	**347.02**
12.00	13.00	12.50	1.00	10.5	19.00	9.00	115.46	3.14	7.1	7.1	1.0	45.20	587.77	57	1.0	179.1	565.7	13.0	29.5	0	9.19	20.13	21.25	120.0	1974.4	3127.9	123.7	1277.2	**1251.15**	**425.73**
13.00	14.50	13.75	1.50	12.0	19.19	9.19	126.85	4.71	29.5	29.5	1.0	338.34	926.11	0	1.0	0.0	565.7	14.5	12.5	42	10.60	3.20	1.94	133.7	641.8	2133.6	141.4	1633.2	**853.43**	**544.40**
14.50	17.50	16.00	3.00	15.0	20.60	10.60	126.85	9.43	12.5	12.5	1.0	265.16	1191.26	42	1.0	396.0	961.7	17.5	10.0	42	10.60	2.47	1.22	133.7	561.6	2714.6	176.7	2329.7	**1085.85**	**776.56**
17.50	20.50	19.00	3.00	18.0	20.60	10.60	126.85	9.43	10.0	10.0	1.0	210.89	1402.16	42	1.0	396.0	1357.7	20.5	10.0	40	9.11	2.47	1.22	133.7	546.8	3306.7	212.1	2971.9	**1322.66**	**990.64**
20.50	22.00	21.25	1.50	19.5	19.11	9.11	126.85	4.71	10.0	10.0	1.0	105.45	1507.60	40	1.0	188.6	1546.3	22.0	27.3	0	9.11	15.18	16.18	133.7	1653.0	4706.9	229.7	3283.6	**1882.77**	**1094.54**
22.00	23.50	22.75	1.50	21.0	19.11	9.11	126.85	4.71	27.3	27.3	1.0	308.66	1816.26	0	1.0	0.0	1546.3	23.5	25.4	0	9.11	10.90	11.80	133.7	1187.7	4550.3	247.4	3610.0	**1820.12**	**1203.32**
23.50	25.00	24.25	1.50	22.5	19.11	9.11	126.85	4.71	25.4	25.4	1.0	283.96	2100.22	0	1.0	0.0	1546.3	25.0	25.5	13	10.29	11.13	12.03	133.7	1309.7	4956.3	265.1	3911.6	**1982.50**	**1303.86**
25.00	26.50	25.75	1.50	24.0	20.29	10.29	126.85	4.71	25.5	25.5	1.0	285.24	2385.47	13	1.0	61.3	1607.6	26.5	25.5	13	10.29	11.13	12.03	133.7	1309.7	5302.8	282.7	4275.8	**2121.11**	**1425.26**
26.50	27.50	27.00	1.00	25.0	20.29	10.29	126.85	3.14	25.5	25.5	1.0	190.16	2575.63	13	1.0	40.9	1648.4	27.5	9.5	62	10.29	2.38	1.14	133.7	693.2	4917.2	294.5	4518.6	**1966.88**	**1506.19**
27.50	28.00	27.75	0.50	25.5	20.29	10.29	126.85	1.57	9.5	9.5	1.0	33.36	2608.98	62	1.0	97.4	1745.9	28.0	8.5	62	9.15	2.20	0.99	133.7	673.2	5028.0	300.4	4655.3	**2011.20**	**1551.75**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
28.00	29.50	28.75	1.50	27.0	19.15	9.15	126.85	4.71	8.5	8.5	1.0	89.37	2698.36	62	1.0	292.3	2038.1	29.5	8.5	62	9.15	2.20	0.99	133.7	673.2	5409.7	318.1	5054.6	**2163.87**	**1684.86**
29.50	30.00	29.75	0.50	27.5	19.15	9.15	126.85	1.57	8.5	8.5	1.0	29.79	2728.15	62	1.0	97.4	2135.6	30.0	8.5	68	9.15	2.20	0.99	133.7	715.6	5579.3	324.0	5187.7	**2231.73**	**1729.23**
30.00	32.50	31.25	2.50	30.0	19.15	9.15	126.85	7.86	8.5	8.5	1.0	148.96	2877.11	68	1.0	534.3	2669.9	32.5	8.5	68	10.23	2.20	0.99	133.7	716.0	6263.0	353.4	5900.4	**2505.19**	**1966.80**
32.50	35.00	33.75	2.50	32.5	20.23	10.23	126.85	7.86	8.5	8.5	1.0	148.96	3026.06	68	1.0	534.3	3204.1	35.0	9.1	54	10.23	2.31	1.08	133.7	628.7	6858.9	382.9	6613.1	**2743.58**	**2204.36**
35.00	35.50	35.25	0.50	33.0	20.23	10.23	126.85	1.57	9.1	9.1	1.0	31.93	3057.99	54	1.0	84.9	3289.0	35.5	9.1	54	10.23	2.31	1.08	133.7	628.7	6975.7	388.8	6735.8	**2790.29**	**2245.26**
35.50	37.50	36.50	2.00	35.0	20.23	10.23	126.85	6.29	9.1	9.1	1.0	127.72	3185.71	54	1.0	339.4	3628.4	37.5	9.1	54	8.90	2.31	1.08	133.7	628.2	7442.3	412.3	7226.5	**2976.93**	**2408.82**
37.50	38.50	38.00	1.00	36.0	18.90	8.90	126.85	3.14	9.1	9.1	1.0	63.86	3249.57	54	1.0	169.7	3798.1	38.5	10.0	52	9.04	2.47	1.22	133.7	631.6	7679.3	424.1	7471.8	**3071.73**	**2490.61**
38.50	40.00	39.25	1.50	37.5	19.04	9.04	126.85	4.71	10.0	10.0	1.0	105.45	3355.01	52	1.0	245.1	4043.3	40.0	10.0	52	9.04	2.47	1.22	133.7	631.6	8029.9	441.8	7840.1	**3211.96**	**2613.36**
BORE NO: P55, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	19.71	9.71	26.70	1.57	24.6	24.6	1.0	19.21	0	0	1.0	0.0	0	3.0	28.7	0	9.13	18.33	19.40	29.1	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	5.00	4.00	2.00	2.5	19.13	9.13	38.26	6.29	28.7	28.7	1.0	131.67	0	0	1.0	0.0	0	5.0	29.6	0	9.13	20.36	21.48	47.4	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.5	19.13	9.13	51.96	3.14	29.6	29.6	1.0	92.76	0	0	1.0	0.0	0	6.0	29.6	0	8.97	20.36	21.48	56.5	0	0.0	41.2	41.2	**0.00**	**13.74**
6.00	8.00	7.00	2.00	5.5	18.97	8.97	65.49	6.29	29.6	29.6	1.0	233.85	0	0	1.0	0.0	0	8.0	29.6	0	8.97	20.36	21.48	74.5	0	0.0	64.8	64.8	**0.00**	**21.60**
8.00	9.00	8.50	1.00	6.5	18.97	8.97	78.95	3.14	29.6	29.6	1.0	140.95	0	0	1.0	0.0	0	9.0	28.5	0	8.97	17.88	18.94	83.4	0	0.0	76.6	76.6	**0.00**	**25.53**
9.00	10.00	9.50	1.00	7.5	18.97	8.97	87.92	3.14	28.5	28.5	1.0	150.02	0	0	1.0	0.0	0	10.0	9.2	48	10.06	2.33	1.10	92.4	512.6	512.6	88.4	88.4	**205.05**	**29.45**
10.00	11.00	10.50	1.00	8.5	20.06	10.06	97.43	3.14	9.2	9.2	1.0	49.59	49.59	48	1.0	150.9	150.9	11.0	12.8	52	10.06	3.29	2.02	102.5	640.7	841.1	100.1	300.6	**336.46**	**100.20**
11.00	12.00	11.50	1.00	9.5	20.06	10.06	107.49	3.14	12.8	12.8	1.0	76.75	126.35	52	1.0	163.4	314.3	12.0	8.5	54	10.00	2.20	0.99	112.5	580.2	1020.9	111.9	552.6	**408.35**	**184.18**
12.00	14.50	13.25	2.50	12.0	20.00	10.00	125.02	7.86	8.5	8.5	1.0	146.81	273.15	54	1.0	424.3	738.6	14.5	11.6	56	10.30	2.94	1.68	137.5	720.5	1732.2	141.4	1153.1	**692.89**	**384.37**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
14.50	17.50	16.00	3.00	15.0	20.30	10.30	125.02	9.43	11.6	11.6	1.0	241.96	515.12	56	1.0	528.0	1266.6	17.5	23.2	0	10.30	8.70	8.90	137.5	976.5	2758.2	176.7	1958.4	**1103.28**	**652.80**
17.50	19.00	18.25	1.50	16.5	20.30	10.30	125.02	4.71	23.2	23.2	1.0	252.61	767.73	0	1.0	0.0	1266.6	19.0	10.5	51	9.62	2.62	1.36	137.5	648.6	2682.9	194.4	2228.7	**1073.14**	**742.89**
19.00	20.50	19.75	1.50	18.0	19.62	9.62	125.02	4.71	10.5	10.5	1.0	109.24	876.96	51	1.0	240.4	1507.0	20.5	23.9	11	9.91	9.21	9.67	137.5	1110.4	3494.3	212.1	2596.0	**1397.74**	**865.34**
20.50	23.50	22.00	3.00	21.0	19.91	9.91	125.02	9.43	23.9	23.9	1.0	522.35	1399.32	11	1.0	103.7	1610.7	23.5	23.9	11	9.91	9.21	9.67	137.5	1110.4	4120.4	247.4	3257.4	**1648.16**	**1085.81**
23.50	25.00	24.25	1.50	22.5	19.91	9.91	125.02	4.71	23.9	23.9	1.0	261.18	1660.49	11	1.0	51.9	1662.6	25.0	12.6	70	10.42	3.23	1.96	137.5	852.4	4175.5	265.1	3588.1	**1670.18**	**1196.05**
25.00	26.50	25.75	1.50	24.0	20.42	10.42	125.02	4.71	12.6	12.6	1.0	131.74	1792.24	70	1.0	330.0	1992.6	26.5	12.6	70	10.42	3.23	1.96	137.5	852.4	4637.2	282.7	4067.5	**1854.88**	**1355.85**
26.50	27.50	27.00	1.00	25.0	20.42	10.42	125.02	3.14	12.6	12.6	1.0	87.83	1880.06	70	1.0	220.0	2212.6	27.5	12.6	70	10.42	3.23	1.96	137.5	852.4	4945.0	294.5	4387.2	**1978.01**	**1462.39**
27.50	28.00	27.75	0.50	25.5	20.42	10.42	125.02	1.57	12.6	12.6	1.0	43.91	1923.98	70	1.0	110.0	2322.6	28.0	12.6	70	10.42	3.23	1.96	137.5	852.4	5098.9	300.4	4547.0	**2039.58**	**1515.65**
28.00	29.50	28.75	1.50	27.0	20.42	10.42	125.02	4.71	12.6	12.6	1.0	131.74	2055.72	70	1.0	330.0	2652.6	29.5	18.5	48	9.18	5.64	4.57	137.5	965.5	5673.8	318.1	5026.4	**2269.53**	**1675.46**
29.50	30.00	29.75	0.50	27.5	19.18	9.18	125.02	1.57	18.5	18.5	1.0	65.73	2121.45	48	1.0	75.4	2728.0	30.0	18.5	48	9.18	5.64	4.57	137.5	965.5	5815.0	324.0	5173.4	**2325.99**	**1724.48**
30.00	31.00	30.50	1.00	28.5	19.18	9.18	125.02	3.14	18.5	18.5	1.0	131.47	2252.92	48	1.0	150.9	2878.9	31.0	18.5	48	8.41	5.64	4.57	137.5	964.1	6095.9	335.8	5467.5	**2438.37**	**1822.51**
31.00	32.50	31.75	1.50	30.0	18.41	8.41	125.02	4.71	18.5	18.5	1.0	197.20	2450.13	48	1.0	226.3	3105.1	32.5	20.0	48	8.94	6.40	5.39	137.5	1049.9	6605.2	353.4	5908.7	**2642.06**	**1969.57**
32.50	34.00	33.25	1.50	31.5	18.94	8.94	125.02	4.71	20.0	20.0	1.0	214.52	2664.64	48	1.0	226.3	3331.4	34.0	12.0	54	9.41	3.06	1.79	137.5	718.9	6715.0	371.1	6367.2	**2685.99**	**2122.39**
34.00	35.00	34.50	1.00	32.5	19.41	9.41	125.02	3.14	12.0	12.0	1.0	83.52	2748.16	54	1.0	169.7	3501.1	35.0	12.0	54	9.41	3.06	1.79	137.5	718.9	6968.2	382.9	6632.2	**2787.28**	**2210.73**
35.00	35.50	35.25	0.50	33.0	19.41	9.41	125.02	1.57	12.0	12.0	1.0	41.76	2789.92	54	1.0	84.9	3586.0	35.5	14.1	52	8.53	3.68	2.39	137.5	773.3	7149.2	388.8	6764.7	**2859.67**	**2254.90**
35.50	37.00	36.25	1.50	34.5	18.53	8.53	125.02	4.71	14.1	14.1	1.0	148.04	2937.96	52	1.0	245.1	3831.1	37.0	14.1	52	9.58	3.68	2.39	137.5	774.2	7543.3	406.4	7175.5	**3017.34**	**2391.85**
37.00	37.50	37.25	0.50	35.0	19.58	9.58	125.02	1.57	14.1	14.1	1.0	49.35	2987.31	52	1.0	81.7	3912.9	37.5	14.1	52	9.58	3.68	2.39	137.5	774.2	7674.4	412.3	7312.5	**3069.76**	**2437.50**
37.50	38.50	38.00	1.00	36.0	19.58	9.58	125.02	3.14	14.1	14.1	1.0	98.69	3086.00	52	1.0	163.4	4076.3	38.5	14.5	36	9.64	3.80	2.51	137.5	674.1	7836.4	424.1	7586.4	**3134.56**	**2528.80**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
38.50	40.00	39.25	1.50	37.5	19.64	9.64	125.02	4.71	14.5	14.5	1.0	152.42	3238.43	36	1.0	169.7	4246.0	40.0	14.5	36	9.64	3.80	2.51	137.5	674.1	8158.5	441.8	7926.2	**3263.42**	**2642.07**
BORE NO: P56, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	19.45	9.45	25.99	1.57	27.1	27.1	1.0	20.90	0	4	1.0	6.3	0	3.0	29.7	0	9.31	20.58	21.71	28.4	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	5.00	4.00	2.00	2.5	19.31	9.31	37.66	6.29	29.7	29.7	1.0	135.02	0	0	1.0	0.0	0	5.0	28.9	0	9.31	18.78	19.87	47.0	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.5	19.31	9.31	51.63	3.14	28.9	28.9	1.0	89.57	0	0	1.0	0.0	0	6.0	28.9	0	9.30	18.78	19.87	56.3	0	0.0	41.2	41.2	**0.00**	**13.74**
6.00	8.00	7.00	2.00	5.5	19.30	9.30	65.58	6.29	28.9	28.9	1.0	227.56	0	0	1.0	0.0	0	8.0	11.4	42	9.30	2.88	1.62	74.9	472.5	472.5	64.8	64.8	**188.98**	**21.60**
8.00	9.00	8.50	1.00	6.5	19.30	9.30	79.53	3.14	11.4	11.4	1.0	50.40	50.40	42	1.0	132.0	132.0	9.0	11.4	42	9.96	2.88	1.62	84.2	493.9	676.3	76.6	259.0	**270.53**	**86.33**
9.00	11.00	10.00	2.00	8.5	19.96	9.96	94.14	6.29	11.4	11.4	1.0	119.32	169.71	42	1.0	264.0	396.0	11.0	10.6	42	9.96	2.65	1.39	104.1	518.9	1084.6	100.1	665.9	**433.85**	**221.95**
11.00	12.50	11.75	1.50	10.0	19.96	9.96	111.57	4.71	10.6	10.6	1.0	98.43	268.15	42	1.0	198.0	594.0	12.5	7.5	96	10.11	2.02	0.84	119.0	871.1	1733.3	117.8	980.0	**693.30**	**326.65**
12.50	14.50	13.50	2.00	12.0	20.11	10.11	129.15	6.29	7.5	7.5	1.0	106.88	375.02	96	1.0	603.4	1197.4	14.5	8.2	58	10.39	2.15	0.94	139.3	648.8	2221.3	141.4	1713.8	**888.50**	**571.27**
14.50	17.50	16.00	3.00	15.0	20.39	10.39	129.15	9.43	8.2	8.2	1.0	175.47	550.50	58	1.0	546.9	1744.3	17.5	9.7	52	10.26	2.42	1.17	139.3	636.8	2931.6	176.7	2471.5	**1172.63**	**823.83**
17.50	20.50	19.00	3.00	18.0	20.26	10.26	129.15	9.43	9.7	9.7	1.0	208.15	758.64	52	1.0	490.3	2234.6	20.5	8.0	60	10.52	2.11	0.91	139.3	658.9	3652.1	212.1	3205.3	**1460.86**	**1068.42**
20.50	23.50	22.00	3.00	21.0	20.52	10.52	129.15	9.43	8.0	8.0	1.0	171.14	929.78	60	1.0	565.7	2800.3	23.5	8.0	60	10.52	2.11	0.91	139.3	658.9	4389.0	247.4	3977.5	**1755.60**	**1325.82**
23.50	26.50	25.00	3.00	24.0	20.52	10.52	129.15	9.43	8.0	8.0	1.0	171.14	1100.91	60	1.0	565.7	3366.0	26.5	7.5	65	10.10	2.02	0.84	139.3	684.0	5150.9	282.7	4749.7	**2060.36**	**1583.22**
26.50	27.50	27.00	1.00	25.0	20.10	10.10	129.15	3.14	7.5	7.5	1.0	53.44	1154.35	65	1.0	204.3	3570.3	27.5	7.5	65	10.33	2.02	0.84	139.3	684.1	5408.7	294.5	5019.2	**2163.48**	**1673.05**
27.50	28.00	27.75	0.50	25.5	20.33	10.33	129.15	1.57	7.5	7.5	1.0	26.72	1181.07	65	1.0	102.1	3672.4	28.0	7.5	65	10.33	2.02	0.84	139.3	684.1	5537.6	300.4	5153.9	**2215.02**	**1717.97**
28.00	29.50	28.75	1.50	27.0	20.33	10.33	129.15	4.71	7.5	7.5	1.0	80.16	1261.23	65	1.0	306.4	3978.9	29.5	7.5	65	10.33	2.02	0.84	139.3	684.1	5924.1	318.1	5558.2	**2369.66**	**1852.72**
29.50	30.00	29.75	0.50	27.5	20.33	10.33	129.15	1.57	7.5	7.5	1.0	26.72	1287.95	65	1.0	102.1	4081.0	30.0	8.7	66	10.33	2.24	1.02	139.3	715.5	6084.5	324.0	5692.9	**2433.78**	**1897.64**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
30.00	31.00	30.50	1.00	28.5	20.33	10.33	129.15	3.14	8.7	8.7	1.0	62.11	1350.06	66	1.0	207.4	4288.4	31.0	8.7	66	10.33	2.24	1.02	139.3	715.5	6354.0	335.8	5974.2	**2541.60**	**1991.41**
31.00	32.50	31.75	1.50	30.0	20.33	10.33	129.15	4.71	8.7	8.7	1.0	93.17	1443.23	66	1.0	311.1	4599.6	32.5	8.7	60	10.33	2.24	1.02	139.3	673.1	6715.9	353.4	6396.2	**2686.35**	**2132.08**
32.50	34.00	33.25	1.50	31.5	20.33	10.33	129.15	4.71	8.7	8.7	1.0	93.17	1536.39	60	1.0	282.9	4882.4	34.0	8.7	66	10.33	2.24	1.02	139.3	715.5	7134.3	371.1	6789.9	**2853.73**	**2263.31**
34.00	35.00	34.50	1.00	32.5	20.33	10.33	129.15	3.14	8.7	8.7	1.0	62.11	1598.50	66	1.0	207.4	5089.9	35.0	8.7	65	8.86	2.24	1.02	139.3	707.9	7396.2	382.9	7071.2	**2958.49**	**2357.08**
35.00	35.50	35.25	0.50	33.0	18.86	8.86	129.15	1.57	8.7	8.7	1.0	31.06	1629.56	65	1.0	102.1	5192.0	35.5	8.7	65	8.94	2.24	1.02	139.3	707.9	7529.4	388.8	7210.3	**3011.78**	**2403.44**
35.50	37.00	36.25	1.50	34.5	18.94	8.94	129.15	4.71	8.7	8.7	1.0	93.17	1722.73	65	1.0	306.4	5498.4	37.0	9.0	65	8.86	2.29	1.07	139.3	713.9	7935.1	406.4	7627.6	**3174.03**	**2542.53**
37.00	37.50	37.25	0.50	35.0	18.86	8.86	129.15	1.57	9.0	9.0	1.0	32.14	1754.87	65	1.0	102.1	5600.6	37.5	9.0	62	8.86	2.29	1.07	139.3	692.7	8048.1	412.3	7767.8	**3219.26**	**2589.26**
37.50	38.50	38.00	1.00	36.0	18.86	8.86	129.15	3.14	9.0	9.0	1.0	64.29	1819.16	62	1.0	194.9	5795.4	38.5	10.0	59	9.19	2.47	1.22	139.3	691.9	8306.5	424.1	8038.7	**3322.59**	**2679.57**
38.50	40.00	39.25	1.50	37.5	19.19	9.19	129.15	4.71	10.0	10.0	1.0	107.36	1926.52	59	1.0	278.1	6073.6	40.0	10.0	59	9.19	2.47	1.22	139.3	691.9	8692.0	441.8	8441.9	**3476.79**	**2813.96**
BORE NO: P57, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	19.59	9.59	26.37	1.57	24.8	24.8	1.0	19.15	0	0	1.0	0.0	0	3.0	25.4	0	9.59	10.90	11.80	28.8	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	5.00	4.00	2.00	2.5	19.59	9.59	38.36	6.29	25.4	25.4	1.0	114.49	0	0	1.0	0.0	0	5.0	27.6	2	10.74	15.85	16.87	48.0	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.5	20.74	10.74	53.32	3.14	27.6	27.6	1.0	87.61	0	2	1.0	6.3	0	6.0	27.6	2	10.74	15.85	16.87	58.7	816.5	816.5	41.2	41.2	**326.58**	**13.74**
6.00	8.00	7.00	2.00	5.5	20.74	10.74	69.43	6.29	27.6	27.6	1.0	228.15	228.15	2	1.0	12.6	12.6	8.0	27.6	2	10.74	15.85	16.87	80.2	1084.0	1324.8	64.8	305.5	**529.91**	**101.84**
8.00	9.00	8.50	1.00	6.5	20.74	10.74	85.54	3.14	27.6	27.6	1.0	140.55	368.70	2	1.0	6.3	18.9	9.0	9.6	53	10.32	2.40	1.16	90.9	550.8	938.3	76.6	464.1	**375.33**	**154.71**
9.00	11.00	10.00	2.00	8.5	20.32	10.32	101.23	6.29	9.6	9.6	1.0	107.62	476.32	53	1.0	333.1	352.0	11.0	9.6	53	10.32	2.40	1.16	111.6	589.7	1418.0	100.1	928.5	**567.19**	**309.49**
11.00	12.00	11.50	1.00	9.5	20.32	10.32	116.71	3.14	9.6	9.6	1.0	62.04	538.36	53	1.0	166.6	518.6	12.0	9.6	53	10.32	2.40	1.16	121.9	609.1	1666.0	111.9	1168.9	**666.41**	**389.62**
12.00	13.00	12.50	1.00	10.5	20.32	10.32	127.03	3.14	9.6	9.6	1.0	67.53	605.89	53	1.0	166.6	685.1	13.0	10.5	48	10.40	2.62	1.36	132.2	616.8	1907.8	123.7	1414.7	**763.14**	**471.58**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
13.00	14.50	13.75	1.50	12.0	20.40	10.40	139.99	4.71	10.5	10.5	1.0	122.32	728.20	48	1.0	226.3	911.4	14.5	10.5	48	10.40	2.62	1.36	147.8	648.9	2288.5	141.4	1781.0	**915.41**	**593.67**
14.50	16.00	15.25	1.50	13.5	20.40	10.40	139.99	4.71	10.5	10.5	1.0	122.32	850.52	48	1.0	226.3	1137.7	16.0	11.3	56	10.60	2.85	1.59	147.8	733.8	2722.1	159.0	2147.3	**1088.82**	**715.76**
16.00	17.50	16.75	1.50	15.0	20.60	10.60	139.99	4.71	11.3	11.3	1.0	131.87	982.39	56	1.0	264.0	1401.7	17.5	11.3	56	10.60	2.85	1.59	147.8	733.8	3117.9	176.7	2560.8	**1247.17**	**853.61**
17.50	19.00	18.25	1.50	16.5	20.60	10.60	139.99	4.71	11.3	11.3	1.0	131.87	1114.26	56	1.0	264.0	1665.7	19.0	25.2	6	9.55	10.45	11.34	147.8	1298.5	4078.5	194.4	2974.4	**1631.38**	**991.45**
19.00	20.50	19.75	1.50	18.0	19.55	9.55	139.99	4.71	25.2	25.2	1.0	310.55	1424.81	6	1.0	28.3	1694.0	20.5	9.1	45	9.55	2.31	1.08	147.8	590.3	3709.1	212.1	3330.9	**1483.64**	**1110.29**
20.50	22.50	21.50	2.00	20.0	19.55	9.55	139.99	6.29	9.1	9.1	1.0	140.94	1565.75	45	1.0	282.9	1976.9	22.5	9.1	57	10.17	2.31	1.08	147.8	675.4	4218.0	235.6	3778.2	**1687.20**	**1259.41**
22.50	23.50	23.00	1.00	21.0	20.17	10.17	139.99	3.14	9.1	9.1	1.0	70.47	1636.23	57	1.0	179.1	2156.0	23.5	9.1	57	10.17	2.31	1.08	147.8	675.4	4467.6	247.4	4039.6	**1787.05**	**1346.54**
23.50	25.00	24.25	1.50	22.5	20.17	10.17	139.99	4.71	9.1	9.1	1.0	105.71	1741.93	57	1.0	268.7	2424.7	25.0	28.1	0	10.17	16.98	18.02	147.8	2043.8	6210.5	265.1	4431.7	**2484.20**	**1477.24**
25.00	26.50	25.75	1.50	24.0	20.17	10.17	139.99	4.71	28.1	28.1	1.0	352.38	2094.32	0	1.0	0.0	2424.7	26.5	28.1	0	10.03	16.98	18.02	147.8	2042.8	6561.9	282.7	4801.8	**2624.75**	**1600.59**
26.50	27.50	27.00	1.00	25.0	20.03	10.03	139.99	3.14	28.1	28.1	1.0	234.92	2329.24	0	1.0	0.0	2424.7	27.5	28.1	0	10.03	16.98	18.02	147.8	2042.8	6796.8	294.5	5048.5	**2718.72**	**1682.83**
27.50	28.00	27.75	0.50	25.5	20.03	10.03	139.99	1.57	28.1	28.1	1.0	117.46	2446.70	0	1.0	0.0	2424.7	28.0	12.5	54	8.52	3.20	1.94	147.8	760.4	5631.8	300.4	5171.8	**2252.72**	**1723.94**
28.00	29.50	28.75	1.50	27.0	18.52	8.52	139.99	4.71	12.5	12.5	1.0	146.31	2593.01	54	1.0	254.6	2679.3	29.5	12.5	54	8.71	3.20	1.94	147.8	760.5	6032.8	318.1	5590.4	**2413.13**	**1863.46**
29.50	30.00	29.75	0.50	27.5	18.71	8.71	139.99	1.57	12.5	12.5	1.0	48.77	2641.77	54	1.0	84.9	2764.1	30.0	12.5	54	11.19	3.20	1.94	147.8	762.4	6168.3	324.0	5729.9	**2467.33**	**1909.96**
30.00	31.00	30.50	1.00	28.5	21.19	11.19	139.99	3.14	12.5	12.5	1.0	97.54	2739.31	54	1.0	169.7	2933.9	31.0	10.5	50	11.19	2.62	1.36	147.8	663.5	6336.6	335.8	6008.9	**2534.65**	**2002.98**
31.00	32.50	31.75	1.50	30.0	21.19	11.19	139.99	4.71	10.5	10.5	1.0	122.32	2861.63	50	1.0	235.7	3169.6	32.5	10.5	50	11.19	2.62	1.36	147.8	663.5	6694.7	353.4	6384.6	**2677.86**	**2128.21**
32.50	34.00	33.25	1.50	31.5	21.19	11.19	139.99	4.71	10.5	10.5	1.0	122.32	2983.94	50	1.0	235.7	3405.3	34.0	28.8	0	11.19	18.56	19.64	147.8	2241.2	8630.4	371.1	6760.3	**3452.17**	**2253.44**
34.00	35.00	34.50	1.00	32.5	21.19	11.19	139.99	3.14	28.8	28.8	1.0	241.87	3225.82	0	1.0	0.0	3405.3	35.0	28.8	0	11.19	18.56	19.64	147.8	2241.2	8872.3	382.9	7014.0	**3548.92**	**2338.00**
35.00	35.50	35.25	0.50	33.0	21.19	11.19	139.99	1.57	28.8	28.8	1.0	120.94	3346.76	0	1.0	0.0	3405.3	35.5	30.9	0	11.19	25.79	27.01	147.8	3113.9	9865.9	388.8	7140.8	**3946.37**	**2380.27**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
35.50	37.50	36.50	2.00	35.0	21.19	11.19	139.99	6.29	30.9	30.9	1.0	550.33	3897.09	0	1.0	0.0	3405.3	37.5	30.1	0	8.95	21.76	22.91	147.8	2607.7	9910.1	412.3	7714.7	**3964.04**	**2571.57**
37.50	38.50	38.00	1.00	36.0	18.95	8.95	139.99	3.14	30.1	30.1	1.0	256.32	4153.40	0	1.0	0.0	3405.3	38.5	29.8	0	9.01	20.81	21.94	147.8	2494.0	10052.7	424.1	7982.8	**4021.09**	**2660.93**
38.50	40.00	39.25	1.50	37.5	19.01	9.01	139.99	4.71	29.8	29.8	1.0	377.96	4531.36	0	1.0	0.0	3405.3	40.0	29.8	0	9.01	20.81	21.94	147.8	2494.0	10430.7	441.8	8378.4	**4172.27**	**2792.81**
BORE NO: P58, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	20.05	10.05	27.64	1.57	12.1	12.1	1.0	9.31	0	15	1.0	23.6	0	3.0	24.5	0	10.05	9.64	10.33	30.2	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.5	20.05	10.05	35.18	3.14	24.5	24.5	1.0	50.38	0	0	1.0	0.0	0	4.0	27.4	2	9.79	15.40	16.41	40.2	563.8	563.8	17.7	17.7	**225.53**	**5.89**
4.00	6.00	5.00	2.00	3.5	19.79	9.79	49.99	6.29	27.4	27.4	1.0	162.88	162.88	2	1.0	12.6	12.6	6.0	28.7	0	9.79	18.33	19.40	59.8	935.7	1111.1	41.2	216.7	**444.46**	**72.23**
6.00	7.00	6.50	1.00	4.5	19.79	9.79	64.68	3.14	28.7	28.7	1.0	111.28	274.16	0	1.0	0.0	12.6	7.0	28.7	0	9.40	18.33	19.40	69.6	1073.7	1360.5	53.0	339.7	**544.18**	**113.25**
7.00	9.00	8.00	2.00	6.5	19.40	9.40	78.97	6.29	28.7	28.7	1.0	271.76	545.92	0	1.0	0.0	12.6	9.0	28.7	0	9.40	18.33	19.40	88.4	1344.5	1903.0	76.6	635.1	**761.21**	**211.69**
9.00	10.00	9.50	1.00	7.5	19.40	9.40	93.07	3.14	28.7	28.7	1.0	160.14	706.07	0	1.0	0.0	12.6	10.0	28.0	0	9.40	16.76	17.79	97.8	1352.9	2071.5	88.4	807.0	**828.60**	**269.00**
10.00	11.00	10.50	1.00	8.5	19.40	9.40	102.47	3.14	28.0	28.0	1.0	171.24	877.30	0	1.0	0.0	12.6	11.0	24.8	8	10.21	9.86	10.66	107.2	929.3	1819.1	100.1	990.0	**727.65**	**330.00**
11.00	12.50	11.75	1.50	10.0	20.21	10.21	114.83	4.71	24.8	24.8	1.0	250.13	1127.43	8	1.0	37.7	50.3	12.5	10.6	50	10.27	2.65	1.39	122.5	613.9	1791.6	117.8	1295.5	**716.64**	**431.84**
12.50	15.50	14.00	3.00	13.0	20.27	10.27	137.89	9.43	10.6	10.6	1.0	243.31	1370.74	50	1.0	471.4	521.7	15.5	10.6	50	10.27	2.65	1.39	122.5	613.9	2506.3	153.2	2045.6	**1002.53**	**681.87**
15.50	17.00	16.25	1.50	14.5	20.27	10.27	137.89	4.71	10.6	10.6	1.0	121.65	1492.39	50	1.0	235.7	757.4	17.0	26.8	0	9.29	14.05	15.03	122.5	1407.3	3657.1	170.8	2420.6	**1462.86**	**806.88**
17.00	18.50	17.75	1.50	16.0	19.29	9.29	137.89	4.71	26.8	26.8	1.0	328.37	1820.76	0	1.0	0.0	757.4	18.5	26.8	0	9.29	14.05	15.03	122.5	1407.3	3985.5	188.5	2766.7	**1594.20**	**922.23**
18.50	20.00	19.25	1.50	17.5	19.29	9.29	137.89	4.71	26.8	26.8	1.0	328.37	2149.12	0	1.0	0.0	757.4	20.0	27.2	6	9.68	14.95	15.95	122.5	1542.2	4448.8	206.2	3112.7	**1779.52**	**1037.57**
20.00	21.50	20.75	1.50	19.0	19.68	9.68	137.89	4.71	27.2	27.2	1.0	334.08	2483.21	6	1.0	28.3	785.7	21.5	11.0	45	9.68	2.76	1.51	122.5	589.9	3858.9	223.8	3492.8	**1543.55**	**1164.25**
21.50	23.00	22.25	1.50	20.5	19.68	9.68	137.89	4.71	11.0	11.0	1.0	126.36	2609.56	45	1.0	212.1	997.9	23.0	11.0	45	9.68	2.76	1.51	122.5	589.9	4197.4	241.5	3848.9	**1678.95**	**1282.98**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
23.00	24.50	23.75	1.50	22.0	19.68	9.68	137.89	4.71	11.0	11.0	1.0	126.36	2735.92	45	1.0	212.1	1210.0	24.5	9.4	58	10.37	2.36	1.13	122.5	642.1	4588.0	259.2	4205.1	**1835.19**	**1401.70**
24.50	27.50	26.00	3.00	25.0	20.37	10.37	137.89	9.43	9.4	9.4	1.0	215.23	2951.15	58	1.0	546.9	1756.9	27.5	7.0	70	10.37	1.93	0.76	122.5	683.8	5391.8	294.5	5002.5	**2156.73**	**1667.51**
27.50	29.00	28.25	1.50	26.5	20.37	10.37	137.89	4.71	7.0	7.0	1.0	79.82	3030.97	70	1.0	330.0	2086.9	29.0	9.0	54	10.37	2.29	1.07	122.5	606.6	5724.4	312.2	5430.0	**2289.76**	**1810.01**
29.00	30.00	29.50	1.00	27.5	20.37	10.37	137.89	3.14	9.0	9.0	1.0	68.64	3099.61	54	1.0	169.7	2256.6	30.0	9.0	54	8.77	2.29	1.07	122.5	605.9	5962.1	324.0	5680.2	**2384.84**	**1893.39**
30.00	30.50	30.25	0.50	28.0	18.77	8.77	137.89	1.57	9.0	9.0	1.0	34.32	3133.93	54	1.0	84.9	2341.4	30.5	31.2	0	9.06	27.30	28.55	122.5	2729.4	8204.7	329.9	5805.2	**3281.88**	**1935.07**
30.50	32.00	31.25	1.50	29.5	19.06	9.06	137.89	4.71	31.2	31.2	1.1	417.31	3551.23	0	1.0	0.0	2341.4	32.0	20.0	48	9.06	6.40	5.39	122.5	974.5	6867.2	347.5	6240.2	**2746.88**	**2080.07**
32.00	32.50	32.25	0.50	30.0	19.06	9.06	137.89	1.57	20.0	20.0	1.0	78.87	3630.10	48	1.0	75.4	2416.9	32.5	20.0	48	9.06	6.40	5.39	122.5	974.5	7021.5	353.4	6400.4	**2808.60**	**2133.46**
32.50	33.50	33.00	1.00	31.0	19.06	9.06	137.89	3.14	20.0	20.0	1.0	157.73	3787.83	48	1.0	150.9	2567.7	33.5	31.1	0	8.86	26.80	28.04	122.5	2676.8	9032.4	365.2	6720.8	**3612.96**	**2240.25**
33.50	35.00	34.25	1.50	32.5	18.86	8.86	137.89	4.71	31.1	31.1	1.1	413.70	4201.54	0	1.0	0.0	2567.7	35.0	31.3	0	8.69	27.81	29.06	122.5	2775.4	9544.7	382.9	7152.1	**3817.87**	**2384.04**
35.00	36.50	35.75	1.50	34.0	18.69	8.69	137.89	4.71	31.3	31.3	1.1	420.93	4622.47	0	1.0	0.0	2567.7	36.5	31.3	0	8.63	27.81	29.06	122.5	2774.7	9964.9	400.6	7590.7	**3985.97**	**2530.24**
36.50	37.50	37.00	1.00	35.0	18.63	8.63	137.89	3.14	31.3	31.3	1.1	280.62	4903.09	0	1.0	0.0	2567.7	37.5	31.9	0	8.63	30.83	32.14	122.5	3076.1	10546.9	412.3	7883.1	**4218.74**	**2627.71**
37.50	38.00	37.75	0.50	35.5	18.63	8.63	137.89	1.57	31.9	31.9	1.1	147.69	5050.77	0	1.0	0.0	2567.7	38.0	34.3	0	8.62	42.92	44.44	122.5	4281.1	11899.6	418.2	8036.7	**4759.83**	**2678.90**
38.00	40.00	39.00	2.00	37.5	18.62	8.62	137.89	6.29	34.3	34.3	1.2	718.37	5769.14	0	1.0	0.0	2567.7	40.0	34.3	0	8.62	42.92	44.44	122.5	4281.1	12617.9	441.8	8778.6	**5047.18**	**2926.21**
BORE NO: P59, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	19.41	9.41	25.88	1.57	26.7	26.7	1.0	20.45	0	4	1.0	6.3	0	3.0	26.7	0	9.41	13.83	14.80	28.2	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.5	19.41	9.41	32.94	3.14	26.7	26.7	1.0	52.06	0	0	1.0	0.0	0	4.0	7.2	62	9.29	1.97	0.79	37.6	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	5.00	4.50	1.00	2.5	19.29	9.29	42.29	3.14	7.2	7.2	1.0	16.79	0	62	1.0	194.9	0	5.0	7.2	62	9.29	1.97	0.79	46.9	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.5	19.29	9.29	51.58	3.14	7.2	7.2	1.0	20.48	0	62	1.0	194.9	0	6.0	7.2	62	9.29	1.97	0.79	56.2	0	0.0	41.2	41.2	**0.00**	**13.74**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
6.00	7.00	6.50	1.00	4.5	19.29	9.29	60.87	3.14	7.2	7.2	1.0	24.17	0	62	1.0	194.9	0	7.0	28.4	0	9.00	17.66	18.71	65.5	0	0.0	53.0	53.0	**0.00**	**17.67**
7.00	8.00	7.50	1.00	5.5	19.00	9.00	70.01	3.14	28.4	28.4	1.0	118.97	0	0	1.0	0.0	0	8.0	28.4	0	9.00	17.66	18.71	74.5	1099.8	1099.8	64.8	64.8	**439.94**	**21.60**
8.00	9.00	8.50	1.00	6.5	19.00	9.00	79.01	3.14	28.4	28.4	1.0	134.26	134.26	0	1.0	0.0	0.0	9.0	28.7	0	9.00	18.33	19.40	83.5	1271.5	1405.7	76.6	210.8	**562.29**	**70.28**
9.00	10.00	9.50	1.00	7.5	19.00	9.00	88.01	3.14	28.7	28.7	1.0	151.44	285.70	0	1.0	0.0	0.0	10.0	11.5	40	10.10	2.91	1.65	92.5	501.0	786.7	88.4	374.1	**314.68**	**124.69**
10.00	11.00	10.50	1.00	8.5	20.10	10.10	97.56	3.14	11.5	11.5	1.0	62.38	348.08	40	1.0	125.7	125.7	11.0	8.4	55	10.10	2.18	0.97	102.6	568.7	1042.5	100.1	573.9	**417.00**	**191.31**
11.00	12.00	11.50	1.00	9.5	20.10	10.10	107.66	3.14	8.4	8.4	1.0	49.96	398.05	55	1.0	172.9	298.6	12.0	8.4	55	10.31	2.18	0.97	112.7	586.1	1282.7	111.9	808.5	**513.09**	**269.51**
12.00	14.50	13.25	2.50	12.0	20.31	10.31	125.60	7.86	8.4	8.4	1.0	145.72	543.77	55	1.0	432.1	730.7	14.5	8.4	55	9.77	2.18	0.97	138.5	630.1	1904.6	141.4	1415.9	**761.83**	**471.95**
14.50	17.50	16.00	3.00	15.0	19.77	9.77	125.60	9.43	8.4	8.4	1.0	174.87	718.64	55	1.0	518.6	1249.3	17.5	11.8	50	9.77	3.00	1.73	138.5	686.6	2654.5	176.7	2144.6	**1061.80**	**714.88**
17.50	19.00	18.25	1.50	16.5	19.77	9.77	125.60	4.71	11.8	11.8	1.0	123.70	842.34	50	1.0	235.7	1485.0	19.0	27.6	2	9.52	15.85	16.87	138.5	1802.4	4129.7	194.4	2521.7	**1651.90**	**840.57**
19.00	20.50	19.75	1.50	18.0	19.52	9.52	125.60	4.71	27.6	27.6	1.0	309.54	1151.88	2	1.0	9.4	1494.4	20.5	27.6	2	9.52	15.85	16.87	138.5	1802.4	4448.7	212.1	2858.4	**1779.49**	**952.79**
20.50	23.50	22.00	3.00	21.0	19.52	9.52	125.60	9.43	27.6	27.6	1.0	619.09	1770.97	2	1.0	18.9	1513.3	23.5	12.6	38	9.07	3.23	1.96	138.5	627.5	3911.8	247.4	3531.7	**1564.71**	**1177.22**
23.50	25.00	24.25	1.50	22.5	19.07	9.07	125.60	4.71	12.6	12.6	1.0	132.35	1903.32	38	1.0	179.1	1692.4	25.0	12.6	38	9.41	3.23	1.96	138.5	627.8	4223.5	265.1	3860.8	**1689.41**	**1286.94**
25.00	26.50	25.75	1.50	24.0	19.41	9.41	125.60	4.71	12.6	12.6	1.0	132.35	2035.67	38	1.0	179.1	1871.6	26.5	12.6	38	9.80	3.23	1.96	138.5	628.1	4535.3	282.7	4190.0	**1814.13**	**1396.66**
26.50	27.50	27.00	1.00	25.0	19.80	9.80	125.60	3.14	12.6	12.6	1.0	88.23	2123.90	38	1.0	119.4	1991.0	27.5	13.0	45	10.12	3.35	2.08	138.5	691.0	4805.9	294.5	4409.4	**1922.36**	**1469.81**
27.50	28.00	27.75	0.50	25.5	20.12	10.12	125.60	1.57	13.0	13.0	1.0	45.57	2169.47	45	1.0	70.7	2061.7	28.0	7.0	75	10.12	1.93	0.76	138.5	743.4	4974.6	300.4	4531.6	**1989.82**	**1510.53**
28.00	29.50	28.75	1.50	27.0	20.12	10.12	125.60	4.71	7.0	7.0	1.0	72.70	2242.17	75	1.0	353.6	2415.3	29.5	15.3	40	10.12	4.09	2.81	138.5	738.8	5396.3	318.1	4975.5	**2158.51**	**1658.51**
29.50	30.00	29.75	0.50	27.5	20.12	10.12	125.60	1.57	15.3	15.3	1.0	53.99	2296.16	40	1.0	62.9	2478.1	30.0	15.3	40	10.12	4.09	2.81	138.5	738.8	5513.1	324.0	5098.3	**2205.25**	**1699.43**
30.00	31.00	30.50	1.00	28.5	20.12	10.12	125.60	3.14	15.3	15.3	1.0	107.99	2404.15	40	1.0	125.7	2603.9	31.0	28.4	0	10.12	17.66	18.71	138.5	1995.6	7003.6	335.8	5343.8	**2801.44**	**1781.25**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
31.00	32.50	31.75	1.50	30.0	20.12	10.12	125.60	4.71	28.4	28.4	1.0	320.15	2724.30	0	1.0	0.0	2603.9	32.5	28.4	0	10.12	17.66	18.71	138.5	1995.6	7323.7	353.4	5681.6	**2929.50**	**1893.86**
32.50	34.00	33.25	1.50	31.5	20.12	10.12	125.60	4.71	28.4	28.4	1.0	320.15	3044.45	0	1.0	0.0	2603.9	34.0	29.6	5	10.28	20.36	21.48	138.5	2337.3	7985.6	371.1	6019.4	**3194.25**	**2006.47**
34.00	35.00	34.50	1.00	32.5	20.28	10.28	125.60	3.14	29.6	29.6	1.0	224.24	3268.69	5	1.0	15.7	2619.6	35.0	29.6	5	10.28	20.36	21.48	138.5	2337.3	8225.6	382.9	6271.1	**3290.23**	**2090.38**
35.00	35.50	35.25	0.50	33.0	20.28	10.28	125.60	1.57	29.6	29.6	1.0	112.12	3380.81	5	1.0	7.9	2627.4	35.5	29.2	0	10.28	19.46	20.56	138.5	2200.2	8208.5	388.8	6397.0	**3283.39**	**2132.34**
35.50	37.00	36.25	1.50	34.5	20.28	10.28	125.60	4.71	29.2	29.2	1.0	330.91	3711.72	0	1.0	0.0	2627.4	37.0	29.2	0	10.28	19.46	20.56	138.5	2200.2	8539.4	406.4	6745.6	**3415.76**	**2248.53**
37.00	37.50	37.25	0.50	35.0	20.28	10.28	125.60	1.57	29.2	29.2	1.0	110.30	3822.03	0	1.0	0.0	2627.4	37.5	29.2	0	8.86	19.46	20.56	138.5	2188.8	8638.2	412.3	6861.8	**3455.29**	**2287.26**
37.50	38.50	38.00	1.00	36.0	18.86	8.86	125.60	3.14	29.2	29.2	1.0	220.61	4042.64	0	1.0	0.0	2627.4	38.5	29.2	0	8.80	19.46	20.56	138.5	2188.3	8858.4	424.1	7094.2	**3543.34**	**2364.73**
38.50	40.00	39.25	1.50	37.5	18.80	8.80	125.60	4.71	29.2	29.2	1.0	330.91	4373.55	0	1.0	0.0	2627.4	40.0	29.2	0	8.80	19.46	20.56	138.5	2188.3	9189.3	441.8	7442.8	**3675.71**	**2480.92**
BORE NO: P60, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	20.72	10.72	29.48	1.57	9.7	9.7	1.0	7.92	0	62.0	1.0	97.4	0	3.0	8.1	30	10.72	2.13	0.93	32.2	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.5	20.72	10.72	37.52	3.14	8.1	8.1	1.0	16.78	0	30.0	1.0	94.3	0	4.0	8.1	30	10.72	2.13	0.93	42.9	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	5.00	4.50	1.00	2.5	20.72	10.72	48.24	3.14	8.1	8.1	1.0	21.58	0	30.0	1.0	94.3	0	5.0	29.4	5	9.64	19.91	21.02	53.6	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.5	19.64	9.64	58.42	3.14	29.4	29.4	1.0	103.46	0	5.0	1.0	15.7	0	6.0	29.4	5	9.64	19.91	21.02	63.2	1104.2	1104.2	41.2	41.2	**441.67**	**13.74**
6.00	7.00	6.50	1.00	4.5	19.64	9.64	68.06	3.14	29.4	29.4	1.0	120.53	120.53	5.0	1.0	15.7	15.7	7.0	28.7	0	9.64	18.33	19.40	72.9	1123.2	1259.5	53.0	189.3	**503.79**	**63.09**
7.00	9.00	8.00	2.00	6.5	19.64	9.64	82.52	6.29	28.7	28.7	1.0	283.98	404.51	0.0	1.0	0.0	15.7	9.0	24.6	14	10.41	9.71	10.44	92.2	845.0	1265.2	76.6	496.8	**506.07**	**165.60**
9.00	10.00	9.50	1.00	7.5	20.41	10.41	97.37	3.14	24.6	24.6	1.0	140.10	544.61	14.0	1.0	44.0	59.7	10.0	24.6	14	10.41	9.71	10.44	102.6	924.4	1528.7	88.4	692.7	**611.49**	**230.89**
10.00	11.00	10.50	1.00	8.5	20.41	10.41	107.78	3.14	24.6	24.6	1.0	155.08	699.68	14.0	1.0	44.0	103.7	11.0	24.6	14	10.41	9.71	10.44	113.0	1003.8	1807.2	100.1	903.5	**722.89**	**301.18**
11.00	12.50	11.75	1.50	10.0	20.41	10.41	120.79	4.71	24.6	24.6	1.0	260.70	960.39	14.0	1.0	66.0	169.7	12.5	24.6	14	10.41	9.71	10.44	128.6	1123.0	2253.1	117.8	1247.9	**901.24**	**415.97**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
12.50	14.00	13.25	1.50	11.5	20.41	10.41	136.40	4.71	24.6	24.6	1.0	294.41	1254.80	14.0	1.0	66.0	235.7	14.0	24.6	14	10.86	9.71	10.44	144.2	1244.0	2734.5	135.5	1626.0	**1093.80**	**542.00**
14.00	15.50	14.75	1.50	13.0	20.86	10.86	152.36	4.71	24.6	24.6	1.0	328.84	1583.63	14.0	1.0	66.0	301.7	15.5	24.6	14	10.86	9.71	10.44	144.2	1244.0	3129.3	153.2	2038.5	**1251.74**	**679.50**
15.50	17.00	16.25	1.50	14.5	20.86	10.86	152.36	4.71	24.6	24.6	1.0	328.84	1912.47	14.0	1.0	66.0	367.7	17.0	23.9	15	10.66	9.21	9.67	144.2	1189.9	3470.1	170.8	2451.0	**1388.04**	**817.00**
17.00	18.50	17.75	1.50	16.0	20.66	10.66	152.36	4.71	23.9	23.9	1.0	318.28	2230.75	15.0	1.0	70.7	438.4	18.5	23.9	15	10.66	9.21	9.67	144.2	1189.9	3859.1	188.5	2857.7	**1543.64**	**952.56**
18.50	20.00	19.25	1.50	17.5	20.66	10.66	152.36	4.71	23.9	23.9	1.0	318.28	2549.04	15.0	1.0	70.7	509.1	20.0	23.7	19	10.65	9.06	9.45	144.2	1200.9	4259.1	206.2	3264.3	**1703.64**	**1088.12**
20.00	21.50	20.75	1.50	19.0	20.65	10.65	152.36	4.71	23.7	23.7	1.0	315.29	2864.32	19.0	1.0	89.6	598.7	21.5	23.7	19	9.78	9.06	9.45	144.2	1197.7	4660.7	223.8	3686.9	**1864.29**	**1228.96**
21.50	24.50	23.00	3.00	22.0	19.78	9.78	152.36	9.43	23.7	23.7	1.0	630.58	3494.90	19.0	1.0	179.1	777.9	24.5	23.7	19	9.78	9.06	9.45	144.2	1197.7	5470.5	259.2	4531.9	**2188.18**	**1510.65**
24.50	26.00	25.25	1.50	23.5	19.78	9.78	152.36	4.71	23.7	23.7	1.0	315.29	3810.19	19.0	1.0	89.6	867.4	26.0	6.4	60	9.96	1.82	0.67	144.2	633.3	5311.0	276.9	4954.5	**2124.38**	**1651.49**
26.00	27.50	26.75	1.50	25.0	19.96	9.96	152.36	4.71	6.4	6.4	1.0	80.56	3890.75	60.0	1.0	282.9	1150.3	27.5	6.4	60	9.96	1.82	0.67	144.2	633.3	5674.4	294.5	5335.6	**2269.75**	**1778.52**
27.50	29.00	28.25	1.50	26.5	19.96	9.96	152.36	4.71	6.4	6.4	1.0	80.56	3971.32	60.0	1.0	282.9	1433.1	29.0	9.1	39	10.86	2.31	1.08	144.2	541.9	5946.4	312.2	5716.7	**2378.55**	**1905.55**
29.00	30.00	29.50	1.00	27.5	20.86	10.86	152.36	3.14	9.1	9.1	1.0	76.70	4048.01	39.0	1.0	122.6	1555.7	30.0	9.1	39	10.86	2.31	1.08	144.2	541.9	6145.6	324.0	5927.7	**2458.26**	**1975.90**
30.00	30.50	30.25	0.50	28.0	20.86	10.86	152.36	1.57	9.1	9.1	1.0	38.35	4086.36	39.0	1.0	61.3	1617.0	30.5	6.4	60	10.86	1.82	0.67	144.2	633.6	6336.9	329.9	6033.2	**2534.77**	**2011.08**
30.50	32.00	31.25	1.50	29.5	20.86	10.86	152.36	4.71	6.4	6.4	1.0	80.56	4166.92	60.0	1.0	282.9	1899.9	32.0	9.1	39	9.30	2.31	1.08	144.2	541.3	6608.0	347.5	6414.3	**2643.21**	**2138.11**
32.00	32.50	32.25	0.50	30.0	19.30	9.30	152.36	1.57	9.1	9.1	1.0	38.35	4205.27	39.0	1.0	61.3	1961.1	32.5	9.1	39	9.30	2.31	1.08	144.2	541.3	6707.7	353.4	6519.8	**2683.07**	**2173.28**
32.50	33.50	33.00	1.00	31.0	19.30	9.30	152.36	3.14	9.1	9.1	1.0	76.70	4281.97	39.0	1.0	122.6	2083.7	33.5	23.0	0	9.30	8.56	8.68	144.2	1001.6	7367.3	365.2	6730.9	**2946.93**	**2243.63**
33.50	35.00	34.25	1.50	32.5	19.30	9.30	152.36	4.71	23.0	23.0	1.0	304.88	4586.84	0.0	1.0	0.0	2083.7	35.0	15.5	52	9.30	4.19	2.92	144.2	852.7	7523.3	382.9	7053.4	**3009.31**	**2351.15**
35.00	36.50	35.75	1.50	34.0	19.30	9.30	152.36	4.71	15.5	15.5	1.0	199.19	4786.03	52.0	1.0	245.1	2328.9	36.5	8.5	46	9.60	2.20	0.99	144.2	578.3	7693.2	400.6	7515.4	**3077.27**	**2505.15**
36.50	37.50	37.00	1.00	35.0	19.60	9.60	152.36	3.14	8.5	8.5	1.0	71.56	4857.59	46.0	1.0	144.6	2473.4	37.5	8.5	46	9.60	2.20	0.99	144.2	578.3	7909.3	412.3	7743.4	**3163.73**	**2581.12**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
37.50	38.00	37.75	0.50	35.5	19.60	9.60	152.36	1.57	8.5	8.5	1.0	35.78	4893.37	46.0	1.0	72.3	2545.7	38.0	8.5	67	8.10	2.20	0.99	144.2	726.2	8165.3	418.2	7857.3	**3266.12**	**2619.10**
38.00	40.00	39.00	2.00	37.5	18.10	8.10	152.36	6.29	8.5	8.5	1.0	143.12	5036.50	67.0	1.0	421.1	2966.9	40.0	8.5	67	8.10	2.20	0.99	144.2	726.2	8729.6	441.8	8445.1	**3491.83**	**2815.05**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
BORE NO: P41, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	20.61	10.61	29.18	1.89	7.4	7.4	1.0	7.15	0	62	1.0	116.9	0	3.0	7.4	62	10.61	2.00	0.82	31.8	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.5	20.61	10.61	37.14	3.77	7.4	7.4	1.0	18.19	0	62	1.0	233.8	0	4.0	6.8	60	10.61	1.89	0.73	42.4	0	0.0	25.4	25.4	**0.00**	**8.48**
4.00	5.00	4.50	1.00	2.5	20.61	10.61	47.75	3.77	6.8	6.8	1.0	21.47	0	60	1.0	226.3	0	5.0	28.3	1	9.32	17.43	18.48	53.1	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.5	19.32	9.32	57.71	3.77	28.3	28.3	1.0	117.19	0	1	1.0	3.8	0	6.0	28.3	1	9.32	17.43	18.48	62.4	1357.2	1357.2	59.4	59.4	**542.88**	**19.79**
6.00	7.00	6.50	1.00	4.5	19.32	9.32	67.03	3.77	28.3	28.3	1.0	136.12	136.12	1	1.0	3.8	3.8	7.0	12.2	43	9.32	3.12	1.85	71.7	702.3	842.2	76.3	216.2	**336.89**	**72.08**
7.00	8.00	7.50	1.00	5.5	19.32	9.32	76.35	3.77	12.2	12.2	1.0	62.26	198.37	43	1.0	162.2	165.9	8.0	12.2	43	10.08	3.12	1.85	81.0	736.2	1100.5	93.3	457.6	**440.19**	**152.54**
8.00	9.00	8.50	1.00	6.5	20.08	10.08	86.05	3.77	12.2	12.2	1.0	70.17	268.54	43	1.0	162.2	328.1	9.0	12.2	43	10.08	3.12	1.85	91.1	771.7	1368.4	110.3	706.9	**547.34**	**235.64**
9.00	10.00	9.50	1.00	7.5	20.08	10.08	96.13	3.77	12.2	12.2	1.0	78.39	346.93	43	1.0	162.2	490.3	10.0	10.7	53	10.08	2.68	1.42	101.2	855.7	1692.9	127.2	964.4	**677.16**	**321.48**
10.00	11.00	10.50	1.00	8.5	20.08	10.08	106.21	3.77	10.7	10.7	1.0	75.69	422.61	53	1.0	199.9	690.2	11.0	10.7	53	10.37	2.68	1.42	111.3	886.5	1999.3	144.2	1257.0	**799.71**	**418.99**
11.00	12.50	11.75	1.50	10.0	20.37	10.37	119.03	5.66	10.7	10.7	1.0	127.23	549.85	53	1.0	299.8	990.0	12.5	11.5	58	10.16	2.91	1.65	126.8	1019.6	2559.5	169.6	1709.5	**1023.79**	**569.83**
12.50	15.50	14.00	3.00	13.0	20.16	10.16	142.05	11.31	11.5	11.5	1.0	326.98	876.82	58	1.0	656.2	1646.2	15.5	9.7	62	10.40	2.42	1.17	157.3	1069.6	3592.6	220.5	2743.6	**1437.05**	**914.53**
15.50	18.50	17.00	3.00	16.0	20.40	10.40	172.89	11.31	9.7	9.7	1.0	334.36	1211.18	62	1.0	701.5	2347.7	18.5	14.8	31	10.40	3.88	2.59	157.3	1024.8	4583.7	271.4	3830.3	**1833.48**	**1276.78**
18.50	20.00	19.25	1.50	17.5	20.40	10.40	172.89	5.66	14.8	14.8	1.0	258.41	1469.59	31	1.0	175.4	2523.1	20.0	8.3	60	10.40	2.16	0.96	157.3	1002.8	4995.5	296.9	4289.6	**1998.20**	**1429.85**
20.00	21.50	20.75	1.50	19.0	20.40	10.40	172.89	5.66	8.3	8.3	1.0	142.68	1612.27	60	1.0	339.4	2862.5	21.5	8.9	48	10.86	2.27	1.05	157.3	900.8	5375.6	322.3	4797.1	**2150.25**	**1599.04**
21.50	24.50	23.00	3.00	22.0	20.86	10.86	172.89	11.31	8.9	8.9	1.0	306.31	1918.58	48	1.0	543.1	3405.6	24.5	8.9	48	10.86	2.27	1.05	157.3	900.8	6225.0	373.2	5697.4	**2490.01**	**1899.13**
24.50	26.00	25.25	1.50	23.5	20.86	10.86	172.89	5.66	8.9	8.9	1.0	153.16	2071.74	48	1.0	271.5	3677.1	26.0	24.8	8	9.49	9.86	10.66	157.3	1904.1	7653.0	398.7	6147.5	**3061.18**	**2049.18**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
26.00	27.50	26.75	1.50	25.0	19.49	9.49	172.89	5.66	24.8	24.8	1.0	451.92	2523.65	8	1.0	45.3	3722.4	27.5	10.0	45	9.49	2.47	1.22	157.3	905.6	7151.7	424.1	6670.2	**2860.68**	**2223.39**
27.50	29.00	28.25	1.50	26.5	19.49	9.49	172.89	5.66	10.0	10.0	1.0	172.45	2696.10	45	1.0	254.6	3977.0	29.0	24.7	10	9.76	9.78	10.55	157.3	1912.9	8585.9	449.6	7122.6	**3434.38**	**2374.21**
29.00	30.00	29.50	1.00	27.5	19.76	9.76	172.89	3.77	24.7	24.7	1.0	299.90	2996.00	10	1.0	37.7	4014.7	30.0	24.0	0	9.76	9.28	9.78	157.3	1716.3	8726.9	466.5	7477.2	**3490.78**	**2492.40**
30.00	30.50	30.25	0.50	28.0	19.76	9.76	172.89	1.89	24.0	24.0	1.0	145.15	3141.15	0	1.0	0.0	4014.7	30.5	24.4	0	9.76	9.57	10.22	157.3	1770.4	8926.2	475.0	7630.8	**3570.50**	**2543.62**
30.50	32.00	31.25	1.50	29.5	19.76	9.76	172.89	5.66	24.4	24.4	1.0	443.66	3584.81	0	1.0	0.0	4014.7	32.0	7.6	41	10.43	2.04	0.85	157.3	786.2	8385.7	500.5	8099.9	**3354.28**	**2699.98**
32.00	32.50	32.25	0.50	30.0	20.43	10.43	172.89	1.89	7.6	7.6	1.0	43.50	3628.31	41	1.0	77.3	4092.0	32.5	7.6	41	10.43	2.04	0.85	157.3	786.2	8506.5	508.9	8229.2	**3402.60**	**2743.08**
32.50	33.50	33.00	1.00	31.0	20.43	10.43	172.89	3.77	7.6	7.6	1.0	87.00	3715.31	41	1.0	154.6	4246.6	33.5	28.3	0	10.43	17.43	18.48	157.3	3232.9	11194.8	525.9	8487.8	**4477.93**	**2829.28**
33.50	35.00	34.25	1.50	32.5	20.43	10.43	172.89	5.66	28.3	28.3	1.0	526.62	4241.92	0	1.0	0.0	4246.6	35.0	26.1	4	10.84	12.48	13.41	157.3	2359.8	10848.4	551.3	9039.9	**4339.35**	**3013.30**
35.00	36.50	35.75	1.50	34.0	20.84	10.84	172.89	5.66	26.1	26.1	1.0	479.13	4721.06	4	1.0	22.6	4269.3	36.5	8.1	60	10.84	2.13	0.93	157.3	996.5	9986.8	576.8	9567.1	**3994.72**	**3189.04**
36.50	37.50	37.00	1.00	35.0	20.84	10.84	172.89	3.77	8.1	8.1	1.0	92.80	4813.85	60	1.0	226.3	4495.5	37.5	8.1	60	10.84	2.13	0.93	157.3	996.5	10305.9	593.8	9903.2	**4122.35**	**3301.05**
37.50	38.00	37.75	0.50	35.5	20.84	10.84	172.89	1.89	8.1	8.1	1.0	46.40	4860.25	60	1.0	113.1	4608.7	38.0	8.1	60	9.63	2.13	0.93	157.3	995.7	10464.7	602.2	10071.2	**4185.87**	**3357.06**
38.00	40.00	39.00	2.00	37.5	19.63	9.63	172.89	7.54	8.1	8.1	1.0	185.59	5045.85	60	1.0	452.6	5061.3	40.0	8.1	60	9.20	2.13	0.93	157.3	995.5	11102.6	636.2	10743.3	**4441.02**	**3581.09**
BORE NO: P42, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	20.28	10.28	28.27	1.89	8.6	8.6	1.0	8.06	0	47	1.0	88.6	0	3.0	14.4	36	10.28	3.77	2.48	30.8	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.5	20.28	10.28	35.98	3.77	14.4	14.4	1.0	34.84	0	36	1.0	135.8	0	4.0	7.8	71	10.08	2.07	0.88	41.1	0	0.0	25.4	25.4	**0.00**	**8.48**
4.00	5.00	4.50	1.00	2.5	20.08	10.08	46.16	3.77	7.8	7.8	1.0	23.85	0	71	1.0	267.8	0	5.0	28.8	0	10.08	18.56	19.64	51.2	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.5	20.08	10.08	56.24	3.77	28.8	28.8	1.0	116.61	0	0	1.0	0.0	0	6.0	29.0	0	10.08	19.01	20.10	61.3	0	0.0	59.4	59.4	**0.00**	**19.79**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
6.00	8.00	7.00	2.00	5.5	20.08	10.08	71.36	7.54	29.0	29.0	1.0	298.36	0	0	1.0	0.0	0	8.0	28.5	0	10.76	17.88	18.94	81.4	0	0.0	93.3	93.3	**0.00**	**31.10**
8.00	9.00	8.50	1.00	6.5	20.76	10.76	86.82	3.77	28.5	28.5	1.0	177.78	0	0	1.0	0.0	0	9.0	11.6	52	10.76	2.94	1.68	92.2	848.5	848.5	110.3	110.3	**339.40**	**36.76**
9.00	11.00	10.00	2.00	8.5	20.76	10.76	102.96	7.54	11.6	11.6	1.0	159.42	159.42	52	1.0	392.2	392.2	11.0	11.6	52	10.76	2.94	1.68	113.7	920.1	1471.7	144.2	695.8	**588.69**	**231.95**
11.00	12.00	11.50	1.00	9.5	20.76	10.76	119.10	3.77	11.6	11.6	1.0	92.20	251.62	52	1.0	196.1	588.3	12.0	10.0	50	10.39	2.47	1.22	124.5	865.6	1705.6	161.2	1001.1	**682.23**	**333.71**
12.00	14.50	13.25	2.50	12.0	20.39	10.39	137.47	9.43	10.0	10.0	1.0	228.54	480.16	50	1.0	471.4	1059.8	14.5	24.6	14	10.33	9.71	10.44	150.5	1869.0	3409.0	203.6	1743.5	**1363.59**	**581.17**
14.50	17.50	16.00	3.00	15.0	20.33	10.33	165.95	11.31	24.6	24.6	1.0	859.64	1339.79	14	1.0	158.4	1218.2	17.5	26.3	11	10.03	12.93	13.88	181.4	2860.4	5418.4	254.5	2812.4	**2167.34**	**937.48**
17.50	20.50	19.00	3.00	18.0	20.03	10.03	165.95	11.31	26.3	26.3	1.0	927.97	2267.77	11	1.0	124.5	1342.6	20.5	12.4	62	10.03	3.17	1.91	181.4	1296.1	4906.5	305.4	3915.8	**1962.59**	**1305.25**
20.50	22.00	21.25	1.50	19.5	20.03	10.03	165.95	5.66	12.4	12.4	1.0	206.41	2474.17	62	1.0	350.7	1693.4	22.0	8.3	62	10.15	2.16	0.96	181.4	1082.2	5249.7	330.8	4498.4	**2099.90**	**1499.45**
22.00	23.50	22.75	1.50	21.0	20.15	10.15	165.95	5.66	8.3	8.3	1.0	136.96	2611.13	62	1.0	350.7	2044.1	23.5	8.3	62	10.15	2.16	0.96	181.4	1082.2	5737.4	356.3	5011.5	**2294.97**	**1670.50**
23.50	25.00	24.25	1.50	22.5	20.15	10.15	165.95	5.66	8.3	8.3	1.0	136.96	2748.09	62	1.0	350.7	2394.9	25.0	10.6	49	10.35	2.65	1.39	181.4	1052.0	6195.0	381.7	5524.6	**2477.99**	**1841.55**
25.00	26.50	25.75	1.50	24.0	20.35	10.35	165.95	5.66	10.6	10.6	1.0	175.69	2923.78	49	1.0	277.2	2672.1	26.5	10.6	49	10.35	2.65	1.39	181.4	1052.0	6647.9	407.2	6003.0	**2659.14**	**2001.00**
26.50	27.50	27.00	1.00	25.0	20.35	10.35	165.95	3.77	10.6	10.6	1.0	117.13	3040.91	49	1.0	184.8	2856.9	27.5	9.7	54	10.35	2.42	1.17	181.4	1054.1	6951.9	424.1	6321.9	**2780.75**	**2107.29**
27.50	28.00	27.75	0.50	25.5	20.35	10.35	165.95	1.89	9.7	9.7	1.0	53.49	3094.40	54	1.0	101.8	2958.7	28.0	9.0	40	10.73	2.29	1.07	181.4	885.2	6938.3	432.6	6485.7	**2775.31**	**2161.89**
28.00	29.50	28.75	1.50	27.0	20.73	10.73	165.95	5.66	9.0	9.0	1.0	148.69	3243.09	40	1.0	226.3	3185.0	29.5	27.1	0	10.73	14.73	15.72	181.4	3138.2	9566.3	458.0	6886.1	**3826.52**	**2295.37**
29.50	30.00	29.75	0.50	27.5	20.73	10.73	165.95	1.89	27.1	27.1	1.0	160.14	3403.23	0	1.0	0.0	3185.0	30.0	27.1	0	10.73	14.73	15.72	181.4	3138.2	9726.4	466.5	7054.7	**3890.58**	**2351.58**
30.00	31.00	30.50	1.00	28.5	20.73	10.73	165.95	3.77	27.1	27.1	1.0	320.27	3723.50	0	1.0	0.0	3185.0	31.0	26.5	2	10.05	13.38	14.34	181.4	2864.5	9773.0	483.5	7392.0	**3909.21**	**2463.99**
31.00	32.50	31.75	1.50	30.0	20.05	10.05	165.95	5.66	26.5	26.5	1.0	468.07	4191.57	2	1.0	11.3	3196.3	32.5	12.0	46	10.05	3.06	1.79	181.4	1108.4	8496.3	508.9	7896.8	**3398.51**	**2632.26**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
32.50	34.00	33.25	1.50	31.5	20.05	10.05	165.95	5.66	12.0	12.0	1.0	199.55	4391.12	46	1.0	260.2	3456.5	34.0	9.5	46	10.05	2.38	1.14	181.4	964.8	8812.4	534.4	8382.0	**3524.98**	**2794.01**
34.00	35.00	34.50	1.00	32.5	20.05	10.05	165.95	3.77	9.5	9.5	1.0	104.73	4495.85	46	1.0	173.5	3630.0	35.0	9.5	48	8.75	2.38	1.14	181.4	984.2	9110.0	551.3	8677.2	**3644.01**	**2892.40**
35.00	35.50	35.25	0.50	33.0	18.75	8.75	165.95	1.89	9.5	9.5	1.0	52.37	4548.22	48	1.0	90.5	3720.5	35.5	13.0	57	9.00	3.35	2.08	181.4	1280.8	9549.6	559.8	8828.6	**3819.83**	**2942.86**
35.50	37.00	36.25	1.50	34.5	19.00	9.00	165.95	5.66	13.0	13.0	1.0	216.74	4764.96	57	1.0	322.5	4043.0	37.0	13.0	57	9.22	3.35	2.08	181.4	1281.2	10089.1	585.3	9393.2	**4035.64**	**3131.07**
37.00	37.50	37.25	0.50	35.0	19.22	9.22	165.95	1.89	13.0	13.0	1.0	72.25	4837.21	57	1.0	107.5	4150.5	37.5	13.0	57	9.22	3.35	2.08	181.4	1281.2	10268.8	593.8	9581.4	**4107.53**	**3193.81**
37.50	38.50	38.00	1.00	36.0	19.22	9.22	165.95	3.77	13.0	13.0	1.0	144.49	4981.70	57	1.0	215.0	4365.4	38.5	17.5	57	9.20	5.17	4.02	181.4	1666.9	11014.0	610.7	9957.9	**4405.61**	**3319.28**
38.50	40.00	39.25	1.50	37.5	19.20	9.20	165.95	5.66	17.5	17.5	1.0	296.00	5277.70	57	1.0	322.5	4687.9	40.0	17.5	57	9.20	5.17	4.02	181.4	1666.9	11632.5	636.2	10601.8	**4652.99**	**3533.92**
BORE NO: P43, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	19.38	9.38	25.80	1.89	11.2	11.2	1.0	9.63	0	31	1.0	58.5	0	3.0	27.3	0	9.38	15.18	16.18	28.1	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	5.00	4.00	2.00	2.5	19.38	9.38	37.52	7.54	27.3	27.3	1.0	146.07	0	0	1.0	0.0	0	5.0	27.3	0	9.38	15.18	16.18	46.9	908.5	908.5	42.4	42.4	**363.40**	**14.14**
5.00	6.00	5.50	1.00	3.5	19.38	9.38	51.59	3.77	27.3	27.3	1.0	100.42	100.42	0	1.0	0.0	0.0	6.0	26.3	0	9.38	12.93	13.88	56.3	911.5	1012.0	59.4	159.8	**404.78**	**53.27**
6.00	7.00	6.50	1.00	4.5	19.38	9.38	60.97	3.77	26.3	26.3	1.0	113.65	214.07	0	1.0	0.0	0.0	7.0	26.5	8	10.36	13.38	14.34	65.7	1176.1	1390.2	76.3	290.4	**556.08**	**96.80**
7.00	8.00	7.50	1.00	5.5	20.36	10.36	70.84	3.77	26.5	26.5	1.0	133.21	347.27	8	1.0	30.2	30.2	8.0	9.0	48	10.36	2.29	1.07	76.0	693.2	1070.7	93.3	470.8	**428.27**	**156.92**
8.00	9.00	8.50	1.00	6.5	20.36	10.36	81.20	3.77	9.0	9.0	1.0	48.50	395.78	48	1.0	181.0	211.2	9.0	9.5	44	10.15	2.38	1.14	86.4	688.5	1295.5	110.3	717.2	**518.20**	**239.08**
9.00	11.00	10.00	2.00	8.5	20.15	10.15	96.53	7.54	9.5	9.5	1.0	121.84	517.62	44	1.0	331.9	543.1	11.0	9.5	44	10.15	2.38	1.14	106.7	743.2	1803.9	144.2	1204.9	**721.56**	**401.64**
11.00	12.00	11.50	1.00	9.5	20.15	10.15	111.76	3.77	9.5	9.5	1.0	70.53	588.15	44	1.0	165.9	709.0	12.0	8.5	55	10.65	2.20	0.99	116.8	858.0	2155.2	161.2	1458.3	**862.08**	**486.12**
12.00	14.50	13.25	2.50	12.0	20.65	10.65	130.14	9.43	8.5	8.5	1.0	183.39	771.54	55	1.0	518.6	1227.6	14.5	8.5	57	10.27	2.20	0.99	143.5	944.4	2943.5	203.6	2202.7	**1177.41**	**734.24**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 1.13 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
14.50	17.50	16.00	3.00	15.0	20.27	10.27	158.86	11.31	8.5	8.5	1.0	268.62	1040.16	57	1.0	644.9	1872.5	17.5	9.3	57	10.27	2.34	1.11	174.3	1050.3	3963.0	254.5	3167.1	**1585.21**	**1055.71**
17.50	20.50	19.00	3.00	18.0	20.27	10.27	158.86	11.31	9.3	9.3	1.0	294.33	1334.49	57	1.0	644.9	2517.4	20.5	14.3	39	10.41	3.74	2.45	174.3	1151.3	5003.2	305.4	4157.3	**2001.27**	**1385.76**
20.50	22.00	21.25	1.50	19.5	20.41	10.41	158.86	5.66	14.3	14.3	1.0	229.07	1563.57	39	1.0	220.6	2738.1	22.0	9.4	52	10.41	2.36	1.13	174.3	1003.2	5304.8	330.8	4632.4	**2121.93**	**1544.14**
22.00	23.50	22.75	1.50	21.0	20.41	10.41	158.86	5.66	9.4	9.4	1.0	148.78	1712.34	52	1.0	294.2	3032.2	23.5	9.4	52	10.41	2.36	1.13	174.3	1003.2	5747.8	356.3	5100.8	**2299.11**	**1700.28**
23.50	26.50	25.00	3.00	24.0	20.41	10.41	158.86	11.31	9.4	9.4	1.0	297.56	2009.90	52	1.0	588.3	3620.6	26.5	9.4	60	10.97	2.36	1.13	174.3	1085.1	6715.6	407.2	6037.6	**2686.22**	**2012.54**
26.50	27.50	27.00	1.00	25.0	20.97	10.97	158.86	3.77	9.4	9.4	1.0	99.19	2109.09	60	1.0	226.3	3846.9	27.5	9.2	62	10.97	2.33	1.10	174.3	1098.1	7054.1	424.1	6380.1	**2821.62**	**2126.69**
27.50	29.50	28.50	2.00	27.0	20.97	10.97	158.86	7.54	9.2	9.2	1.0	194.08	2303.16	62	1.0	467.7	4314.5	29.5	9.2	62	10.97	2.33	1.10	174.3	1098.1	7715.8	458.0	7075.7	**3086.32**	**2358.57**
29.50	30.00	29.75	0.50	27.5	20.97	10.97	158.86	1.89	9.2	9.2	1.0	48.52	2351.68	62	1.0	116.9	4431.4	30.0	10.8	46	9.62	2.71	1.45	174.3	1011.3	7794.4	466.5	7249.6	**3117.74**	**2416.55**
30.00	32.50	31.25	2.50	30.0	19.62	9.62	158.86	9.43	10.8	10.8	1.0	285.72	2637.41	46	1.0	433.7	4865.1	32.5	29.4	0	9.62	19.91	21.02	174.3	4062.6	11565.1	508.9	8011.5	**4626.04**	**2670.50**
32.50	34.00	33.25	1.50	31.5	19.62	9.62	158.86	5.66	29.4	29.4	1.0	506.39	3143.79	0	1.0	0.0	4865.1	34.0	29.4	0	9.62	19.91	21.02	174.3	4062.6	12071.5	534.4	8543.3	**4828.60**	**2847.77**
34.00	35.00	34.50	1.00	32.5	19.62	9.62	158.86	3.77	29.4	29.4	1.0	337.59	3481.38	0	1.0	0.0	4865.1	35.0	27.8	0	10.29	16.31	17.33	174.3	3336.0	11682.5	551.3	8897.9	**4673.00**	**2965.96**
35.00	35.50	35.25	0.50	33.0	20.29	10.29	158.86	1.89	27.8	27.8	1.0	157.94	3639.33	0	1.0	0.0	4865.1	35.5	27.8	0	10.29	16.31	17.33	174.3	3336.0	11840.4	559.8	9064.3	**4736.17**	**3021.43**
35.50	37.00	36.25	1.50	34.5	20.29	10.29	158.86	5.66	27.8	27.8	1.0	473.83	4113.15	0	1.0	0.0	4865.1	37.0	25.4	18	10.29	10.90	11.80	174.3	2415.0	11393.3	585.3	9563.6	**4557.33**	**3187.86**
37.00	37.50	37.25	0.50	35.0	20.29	10.29	158.86	1.89	25.4	25.4	1.0	142.24	4255.40	18	1.0	33.9	4899.1	37.5	25.4	18	10.29	10.90	11.80	174.3	2415.0	11569.5	593.8	9748.2	**4627.80**	**3249.42**
37.50	38.50	38.00	1.00	36.0	20.29	10.29	158.86	3.77	25.4	25.4	1.0	284.49	4539.89	18	1.0	67.9	4967.0	38.5	21.2	36	10.29	7.26	6.71	174.3	1845.7	11352.5	610.7	10117.6	**4541.01**	**3372.53**
38.50	40.00	39.25	1.50	37.5	20.29	10.29	158.86	5.66	21.2	21.2	1.0	348.58	4888.47	36	1.0	203.7	5170.6	40.0	21.2	36	10.29	7.26	6.71	174.3	1845.7	11904.8	636.2	10695.3	**4761.91**	**3565.09**
BORE NO: P44, CUT OFF LENGTH: 2.50 m, Nc= 9																														

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
2.50	3.00	2.75	0.50	0.5	20.75	10.75	29.56	1.89	18.0	18.0	1.0	18.11	0	33	1.0	62.2	0	3.0	26.7	5	9.39	13.83	14.80	32.3	649.8	649.8	8.5	8.5	**259.92**	**2.83**
3.00	5.00	4.00	2.00	2.5	19.39	9.39	41.64	7.54	26.7	26.7	1.0	157.97	157.97	5	1.0	37.7	37.7	5.0	26.7	5	9.39	13.83	14.80	51.0	943.6	1139.3	42.4	238.1	**455.73**	**79.36**
5.00	6.00	5.50	1.00	3.5	19.39	9.39	55.73	3.77	26.7	26.7	1.0	105.70	263.67	5	1.0	18.9	56.6	6.0	25.8	0	9.39	11.80	12.72	60.4	887.9	1208.1	59.4	379.6	**483.24**	**126.54**
6.00	7.00	6.50	1.00	4.5	19.39	9.39	65.12	3.77	25.8	25.8	1.0	118.72	382.39	0	1.0	0.0	56.6	7.0	26.2	8	10.09	12.70	13.64	69.8	1178.2	1617.2	76.3	515.3	**646.87**	**171.77**
7.00	8.00	7.50	1.00	5.5	20.09	10.09	74.86	3.77	26.2	26.2	1.0	138.91	521.30	8	1.0	30.2	86.7	8.0	26.2	8	10.09	12.70	13.64	79.9	1323.2	1931.3	93.3	701.3	**772.51**	**233.78**
8.00	9.00	8.50	1.00	6.5	20.09	10.09	84.95	3.77	26.2	26.2	1.0	157.64	678.94	8	1.0	30.2	116.9	9.0	8.6	58	9.04	2.22	1.00	90.0	822.6	1618.5	110.3	906.1	**647.38**	**302.04**
9.00	11.00	10.00	2.00	8.5	19.04	9.04	99.03	7.54	8.6	8.6	1.0	112.97	791.91	58	1.0	437.5	554.4	11.0	8.6	58	9.04	2.22	1.00	108.1	868.0	2214.3	144.2	1490.5	**885.71**	**496.84**
11.00	12.00	11.50	1.00	9.5	19.04	9.04	112.59	3.77	8.6	8.6	1.0	64.22	856.12	58	1.0	218.7	773.1	12.0	9.8	57	10.61	2.43	1.19	117.1	911.5	2540.8	161.2	1790.4	**1016.31**	**596.81**
12.00	14.50	13.25	2.50	12.0	20.61	10.61	130.37	9.43	9.8	9.8	1.0	212.32	1068.45	57	1.0	537.4	1310.6	14.5	9.8	57	10.61	2.43	1.19	143.6	984.5	3363.6	203.6	2582.6	**1345.43**	**860.87**
14.50	17.50	16.00	3.00	15.0	20.61	10.61	159.55	11.31	9.8	9.8	1.0	311.81	1380.26	57	1.0	644.9	1955.5	17.5	9.5	52	10.18	2.38	1.14	175.5	1009.9	4345.6	254.5	3590.2	**1738.26**	**1196.74**
17.50	20.50	19.00	3.00	18.0	20.18	10.18	159.55	11.31	9.5	9.5	1.0	302.09	1682.35	52	1.0	588.3	2543.8	20.5	9.5	52	10.18	2.38	1.14	175.5	1009.9	5236.1	305.4	4531.5	**2094.43**	**1510.51**
20.50	23.50	22.00	3.00	21.0	20.18	10.18	159.55	11.31	9.5	9.5	1.0	302.09	1984.43	52	1.0	588.3	3132.2	23.5	13.7	23	10.55	3.56	2.28	175.5	957.3	6073.9	356.3	5472.9	**2429.55**	**1824.29**
23.50	25.00	24.25	1.50	22.5	20.55	10.55	159.55	5.66	13.7	13.7	1.0	220.03	2204.46	23	1.0	130.1	3262.3	25.0	10.2	55	10.55	2.53	1.28	175.5	1071.2	6538.0	381.7	5848.5	**2615.19**	**1949.48**
25.00	26.50	25.75	1.50	24.0	20.55	10.55	159.55	5.66	10.2	10.2	1.0	162.40	2366.86	55	1.0	311.1	3573.4	26.5	9.9	50	10.55	2.45	1.20	175.5	1004.6	6944.8	407.2	6347.4	**2777.94**	**2115.81**
26.50	27.50	27.00	1.00	25.0	20.55	10.55	159.55	3.77	9.9	9.9	1.0	105.02	2471.88	50	1.0	188.6	3762.0	27.5	9.9	50	10.55	2.45	1.20	175.5	1004.6	7238.4	424.1	6658.0	**2895.38**	**2219.33**
27.50	28.00	27.75	0.50	25.5	20.55	10.55	159.55	1.89	9.9	9.9	1.0	52.51	2524.39	50	1.0	94.3	3856.3	28.0	28.5	2	9.71	17.88	18.94	175.5	3695.2	10075.9	432.6	6813.3	**4030.36**	**2271.09**
28.00	29.50	28.75	1.50	27.0	19.71	9.71	159.55	5.66	28.5	28.5	1.0	490.07	3014.46	2	1.0	11.3	3867.6	29.5	24.5	20	9.71	9.64	10.33	175.5	2185.5	9067.6	458.0	7340.1	**3627.04**	**2446.70**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 1.13 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
29.50	30.00	29.75	0.50	27.5	19.71	9.71	159.55	1.89	24.5	24.5	1.0	137.11	3151.58	20	1.0	37.7	3905.3	30.0	24.0	20	9.71	9.28	9.78	175.5	2110.5	9167.3	466.5	7523.4	**3666.94**	**2507.81**
30.00	31.00	30.50	1.00	28.5	19.71	9.71	159.55	3.77	24.0	24.0	1.0	267.91	3419.48	20	1.0	75.4	3980.7	31.0	28.2	0	9.71	17.21	18.25	175.5	3536.2	10936.4	483.5	7883.7	**4374.56**	**2627.91**
31.00	32.50	31.75	1.50	30.0	19.71	9.71	159.55	5.66	28.2	28.2	1.0	483.97	3903.45	0	1.0	0.0	3980.7	32.5	20.3	25	7.75	6.62	5.72	175.5	1598.1	9482.3	508.9	8393.1	**3792.92**	**2797.71**
32.50	34.00	33.25	1.50	31.5	17.75	7.75	159.55	5.66	20.3	20.3	1.0	333.88	4237.33	25	1.0	141.4	4122.2	34.0	18.0	39	8.11	5.42	4.29	175.5	1496.0	9855.5	534.4	8893.9	**3942.20**	**2964.63**
34.00	35.00	34.50	1.00	32.5	18.11	8.11	159.55	3.77	18.0	18.0	1.0	195.51	4432.85	39	1.0	147.1	4269.3	35.0	18.0	39	8.11	5.42	4.29	175.5	1496.0	10198.1	551.3	9253.5	**4079.24**	**3084.48**
35.00	35.50	35.25	0.50	33.0	18.11	8.11	159.55	1.89	18.0	18.0	1.0	97.76	4530.60	39	1.0	73.5	4342.8	35.5	29.1	0	8.11	19.23	20.33	175.5	3930.1	12803.5	559.8	9433.2	**5121.41**	**3144.41**
35.50	37.00	36.25	1.50	34.5	18.11	8.11	159.55	5.66	29.1	29.1	1.0	502.38	5032.98	0	1.0	0.0	4342.8	37.0	29.1	0	7.75	19.23	20.33	175.5	3925.2	13300.9	585.3	9961.1	**5320.38**	**3320.35**
37.00	37.50	37.25	0.50	35.0	17.75	7.75	159.55	1.89	29.1	29.1	1.0	167.46	5200.44	0	1.0	0.0	4342.8	37.5	28.9	0	7.75	18.78	19.87	175.5	3833.3	13376.6	593.8	10137.0	**5350.62**	**3379.00**
37.50	38.50	38.00	1.00	36.0	17.75	7.75	159.55	3.77	28.9	28.9	1.0	332.17	5532.62	0	1.0	0.0	4342.8	38.5	20.7	39	8.08	6.90	6.16	175.5	1801.5	11677.0	610.7	10486.1	**4670.78**	**3495.38**
38.50	40.00	39.25	1.50	37.5	18.08	8.08	159.55	5.66	20.7	20.7	1.0	341.06	5873.68	39	1.0	220.6	4563.4	40.0	20.7	39	8.08	6.90	6.16	175.5	1801.5	12238.6	636.2	11073.3	**4895.46**	**3691.09**
BORE NO: P45, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	19.47	9.47	26.04	1.89	9.2	9.2	1.0	7.95	0	50	1.0	94.3	0	3.0	9.2	50	9.47	2.33	1.10	28.4	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.5	19.47	9.47	33.15	3.77	9.2	9.2	1.0	20.25	0	50	1.0	188.6	0	4.0	27.2	0	9.60	14.95	15.95	37.9	0	0.0	25.4	25.4	**0.00**	**8.48**
4.00	5.00	4.50	1.00	2.5	19.60	9.60	42.68	3.77	27.2	27.2	1.0	82.72	0	0	1.0	0.0	0	5.0	28.1	0	9.60	16.98	18.02	47.5	1029.7	1029.7	42.4	42.4	**411.87**	**14.14**
5.00	6.00	5.50	1.00	3.5	19.60	9.60	52.28	3.77	28.1	28.1	1.0	105.28	105.28	0	1.0	0.0	0.0	6.0	28.1	0	9.70	16.98	18.02	57.1	1215.3	1320.6	59.4	164.7	**528.25**	**54.89**
6.00	8.00	7.00	2.00	5.5	19.70	9.70	66.78	7.54	28.1	28.1	1.0	268.96	374.24	0	1.0	0.0	0.0	8.0	28.1	0	9.70	16.98	18.02	76.5	1588.1	1962.3	93.3	467.5	**784.92**	**155.85**
8.00	9.00	8.50	1.00	6.5	19.70	9.70	81.33	3.77	28.1	28.1	1.0	163.78	538.02	0	1.0	0.0	0.0	9.0	27.4	0	9.70	15.40	16.41	86.2	1610.1	2148.1	110.3	648.3	**859.25**	**216.09**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 1.13 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
9.00	10.00	9.50	1.00	7.5	19.70	9.70	91.03	3.77	27.4	27.4	1.0	177.96	715.97	0	1.0	0.0	0.0	10.0	12.3	47	10.17	3.15	1.88	95.9	832.8	1548.8	127.2	843.2	**619.51**	**281.07**
10.00	11.00	10.50	1.00	8.5	20.17	10.17	100.97	3.77	12.3	12.3	1.0	83.02	799.00	47	1.0	177.3	177.3	11.0	10.9	55	10.17	2.73	1.48	106.1	898.4	1874.6	144.2	1120.5	**749.85**	**373.48**
11.00	12.00	11.50	1.00	9.5	20.17	10.17	111.14	3.77	10.9	10.9	1.0	80.71	879.71	55	1.0	207.4	384.7	12.0	12.0	69	10.42	3.06	1.79	116.2	1117.4	2381.8	161.2	1425.6	**952.72**	**475.19**
12.00	14.50	13.25	2.50	12.0	20.42	10.42	129.25	9.43	12.0	12.0	1.0	259.02	1138.73	69	1.0	650.6	1035.3	14.5	9.3	59	10.57	2.34	1.11	142.3	986.1	3160.1	203.6	2377.6	**1264.03**	**792.52**
14.50	17.50	16.00	3.00	15.0	20.57	10.57	158.13	11.31	9.3	9.3	1.0	292.97	1431.70	59	1.0	667.5	1702.8	17.5	11.2	57	10.50	2.82	1.56	174.0	1147.2	4281.7	254.5	3389.0	**1712.69**	**1129.66**
17.50	20.50	19.00	3.00	18.0	20.50	10.50	158.13	11.31	11.2	11.2	1.0	354.25	1785.95	57	1.0	644.9	2347.7	20.5	8.2	61	10.36	2.15	0.94	174.0	1050.2	5183.9	305.4	4439.0	**2073.55**	**1479.67**
20.50	23.50	22.00	3.00	21.0	20.36	10.36	158.13	11.31	8.2	8.2	1.0	257.81	2043.76	61	1.0	690.2	3037.9	23.5	10.4	55	10.50	2.59	1.33	174.0	1078.9	6160.6	356.3	5437.9	**2464.23**	**1812.63**
23.50	26.50	25.00	3.00	24.0	20.50	10.50	158.13	11.31	10.4	10.4	1.0	328.36	2372.11	55	1.0	622.3	3660.2	26.5	13.3	41	10.50	3.44	2.16	174.0	1110.1	7142.4	407.2	6439.4	**2856.94**	**2146.48**
26.50	27.50	27.00	1.00	25.0	20.50	10.50	158.13	3.77	13.3	13.3	1.0	140.97	2513.08	41	1.0	154.6	3814.8	27.5	13.3	41	10.50	3.44	2.16	174.0	1110.1	7438.0	424.1	6752.0	**2975.18**	**2250.67**
27.50	28.00	27.75	0.50	25.5	20.50	10.50	158.13	1.89	13.3	13.3	1.0	70.49	2583.57	41	1.0	77.3	3892.1	28.0	12.3	77	10.40	3.15	1.88	174.0	1416.5	7892.2	432.6	6908.3	**3156.89**	**2302.76**
28.00	29.50	28.75	1.50	27.0	20.40	10.40	158.13	5.66	12.3	12.3	1.0	195.04	2778.61	77	1.0	435.6	4327.7	29.5	12.3	77	10.40	3.15	1.88	174.0	1416.5	8522.9	458.0	7564.4	**3409.14**	**2521.46**
29.50	30.00	29.75	0.50	27.5	20.40	10.40	158.13	1.89	12.3	12.3	1.0	65.01	2843.62	77	1.0	145.2	4472.9	30.0	12.3	77	10.40	3.15	1.88	174.0	1416.5	8733.1	466.5	7783.1	**3493.23**	**2594.36**
30.00	31.00	30.50	1.00	28.5	20.40	10.40	158.13	3.77	12.3	12.3	1.0	130.03	2973.65	77	1.0	290.4	4763.3	31.0	12.3	77	10.40	3.15	1.88	174.0	1416.5	9153.5	483.5	8220.5	**3661.40**	**2740.15**
31.00	32.50	31.75	1.50	30.0	20.40	10.40	158.13	5.66	12.3	12.3	1.0	195.04	3168.69	77	1.0	435.6	5198.9	32.5	12.0	30	10.07	3.06	1.79	174.0	919.7	9287.3	508.9	8876.5	**3714.92**	**2958.85**
32.50	35.00	33.75	2.50	32.5	20.07	10.07	158.13	9.43	12.0	12.0	1.0	316.90	3485.59	30	1.0	282.9	5481.8	35.0	20.1	14	10.07	6.47	5.50	174.0	1454.1	10421.5	551.3	9518.7	**4168.60**	**3172.90**
35.00	35.50	35.25	0.50	33.0	20.07	10.07	158.13	1.89	20.1	20.1	1.0	109.12	3594.71	14	1.0	26.4	5508.2	35.5	20.0	14	10.07	6.40	5.39	174.0	1439.2	10542.1	559.8	9662.7	**4216.84**	**3220.90**
35.50	37.00	36.25	1.50	34.5	20.07	10.07	158.13	5.66	20.0	20.0	1.0	325.58	3920.29	14	1.0	79.2	5587.4	37.0	23.0	10	10.07	8.56	8.68	174.0	1846.2	11353.9	585.3	10092.9	**4541.54**	**3364.31**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
37.00	37.50	37.25	0.50	35.0	20.07	10.07	158.13	1.89	23.0	23.0	1.0	126.57	4046.86	10	1.0	18.9	5606.2	37.5	23.0	0	8.77	8.56	8.68	174.0	1736.7	11389.8	593.8	10246.9	**4555.92**	**3415.62**
37.50	38.50	38.00	1.00	36.0	18.77	8.77	158.13	3.77	23.0	23.0	1.0	253.14	4300.00	0	1.0	0.0	5606.2	38.5	19.8	35	8.81	6.29	5.28	174.0	1626.9	11533.1	610.7	10517.0	**4613.23**	**3505.65**
38.50	40.00	39.25	1.50	37.5	18.81	8.81	158.13	5.66	19.8	19.8	1.0	322.05	4622.05	35	1.0	198.0	5804.2	40.0	19.8	35	8.81	6.29	5.28	174.0	1626.9	12053.1	636.2	11062.5	**4821.25**	**3687.49**
BORE NO: P46, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	19.42	9.42	25.91	1.89	26.3	26.3	1.0	24.14	0	1	1.0	1.9	0	3.0	26.3	1	9.42	12.93	13.88	28.3	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.5	19.42	9.42	32.97	3.77	26.3	26.3	1.0	61.45	0	1	1.0	3.8	0	4.0	26.3	1	10.02	12.93	13.88	37.7	0	0.0	25.4	25.4	**0.00**	**8.48**
4.00	5.00	4.50	1.00	2.5	20.02	10.02	42.69	3.77	26.3	26.3	1.0	79.57	0	1	1.0	3.8	0	5.0	29.5	0	10.02	20.13	21.25	47.7	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.5	20.02	10.02	52.71	3.77	29.5	29.5	1.0	112.47	0	0	1.0	0.0	0	6.0	29.5	0	8.96	20.13	21.25	57.7	0	0.0	59.4	59.4	**0.00**	**19.79**
6.00	8.00	7.00	2.00	5.5	18.96	8.96	66.68	7.54	29.5	29.5	1.0	284.56	0	0	1.0	0.0	0	8.0	29.5	0	8.96	20.13	21.25	75.6	0	0.0	93.3	93.3	**0.00**	**31.10**
8.00	9.00	8.50	1.00	6.5	18.96	8.96	80.12	3.77	29.5	29.5	1.0	170.96	0	0	1.0	0.0	0	9.0	10.2	47	10.24	2.53	1.28	84.6	729.5	729.5	110.3	110.3	**291.81**	**36.76**
9.00	11.00	10.00	2.00	8.5	20.24	10.24	94.84	7.54	10.2	10.2	1.0	128.71	128.71	47	1.0	354.5	354.5	11.0	10.2	47	10.24	2.53	1.28	105.1	788.1	1271.4	144.2	627.4	**508.54**	**209.14**
11.00	12.00	11.50	1.00	9.5	20.24	10.24	110.20	3.77	10.2	10.2	1.0	74.78	203.49	47	1.0	177.3	531.8	12.0	9.2	57	10.43	2.33	1.10	115.3	891.7	1626.9	161.2	896.4	**650.78**	**298.81**
12.00	14.50	13.25	2.50	12.0	20.43	10.43	128.36	9.43	9.2	9.2	1.0	196.01	399.51	57	1.0	537.4	1069.2	14.5	9.2	57	10.43	2.33	1.10	141.4	960.3	2429.0	203.6	1672.3	**971.60**	**557.43**
14.50	16.00	15.25	1.50	13.5	20.43	10.43	149.22	5.66	9.2	9.2	1.0	136.72	536.23	57	1.0	322.5	1391.7	16.0	26.2	7	10.15	12.70	13.64	157.0	2422.2	4350.1	229.0	2156.9	**1740.05**	**718.97**
16.00	17.50	16.75	1.50	15.0	20.15	10.15	164.65	5.66	26.2	26.2	1.0	458.34	994.57	7	1.0	39.6	1431.3	17.5	26.2	7	10.15	12.70	13.64	172.3	2641.0	5066.9	254.5	2680.3	**2026.75**	**893.43**
17.50	19.00	18.25	1.50	16.5	20.15	10.15	164.65	5.66	26.2	26.2	1.0	458.34	1452.90	7	1.0	39.6	1470.9	19.0	10.7	48	10.17	2.68	1.42	172.3	1020.1	3943.9	279.9	3203.7	**1577.55**	**1067.89**
19.00	20.50	19.75	1.50	18.0	20.17	10.17	164.65	5.66	10.7	10.7	1.0	176.00	1628.91	48	1.0	271.5	1742.4	20.5	10.0	52	10.34	2.47	1.22	172.3	1019.5	4390.8	305.4	3676.7	**1756.32**	**1225.56**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
20.50	23.50	22.00	3.00	21.0	20.34	10.34	164.65	11.31	10.0	10.0	1.0	328.48	1957.39	52	1.0	588.3	2330.7	23.5	16.5	30	10.34	4.68	3.47	172.3	1241.6	5529.8	356.3	4644.4	**2211.90**	**1548.13**
23.50	25.00	24.25	1.50	22.5	20.34	10.34	164.65	5.66	16.5	16.5	1.0	275.91	2233.30	30	1.0	169.7	2500.5	25.0	9.5	50	10.34	2.38	1.14	172.3	981.0	5714.8	381.7	5115.5	**2285.92**	**1705.15**
25.00	26.50	25.75	1.50	24.0	20.34	10.34	164.65	5.66	9.5	9.5	1.0	155.87	2389.17	50	1.0	282.9	2783.3	26.5	9.5	50	9.38	2.38	1.14	172.3	980.3	6152.8	407.2	5579.6	**2461.11**	**1859.88**
26.50	27.50	27.00	1.00	25.0	19.38	9.38	164.65	3.77	9.5	9.5	1.0	103.92	2493.09	50	1.0	188.6	2971.9	27.5	9.5	50	9.38	2.38	1.14	172.3	980.3	6445.3	424.1	5889.1	**2578.11**	**1963.03**
27.50	28.00	27.75	0.50	25.5	19.38	9.38	164.65	1.89	9.5	9.5	1.0	51.96	2545.05	50	1.0	94.3	3066.2	28.0	7.3	72	9.86	1.98	0.80	172.3	1125.2	6736.5	432.6	6043.8	**2694.58**	**2014.61**
28.00	29.50	28.75	1.50	27.0	19.86	9.86	164.65	5.66	7.3	7.3	1.0	119.32	2664.37	72	1.0	407.3	3473.5	29.5	30.0	0	8.36	21.26	22.40	172.3	4270.7	10408.6	458.0	6595.9	**4163.43**	**2198.63**
29.50	30.00	29.75	0.50	27.5	18.36	8.36	164.65	1.89	30.0	30.0	1.0	179.26	2843.63	0	1.0	0.0	3473.5	30.0	30.0	0	11.65	21.26	22.40	172.3	4320.8	10637.9	466.5	6783.6	**4255.15**	**2261.21**
30.00	31.00	30.50	1.00	28.5	21.65	11.65	164.65	3.77	30.0	30.0	1.0	358.52	3202.15	0	1.0	0.0	3473.5	31.0	28.7	0	11.65	18.33	19.40	172.3	3726.5	10402.1	483.5	7159.1	**4160.85**	**2386.38**
31.00	32.50	31.75	1.50	30.0	21.65	11.65	164.65	5.66	28.7	28.7	1.0	509.96	3712.11	0	1.0	0.0	3473.5	32.5	34.2	0	11.65	42.42	43.93	172.3	8614.7	15800.3	508.9	7694.5	**6320.11**	**2564.85**
32.50	35.00	33.75	2.50	32.5	21.65	11.65	164.65	9.43	34.2	34.2	1.2	1276.59	4988.71	0	1.0	0.0	3473.5	35.0	33.4	0	11.65	38.39	39.83	172.3	7796.8	16259.0	551.3	9013.5	**6503.59**	**3004.51**
35.00	35.50	35.25	0.50	33.0	21.65	11.65	164.65	1.89	33.4	33.4	1.2	239.53	5228.24	0	1.0	0.0	3473.5	35.5	33.4	0	11.65	38.39	39.83	172.3	7796.8	16498.5	559.8	9261.6	**6599.41**	**3087.19**
35.50	37.50	36.50	2.00	35.0	21.65	11.65	164.65	7.54	33.4	33.4	1.2	958.13	6186.37	0	1.0	0.0	3473.5	37.5	33.6	0	9.47	39.39	40.85	172.3	7940.8	17600.7	593.8	10253.6	**7040.26**	**3417.87**
37.50	38.50	38.00	1.00	36.0	19.47	9.47	164.65	3.77	33.6	33.6	1.2	486.84	6673.21	0	1.0	0.0	3473.5	38.5	34.1	0	9.44	41.91	43.42	172.3	8447.3	18594.0	610.7	10757.4	**7437.60**	**3585.81**
38.50	40.00	39.25	1.50	37.5	19.44	9.44	164.65	5.66	34.1	34.1	1.2	759.93	7433.14	0	1.0	0.0	3473.5	40.0	34.1	0	9.44	41.91	43.42	172.3	8447.3	19353.9	636.2	11542.8	**7741.57**	**3847.60**
BORE NO: P47, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	18.89	8.89	24.45	1.89	13.5	13.5	1.0	11.07	0	18	1.0	33.9	0	3.0	9.0	41	8.89	2.29	1.07	26.7	493.0	493.0	8.5	8.5	**197.21**	**2.83**
3.00	4.00	3.50	1.00	1.5	18.89	8.89	31.12	3.77	9.0	9.0	1.0	18.59	18.59	41	1.0	154.6	154.6	4.0	27.4	0	8.89	15.40	16.41	35.6	718.8	892.0	25.4	198.7	**356.81**	**66.22**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 1.13 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
4.00	6.00	5.00	2.00	3.5	18.89	8.89	44.45	7.54	27.4	27.4	1.0	173.79	192.38	0	1.0	0.0	154.6	6.0	28.2	0	8.89	17.21	18.25	53.3	1148.6	1495.6	59.4	406.4	**598.22**	**135.46**
6.00	7.00	6.50	1.00	4.5	18.89	8.89	57.79	3.77	28.2	28.2	1.0	116.85	309.23	0	1.0	0.0	154.6	7.0	28.2	0	9.35	17.21	18.25	62.2	1327.3	1791.2	76.3	540.2	**716.47**	**180.07**
7.00	9.00	8.00	2.00	6.5	19.35	9.35	71.58	7.54	28.2	28.2	1.0	289.50	598.73	0	1.0	0.0	154.6	9.0	28.2	0	9.35	17.21	18.25	80.9	1691.4	2444.7	110.3	863.6	**977.89**	**287.88**
9.00	10.00	9.50	1.00	7.5	19.35	9.35	85.61	3.77	28.2	28.2	1.0	173.11	771.85	0	1.0	0.0	154.6	10.0	27.4	0	9.35	15.40	16.41	90.3	1677.7	2604.1	127.2	1053.7	**1041.66**	**351.24**
10.00	11.00	10.50	1.00	8.5	19.35	9.35	94.96	3.77	27.4	27.4	1.0	185.63	957.48	0	1.0	0.0	154.6	11.0	9.1	50	10.17	2.31	1.08	99.6	776.8	1888.9	144.2	1256.3	**755.55**	**418.77**
11.00	12.50	11.75	1.50	10.0	20.17	10.17	107.26	5.66	9.1	9.1	1.0	97.19	1054.67	50	1.0	282.9	437.5	12.5	9.1	50	10.17	2.31	1.08	114.9	816.6	2308.8	169.6	1661.8	**923.51**	**553.93**
12.50	14.00	13.25	1.50	11.5	20.17	10.17	122.51	5.66	9.1	9.1	1.0	111.01	1165.68	50	1.0	282.9	720.3	14.0	27.2	0	10.17	14.95	15.95	130.1	2312.0	4198.0	195.1	2081.1	**1679.22**	**693.70**
14.00	15.50	14.75	1.50	13.0	20.17	10.17	137.77	5.66	27.2	27.2	1.0	400.54	1566.22	0	1.0	0.0	720.3	15.5	9.0	51	10.32	2.29	1.07	145.4	903.5	3190.1	220.5	2507.1	**1276.03**	**835.70**
15.50	17.00	16.25	1.50	14.5	20.32	10.32	153.14	5.66	9.0	9.0	1.0	137.21	1703.43	51	1.0	288.5	1008.9	17.0	10.4	54	10.32	2.59	1.33	160.9	1030.2	3742.5	246.0	2958.3	**1497.00**	**986.09**
17.00	18.50	17.75	1.50	16.0	20.32	10.32	168.62	5.66	10.4	10.4	1.0	175.07	1878.50	54	1.0	305.5	1314.3	18.5	10.4	54	10.19	2.59	1.33	160.9	1030.1	4222.9	271.4	3464.3	**1689.17**	**1154.76**
18.50	21.50	20.00	3.00	19.0	20.19	10.19	168.62	11.31	10.4	10.4	1.0	350.14	2228.64	54	1.0	611.0	1925.3	21.5	10.6	53	10.49	2.65	1.39	160.9	1031.3	5185.2	322.3	4476.3	**2074.10**	**1492.09**
21.50	24.50	23.00	3.00	22.0	20.49	10.49	168.62	11.31	10.6	10.6	1.0	357.03	2585.66	53	1.0	599.7	2525.0	24.5	9.4	63	10.49	2.36	1.13	160.9	1079.5	6190.1	373.2	5483.9	**2476.05**	**1827.95**
24.50	26.00	25.25	1.50	23.5	20.49	10.49	168.62	5.66	9.4	9.4	1.0	157.91	2743.58	63	1.0	356.4	2881.4	26.0	17.6	20	10.49	5.22	4.07	160.9	1182.7	6807.6	398.7	6023.6	**2723.05**	**2007.87**
26.00	27.50	26.75	1.50	25.0	20.49	10.49	168.62	5.66	17.6	17.6	1.0	302.59	3046.17	20	1.0	113.1	2994.5	27.5	17.6	20	10.16	5.22	4.07	160.9	1181.8	7222.4	424.1	6464.8	**2888.97**	**2154.93**
27.50	29.00	28.25	1.50	26.5	20.16	10.16	168.62	5.66	17.6	17.6	1.0	302.59	3348.75	20	1.0	113.1	3107.7	29.0	11.6	57	10.16	2.94	1.68	160.9	1127.2	7583.6	449.6	6906.0	**3033.45**	**2301.99**
29.00	30.00	29.50	1.00	27.5	20.16	10.16	168.62	3.77	11.6	11.6	1.0	130.54	3479.29	57	1.0	215.0	3322.6	30.0	12.0	50	10.16	3.06	1.79	160.9	1078.1	7880.0	466.5	7268.4	**3152.01**	**2422.82**
30.00	30.50	30.25	0.50	28.0	20.16	10.16	168.62	1.89	12.0	12.0	1.0	67.58	3546.87	50	1.0	94.3	3416.9	30.5	31.6	0	10.16	29.32	30.60	160.9	5547.7	12511.5	475.0	7438.8	**5004.61**	**2479.60**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 1.13 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
30.50	32.50	31.50	2.00	30.0	20.16	10.16	168.62	7.54	31.6	31.6	1.1	845.04	4391.91	0	1.0	0.0	3416.9	32.5	30.9	0	10.86	25.79	27.01	160.9	4894.0	12702.8	508.9	8317.8	**5081.13**	**2772.59**
32.50	33.50	33.00	1.00	31.0	20.86	10.86	168.62	3.77	30.9	30.9	1.0	397.72	4789.63	0	1.0	0.0	3416.9	33.5	30.9	0	10.86	25.79	27.01	160.9	4894.0	13100.5	525.9	8732.4	**5240.22**	**2910.81**
33.50	35.00	34.25	1.50	32.5	20.86	10.86	168.62	5.66	30.9	30.9	1.0	596.57	5386.20	0	1.0	0.0	3416.9	35.0	30.6	0	10.76	24.28	25.48	160.9	4605.9	13409.0	551.3	9354.5	**5363.59**	**3118.16**
35.00	36.50	35.75	1.50	34.0	20.76	10.76	168.62	5.66	30.6	30.6	1.0	581.05	5967.25	0	1.0	0.0	3416.9	36.5	30.6	0	10.76	24.28	25.48	160.9	4605.9	13990.0	576.8	9961.0	**5596.01**	**3320.32**
36.50	37.50	37.00	1.00	35.0	20.76	10.76	168.62	3.77	30.6	30.6	1.0	387.36	6354.61	0	1.0	0.0	3416.9	37.5	30.1	0	10.76	21.76	22.91	160.9	4128.7	13900.2	593.8	10365.3	**5560.08**	**3455.10**
37.50	38.00	37.75	0.50	35.5	20.76	10.76	168.62	1.89	30.1	30.1	1.0	185.24	6539.85	0	1.0	0.0	3416.9	38.0	30.1	0	9.83	21.76	22.91	160.9	4114.2	14071.0	602.2	10559.0	**5628.39**	**3519.67**
38.00	40.00	39.00	2.00	37.5	19.83	9.83	168.62	7.54	30.1	30.1	1.0	740.95	7280.79	0	1.0	0.0	3416.9	40.0	30.1	0	9.83	21.76	22.91	160.9	4114.2	14811.9	636.2	11333.9	**5924.77**	**3777.96**
BORE NO: P48, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	20.10	10.10	27.78	1.89	27.6	27.6	1.0	27.38	0	3	1.0	5.7	0	3.0	7.2	43	10.10	1.97	0.79	30.3	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.5	20.10	10.10	35.35	3.77	7.2	7.2	1.0	16.84	0	43	1.0	162.2	0	4.0	25.9	0	10.00	12.03	12.95	40.4	0	0.0	25.4	25.4	**0.00**	**8.48**
4.00	6.00	5.00	2.00	3.5	20.00	10.00	50.40	7.54	25.9	25.9	1.0	184.60	0	0	1.0	0.0	0	6.0	25.9	0	10.00	12.03	12.95	60.4	0	0.0	59.4	59.4	**0.00**	**19.79**
6.00	7.00	6.50	1.00	4.5	20.00	10.00	65.40	3.77	25.9	25.9	1.0	119.77	0	0	1.0	0.0	0	7.0	24.9	0	10.00	9.93	10.77	70.4	0	0.0	76.3	76.3	**0.00**	**25.45**
7.00	9.00	8.00	2.00	6.5	20.00	10.00	80.40	7.54	24.9	24.9	1.0	281.50	0	0	1.0	0.0	0	9.0	14.3	20	10.21	3.74	2.45	90.4	0	0.0	110.3	110.3	**0.00**	**36.76**
9.00	10.00	9.50	1.00	7.5	20.21	10.21	95.51	3.77	14.3	14.3	1.0	91.81	0	20	1.0	75.4	0	10.0	11.0	55	10.21	2.76	1.51	100.6	885.1	885.1	127.2	127.2	**354.05**	**42.41**
10.00	12.50	11.25	2.50	10.0	20.21	10.21	113.37	9.43	11.0	11.0	1.0	207.78	207.78	55	1.0	518.6	518.6	12.5	9.8	55	10.21	2.43	1.19	126.1	915.7	1642.0	169.6	896.0	**656.81**	**298.67**
12.50	14.00	13.25	1.50	11.5	20.21	10.21	133.79	5.66	9.8	9.8	1.0	130.74	338.52	55	1.0	311.1	829.7	14.0	11.2	71	10.64	2.82	1.56	141.5	1186.0	2354.3	195.1	1363.3	**941.71**	**454.44**
14.00	15.50	14.75	1.50	13.0	20.64	10.64	149.43	5.66	11.2	11.2	1.0	167.38	505.90	71	1.0	401.7	1231.4	15.5	11.2	71	10.64	2.82	1.56	157.4	1237.0	2974.3	220.5	1957.8	**1189.71**	**652.60**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 1.13 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
15.50	17.00	16.25	1.50	14.5	20.64	10.64	165.39	5.66	11.2	11.2	1.0	185.26	691.16	71	1.0	401.7	1633.0	17.0	10.6	57	10.22	2.65	1.39	173.4	1109.2	3433.4	246.0	2570.2	**1373.35**	**856.73**
17.00	18.50	17.75	1.50	16.0	20.22	10.22	181.04	5.66	10.6	10.6	1.0	191.66	882.82	57	1.0	322.5	1955.5	18.5	11.2	53	10.74	2.82	1.56	173.4	1104.8	3943.1	271.4	3109.7	**1577.24**	**1036.58**
18.50	21.50	20.00	3.00	19.0	20.74	10.74	181.04	11.31	11.2	11.2	1.0	405.57	1288.39	53	1.0	599.7	2555.1	21.5	12.5	48	10.74	3.20	1.94	173.4	1131.4	4974.9	322.3	4165.9	**1989.96**	**1388.62**
21.50	23.00	22.25	1.50	20.5	20.74	10.74	181.04	5.66	12.5	12.5	1.0	227.05	1515.44	48	1.0	271.5	2826.7	23.0	29.0	0	10.74	19.01	20.10	173.4	3875.0	8217.1	347.8	4689.9	**3286.84**	**1563.30**
23.00	24.50	23.75	1.50	22.0	20.74	10.74	181.04	5.66	29.0	29.0	1.0	567.69	2083.13	0	1.0	0.0	2826.7	24.5	28.3	0	10.41	17.43	18.48	173.4	3549.9	8459.7	373.2	5283.0	**3383.87**	**1761.01**
24.50	26.00	25.25	1.50	23.5	20.41	10.41	181.04	5.66	28.3	28.3	1.0	551.44	2634.57	0	1.0	0.0	2826.7	26.0	27.1	2	10.41	14.73	15.72	173.4	3020.6	8481.9	398.7	5859.9	**3392.75**	**1953.31**
26.00	27.50	26.75	1.50	25.0	20.41	10.41	181.04	5.66	27.1	27.1	1.0	524.08	3158.65	2	1.0	11.3	2838.0	27.5	9.0	70	10.41	2.29	1.07	173.4	1169.5	7166.2	424.1	6420.8	**2866.47**	**2140.26**
27.50	29.00	28.25	1.50	26.5	20.41	10.41	181.04	5.66	9.0	9.0	1.0	162.21	3320.86	70	1.0	396.0	3234.0	29.0	9.0	40	10.41	2.29	1.07	173.4	864.0	7418.9	449.6	7004.4	**2967.56**	**2334.81**
29.00	30.00	29.50	1.00	27.5	20.41	10.41	181.04	3.77	9.0	9.0	1.0	108.14	3429.00	40	1.0	150.9	3384.9	30.0	9.0	40	10.20	2.29	1.07	173.4	863.9	7677.8	466.5	7280.4	**3071.10**	**2426.79**
30.00	30.50	30.25	0.50	28.0	20.20	10.20	181.04	1.89	9.0	9.0	1.0	54.07	3483.07	40	1.0	75.4	3460.3	30.5	25.2	0	10.20	10.45	11.34	173.4	2128.4	9071.8	475.0	7418.4	**3628.71**	**2472.79**
30.50	32.50	31.50	2.00	30.0	20.20	10.20	181.04	7.54	25.2	25.2	1.0	642.57	4125.64	0	1.0	0.0	3460.3	32.5	26.0	0	10.20	12.25	13.18	173.4	2494.6	10080.5	508.9	8094.9	**4032.20**	**2698.29**
32.50	33.50	33.00	1.00	31.0	20.20	10.20	181.04	3.77	27.6	27.6	1.0	356.94	4482.57	0	1.0	0.0	3460.3	33.5	18.0	28	10.20	5.42	4.29	173.4	1377.2	9320.1	525.9	8468.8	**3728.04**	**2822.92**
33.50	35.00	34.25	1.50	32.5	20.20	10.20	181.04	5.66	18.0	18.0	1.0	332.76	4815.34	28	1.0	158.4	3618.7	35.0	18.0	28	10.20	5.42	4.29	173.4	1377.2	9811.3	551.3	8985.4	**3924.50**	**2995.12**
35.00	36.50	35.75	1.50	34.0	20.20	10.20	181.04	5.66	18.0	18.0	1.0	332.76	5148.10	28	1.0	158.4	3777.1	36.5	18.0	30	8.98	5.42	4.29	173.4	1394.0	10319.2	576.8	9502.0	**4127.69**	**3167.33**
36.50	37.50	37.00	1.00	35.0	18.98	8.98	181.04	3.77	18.0	18.0	1.0	221.84	5369.94	30	1.0	113.1	3890.2	37.5	13.5	48	8.98	3.50	2.22	173.4	1188.9	10449.0	593.8	9853.9	**4179.61**	**3284.64**
37.50	40.00	38.75	2.50	37.5	18.98	8.98	181.04	9.43	13.5	13.5	1.0	409.79	5779.73	48	1.0	452.6	4342.8	40.0	13.5	48	8.98	3.50	2.22	173.4	1188.9	11311.4	636.2	10758.7	**4524.56**	**3586.24**
BORE NO: P49, CUT OFF LENGTH: 2.50 m, Nc= 9																														

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 1.13 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
2.50	3.00	2.75	0.50	0.5	19.98	9.98	27.45	1.89	14.1	14.1	1.0	13.00	0	31	1.0	58.5	0	3.0	26.1	0	9.98	12.48	13.41	29.9	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.5	19.98	9.98	34.93	3.77	26.1	26.1	1.0	64.54	0	0	1.0	0.0	0	4.0	24.5	0	9.98	9.64	10.33	39.9	0	0.0	25.4	25.4	**0.00**	**8.48**
4.00	6.00	5.00	2.00	3.5	19.98	9.98	49.90	7.54	24.5	24.5	1.0	171.53	0	0	1.0	0.0	0	6.0	28.3	0	9.98	17.43	18.48	59.9	0	0.0	59.4	59.4	**0.00**	**19.79**
6.00	7.00	6.50	1.00	4.5	19.98	9.98	64.87	3.77	28.3	28.3	1.0	131.73	0	0	1.0	0.0	0	7.0	28.3	0	9.98	17.43	18.48	69.9	0	0.0	76.3	76.3	**0.00**	**25.45**
7.00	8.00	7.50	1.00	5.5	19.98	9.98	74.85	3.77	28.3	28.3	1.0	152.00	0	0	1.0	0.0	0	8.0	24.7	7	9.19	9.78	10.55	79.8	0	0.0	93.3	93.3	**0.00**	**31.10**
8.00	9.00	8.50	1.00	6.5	19.19	9.19	84.44	3.77	24.7	24.7	1.0	146.47	0	7	1.0	26.4	0	9.0	24.7	7	9.19	9.78	10.55	89.0	0	0.0	110.3	110.3	**0.00**	**36.76**
9.00	10.00	9.50	1.00	7.5	19.19	9.19	93.63	3.77	24.7	24.7	1.0	162.41	0	7	1.0	26.4	0	10.0	8.2	48	10.48	2.15	0.94	98.2	734.0	734.0	127.2	127.2	**293.59**	**42.41**
10.00	12.50	11.25	2.50	10.0	20.48	10.48	111.32	9.43	8.2	8.2	1.0	151.25	151.25	48	1.0	452.6	452.6	12.5	9.1	61	10.32	2.31	1.08	124.4	953.6	1557.5	169.6	773.5	**622.98**	**257.82**
12.50	15.50	14.00	3.00	13.0	20.32	10.32	139.90	11.31	9.1	9.1	1.0	253.53	404.78	61	1.0	690.2	1142.7	15.5	8.7	56	10.05	2.24	1.02	155.4	970.3	2517.8	220.5	1768.1	**1007.13**	**589.36**
15.50	18.50	17.00	3.00	16.0	20.05	10.05	170.46	11.31	8.7	8.7	1.0	295.11	699.90	56	1.0	633.6	1776.3	18.5	18.8	40	10.05	5.78	4.73	155.4	1455.3	3931.6	271.4	2747.7	**1572.62**	**915.89**
18.50	20.00	19.25	1.50	17.5	20.05	10.05	170.46	5.66	18.8	18.8	1.0	328.27	1028.17	40	1.0	226.3	2002.6	20.0	9.8	52	9.64	2.43	1.19	155.4	965.2	3996.0	296.9	3327.7	**1598.39**	**1109.23**
20.00	21.50	20.75	1.50	19.0	19.64	9.64	170.46	5.66	9.8	9.8	1.0	166.56	1194.73	52	1.0	294.2	2296.8	21.5	9.5	52	10.56	2.38	1.14	155.4	956.1	4447.6	322.3	3813.9	**1779.06**	**1271.29**
21.50	24.50	23.00	3.00	22.0	20.56	10.56	170.46	11.31	9.5	9.5	1.0	322.73	1517.46	52	1.0	588.3	2885.1	24.5	10.4	58	10.56	2.59	1.33	155.4	1055.1	5457.7	373.2	4775.8	**2183.07**	**1591.94**
24.50	27.50	26.00	3.00	25.0	20.56	10.56	170.46	11.31	10.4	10.4	1.0	353.96	1871.42	58	1.0	656.2	3541.4	27.5	27.9	0	9.98	16.53	17.56	155.4	3025.1	8437.9	424.1	5836.9	**3375.14**	**1945.64**
27.50	29.00	28.25	1.50	26.5	19.98	9.98	170.46	5.66	27.9	27.9	1.0	510.56	2381.99	0	1.0	0.0	3541.4	29.0	26.5	13	9.98	13.38	14.34	155.4	2581.3	8504.7	449.6	6372.9	**3401.88**	**2124.31**
29.00	30.00	29.50	1.00	27.5	19.98	9.98	170.46	3.77	26.5	26.5	1.0	320.52	2702.50	13	1.0	49.0	3590.4	30.0	27.3	0	9.98	15.18	16.18	155.4	2778.2	9071.1	466.5	6759.4	**3628.43**	**2253.14**
30.00	30.50	30.25	0.50	28.0	19.98	9.98	170.46	1.89	27.3	27.3	1.0	165.90	2868.41	0	1.0	0.0	3590.4	30.5	27.3	0	9.98	15.18	16.18	155.4	2778.2	9237.0	475.0	6933.8	**3694.79**	**2311.27**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
30.50	32.00	31.25	1.50	29.5	19.98	9.98	170.46	5.66	27.3	27.3	1.0	497.71	3366.11	0	1.0	0.0	3590.4	32.0	11.5	49	9.57	2.91	1.65	155.4	1021.4	7977.9	500.5	7457.0	**3191.18**	**2485.66**
32.00	32.50	32.25	0.50	30.0	19.57	9.57	170.46	1.89	11.5	11.5	1.0	65.40	3431.51	49	1.0	92.4	3682.8	32.5	11.5	49	9.57	2.91	1.65	155.4	1021.4	8135.7	508.9	7623.2	**3254.30**	**2541.08**
32.50	33.50	33.00	1.00	31.0	19.57	9.57	170.46	3.77	11.5	11.5	1.0	130.79	3562.30	49	1.0	184.8	3867.6	33.5	11.5	49	9.57	2.91	1.65	155.4	1021.4	8451.3	525.9	7955.8	**3380.53**	**2651.93**
33.50	35.00	34.25	1.50	32.5	19.57	9.57	170.46	5.66	11.5	11.5	1.0	196.19	3758.48	49	1.0	277.2	4144.8	35.0	11.5	49	9.57	2.91	1.65	155.4	1021.4	8924.7	551.3	8454.6	**3569.89**	**2818.21**
35.00	36.50	35.75	1.50	34.0	19.57	9.57	170.46	5.66	11.5	11.5	1.0	196.19	3954.67	49	1.0	277.2	4422.0	36.5	15.8	38	10.24	4.33	3.09	155.4	1170.3	9546.9	576.8	8953.5	**3818.78**	**2984.49**
36.50	37.50	37.00	1.00	35.0	20.24	10.24	170.46	3.77	15.8	15.8	1.0	181.91	4136.58	38	1.0	143.3	4565.3	37.5	15.8	38	10.24	4.33	3.09	155.4	1170.3	9872.2	593.8	9295.7	**3948.87**	**3098.55**
37.50	38.00	37.75	0.50	35.5	20.24	10.24	170.46	1.89	15.8	15.8	1.0	90.96	4227.54	38	1.0	71.7	4637.0	38.0	28.0	0	10.24	16.76	17.79	155.4	3069.4	11933.9	602.2	9466.8	**4773.55**	**3155.58**
38.00	40.00	39.00	2.00	37.5	20.24	10.24	170.46	7.54	28.0	28.0	1.0	683.63	4911.17	0	1.0	0.0	4637.0	40.0	28.0	0	10.24	16.76	17.79	155.4	3069.4	12617.5	636.2	10184.3	**5047.00**	**3394.77**
BORE NO: P50, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	20.30	10.30	28.33	1.89	24.5	24.5	1.0	24.34	0	8	1.0	15.1	0	3.0	24.5	8	10.30	9.64	10.33	30.9	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.5	20.30	10.30	36.05	3.77	24.5	24.5	1.0	61.96	0	8	1.0	30.2	0	4.0	27.6	0	9.23	15.85	16.87	41.2	0	0.0	25.4	25.4	**0.00**	**8.48**
4.00	5.00	4.50	1.00	2.5	19.23	9.23	45.82	3.77	27.6	27.6	1.0	90.33	0	0	1.0	0.0	0	5.0	27.6	0	9.23	15.85	16.87	50.4	1010.4	1010.4	42.4	42.4	**404.14**	**14.14**
5.00	6.00	5.50	1.00	3.5	19.23	9.23	55.05	3.77	27.6	27.6	1.0	108.53	108.53	0	1.0	0.0	0.0	6.0	28.7	0	9.23	18.33	19.40	59.7	1359.0	1467.5	59.4	167.9	**587.02**	**55.97**
6.00	8.00	7.00	2.00	5.5	19.23	9.23	68.89	7.54	28.7	28.7	1.0	284.49	393.02	0	1.0	0.0	0.0	8.0	29.6	0	10.30	20.36	21.48	78.1	1949.6	2342.7	93.3	486.3	**937.06**	**162.11**
8.00	9.00	8.50	1.00	6.5	20.30	10.30	83.27	3.77	29.6	29.6	1.0	178.40	571.42	0	1.0	0.0	0.0	9.0	29.6	0	10.30	20.36	21.48	88.4	2186.9	2758.3	110.3	681.7	**1103.32**	**227.23**
9.00	10.00	9.50	1.00	7.5	20.30	10.30	93.57	3.77	29.6	29.6	1.0	200.47	771.89	0	1.0	0.0	0.0	10.0	8.5	54	10.30	2.20	0.99	98.7	802.5	1574.4	127.2	899.1	**629.76**	**299.71**
10.00	11.00	10.50	1.00	8.5	20.30	10.30	103.87	3.77	8.5	8.5	1.0	58.55	830.44	54	1.0	203.7	203.7	11.0	8.5	54	10.30	2.20	0.99	109.0	828.2	1862.3	144.2	1178.3	**744.90**	**392.76**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 1.13 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
11.00	12.00	11.50	1.00	9.5	20.30	10.30	114.17	3.77	8.5	8.5	1.0	64.35	894.79	54	1.0	203.7	407.3	12.0	29.1	0	10.30	19.23	20.33	119.3	2738.6	4040.7	161.2	1463.3	**1616.28**	**487.76**
12.00	13.00	12.50	1.00	10.5	20.30	10.30	124.47	3.77	29.1	29.1	1.0	261.28	1156.07	0	1.0	0.0	407.3	13.0	8.3	58	10.30	2.16	0.96	129.6	914.7	2478.1	178.1	1741.5	**991.22**	**580.50**
13.00	14.50	13.75	1.50	12.0	20.30	10.30	137.35	5.66	8.3	8.3	1.0	113.35	1269.42	58	1.0	328.1	735.4	14.5	8.6	57	10.15	2.22	1.00	145.1	951.4	2956.2	203.6	2208.4	**1182.50**	**736.14**
14.50	17.50	16.00	3.00	15.0	20.15	10.15	160.30	11.31	8.6	8.6	1.0	274.28	1543.70	57	1.0	644.9	1380.3	17.5	8.6	57	10.15	2.22	1.00	175.5	1027.8	3951.9	254.5	3178.5	**1580.74**	**1059.51**
17.50	19.00	18.25	1.50	16.5	20.15	10.15	160.30	5.66	8.6	8.6	1.0	137.14	1680.85	57	1.0	322.5	1702.8	19.0	27.2	7	9.78	14.95	15.95	175.5	3146.9	6530.5	279.9	3663.6	**2612.22**	**1221.19**
19.00	20.50	19.75	1.50	18.0	19.78	9.78	160.30	5.66	27.2	27.2	1.0	466.04	2146.88	7	1.0	39.6	1742.4	20.5	12.3	58	9.78	3.15	1.88	175.5	1227.8	5117.0	305.4	4194.6	**2046.81**	**1398.22**
20.50	23.50	22.00	3.00	21.0	19.78	9.78	160.30	11.31	12.3	12.3	1.0	395.43	2542.32	58	1.0	656.2	2398.6	23.5	12.3	58	10.91	3.15	1.88	175.5	1229.2	6170.1	356.3	5297.2	**2468.06**	**1765.73**
23.50	25.00	24.25	1.50	22.5	20.91	10.91	160.30	5.66	12.3	12.3	1.0	197.72	2740.03	58	1.0	328.1	2726.7	25.0	14.3	42	10.91	3.74	2.45	175.5	1187.9	6654.7	381.7	5848.5	**2661.89**	**1949.49**
25.00	26.50	25.75	1.50	24.0	20.91	10.91	160.30	5.66	14.3	14.3	1.0	231.14	2971.18	42	1.0	237.6	2964.3	26.5	10.5	58	10.91	2.62	1.36	175.5	1120.4	7055.9	407.2	6342.7	**2822.37**	**2114.22**
26.50	27.50	27.00	1.00	25.0	20.91	10.91	160.30	3.77	10.5	10.5	1.0	112.05	3083.22	58	1.0	218.7	3183.1	27.5	10.5	58	10.91	2.62	1.36	175.5	1120.4	7386.7	424.1	6690.4	**2954.69**	**2230.14**
27.50	29.50	28.50	2.00	27.0	20.91	10.91	160.30	7.54	10.5	10.5	1.0	224.09	3307.31	58	1.0	437.5	3620.6	29.5	7.5	61	10.56	2.02	0.84	175.5	1028.3	7956.2	458.0	7385.9	**3182.47**	**2461.98**
29.50	30.00	29.75	0.50	27.5	20.56	10.56	160.30	1.89	7.5	7.5	1.0	39.79	3347.11	61	1.0	115.0	3735.6	30.0	7.5	61	10.56	2.02	0.84	175.5	1028.3	8111.0	466.5	7549.2	**3244.40**	**2516.41**
30.00	32.50	31.25	2.50	30.0	20.56	10.56	160.30	9.43	7.5	7.5	1.0	198.97	3546.08	61	1.0	575.1	4310.7	32.5	8.6	60	10.56	2.22	1.00	175.5	1058.6	8915.5	508.9	8365.8	**3566.19**	**2788.59**
32.50	35.00	33.75	2.50	32.5	20.56	10.56	160.30	9.43	8.6	8.6	1.0	228.57	3774.65	60	1.0	565.7	4876.5	35.0	19.6	30	10.60	6.19	5.17	175.5	1571.4	10222.5	551.3	9202.5	**4089.00**	**3067.49**
35.00	35.50	35.25	0.50	33.0	20.60	10.60	160.30	1.89	19.6	19.6	1.0	107.63	3882.29	30	1.0	56.6	4933.0	35.5	26.4	0	10.60	13.15	14.11	175.5	2713.5	11528.8	559.8	9375.1	**4611.51**	**3125.05**
35.50	37.50	36.50	2.00	35.0	20.60	10.60	160.30	7.54	26.4	26.4	1.0	600.19	4482.48	0	1.0	0.0	4933.0	37.5	28.5	0	10.60	17.88	18.94	175.5	3687.4	13102.9	593.8	10009.3	**5241.17**	**3336.42**
37.50	38.50	38.00	1.00	36.0	20.60	10.60	160.30	3.77	28.5	28.5	1.0	328.24	4810.72	0	1.0	0.0	4933.0	38.5	28.0	0	10.60	16.76	17.79	175.5	3455.5	13199.3	610.7	10354.5	**5279.71**	**3451.49**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 1.13 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
38.50	40.00	39.25	1.50	37.5	20.60	10.60	160.30	5.66	28.0	28.0	1.0	482.16	5292.88	0	1.0	0.0	4933.0	40.0	28.0	0	10.60	16.76	17.79	175.5	3455.5	13681.4	636.2	10862.1	**5472.57**	**3620.69**
BORE NO: P51, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	19.69	9.69	26.65	1.89	23.9	23.9	1.0	22.27	0	0	1.0	0.0	0	3.0	26.4	0	9.69	13.15	14.11	29.1	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	5.00	4.00	2.00	2.5	19.69	9.69	38.76	7.54	26.4	26.4	1.0	145.13	0	0	1.0	0.0	0	5.0	26.4	0	9.69	13.15	14.11	48.5	813.8	813.8	42.4	42.4	**325.52**	**14.14**
5.00	6.00	5.50	1.00	3.5	19.69	9.69	53.30	3.77	26.4	26.4	1.0	99.78	99.78	0	1.0	0.0	0.0	6.0	30.3	0	9.69	22.77	23.94	58.1	1655.4	1755.1	59.4	159.2	**702.05**	**53.05**
6.00	8.00	7.00	2.00	5.5	19.69	9.69	67.83	7.54	30.3	30.3	1.0	303.46	403.23	0	1.0	0.0	0.0	8.0	28.5	0	10.66	17.88	18.94	77.5	1705.5	2108.7	93.3	496.5	**843.48**	**165.51**
8.00	9.00	8.50	1.00	6.5	20.66	10.66	82.85	3.77	28.5	28.5	1.0	169.65	572.89	0	1.0	0.0	0.0	9.0	28.5	0	10.66	17.88	18.94	88.2	1921.1	2494.0	110.3	683.2	**997.61**	**227.72**
9.00	11.00	10.00	2.00	8.5	20.66	10.66	98.84	7.54	28.5	28.5	1.0	404.79	977.68	0	1.0	0.0	0.0	11.0	10.4	40	10.66	2.59	1.33	109.5	737.6	1715.2	144.2	1121.9	**686.09**	**373.96**
11.00	12.00	11.50	1.00	9.5	20.66	10.66	114.83	3.77	10.4	10.4	1.0	79.48	1057.16	40	1.0	150.9	150.9	12.0	10.4	40	10.66	2.59	1.33	120.2	768.8	1976.8	161.2	1369.2	**790.71**	**456.40**
12.00	13.00	12.50	1.00	10.5	20.66	10.66	125.49	3.77	10.4	10.4	1.0	86.86	1144.03	40	1.0	150.9	301.7	13.0	9.5	53	10.49	2.38	1.14	130.8	900.1	2345.8	178.1	1623.9	**938.34**	**541.29**
13.00	14.50	13.75	1.50	12.0	20.49	10.49	138.69	5.66	9.5	9.5	1.0	131.29	1275.32	53	1.0	299.8	601.5	14.5	10.4	58	10.60	2.59	1.33	146.6	1029.3	2906.1	203.6	2080.4	**1162.46**	**693.48**
14.50	17.50	16.00	3.00	15.0	20.60	10.60	162.46	11.31	10.4	10.4	1.0	337.35	1612.67	58	1.0	656.2	1257.8	17.5	10.4	58	10.60	2.59	1.33	178.4	1122.4	3992.8	254.5	3124.9	**1597.13**	**1041.64**
17.50	19.00	18.25	1.50	16.5	20.60	10.60	162.46	5.66	10.4	10.4	1.0	168.67	1781.34	58	1.0	328.1	1585.9	19.0	27.4	0	8.71	15.40	16.41	178.4	3205.6	6572.8	279.9	3647.1	**2629.13**	**1215.71**
19.00	20.50	19.75	1.50	18.0	18.71	8.71	162.46	5.66	27.4	27.4	1.0	476.38	2257.72	0	1.0	0.0	1585.9	20.5	26.1	0	8.25	12.48	13.41	178.4	2593.0	6436.6	305.4	4149.0	**2574.63**	**1382.99**
20.50	23.50	22.00	3.00	21.0	18.25	8.25	162.46	11.31	26.1	26.1	1.0	900.46	3158.18	0	1.0	0.0	1585.9	23.5	26.0	0	8.25	12.25	13.18	178.4	2546.2	7290.3	356.3	5100.3	**2916.12**	**1700.11**
23.50	26.50	25.00	3.00	24.0	18.25	8.25	162.46	11.31	26.0	26.0	1.0	896.48	4054.66	0	1.0	0.0	1585.9	26.5	26.7	0	8.37	13.83	14.80	178.4	2874.6	8515.1	407.2	6047.7	**3406.04**	**2015.90**
26.50	27.50	27.00	1.00	25.0	18.37	8.37	162.46	3.77	26.7	26.7	1.0	308.15	4362.81	0	1.0	0.0	1585.9	27.5	26.7	0	8.37	13.83	14.80	178.4	2874.6	8823.3	424.1	6372.8	**3529.30**	**2124.27**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
27.50	29.50	28.50	2.00	27.0	18.37	8.37	162.46	7.54	26.7	26.7	1.0	616.30	4979.11	0	1.0	0.0	1585.9	29.5	27.5	0	8.37	15.63	16.64	178.4	3248.6	9813.6	458.0	7023.0	**3925.43**	**2341.01**
29.50	30.00	29.75	0.50	27.5	18.37	8.37	162.46	1.89	27.5	27.5	1.0	159.47	5138.58	0	1.0	0.0	1585.9	30.0	27.8	0	8.37	16.31	17.33	178.4	3388.8	10113.3	466.5	7191.0	**4045.32**	**2397.00**
30.00	32.50	31.25	2.50	30.0	18.37	8.37	162.46	9.43	27.8	27.8	1.0	807.58	5946.17	0	1.0	0.0	1585.9	32.5	27.8	0	9.29	16.31	17.33	178.4	3399.7	10931.7	508.9	8041.0	**4372.68**	**2680.33**
32.50	35.00	33.75	2.50	32.5	19.29	9.29	162.46	9.43	27.8	27.8	1.0	807.58	6753.75	0	1.0	0.0	1585.9	35.0	29.3	0	9.29	19.68	20.79	178.4	4103.1	12442.7	551.3	8891.0	**4977.09**	**2963.66**
35.00	35.50	35.25	0.50	33.0	19.29	9.29	162.46	1.89	29.3	29.3	1.0	171.91	6925.66	0	1.0	0.0	1585.9	35.5	29.3	0	9.29	19.68	20.79	178.4	4103.1	12614.6	559.8	9071.4	**5045.85**	**3023.79**
35.50	37.50	36.50	2.00	35.0	19.29	9.29	162.46	7.54	29.3	29.3	1.0	687.65	7613.31	0	1.0	0.0	1585.9	37.5	29.3	0	8.91	19.68	20.79	178.4	4097.7	13296.9	593.8	9793.0	**5318.77**	**3264.32**
37.50	38.50	38.00	1.00	36.0	18.91	8.91	162.46	3.77	29.3	29.3	1.0	343.82	7957.14	0	1.0	0.0	1585.9	38.5	29.0	0	8.91	19.01	20.10	178.4	3957.2	13500.2	610.7	10153.7	**5400.09**	**3384.58**
38.50	40.00	39.25	1.50	37.5	18.91	8.91	162.46	5.66	29.0	29.0	1.0	509.43	8466.56	0	1.0	0.0	1585.9	40.0	29.0	0	8.91	19.01	20.10	178.4	3957.2	14009.7	636.2	10688.6	**5603.86**	**3562.87**
BORE NO: P52, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	19.45	9.45	25.99	1.89	28.6	28.6	1.0	26.72	0	0	1.0	0.0	0	3.0	28.6	0	9.44	18.11	19.17	28.4	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	5.00	4.00	2.00	2.5	19.44	9.44	37.79	7.54	28.6	28.6	1.0	155.41	0	0	1.0	0.0	0	5.0	27.9	0	9.44	16.53	17.56	47.2	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.5	19.44	9.44	51.95	3.77	27.9	27.9	1.0	103.74	0	0	1.0	0.0	0	6.0	27.9	0	9.55	16.53	17.56	56.7	0	0.0	59.4	59.4	**0.00**	**19.79**
6.00	8.00	7.00	2.00	5.5	19.55	9.55	66.22	7.54	27.9	27.9	1.0	264.47	0	0	1.0	0.0	0	8.0	27.9	0	9.55	16.53	17.56	75.8	0	0.0	93.3	93.3	**0.00**	**31.10**
8.00	9.00	8.50	1.00	6.5	19.55	9.55	80.55	3.77	27.9	27.9	1.0	160.84	0	0	1.0	0.0	0	9.0	26.2	6	9.84	12.70	13.64	85.3	0	0.0	110.3	110.3	**0.00**	**36.76**
9.00	11.00	10.00	2.00	8.5	19.84	9.84	95.16	7.54	26.2	26.2	1.0	353.19	0	6	1.0	45.3	0	11.0	24.0	0	9.84	9.28	9.78	105.0	0	0.0	144.2	144.2	**0.00**	**48.07**
11.00	12.00	11.50	1.00	9.5	19.84	9.84	109.92	3.77	24.0	24.0	1.0	184.57	0	0	1.0	0.0	0	12.0	13.5	21	9.84	3.50	2.22	114.8	683.4	683.4	161.2	161.2	**273.38**	**53.72**
12.00	13.00	12.50	1.00	10.5	19.84	9.84	119.76	3.77	13.5	13.5	1.0	108.44	108.44	21	1.0	79.2	79.2	13.0	10.4	46	10.14	2.59	1.33	124.7	842.6	1030.3	178.1	365.8	**412.10**	**121.92**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 1.13 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
13.00	14.50	13.75	1.50	12.0	20.14	10.14	132.29	5.66	10.4	10.4	1.0	137.35	245.78	46	1.0	260.2	339.4	14.5	10.4	46	10.14	2.59	1.33	139.9	887.2	1472.4	203.6	788.8	**588.95**	**262.93**
14.50	16.00	15.25	1.50	13.5	20.14	10.14	147.50	5.66	10.4	10.4	1.0	153.14	398.93	46	1.0	260.2	599.7	16.0	12.2	44	10.24	3.12	1.85	155.1	1007.8	2006.4	229.0	1227.6	**802.55**	**409.20**
16.00	17.50	16.75	1.50	15.0	20.24	10.24	162.78	5.66	12.2	12.2	1.0	199.10	598.02	44	1.0	248.9	848.6	17.5	12.2	44	10.24	3.12	1.85	170.5	1061.9	2508.5	254.5	1701.1	**1003.41**	**567.02**
17.50	19.00	18.25	1.50	16.5	20.24	10.24	162.78	5.66	12.2	12.2	1.0	199.10	797.12	44	1.0	248.9	1097.5	19.0	25.4	5	9.38	10.90	11.80	170.5	2228.4	4123.0	279.9	2174.5	**1649.21**	**724.84**
19.00	20.50	19.75	1.50	18.0	19.38	9.38	162.78	5.66	25.4	25.4	1.0	437.26	1234.38	5	1.0	28.3	1125.8	20.5	25.4	5	9.38	10.90	11.80	170.5	2228.4	4588.6	305.4	2665.5	**1835.43**	**888.51**
20.50	22.00	21.25	1.50	19.5	19.38	9.38	162.78	5.66	25.4	25.4	1.0	437.26	1671.65	5	1.0	28.3	1154.1	22.0	28.3	0	9.64	17.43	18.48	170.5	3482.8	6308.5	330.8	3156.5	**2523.41**	**1052.17**
22.00	23.50	22.75	1.50	21.0	19.64	9.64	162.78	5.66	28.3	28.3	1.0	495.84	2167.48	0	1.0	0.0	1154.1	23.5	28.3	0	9.64	17.43	18.48	170.5	3482.8	6804.4	356.3	3677.8	**2721.74**	**1225.93**
23.50	26.50	25.00	3.00	24.0	19.64	9.64	162.78	11.31	28.3	28.3	1.0	991.67	3159.16	0	1.0	0.0	1154.1	26.5	6.2	70	10.28	1.79	0.63	170.5	1061.7	5374.9	407.2	4720.4	**2149.96**	**1573.46**
26.50	27.50	27.00	1.00	25.0	20.28	10.28	162.78	3.77	6.2	6.2	1.0	66.69	3225.85	70	1.0	264.0	1418.1	27.5	6.2	70	10.28	1.79	0.63	170.5	1061.7	5705.6	424.1	5068.0	**2282.24**	**1689.34**
27.50	28.00	27.75	0.50	25.5	20.28	10.28	162.78	1.89	6.2	6.2	1.0	33.35	3259.20	70	1.0	132.0	1550.1	28.0	30.4	0	8.98	23.27	24.45	170.5	4637.9	9447.1	432.6	5241.9	**3778.84**	**1747.28**
28.00	29.50	28.75	1.50	27.0	18.98	8.98	162.78	5.66	30.4	30.4	1.0	551.08	3810.27	0	1.0	0.0	1550.1	29.5	30.4	0	9.07	23.27	24.45	170.5	4639.3	9999.7	458.0	5818.4	**3999.87**	**1939.46**
29.50	30.00	29.75	0.50	27.5	19.07	9.07	162.78	1.89	30.4	30.4	1.0	183.69	3993.96	0	1.0	0.0	1550.1	30.0	31.0	0	9.07	26.30	27.53	170.5	5241.2	10785.2	466.5	6010.5	**4314.09**	**2003.52**
30.00	31.00	30.50	1.00	28.5	19.07	9.07	162.78	3.77	31.0	31.0	1.1	387.32	4381.28	0	1.0	0.0	1550.1	31.0	31.9	0	9.18	30.83	32.14	170.5	6146.4	12077.7	483.5	6414.8	**4831.09**	**2138.28**
31.00	32.50	31.75	1.50	30.0	19.18	9.18	162.78	5.66	31.9	31.9	1.1	627.64	5008.93	0	1.0	0.0	1550.1	32.5	31.9	0	8.92	30.83	32.14	170.5	6140.7	12699.7	508.9	7067.9	**5079.88**	**2355.97**
32.50	34.00	33.25	1.50	31.5	18.92	8.92	162.78	5.66	31.9	31.9	1.1	627.64	5636.57	0	1.0	0.0	1550.1	34.0	33.4	0	10.23	38.39	39.83	170.5	7680.0	14866.6	534.4	7721.0	**5946.65**	**2573.67**
34.00	35.00	34.50	1.00	32.5	20.23	10.23	162.78	3.77	33.4	33.4	1.2	473.62	6110.19	0	1.0	0.0	1550.1	35.0	33.2	0	10.23	37.38	38.80	170.5	7478.6	15138.8	551.3	8211.6	**6055.53**	**2737.20**
35.00	35.50	35.25	0.50	33.0	20.23	10.23	162.78	1.89	33.2	33.2	1.2	233.01	6343.20	0	1.0	0.0	1550.1	35.5	22.5	28	9.00	8.20	8.14	170.5	1916.3	9809.6	559.8	8453.1	**3923.82**	**2817.69**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 1.13 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
35.50	37.00	36.25	1.50	34.5	19.00	9.00	162.78	5.66	22.5	22.5	1.0	381.44	6724.63	28	1.0	158.4	1708.5	37.0	20.5	34	9.12	6.76	5.94	170.5	1686.7	10119.8	585.3	9018.4	**4047.93**	**3006.12**
37.00	37.50	37.25	0.50	35.0	19.12	9.12	162.78	1.89	20.5	20.5	1.0	114.77	6839.40	34	1.0	64.1	1772.6	37.5	20.5	34	9.12	6.76	5.94	170.5	1686.7	10298.7	593.8	9205.7	**4119.49**	**3068.58**
37.50	38.50	38.00	1.00	36.0	19.12	9.12	162.78	3.77	20.5	20.5	1.0	229.53	7068.93	34	1.0	128.2	1900.8	38.5	20.5	34	9.37	6.76	5.94	170.5	1687.8	10657.5	610.7	9580.5	**4262.99**	**3193.49**
38.50	40.00	39.25	1.50	37.5	19.37	9.37	162.78	5.66	20.5	20.5	1.0	344.30	7413.23	34	1.0	192.3	2093.1	40.0	28.0	0	9.37	16.76	17.79	170.5	3344.7	12851.1	636.2	10142.5	**5140.44**	**3380.85**
BORE NO: P53, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	19.63	9.63	26.48	1.89	28.9	28.9	1.0	27.57	0	0	1.0	0.0	0	3.0	28.9	0	9.63	18.78	19.87	28.9	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.5	19.63	9.63	33.71	3.77	28.9	28.9	1.0	70.17	0	0	1.0	0.0	0	4.0	28.9	0	9.21	18.78	19.87	38.5	0	0.0	25.4	25.4	**0.00**	**8.48**
4.00	5.00	4.50	1.00	2.5	19.21	9.21	43.13	3.77	28.9	28.9	1.0	89.78	0	0	1.0	0.0	0	5.0	28.4	0	9.21	17.66	18.71	47.7	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.5	19.21	9.21	52.34	3.77	28.4	28.4	1.0	106.72	0	0	1.0	0.0	0	6.0	32.8	0	9.21	35.36	36.75	56.9	2508.1	2508.1	59.4	59.4	**1003.23**	**19.79**
6.00	8.00	7.00	2.00	5.5	19.21	9.21	66.15	7.54	32.8	32.8	1.1	366.58	366.58	0	1.0	0.0	0.0	8.0	31.2	0	9.80	27.30	28.55	75.4	2518.0	2884.6	93.3	459.9	**1153.85**	**153.29**
8.00	9.00	8.50	1.00	6.5	19.80	9.80	80.26	3.77	31.2	31.2	1.1	194.32	560.89	0	1.0	0.0	0.0	9.0	24.2	11	9.80	9.42	10.00	85.2	1086.6	1647.5	110.3	671.2	**658.99**	**223.72**
9.00	10.00	9.50	1.00	7.5	19.80	9.80	90.06	3.77	24.2	24.2	1.0	152.65	713.54	11	1.0	41.5	41.5	10.0	24.2	11	9.80	9.42	10.00	95.0	1191.1	1946.1	127.2	882.3	**778.44**	**294.09**
10.00	11.00	10.50	1.00	8.5	19.80	9.80	99.86	3.77	24.2	24.2	1.0	169.26	882.80	11	1.0	41.5	83.0	11.0	24.2	11	9.80	9.42	10.00	104.8	1295.6	2261.3	144.2	1110.0	**904.53**	**369.99**
11.00	12.00	11.50	1.00	9.5	19.80	9.80	109.66	3.77	24.2	24.2	1.0	185.87	1068.67	11	1.0	41.5	124.5	12.0	9.4	52	9.80	2.36	1.13	114.6	843.2	2036.3	161.2	1354.3	**814.51**	**451.43**
12.00	13.00	12.50	1.00	10.5	19.80	9.80	119.46	3.77	9.4	9.4	1.0	74.59	1143.25	52	1.0	196.1	320.6	13.0	9.4	52	10.40	2.36	1.13	124.4	869.8	2333.6	178.1	1642.0	**933.45**	**547.32**
13.00	14.50	13.75	1.50	12.0	20.40	10.40	132.16	5.66	9.4	9.4	1.0	123.77	1267.02	52	1.0	294.2	614.7	14.5	11.5	49	10.23	2.91	1.65	140.0	971.4	2853.1	203.6	2085.3	**1141.26**	**695.11**
14.50	17.50	16.00	3.00	15.0	20.23	10.23	155.31	11.31	11.5	11.5	1.0	357.50	1624.52	49	1.0	554.4	1169.1	17.5	11.5	49	10.23	2.91	1.65	170.7	1072.5	3866.1	254.5	3048.1	**1546.45**	**1016.04**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 1.13 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)													
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
17.50	19.00	18.25	1.50	16.5	20.23	10.23	155.31	5.66	11.5	11.5	1.0	178.75	1803.27	49	1.0	277.2	1446.3	19.0	26.4	7	9.95	13.15	14.11	170.7	2706.1	5955.7	279.9	3529.5	**2382.27**	**1176.51**
19.00	20.50	19.75	1.50	18.0	19.95	9.95	155.31	5.66	26.4	26.4	1.0	436.13	2239.40	7	1.0	39.6	1485.9	20.5	25.8	9	9.95	11.80	12.72	170.7	2456.2	6181.6	305.4	4030.7	**2472.62**	**1343.57**
20.50	22.00	21.25	1.50	19.5	19.95	9.95	155.31	5.66	25.8	25.8	1.0	424.72	2664.13	9	1.0	50.9	1536.9	22.0	25.8	9	9.59	11.80	12.72	170.7	2453.1	6654.1	330.8	4531.8	**2661.63**	**1510.60**
22.00	23.50	22.75	1.50	21.0	19.59	9.59	155.31	5.66	25.8	25.8	1.0	424.72	3088.85	9	1.0	50.9	1587.8	23.5	25.9	9	9.59	12.03	12.95	170.7	2498.1	7174.7	356.3	5032.9	**2869.88**	**1677.63**
23.50	25.00	24.25	1.50	22.5	19.59	9.59	155.31	5.66	25.9	25.9	1.0	426.62	3515.47	9	1.0	50.9	1638.7	25.0	30.3	0	9.59	22.77	23.94	170.7	4552.4	9706.5	381.7	5535.9	**3882.61**	**1845.29**
25.00	26.50	25.75	1.50	24.0	19.59	9.59	155.31	5.66	30.3	30.3	1.0	521.10	4036.57	0	1.0	0.0	1638.7	26.5	30.3	0	10.66	22.77	23.94	170.7	4569.8	10245.0	407.2	6082.4	**4098.01**	**2027.47**
26.50	27.50	27.00	1.00	25.0	20.66	10.66	155.31	3.77	30.3	30.3	1.0	347.40	4383.97	0	1.0	0.0	1638.7	27.5	30.3	0	10.66	22.77	23.94	170.7	4569.8	10592.4	424.1	6446.8	**4236.97**	**2148.92**
27.50	28.00	27.75	0.50	25.5	20.66	10.66	155.31	1.89	30.3	30.3	1.0	173.70	4557.67	0	1.0	0.0	1638.7	28.0	11.4	74	10.66	2.88	1.62	170.7	1321.6	7518.0	432.6	6629.0	**3007.20**	**2209.65**
28.00	29.50	28.75	1.50	27.0	20.66	10.66	155.31	5.66	11.4	11.4	1.0	177.15	4734.83	74	1.0	418.6	2057.3	29.5	32.1	0	10.66	31.84	33.16	170.7	6387.3	13179.4	458.0	7250.2	**5271.76**	**2416.73**
29.50	30.00	29.75	0.50	27.5	20.66	10.66	155.31	1.89	32.1	32.1	1.1	203.00	4937.83	0	1.0	0.0	2057.3	30.0	29.3	2	11.07	19.68	20.79	170.7	3977.0	10972.1	466.5	7461.7	**4388.85**	**2487.22**
30.00	32.50	31.25	2.50	30.0	21.07	11.07	155.31	9.43	29.3	29.3	1.0	821.73	5759.56	2	1.0	18.9	2076.2	32.5	32.8	0	11.07	35.36	36.75	170.7	7104.3	14940.0	508.9	8344.7	**5976.00**	**2781.56**
32.50	34.00	33.25	1.50	31.5	21.07	11.07	155.31	5.66	32.8	32.8	1.1	645.48	6405.04	0	1.0	0.0	2076.2	34.0	33.8	0	11.07	40.40	41.88	170.7	8115.4	16596.6	534.4	9015.6	**6638.65**	**3005.20**
34.00	35.00	34.50	1.00	32.5	21.07	11.07	155.31	3.77	33.8	33.8	1.2	466.61	6871.64	0	1.0	0.0	2076.2	35.0	34.7	0	8.83	44.94	46.49	170.7	8954.7	17902.6	551.3	9499.2	**7161.03**	**3166.39**
35.00	35.50	35.25	0.50	33.0	18.83	8.83	155.31	1.89	34.7	34.7	1.2	250.44	7122.08	0	1.0	0.0	2076.2	35.5	31.8	0	8.91	30.33	31.63	170.7	6046.8	15245.0	559.8	9758.1	**6098.01**	**3252.70**
35.50	37.00	36.25	1.50	34.5	18.91	8.91	155.31	5.66	31.8	31.8	1.1	593.77	7715.85	0	1.0	0.0	2076.2	37.0	31.8	0	8.90	30.33	31.63	170.7	6046.6	15838.6	585.3	10377.3	**6335.43**	**3459.10**
37.00	37.50	37.25	0.50	35.0	18.90	8.90	155.31	1.89	31.8	31.8	1.1	197.92	7913.78	0	1.0	0.0	2076.2	37.5	31.4	0	8.90	28.31	29.58	170.7	5645.1	15635.1	593.8	10583.7	**6254.03**	**3527.90**
37.50	38.50	38.00	1.00	36.0	18.90	8.90	155.31	3.77	31.4	31.4	1.1	382.55	8296.33	0	1.0	0.0	2076.2	38.5	29.6	0	8.77	20.36	21.48	170.7	4058.7	14431.2	610.7	10983.2	**5772.48**	**3661.08**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 1.13 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
38.50	40.00	39.25	1.50	37.5	18.77	8.77	155.31	5.66	29.6	29.6	1.0	499.10	8795.44	0	1.0	0.0	2076.2	40.0	29.6	0	8.77	20.36	21.48	170.7	4058.7	14930.3	636.2	11507.8	**5972.13**	**3835.93**
BORE NO: P54, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	19.37	9.37	25.77	1.89	21.9	21.9	1.0	19.53	0	4	1.0	7.5	0	3.0	21.9	4	9.37	7.77	7.48	28.1	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	5.00	4.00	2.00	2.5	19.37	9.37	37.48	7.54	21.9	21.9	1.0	113.65	0	4	1.0	30.2	0	5.0	21.9	4	9.37	7.77	7.48	46.9	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.5	19.37	9.37	51.54	3.77	21.9	21.9	1.0	78.13	0	4	1.0	15.1	0	6.0	15.3	26	9.37	4.09	2.81	56.2	542.7	542.7	59.4	59.4	**217.07**	**19.79**
6.00	7.00	6.50	1.00	4.5	19.37	9.37	60.91	3.77	15.3	15.3	1.0	62.84	62.84	26	1.0	98.1	98.1	7.0	27.4	0	9.37	15.40	16.41	65.6	1247.6	1408.5	76.3	237.2	**563.38**	**79.08**
7.00	8.00	7.50	1.00	5.5	19.37	9.37	70.28	3.77	27.4	27.4	1.0	137.38	200.22	0	1.0	0.0	98.1	8.0	27.6	0	9.00	15.85	16.87	75.0	1447.8	1746.0	93.3	391.6	**698.42**	**130.53**
8.00	9.00	8.50	1.00	6.5	19.00	9.00	79.46	3.77	27.6	27.6	1.0	156.67	356.89	0	1.0	0.0	98.1	9.0	9.0	38	9.00	2.29	1.07	84.0	611.0	1065.9	110.3	565.2	**426.38**	**188.41**
9.00	10.00	9.50	1.00	7.5	19.00	9.00	88.46	3.77	9.0	9.0	1.0	52.84	409.73	38	1.0	143.3	241.4	10.0	27.5	2	9.00	15.63	16.64	93.0	1765.9	2417.0	127.2	778.3	**966.81**	**259.44**
10.00	11.00	10.50	1.00	8.5	19.00	9.00	97.46	3.77	27.5	27.5	1.0	191.34	601.07	2	1.0	7.5	248.9	11.0	7.1	57	9.00	1.95	0.77	102.0	809.9	1659.9	144.2	994.2	**663.94**	**331.39**
11.00	12.00	11.50	1.00	9.5	19.00	9.00	106.46	3.77	7.1	7.1	1.0	50.01	651.08	57	1.0	215.0	463.9	12.0	7.1	57	9.00	1.95	0.77	111.0	829.7	1944.7	161.2	1276.1	**777.87**	**425.38**
12.00	13.00	12.50	1.00	10.5	19.00	9.00	115.46	3.77	7.1	7.1	1.0	54.24	705.32	57	1.0	215.0	678.9	13.0	29.5	0	9.19	20.13	21.25	120.0	2865.2	4249.4	178.1	1562.3	**1699.76**	**520.77**
13.00	14.50	13.75	1.50	12.0	19.19	9.19	126.85	5.66	29.5	29.5	1.0	406.01	1111.33	0	1.0	0.0	678.9	14.5	12.5	42	10.60	3.20	1.94	133.7	926.4	2716.6	203.6	1993.8	**1086.65**	**664.59**
14.50	17.50	16.00	3.00	15.0	20.60	10.60	149.65	11.31	12.5	12.5	1.0	375.36	1486.69	42	1.0	475.2	1154.1	17.5	10.0	42	10.60	2.47	1.22	165.5	899.1	3539.8	254.5	2895.2	**1415.94**	**965.07**
17.50	20.50	19.00	3.00	18.0	20.60	10.60	149.65	11.31	10.0	10.0	1.0	298.54	1785.23	42	1.0	475.2	1629.3	20.5	10.0	40	9.11	2.47	1.22	165.5	877.5	4292.0	305.4	3719.9	**1716.79**	**1239.95**
20.50	22.00	21.25	1.50	19.5	19.11	9.11	149.65	5.66	10.0	10.0	1.0	149.27	1934.50	40	1.0	226.3	1855.5	22.0	27.3	0	9.11	15.18	16.18	165.5	2943.2	6733.2	330.8	4120.9	**2693.30**	**1373.62**
22.00	23.50	22.75	1.50	21.0	19.11	9.11	149.65	5.66	27.3	27.3	1.0	436.94	2371.45	0	1.0	0.0	1855.5	23.5	25.4	0	9.11	10.90	11.80	165.5	2114.7	6341.7	356.3	4583.2	**2536.69**	**1527.75**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 1.13 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
23.50	25.00	24.25	1.50	22.5	19.11	9.11	149.65	5.66	25.4	25.4	1.0	401.98	2773.42	0	1.0	0.0	1855.5	25.0	25.5	13	10.29	11.13	12.03	165.5	2300.3	6929.3	381.7	5010.7	**2771.72**	**1670.22**
25.00	26.50	25.75	1.50	24.0	20.29	10.29	149.65	5.66	25.5	25.5	1.0	403.79	3177.21	13	1.0	73.5	1929.1	26.5	25.5	13	10.29	11.13	12.03	165.5	2300.3	7406.6	407.2	5513.5	**2962.66**	**1837.82**
26.50	27.50	27.00	1.00	25.0	20.29	10.29	149.65	3.77	25.5	25.5	1.0	269.19	3446.41	13	1.0	49.0	1978.1	27.5	9.5	62	10.29	2.38	1.14	165.5	1085.1	6509.6	424.1	5848.6	**2603.85**	**1949.55**
27.50	28.00	27.75	0.50	25.5	20.29	10.29	149.65	1.89	9.5	9.5	1.0	47.22	3493.63	62	1.0	116.9	2095.0	28.0	8.5	62	9.15	2.20	0.99	165.5	1049.5	6638.2	432.6	6021.3	**2655.28**	**2007.09**
28.00	29.50	28.75	1.50	27.0	19.15	9.15	149.65	5.66	8.5	8.5	1.0	126.52	3620.15	62	1.0	350.7	2445.8	29.5	8.5	62	9.15	2.20	0.99	165.5	1049.5	7115.5	458.0	6524.0	**2846.19**	**2174.65**
29.50	30.00	29.75	0.50	27.5	19.15	9.15	149.65	1.89	8.5	8.5	1.0	42.17	3662.32	62	1.0	116.9	2562.7	30.0	8.5	68	9.15	2.20	0.99	165.5	1110.6	7335.7	466.5	6691.5	**2934.26**	**2230.51**
30.00	32.50	31.25	2.50	30.0	19.15	9.15	149.65	9.43	8.5	8.5	1.0	210.87	3873.19	68	1.0	641.1	3203.8	32.5	8.5	68	10.23	2.20	0.99	165.5	1111.4	8188.4	508.9	7586.0	**3275.35**	**2528.65**
32.50	35.00	33.75	2.50	32.5	20.23	10.23	149.65	9.43	8.5	8.5	1.0	210.87	4084.05	68	1.0	641.1	3845.0	35.0	9.1	54	10.23	2.31	1.08	165.5	989.7	8918.7	551.3	8480.4	**3567.48**	**2826.79**
35.00	35.50	35.25	0.50	33.0	20.23	10.23	149.65	1.89	9.1	9.1	1.0	45.20	4129.25	54	1.0	101.8	3946.8	35.5	9.1	54	10.23	2.31	1.08	165.5	989.7	9065.7	559.8	8635.9	**3626.29**	**2878.63**
35.50	37.50	36.50	2.00	35.0	20.23	10.23	149.65	7.54	9.1	9.1	1.0	180.80	4310.05	54	1.0	407.3	4354.1	37.5	9.1	54	8.90	2.31	1.08	165.5	988.7	9652.9	593.8	9257.9	**3861.15**	**3085.98**
37.50	38.50	38.00	1.00	36.0	18.90	8.90	149.65	3.77	9.1	9.1	1.0	90.40	4400.45	54	1.0	203.7	4557.8	38.5	10.0	52	9.04	2.47	1.22	165.5	999.6	9957.9	610.7	9568.9	**3983.14**	**3189.65**
38.50	40.00	39.25	1.50	37.5	19.04	9.04	149.65	5.66	10.0	10.0	1.0	149.27	4549.72	52	1.0	294.2	4851.9	40.0	10.0	52	9.04	2.47	1.22	165.5	999.6	10401.3	636.2	10037.8	**4160.52**	**3345.95**
BORE NO: P55, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	19.71	9.71	26.70	1.89	24.6	24.6	1.0	23.05	0	0	1.0	0.0	0	3.0	28.7	0	9.13	18.33	19.40	29.1	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	5.00	4.00	2.00	2.5	19.13	9.13	38.26	7.54	28.7	28.7	1.0	158.00	0	0	1.0	0.0	0	5.0	29.6	0	9.13	20.36	21.48	47.4	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.5	19.13	9.13	51.96	3.77	29.6	29.6	1.0	111.31	0	0	1.0	0.0	0	6.0	29.6	0	8.97	20.36	21.48	56.5	0	0.0	59.4	59.4	**0.00**	**19.79**
6.00	8.00	7.00	2.00	5.5	18.97	8.97	65.49	7.54	29.6	29.6	1.0	280.62	0	0	1.0	0.0	0	8.0	29.6	0	8.97	20.36	21.48	74.5	0	0.0	93.3	93.3	**0.00**	**31.10**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
8.00	9.00	8.50	1.00	6.5	18.97	8.97	78.95	3.77	29.6	29.6	1.0	169.14	0	0	1.0	0.0	0	9.0	28.5	0	8.97	17.88	18.94	83.4	0	0.0	110.3	110.3	**0.00**	**36.76**
9.00	10.00	9.50	1.00	7.5	18.97	8.97	87.92	3.77	28.5	28.5	1.0	180.03	0	0	1.0	0.0	0	10.0	9.2	48	10.06	2.33	1.10	92.4	739.4	739.4	127.2	127.2	**295.77**	**42.41**
10.00	11.00	10.50	1.00	8.5	20.06	10.06	97.43	3.77	9.2	9.2	1.0	59.51	59.51	48	1.0	181.0	181.0	11.0	12.8	52	10.06	3.29	2.02	102.5	924.9	1165.4	144.2	384.7	**466.17**	**128.25**
11.00	12.00	11.50	1.00	9.5	20.06	10.06	107.49	3.77	12.8	12.8	1.0	92.10	151.62	52	1.0	196.1	377.1	12.0	8.5	54	10.00	2.20	0.99	112.5	836.7	1365.4	161.2	689.9	**546.17**	**229.97**
12.00	14.50	13.25	2.50	12.0	20.00	10.00	125.02	9.43	8.5	8.5	1.0	176.17	327.78	54	1.0	509.1	886.3	14.5	11.6	56	10.30	2.94	1.68	137.5	1039.5	2253.5	203.6	1417.6	**901.42**	**472.55**
14.50	17.50	16.00	3.00	15.0	20.30	10.30	152.97	11.31	11.6	11.6	1.0	355.27	683.05	56	1.0	633.6	1519.9	17.5	23.2	0	10.30	8.70	8.90	168.4	1720.8	3923.8	254.5	2457.4	**1569.52**	**819.14**
17.50	19.00	18.25	1.50	16.5	20.30	10.30	152.97	5.66	23.2	23.2	1.0	370.90	1053.95	0	1.0	0.0	1519.9	19.0	10.5	51	9.62	2.62	1.36	168.4	1026.9	3600.7	279.9	2853.8	**1440.30**	**951.25**
19.00	20.50	19.75	1.50	18.0	19.62	9.62	152.97	5.66	10.5	10.5	1.0	160.39	1214.34	51	1.0	288.5	1808.4	20.5	23.9	11	9.91	9.21	9.67	168.4	1931.7	4954.5	305.4	3328.1	**1981.78**	**1109.37**
20.50	23.50	22.00	3.00	21.0	19.91	9.91	152.97	11.31	23.9	23.9	1.0	766.96	1981.30	11	1.0	124.5	1932.9	23.5	23.9	11	9.91	9.21	9.67	168.4	1931.7	5845.9	356.3	4270.4	**2338.35**	**1423.47**
23.50	25.00	24.25	1.50	22.5	19.91	9.91	152.97	5.66	23.9	23.9	1.0	383.48	2364.78	11	1.0	62.2	1995.1	25.0	12.6	70	10.42	3.23	1.96	168.4	1342.8	5702.7	381.7	4741.6	**2281.06**	**1580.52**
25.00	26.50	25.75	1.50	24.0	20.42	10.42	152.97	5.66	12.6	12.6	1.0	193.43	2558.22	70	1.0	396.0	2391.1	26.5	12.6	70	10.42	3.23	1.96	168.4	1342.8	6292.1	407.2	5356.5	**2516.84**	**1785.48**
26.50	27.50	27.00	1.00	25.0	20.42	10.42	152.97	3.77	12.6	12.6	1.0	128.96	2687.17	70	1.0	264.0	2655.1	27.5	12.6	70	10.42	3.23	1.96	168.4	1342.8	6685.1	424.1	5766.4	**2674.02**	**1922.12**
27.50	28.00	27.75	0.50	25.5	20.42	10.42	152.97	1.89	12.6	12.6	1.0	64.48	2751.65	70	1.0	132.0	2787.1	28.0	12.6	70	10.42	3.23	1.96	168.4	1342.8	6881.5	432.6	5971.3	**2752.61**	**1990.44**
28.00	29.50	28.75	1.50	27.0	20.42	10.42	152.97	5.66	12.6	12.6	1.0	193.43	2945.08	70	1.0	396.0	3183.1	29.5	18.5	48	9.18	5.64	4.57	168.4	1592.4	7720.5	458.0	6586.2	**3088.21**	**2195.40**
29.50	30.00	29.75	0.50	27.5	19.18	9.18	152.97	1.89	18.5	18.5	1.0	96.52	3041.60	48	1.0	90.5	3273.6	30.0	18.5	48	9.18	5.64	4.57	168.4	1592.4	7907.6	466.5	6781.7	**3163.02**	**2260.58**
30.00	31.00	30.50	1.00	28.5	19.18	9.18	152.97	3.77	18.5	18.5	1.0	193.03	3234.63	48	1.0	181.0	3454.6	31.0	18.5	48	8.41	5.64	4.57	168.4	1590.0	8279.2	483.5	7172.8	**3311.69**	**2390.92**
31.00	32.50	31.75	1.50	30.0	18.41	8.41	152.97	5.66	18.5	18.5	1.0	289.55	3524.18	48	1.0	271.5	3726.2	32.5	20.0	48	8.94	6.40	5.39	168.4	1741.0	8991.4	508.9	7759.3	**3596.56**	**2586.43**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
32.50	34.00	33.25	1.50	31.5	18.94	8.94	152.97	5.66	20.0	20.0	1.0	314.97	3839.15	48	1.0	271.5	3997.7	34.0	12.0	54	9.41	3.06	1.79	168.4	1144.0	8980.9	534.4	8371.3	**3592.36**	**2790.42**
34.00	35.00	34.50	1.00	32.5	19.41	9.41	152.97	3.77	12.0	12.0	1.0	122.63	3961.78	54	1.0	203.7	4201.4	35.0	12.0	54	9.41	3.06	1.79	168.4	1144.0	9307.2	551.3	8714.5	**3722.88**	**2904.83**
35.00	35.50	35.25	0.50	33.0	19.41	9.41	152.97	1.89	12.0	12.0	1.0	61.31	4023.10	54	1.0	101.8	4303.2	35.5	14.1	52	8.53	3.68	2.39	168.4	1244.4	9570.7	559.8	8886.1	**3828.28**	**2962.04**
35.50	37.00	36.25	1.50	34.5	18.53	8.53	152.97	5.66	14.1	14.1	1.0	217.37	4240.46	52	1.0	294.2	4597.4	37.0	14.1	52	9.58	3.68	2.39	168.4	1246.1	10084.0	585.3	9423.1	**4033.58**	**3141.04**
37.00	37.50	37.25	0.50	35.0	19.58	9.58	152.97	1.89	14.1	14.1	1.0	72.46	4312.92	52	1.0	98.1	4695.4	37.5	14.1	52	9.58	3.68	2.39	168.4	1246.1	10254.5	593.8	9602.1	**4101.79**	**3200.70**
37.50	38.50	38.00	1.00	36.0	19.58	9.58	152.97	3.77	14.1	14.1	1.0	144.91	4457.83	52	1.0	196.1	4891.5	38.5	14.5	36	9.64	3.80	2.51	168.4	1106.1	10455.5	610.7	9960.1	**4182.21**	**3320.03**
38.50	40.00	39.25	1.50	37.5	19.64	9.64	152.97	5.66	14.5	14.5	1.0	223.80	4681.63	36	1.0	203.7	5095.2	40.0	14.5	36	9.64	3.80	2.51	168.4	1106.1	10883.0	636.2	10413.0	**4353.19**	**3471.00**
BORE NO: P56, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	19.45	9.45	25.99	1.89	27.1	27.1	1.0	25.08	0	4	1.0	7.5	0	3.0	29.7	0	9.31	20.58	21.71	28.4	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	5.00	4.00	2.00	2.5	19.31	9.31	37.66	7.54	29.7	29.7	1.0	162.03	0	0	1.0	0.0	0	5.0	28.9	0	9.31	18.78	19.87	47.0	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.5	19.31	9.31	51.63	3.77	28.9	28.9	1.0	107.48	0	0	1.0	0.0	0	6.0	28.9	0	9.30	18.78	19.87	56.3	0	0.0	59.4	59.4	**0.00**	**19.79**
6.00	8.00	7.00	2.00	5.5	19.30	9.30	65.58	7.54	28.9	28.9	1.0	273.07	0	0	1.0	0.0	0	8.0	11.4	42	9.30	2.88	1.62	74.9	682.0	682.0	93.3	93.3	**272.82**	**31.10**
8.00	9.00	8.50	1.00	6.5	19.30	9.30	79.53	3.77	11.4	11.4	1.0	60.48	60.48	42	1.0	158.4	158.4	9.0	11.4	42	9.96	2.88	1.62	84.2	713.1	932.0	110.3	329.1	**372.79**	**109.72**
9.00	11.00	10.00	2.00	8.5	19.96	9.96	94.14	7.54	11.4	11.4	1.0	143.18	203.66	42	1.0	316.8	475.2	11.0	10.6	42	9.96	2.65	1.39	104.1	748.8	1427.6	144.2	823.1	**571.06**	**274.35**
11.00	12.50	11.75	1.50	10.0	19.96	9.96	111.57	5.66	10.6	10.6	1.0	118.12	321.78	42	1.0	237.6	712.8	12.5	7.5	96	10.11	2.02	0.84	119.0	1255.3	2289.9	169.6	1204.2	**915.97**	**401.41**
12.50	14.50	13.50	2.00	12.0	20.11	10.11	129.15	7.54	7.5	7.5	1.0	128.25	450.03	96	1.0	724.1	1436.9	14.5	8.2	58	10.39	2.15	0.94	139.3	935.4	2822.3	203.6	2090.5	**1128.93**	**696.84**
14.50	17.50	16.00	3.00	15.0	20.39	10.39	154.85	11.31	8.2	8.2	1.0	252.46	702.49	58	1.0	656.2	2093.1	17.5	9.7	52	10.26	2.42	1.17	170.4	1003.6	3799.2	254.5	3050.1	**1519.68**	**1016.70**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
17.50	20.50	19.00	3.00	18.0	20.26	10.26	154.85	11.31	9.7	9.7	1.0	299.47	1001.96	52	1.0	588.3	2681.5	20.5	8.0	60	10.52	2.11	0.91	170.4	1024.4	4707.8	305.4	3988.8	**1883.12**	**1329.60**
20.50	23.50	22.00	3.00	21.0	20.52	10.52	154.85	11.31	8.0	8.0	1.0	246.22	1248.18	60	1.0	678.9	3360.3	23.5	8.0	60	10.52	2.11	0.91	170.4	1024.4	5632.9	356.3	4964.8	**2253.15**	**1654.93**
23.50	26.50	25.00	3.00	24.0	20.52	10.52	154.85	11.31	8.0	8.0	1.0	246.22	1494.40	60	1.0	678.9	4039.2	26.5	7.5	65	10.10	2.02	0.84	170.4	1057.1	6590.7	407.2	5940.8	**2636.29**	**1980.25**
26.50	27.50	27.00	1.00	25.0	20.10	10.10	154.85	3.77	7.5	7.5	1.0	76.88	1571.28	65	1.0	245.1	4284.3	27.5	7.5	65	10.33	2.02	0.84	170.4	1057.3	6912.9	424.1	6279.7	**2765.15**	**2093.25**
27.50	28.00	27.75	0.50	25.5	20.33	10.33	154.85	1.89	7.5	7.5	1.0	38.44	1609.73	65	1.0	122.6	4406.9	28.0	7.5	65	10.33	2.02	0.84	170.4	1057.3	7073.9	432.6	6449.2	**2829.56**	**2149.75**
28.00	29.50	28.75	1.50	27.0	20.33	10.33	154.85	5.66	7.5	7.5	1.0	115.32	1725.05	65	1.0	367.7	4774.6	29.5	7.5	65	10.33	2.02	0.84	170.4	1057.3	7556.9	458.0	6957.7	**3022.77**	**2319.24**
29.50	30.00	29.75	0.50	27.5	20.33	10.33	154.85	1.89	7.5	7.5	1.0	38.44	1763.49	65	1.0	122.6	4897.2	30.0	8.7	66	10.33	2.24	1.02	170.4	1110.4	7771.1	466.5	7127.2	**3108.43**	**2375.74**
30.00	31.00	30.50	1.00	28.5	20.33	10.33	154.85	3.77	8.7	8.7	1.0	89.36	1852.86	66	1.0	248.9	5146.1	31.0	8.7	66	10.33	2.24	1.02	170.4	1110.4	8109.4	483.5	7482.5	**3243.74**	**2494.15**
31.00	32.50	31.75	1.50	30.0	20.33	10.33	154.85	5.66	8.7	8.7	1.0	134.04	1986.90	66	1.0	373.4	5519.5	32.5	8.7	60	10.33	2.24	1.02	170.4	1049.3	8555.7	508.9	8015.3	**3422.27**	**2671.77**
32.50	34.00	33.25	1.50	31.5	20.33	10.33	154.85	5.66	8.7	8.7	1.0	134.04	2120.94	60	1.0	339.4	5858.9	34.0	8.7	66	10.33	2.24	1.02	170.4	1110.4	9090.2	534.4	8514.2	**3636.10**	**2838.08**
34.00	35.00	34.50	1.00	32.5	20.33	10.33	154.85	3.77	8.7	8.7	1.0	89.36	2210.31	66	1.0	248.9	6107.8	35.0	8.7	65	8.86	2.24	1.02	170.4	1099.2	9417.3	551.3	8869.5	**3766.93**	**2956.49**
35.00	35.50	35.25	0.50	33.0	18.86	8.86	154.85	1.89	8.7	8.7	1.0	44.68	2254.99	65	1.0	122.6	6230.4	35.5	8.7	65	8.94	2.24	1.02	170.4	1099.2	9584.6	559.8	9045.2	**3833.85**	**3015.07**
35.50	37.00	36.25	1.50	34.5	18.94	8.94	154.85	5.66	8.7	8.7	1.0	134.04	2389.03	65	1.0	367.7	6598.1	37.0	9.0	65	8.86	2.29	1.07	170.4	1109.9	10097.0	585.3	9572.4	**4038.81**	**3190.81**
37.00	37.50	37.25	0.50	35.0	18.86	8.86	154.85	1.89	9.0	9.0	1.0	46.25	2435.28	65	1.0	122.6	6720.7	37.5	9.0	62	8.86	2.29	1.07	170.4	1079.3	10235.3	593.8	9749.7	**4094.12**	**3249.91**
37.50	38.50	38.00	1.00	36.0	18.86	8.86	154.85	3.77	9.0	9.0	1.0	92.49	2527.77	62	1.0	233.8	6954.5	38.5	10.0	59	9.19	2.47	1.22	170.4	1084.7	10567.0	610.7	10093.0	**4226.79**	**3364.34**
38.50	40.00	39.25	1.50	37.5	19.19	9.19	154.85	5.66	10.0	10.0	1.0	154.46	2682.23	59	1.0	333.8	7288.3	40.0	10.0	59	9.19	2.47	1.22	170.4	1084.7	11055.2	636.2	10606.7	**4422.08**	**3535.56**
BORE NO: P57, CUT OFF LENGTH: 2.50 m, Nc= 9																														

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 1.13 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
2.50	3.00	2.75	0.50	0.5	19.59	9.59	26.37	1.89	24.8	24.8	1.0	22.98	0	0	1.0	0.0	0	3.0	25.4	0	9.59	10.90	11.80	28.8	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	5.00	4.00	2.00	2.5	19.59	9.59	38.36	7.54	25.4	25.4	1.0	137.39	0	0	1.0	0.0	0	5.0	27.6	2	10.74	15.85	16.87	48.0	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.5	20.74	10.74	53.32	3.77	27.6	27.6	1.0	105.13	0	2	1.0	7.5	0	6.0	27.6	2	10.74	15.85	16.87	58.7	1196.2	1196.2	59.4	59.4	**478.48**	**19.79**
6.00	8.00	7.00	2.00	5.5	20.74	10.74	69.43	7.54	27.6	27.6	1.0	273.78	273.78	2	1.0	15.1	15.1	8.0	27.6	2	10.74	15.85	16.87	80.2	1581.5	1870.4	93.3	382.2	**748.15**	**127.39**
8.00	9.00	8.50	1.00	6.5	20.74	10.74	85.54	3.77	27.6	27.6	1.0	168.66	442.44	2	1.0	7.5	22.6	9.0	9.6	53	10.32	2.40	1.16	90.9	794.5	1259.5	110.3	575.3	**503.81**	**191.78**
9.00	11.00	10.00	2.00	8.5	20.32	10.32	101.23	7.54	9.6	9.6	1.0	129.15	571.59	53	1.0	399.8	422.4	11.0	9.6	53	10.32	2.40	1.16	111.6	850.5	1844.4	144.2	1138.2	**737.78**	**379.40**
11.00	12.00	11.50	1.00	9.5	20.32	10.32	116.71	3.77	9.6	9.6	1.0	74.45	646.03	53	1.0	199.9	622.3	12.0	9.6	53	10.32	2.40	1.16	121.9	878.5	2146.8	161.2	1429.5	**858.71**	**476.49**
12.00	13.00	12.50	1.00	10.5	20.32	10.32	127.03	3.77	9.6	9.6	1.0	81.03	727.07	53	1.0	199.9	822.2	13.0	10.5	48	10.40	2.62	1.36	132.2	889.8	2439.0	178.1	1727.4	**975.62**	**575.79**
13.00	14.50	13.75	1.50	12.0	20.40	10.40	139.99	5.66	10.5	10.5	1.0	146.78	873.84	48	1.0	271.5	1093.7	14.5	10.5	48	10.40	2.62	1.36	147.8	936.0	2903.6	203.6	2171.1	**1161.42**	**723.71**
14.50	16.00	15.25	1.50	13.5	20.40	10.40	155.59	5.66	10.5	10.5	1.0	163.13	1036.98	48	1.0	271.5	1365.3	16.0	11.3	56	10.60	2.85	1.59	163.4	1109.0	3511.2	229.0	2631.3	**1404.48**	**877.09**
16.00	17.50	16.75	1.50	15.0	20.60	10.60	171.34	5.66	11.3	11.3	1.0	193.68	1230.66	56	1.0	316.8	1682.1	17.5	11.3	56	10.60	2.85	1.59	179.3	1160.3	4073.0	254.5	3167.2	**1629.20**	**1055.73**
17.50	19.00	18.25	1.50	16.5	20.60	10.60	171.34	5.66	11.3	11.3	1.0	193.68	1424.35	56	1.0	316.8	1998.9	19.0	25.2	6	9.55	10.45	11.34	179.3	2254.5	5677.7	279.9	3703.1	**2271.09**	**1234.37**
19.00	20.50	19.75	1.50	18.0	19.55	9.55	171.34	5.66	25.2	25.2	1.0	456.12	1880.46	6	1.0	33.9	2032.8	20.5	9.1	45	9.55	2.31	1.08	179.3	933.4	4846.7	305.4	4218.6	**1938.68**	**1406.21**
20.50	22.50	21.50	2.00	20.0	19.55	9.55	171.34	7.54	9.1	9.1	1.0	207.01	2087.47	45	1.0	339.4	2372.2	22.5	9.1	57	10.17	2.31	1.08	179.3	1056.1	5515.8	339.3	4799.0	**2206.31**	**1599.66**
22.50	23.50	23.00	1.00	21.0	20.17	10.17	171.34	3.77	9.1	9.1	1.0	103.50	2190.97	57	1.0	215.0	2587.2	23.5	9.1	57	10.17	2.31	1.08	179.3	1056.1	5834.2	356.3	5134.4	**2333.70**	**1711.48**
23.50	25.00	24.25	1.50	22.5	20.17	10.17	171.34	5.66	9.1	9.1	1.0	155.26	2346.23	57	1.0	322.5	2909.7	25.0	28.1	0	10.17	16.98	18.02	179.3	3569.1	8825.0	381.7	5637.6	**3529.98**	**1879.20**
25.00	26.50	25.75	1.50	24.0	20.17	10.17	171.34	5.66	28.1	28.1	1.0	517.56	2863.79	0	1.0	0.0	2909.7	26.5	28.1	0	10.03	16.98	18.02	179.3	3567.4	9340.8	407.2	6180.6	**3736.32**	**2060.20**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
26.50	27.50	27.00	1.00	25.0	20.03	10.03	171.34	3.77	28.1	28.1	1.0	345.04	3208.82	0	1.0	0.0	2909.7	27.5	28.1	0	10.03	16.98	18.02	179.3	3567.4	9685.8	424.1	6542.6	**3874.33**	**2180.86**
27.50	28.00	27.75	0.50	25.5	20.03	10.03	171.34	1.89	28.1	28.1	1.0	172.52	3381.34	0	1.0	0.0	2909.7	28.0	12.5	54	8.52	3.20	1.94	179.3	1211.0	7502.0	432.6	6723.6	**3000.80**	**2241.20**
28.00	29.50	28.75	1.50	27.0	18.52	8.52	171.34	5.66	12.5	12.5	1.0	214.89	3596.23	54	1.0	305.5	3215.1	29.5	12.5	54	8.71	3.20	1.94	179.3	1211.3	8022.6	458.0	7269.4	**3209.05**	**2423.14**
29.50	30.00	29.75	0.50	27.5	18.71	8.71	171.34	1.89	12.5	12.5	1.0	71.63	3667.86	54	1.0	101.8	3317.0	30.0	12.5	54	11.19	3.20	1.94	179.3	1214.5	8199.3	466.5	7451.4	**3279.74**	**2483.78**
30.00	31.00	30.50	1.00	28.5	21.19	11.19	171.34	3.77	12.5	12.5	1.0	143.26	3811.12	54	1.0	203.7	3520.6	31.0	10.5	50	11.19	2.62	1.36	179.3	1050.4	8382.1	483.5	7815.2	**3352.84**	**2605.08**
31.00	32.50	31.75	1.50	30.0	21.19	11.19	171.34	5.66	10.5	10.5	1.0	179.65	3990.76	50	1.0	282.9	3803.5	32.5	10.5	50	11.19	2.62	1.36	179.3	1050.4	8844.6	508.9	8303.2	**3537.85**	**2767.73**
32.50	34.00	33.25	1.50	31.5	21.19	11.19	171.34	5.66	10.5	10.5	1.0	179.65	4170.41	50	1.0	282.9	4086.3	34.0	28.8	0	11.19	18.56	19.64	179.3	3913.6	12170.3	534.4	8791.1	**4868.13**	**2930.38**
34.00	35.00	34.50	1.00	32.5	21.19	11.19	171.34	3.77	28.8	28.8	1.0	355.25	4525.66	0	1.0	0.0	4086.3	35.0	28.8	0	11.19	18.56	19.64	179.3	3913.6	12525.6	551.3	9163.4	**5010.23**	**3054.45**
35.00	35.50	35.25	0.50	33.0	21.19	11.19	171.34	1.89	28.8	28.8	1.0	177.62	4703.29	0	1.0	0.0	4086.3	35.5	30.9	0	11.19	25.79	27.01	179.3	5437.5	14227.1	559.8	9349.5	**5690.83**	**3116.49**
35.50	37.50	36.50	2.00	35.0	21.19	11.19	171.34	7.54	30.9	30.9	1.0	808.29	5511.57	0	1.0	0.0	4086.3	37.5	30.1	0	8.95	21.76	22.91	179.3	4554.0	14151.9	593.8	10191.7	**5660.76**	**3397.23**
37.50	38.50	38.00	1.00	36.0	18.95	8.95	171.34	3.77	30.1	30.1	1.0	376.46	5888.03	0	1.0	0.0	4086.3	38.5	29.8	0	9.01	20.81	21.94	179.3	4355.4	14329.8	610.7	10585.1	**5731.91**	**3528.37**
38.50	40.00	39.25	1.50	37.5	19.01	9.01	171.34	5.66	29.8	29.8	1.0	555.12	6443.15	0	1.0	0.0	4086.3	40.0	29.8	0	9.01	20.81	21.94	179.3	4355.4	14884.9	636.2	11165.7	**5953.96**	**3721.89**
BORE NO: P58, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	20.05	10.05	27.64	1.89	12.1	12.1	1.0	11.17	0	15	1.0	28.3	0	3.0	24.5	0	10.05	9.64	10.33	30.2	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.5	20.05	10.05	35.18	3.77	24.5	24.5	1.0	60.46	0	0	1.0	0.0	0	4.0	27.4	2	9.79	15.40	16.41	40.2	830.1	830.1	25.4	25.4	**332.03**	**8.48**
4.00	6.00	5.00	2.00	3.5	19.79	9.79	49.99	7.54	27.4	27.4	1.0	195.45	195.45	2	1.0	15.1	15.1	6.0	28.7	0	9.79	18.33	19.40	59.8	1368.9	1579.4	59.4	269.9	**631.77**	**89.97**
6.00	7.00	6.50	1.00	4.5	19.79	9.79	64.68	3.77	28.7	28.7	1.0	133.54	328.99	0	1.0	0.0	15.1	7.0	28.7	0	9.40	18.33	19.40	69.6	1566.8	1910.9	76.3	420.4	**764.35**	**140.14**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
7.00	9.00	8.00	2.00	6.5	19.40	9.40	78.97	7.54	28.7	28.7	1.0	326.11	655.11	0	1.0	0.0	15.1	9.0	28.7	0	9.40	18.33	19.40	88.4	1956.7	2626.9	110.3	780.5	**1050.78**	**260.15**
9.00	10.00	9.50	1.00	7.5	19.40	9.40	93.07	3.77	28.7	28.7	1.0	192.17	847.28	0	1.0	0.0	15.1	10.0	28.0	0	9.40	16.76	17.79	97.8	1967.0	2829.4	127.2	989.6	**1131.77**	**329.87**
10.00	11.00	10.50	1.00	8.5	19.40	9.40	102.47	3.77	28.0	28.0	1.0	205.48	1052.76	0	1.0	0.0	15.1	11.0	24.8	8	10.21	9.86	10.66	107.2	1350.4	2418.3	144.2	1212.0	**967.32**	**404.02**
11.00	12.50	11.75	1.50	10.0	20.21	10.21	114.83	5.66	24.8	24.8	1.0	300.16	1352.92	8	1.0	45.3	60.3	12.5	10.6	50	10.27	2.65	1.39	122.5	885.6	2298.9	169.6	1582.9	**919.54**	**527.64**
12.50	15.50	14.00	3.00	13.0	20.27	10.27	137.89	11.31	10.6	10.6	1.0	291.97	1644.89	50	1.0	565.7	626.1	15.5	10.6	50	10.27	2.65	1.39	153.3	977.8	3248.8	220.5	2491.5	**1299.51**	**830.49**
15.50	17.00	16.25	1.50	14.5	20.27	10.27	161.00	5.66	10.6	10.6	1.0	170.45	1815.34	50	1.0	282.9	908.9	17.0	26.8	0	9.29	14.05	15.03	168.7	2777.2	5501.4	246.0	2970.2	**2200.57**	**990.08**
17.00	18.50	17.75	1.50	16.0	19.29	9.29	175.67	5.66	26.8	26.8	1.0	501.99	2317.33	0	1.0	0.0	908.9	18.5	26.8	0	9.29	14.05	15.03	168.7	2777.2	6003.4	271.4	3497.7	**2401.37**	**1165.89**
18.50	20.00	19.25	1.50	17.5	19.29	9.29	175.67	5.66	26.8	26.8	1.0	501.99	2819.32	0	1.0	0.0	908.9	20.0	27.2	6	9.68	14.95	15.95	168.7	3020.2	6748.5	296.9	4025.1	**2699.39**	**1341.71**
20.00	21.50	20.75	1.50	19.0	19.68	9.68	175.67	5.66	27.2	27.2	1.0	510.73	3330.05	6	1.0	33.9	942.9	21.5	11.0	45	9.68	2.76	1.51	168.7	995.7	5268.6	322.3	4595.2	**2107.44**	**1531.75**
21.50	23.00	22.25	1.50	20.5	19.68	9.68	175.67	5.66	11.0	11.0	1.0	193.17	3523.22	45	1.0	254.6	1197.4	23.0	11.0	45	9.68	2.76	1.51	168.7	995.7	5716.3	347.8	5068.4	**2286.54**	**1689.48**
23.00	24.50	23.75	1.50	22.0	19.68	9.68	175.67	5.66	11.0	11.0	1.0	193.17	3716.39	45	1.0	254.6	1452.0	24.5	9.4	58	10.37	2.36	1.13	168.7	1049.4	6217.8	373.2	5541.6	**2487.11**	**1847.20**
24.50	27.50	26.00	3.00	25.0	20.37	10.37	175.67	11.31	9.4	9.4	1.0	329.04	4045.43	58	1.0	656.2	2108.2	27.5	7.0	70	10.37	1.93	0.76	168.7	1086.5	7240.2	424.1	6577.8	**2896.07**	**2192.59**
27.50	29.00	28.25	1.50	26.5	20.37	10.37	175.67	5.66	7.0	7.0	1.0	122.02	4167.45	70	1.0	396.0	2504.2	29.0	9.0	54	10.37	2.29	1.07	168.7	994.5	7666.2	449.6	7121.2	**3066.46**	**2373.75**
29.00	30.00	29.50	1.00	27.5	20.37	10.37	175.67	3.77	9.0	9.0	1.0	104.93	4272.38	54	1.0	203.7	2707.9	30.0	9.0	54	8.77	2.29	1.07	168.7	993.3	7973.6	466.5	7446.8	**3189.43**	**2482.27**
30.00	30.50	30.25	0.50	28.0	18.77	8.77	175.67	1.89	9.0	9.0	1.0	52.47	4324.85	54	1.0	101.8	2809.7	30.5	31.2	0	9.06	27.30	28.55	168.7	5387.3	12521.8	475.0	7609.6	**5008.73**	**2536.52**
30.50	32.00	31.25	1.50	29.5	19.06	9.06	175.67	5.66	31.2	31.2	1.1	637.96	4962.81	0	1.0	0.0	2809.7	32.0	20.0	48	9.06	6.40	5.39	168.7	1743.5	9516.0	500.5	8273.0	**3806.41**	**2757.66**
32.00	32.50	32.25	0.50	30.0	19.06	9.06	175.67	1.89	20.0	20.0	1.0	120.57	5083.38	48	1.0	90.5	2900.2	32.5	20.0	48	9.06	6.40	5.39	168.7	1743.5	9727.1	508.9	8492.5	**3890.85**	**2830.85**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
32.50	33.50	33.00	1.00	31.0	19.06	9.06	175.67	3.77	20.0	20.0	1.0	241.14	5324.52	48	1.0	181.0	3081.3	33.5	31.1	0	8.86	26.80	28.04	168.7	5284.1	13689.9	525.9	8931.7	**5475.97**	**2977.23**
33.50	35.00	34.25	1.50	32.5	18.86	8.86	175.67	5.66	31.1	31.1	1.1	632.46	5956.97	0	1.0	0.0	3081.3	35.0	31.3	0	8.69	27.81	29.06	168.7	5479.3	14517.5	551.3	9589.6	**5807.00**	**3196.53**
35.00	36.50	35.75	1.50	34.0	18.69	8.69	175.67	5.66	31.3	31.3	1.1	643.50	6600.47	0	1.0	0.0	3081.3	36.5	31.3	0	8.63	27.81	29.06	168.7	5478.1	15159.8	576.8	10258.5	**6063.92**	**3419.51**
36.50	37.50	37.00	1.00	35.0	18.63	8.63	175.67	3.77	31.3	31.3	1.1	429.00	7029.47	0	1.0	0.0	3081.3	37.5	31.9	0	8.63	30.83	32.14	168.7	6073.0	16183.7	593.8	10704.5	**6473.49**	**3568.16**
37.50	38.00	37.75	0.50	35.5	18.63	8.63	175.67	1.89	31.9	31.9	1.1	225.78	7255.25	0	1.0	0.0	3081.3	38.0	34.3	0	8.62	42.92	44.44	168.7	8452.4	18788.9	602.2	10938.8	**7515.56**	**3646.25**
38.00	40.00	39.00	2.00	37.5	18.62	8.62	175.67	7.54	34.3	34.3	1.2	1098.21	8353.46	0	1.0	0.0	3081.3	40.0	34.3	0	8.62	42.92	44.44	168.7	8452.4	19887.1	636.2	12070.9	**7954.84**	**4023.63**
BORE NO: P59, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	19.41	9.41	25.88	1.89	26.7	26.7	1.0	24.54	0	4	1.0	7.5	0	3.0	26.7	0	9.41	13.83	14.80	28.2	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.5	19.41	9.41	32.94	3.77	26.7	26.7	1.0	62.47	0	0	1.0	0.0	0	4.0	7.2	62	9.29	1.97	0.79	37.6	0	0.0	25.4	25.4	**0.00**	**8.48**
4.00	5.00	4.50	1.00	2.5	19.29	9.29	42.29	3.77	7.2	7.2	1.0	20.15	0	62	1.0	233.8	0	5.0	7.2	62	9.29	1.97	0.79	46.9	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.5	19.29	9.29	51.58	3.77	7.2	7.2	1.0	24.57	0	62	1.0	233.8	0	6.0	7.2	62	9.29	1.97	0.79	56.2	0	0.0	59.4	59.4	**0.00**	**19.79**
6.00	7.00	6.50	1.00	4.5	19.29	9.29	60.87	3.77	7.2	7.2	1.0	29.00	0	62	1.0	233.8	0	7.0	28.4	0	9.00	17.66	18.71	65.5	0	0.0	76.3	76.3	**0.00**	**25.45**
7.00	8.00	7.50	1.00	5.5	19.00	9.00	70.01	3.77	28.4	28.4	1.0	142.76	0	0	1.0	0.0	0	8.0	28.4	0	9.00	17.66	18.71	74.5	1602.8	1602.8	93.3	93.3	**641.13**	**31.10**
8.00	9.00	8.50	1.00	6.5	19.00	9.00	79.01	3.77	28.4	28.4	1.0	161.12	161.12	0	1.0	0.0	0.0	9.0	28.7	0	9.00	18.33	19.40	83.5	1850.7	2011.8	110.3	271.4	**804.72**	**90.46**
9.00	10.00	9.50	1.00	7.5	19.00	9.00	88.01	3.77	28.7	28.7	1.0	181.72	342.84	0	1.0	0.0	0.0	10.0	11.5	40	10.10	2.91	1.65	92.5	723.3	1066.2	127.2	470.1	**426.46**	**156.69**
10.00	11.00	10.50	1.00	8.5	20.10	10.10	97.56	3.77	11.5	11.5	1.0	74.86	417.70	40	1.0	150.9	150.9	11.0	8.4	55	10.10	2.18	0.97	102.6	820.1	1388.6	144.2	712.8	**555.44**	**237.58**
11.00	12.00	11.50	1.00	9.5	20.10	10.10	107.66	3.77	8.4	8.4	1.0	59.96	477.66	55	1.0	207.4	358.3	12.0	8.4	55	10.31	2.18	0.97	112.7	845.1	1681.1	161.2	997.1	**672.43**	**332.37**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 1.13 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
12.00	14.50	13.25	2.50	12.0	20.31	10.31	125.60	9.43	8.4	8.4	1.0	174.87	652.52	55	1.0	518.6	876.9	14.5	8.4	55	9.77	2.18	0.97	138.5	908.4	2437.8	203.6	1733.0	**975.11**	**577.65**
14.50	17.50	16.00	3.00	15.0	19.77	9.77	153.14	11.31	8.4	8.4	1.0	255.86	908.38	55	1.0	622.3	1499.1	17.5	11.8	50	9.77	3.00	1.73	167.8	1090.0	3497.6	254.5	2662.0	**1399.03**	**887.33**
17.50	19.00	18.25	1.50	16.5	19.77	9.77	153.14	5.66	11.8	11.8	1.0	180.99	1089.37	50	1.0	282.9	1782.0	19.0	27.6	2	9.52	15.85	16.87	167.8	3139.4	6010.8	279.9	3151.3	**2404.32**	**1050.43**
19.00	20.50	19.75	1.50	18.0	19.52	9.52	153.14	5.66	27.6	27.6	1.0	452.91	1542.28	2	1.0	11.3	1793.3	20.5	27.6	2	9.52	15.85	16.87	167.8	3139.4	6475.0	305.4	3641.0	**2590.01**	**1213.65**
20.50	23.50	22.00	3.00	21.0	19.52	9.52	153.14	11.31	27.6	27.6	1.0	905.82	2448.10	2	1.0	22.6	1815.9	23.5	12.6	38	9.07	3.23	1.96	167.8	1012.9	5276.9	356.3	4620.3	**2110.76**	**1540.10**
23.50	25.00	24.25	1.50	22.5	19.07	9.07	153.14	5.66	12.6	12.6	1.0	193.65	2641.75	38	1.0	215.0	2030.9	25.0	12.6	38	9.41	3.23	1.96	167.8	1013.3	5686.0	381.7	5054.4	**2274.39**	**1684.79**
25.00	26.50	25.75	1.50	24.0	19.41	9.41	153.14	5.66	12.6	12.6	1.0	193.65	2835.39	38	1.0	215.0	2245.9	26.5	12.6	38	9.80	3.23	1.96	167.8	1013.8	6095.1	407.2	5488.4	**2438.04**	**1829.48**
26.50	27.50	27.00	1.00	25.0	19.80	9.80	153.14	3.77	12.6	12.6	1.0	129.10	2964.49	38	1.0	143.3	2389.2	27.5	13.0	45	10.12	3.35	2.08	167.8	1108.5	6462.2	424.1	5777.8	**2584.88**	**1925.94**
27.50	28.00	27.75	0.50	25.5	20.12	10.12	153.14	1.89	13.0	13.0	1.0	66.67	3031.16	45	1.0	84.9	2474.1	28.0	7.0	75	10.12	1.93	0.76	167.8	1135.3	6640.5	432.6	5937.8	**2656.22**	**1979.27**
28.00	29.50	28.75	1.50	27.0	20.12	10.12	153.14	5.66	7.0	7.0	1.0	106.37	3137.54	75	1.0	424.3	2898.3	29.5	15.3	40	10.12	4.09	2.81	167.8	1202.7	7238.6	458.0	6493.9	**2895.42**	**2164.64**
29.50	30.00	29.75	0.50	27.5	20.12	10.12	153.14	1.89	15.3	15.3	1.0	79.00	3216.54	40	1.0	75.4	2973.8	30.0	15.3	40	10.12	4.09	2.81	167.8	1202.7	7393.0	466.5	6656.8	**2957.19**	**2218.94**
30.00	31.00	30.50	1.00	28.5	20.12	10.12	153.14	3.77	15.3	15.3	1.0	158.00	3374.54	40	1.0	150.9	3124.6	31.0	28.4	0	10.12	17.66	18.71	167.8	3480.6	9979.8	483.5	6982.7	**3991.91**	**2327.55**
31.00	32.50	31.75	1.50	30.0	20.12	10.12	153.14	5.66	28.4	28.4	1.0	468.43	3842.96	0	1.0	0.0	3124.6	32.5	28.4	0	10.12	17.66	18.71	167.8	3480.6	10448.2	508.9	7476.5	**4179.28**	**2492.18**
32.50	34.00	33.25	1.50	31.5	20.12	10.12	153.14	5.66	28.4	28.4	1.0	468.43	4311.39	0	1.0	0.0	3124.6	34.0	29.6	5	10.28	20.36	21.48	167.8	4065.9	11501.9	534.4	7970.4	**4600.76**	**2656.80**
34.00	35.00	34.50	1.00	32.5	20.28	10.28	153.14	3.77	29.6	29.6	1.0	328.10	4639.49	5	1.0	18.9	3143.5	35.0	29.6	5	10.28	20.36	21.48	167.8	4065.9	11848.8	551.3	8334.3	**4739.54**	**2778.11**
35.00	35.50	35.25	0.50	33.0	20.28	10.28	153.14	1.89	29.6	29.6	1.0	164.05	4803.54	5	1.0	9.4	3152.9	35.5	29.2	0	10.28	19.46	20.56	167.8	3837.5	11794.0	559.8	8516.3	**4717.59**	**2838.76**
35.50	37.00	36.25	1.50	34.5	20.28	10.28	153.14	5.66	29.2	29.2	1.0	484.18	5287.71	0	1.0	0.0	3152.9	37.0	29.2	0	10.28	19.46	20.56	167.8	3837.5	12278.2	585.3	9025.9	**4911.26**	**3008.64**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
37.00	37.50	37.25	0.50	35.0	20.28	10.28	153.14	1.89	29.2	29.2	1.0	161.39	5449.11	0	1.0	0.0	3152.9	37.5	29.2	0	8.86	19.46	20.56	167.8	3817.7	12419.7	593.8	9195.8	**4967.89**	**3065.26**
37.50	38.50	38.00	1.00	36.0	18.86	8.86	153.14	3.77	29.2	29.2	1.0	322.79	5771.89	0	1.0	0.0	3152.9	38.5	29.2	0	8.80	19.46	20.56	167.8	3816.9	12741.7	610.7	9535.5	**5096.67**	**3178.51**
38.50	40.00	39.25	1.50	37.5	18.80	8.80	153.14	5.66	29.2	29.2	1.0	484.18	6256.07	0	1.0	0.0	3152.9	40.0	29.2	0	8.80	19.46	20.56	167.8	3816.9	13225.9	636.2	10045.2	**5290.34**	**3348.39**
BORE NO: P60, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.5	20.72	10.72	29.48	1.89	9.7	9.7	1.0	9.50	0	62.0	1.0	116.9	0	3.0	8.1	30	10.72	2.13	0.93	32.2	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.5	20.72	10.72	37.52	3.77	8.1	8.1	1.0	20.14	0	30.0	1.0	113.1	0	4.0	8.1	30	10.72	2.13	0.93	42.9	0	0.0	25.4	25.4	**0.00**	**8.48**
4.00	5.00	4.50	1.00	2.5	20.72	10.72	48.24	3.77	8.1	8.1	1.0	25.89	0	30.0	1.0	113.1	0	5.0	29.4	5	9.64	19.91	21.02	53.6	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.5	19.64	9.64	58.42	3.77	29.4	29.4	1.0	124.15	0	5.0	1.0	18.9	0	6.0	29.4	5	9.64	19.91	21.02	63.2	1612.9	1612.9	59.4	59.4	**645.17**	**19.79**
6.00	7.00	6.50	1.00	4.5	19.64	9.64	68.06	3.77	29.4	29.4	1.0	144.63	144.63	5.0	1.0	18.9	18.9	7.0	28.7	0	9.64	18.33	19.40	72.9	1638.6	1802.1	76.3	239.8	**720.85**	**79.94**
7.00	9.00	8.00	2.00	6.5	19.64	9.64	82.52	7.54	28.7	28.7	1.0	340.77	485.41	0.0	1.0	0.0	18.9	9.0	24.6	14	10.41	9.71	10.44	92.2	1229.0	1733.3	110.3	614.5	**693.32**	**204.84**
9.00	10.00	9.50	1.00	7.5	20.41	10.41	97.37	3.77	24.6	24.6	1.0	168.12	653.53	14.0	1.0	52.8	71.7	10.0	24.6	14	10.41	9.71	10.44	102.6	1343.4	2068.6	127.2	852.4	**827.44**	**284.14**
10.00	11.00	10.50	1.00	8.5	20.41	10.41	107.78	3.77	24.6	24.6	1.0	186.09	839.62	14.0	1.0	52.8	124.5	11.0	24.6	14	10.41	9.71	10.44	113.0	1457.8	2421.9	144.2	1108.3	**968.76**	**369.43**
11.00	12.50	11.75	1.50	10.0	20.41	10.41	120.79	5.66	24.6	24.6	1.0	312.84	1152.47	14.0	1.0	79.2	203.7	12.5	24.6	14	10.41	9.71	10.44	128.6	1629.4	2985.5	169.6	1525.8	**1194.21**	**508.59**
12.50	14.00	13.25	1.50	11.5	20.41	10.41	136.40	5.66	24.6	24.6	1.0	353.29	1505.75	14.0	1.0	79.2	282.9	14.0	24.6	14	10.86	9.71	10.44	144.2	1804.2	3592.8	195.1	1983.7	**1437.12**	**661.23**
14.00	15.50	14.75	1.50	13.0	20.86	10.86	152.36	5.66	24.6	24.6	1.0	394.61	1900.36	14.0	1.0	79.2	362.1	15.5	24.6	14	10.86	9.71	10.44	160.5	1983.2	4245.6	220.5	2483.0	**1698.24**	**827.65**
15.50	17.00	16.25	1.50	14.5	20.86	10.86	168.65	5.66	24.6	24.6	1.0	436.80	2337.16	14.0	1.0	79.2	441.3	17.0	23.9	15	10.66	9.21	9.67	176.8	2064.6	4843.0	246.0	3024.4	**1937.19**	**1008.13**
17.00	18.50	17.75	1.50	16.0	20.66	10.66	184.79	5.66	23.9	23.9	1.0	463.24	2800.40	15.0	1.0	84.9	526.1	18.5	23.9	15	10.66	9.21	9.67	176.8	2064.6	5391.1	271.4	3597.9	**2156.43**	**1199.31**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
18.50	20.00	19.25	1.50	17.5	20.66	10.66	184.79	5.66	23.9	23.9	1.0	463.24	3263.63	15.0	1.0	84.9	611.0	20.0	23.7	19	10.65	9.06	9.45	176.8	2074.8	5949.4	296.9	4171.5	**2379.78**	**1390.50**
20.00	21.50	20.75	1.50	19.0	20.65	10.65	184.79	5.66	23.7	23.7	1.0	458.88	3722.51	19.0	1.0	107.5	718.5	21.5	23.7	19	9.78	9.06	9.45	176.8	2069.3	6510.2	322.3	4763.3	**2604.09**	**1587.77**
21.50	24.50	23.00	3.00	22.0	19.78	9.78	184.79	11.31	23.7	23.7	1.0	917.76	4640.27	19.0	1.0	215.0	933.4	24.5	23.7	19	9.78	9.06	9.45	176.8	2069.3	7643.0	373.2	5946.9	**3057.18**	**1982.31**
24.50	26.00	25.25	1.50	23.5	19.78	9.78	184.79	5.66	23.7	23.7	1.0	458.88	5099.15	19.0	1.0	107.5	1040.9	26.0	6.4	60	9.96	1.82	0.67	176.8	979.9	7120.0	398.7	6538.7	**2847.99**	**2179.58**
26.00	27.50	26.75	1.50	25.0	19.96	9.96	184.79	5.66	6.4	6.4	1.0	117.26	5216.40	60.0	1.0	339.4	1380.3	27.5	6.4	60	9.96	1.82	0.67	176.8	979.9	7576.7	424.1	7020.9	**3030.67**	**2340.29**
27.50	29.00	28.25	1.50	26.5	19.96	9.96	184.79	5.66	6.4	6.4	1.0	117.26	5333.66	60.0	1.0	339.4	1719.8	29.0	9.1	39	10.86	2.31	1.08	176.8	866.8	7920.2	449.6	7503.0	**3168.08**	**2501.00**
29.00	30.00	29.50	1.00	27.5	20.86	10.86	184.79	3.77	9.1	9.1	1.0	111.63	5445.29	39.0	1.0	147.1	1866.9	30.0	9.1	39	10.86	2.31	1.08	176.8	866.8	8178.9	466.5	7778.7	**3271.56**	**2592.89**
30.00	30.50	30.25	0.50	28.0	20.86	10.86	184.79	1.89	9.1	9.1	1.0	55.81	5501.10	39.0	1.0	73.5	1940.4	30.5	6.4	60	10.86	1.82	0.67	176.8	980.3	8421.8	475.0	7916.5	**3368.73**	**2638.84**
30.50	32.00	31.25	1.50	29.5	20.86	10.86	184.79	5.66	6.4	6.4	1.0	117.26	5618.35	60.0	1.0	339.4	2279.8	32.0	9.1	39	9.30	2.31	1.08	176.8	865.6	8763.8	500.5	8398.6	**3505.52**	**2799.55**
32.00	32.50	32.25	0.50	30.0	19.30	9.30	184.79	1.89	9.1	9.1	1.0	55.81	5674.17	39.0	1.0	73.5	2353.4	32.5	9.1	39	9.30	2.31	1.08	176.8	865.6	8893.2	508.9	8536.5	**3557.26**	**2845.49**
32.50	33.50	33.00	1.00	31.0	19.30	9.30	184.79	3.77	9.1	9.1	1.0	111.63	5785.79	39.0	1.0	147.1	2500.5	33.5	23.0	0	9.30	8.56	8.68	176.8	1767.0	10053.3	525.9	8812.2	**4021.32**	**2937.38**
33.50	35.00	34.25	1.50	32.5	19.30	9.30	184.79	5.66	23.0	23.0	1.0	443.73	6229.52	0.0	1.0	0.0	2500.5	35.0	15.5	52	9.30	4.19	2.92	176.8	1385.3	10115.3	551.3	9281.3	**4046.10**	**3093.78**
35.00	36.50	35.75	1.50	34.0	19.30	9.30	184.79	5.66	15.5	15.5	1.0	289.90	6519.42	52.0	1.0	294.2	2794.6	36.5	8.5	46	9.60	2.20	0.99	176.8	914.9	10229.0	576.8	9890.8	**4091.59**	**3296.95**
36.50	37.50	37.00	1.00	35.0	19.60	9.60	184.79	3.77	8.5	8.5	1.0	104.15	6623.58	46.0	1.0	173.5	2968.1	37.5	8.5	46	9.60	2.20	0.99	176.8	914.9	10506.6	593.8	10185.5	**4202.64**	**3395.15**
37.50	38.00	37.75	0.50	35.5	19.60	9.60	184.79	1.89	8.5	8.5	1.0	52.08	6675.65	46.0	1.0	86.7	3054.9	38.0	8.5	67	8.10	2.20	0.99	176.8	1127.7	10858.3	602.2	10332.8	**4343.30**	**3444.25**
38.00	40.00	39.00	2.00	37.5	18.10	8.10	184.79	7.54	8.5	8.5	1.0	208.31	6883.96	67.0	1.0	505.4	3560.2	40.0	8.5	67	8.10	2.20	0.99	176.8	1127.7	11571.9	636.2	11080.4	**4628.77**	**3693.45**

APPENDIX-H

TABLE 3: COMPUTATION OF LATERAL PILE LOAD CAPACITY (Dia. 1000 mm)

Bore No.	Dia. of pile (m)	Cut-off length (m)	Scour depth (m)	Concrete Grade	Young' s Modulus (kN/m^2)	Moment of Inertia (m^4)	Average SPT	Modulus of sub grade (k_1)	Stiffness Factor (T)	Cantilever length	L_1/T	L_f/T	Permissible deflection (m)	Depth of Fixity (m)	Allowable Load capacity of pile(kN)
P41	1.00	2.50	0.00	35	29580399	0.0491	16	2264	3.64	3.50	0.96	2.09	0.005	7.60	64
P42	1.00	2.50	0.00	35	29580399	0.0491	17	2408	3.60	6.50	1.81	1.96	0.005	7.05	35
P43	1.00	2.50	0.00	35	29580399	0.0491	16	2264	3.64	2.50	0.69	2.13	0.005	7.75	81
P44	1.00	2.50	0.00	35	29580399	0.0491	15	2120	3.69	0.50	0.14	2.21	0.005	8.16	134
P45	1.00	2.50	0.00	35	29580399	0.0491	16	2264	3.64	2.50	0.69	2.13	0.005	7.75	81
P46	1.00	2.50	0.00	35	29580399	0.0491	22	3128	3.41	6.50	1.90	1.94	0.005	6.64	38
P47	1.00	2.50	0.00	35	29580399	0.0491	15	2120	3.69	0.50	0.14	2.21	0.005	8.16	134
P48	1.00	2.50	0.00	35	29580399	0.0491	23	3272	3.38	7.50	2.22	1.92	0.005	6.51	32
P49	1.00	2.50	0.00	35	29580399	0.0491	20	2840	3.48	7.50	2.15	1.93	0.005	6.71	30
P50	1.00	2.50	0.00	35	29580399	0.0491	18	2552	3.56	2.50	0.70	2.12	0.005	7.56	86
P51	1.00	2.50	0.00	35	29580399	0.0491	17	2408	3.60	2.50	0.69	2.13	0.005	7.65	83
P52	1.00	2.50	0.00	35	29580399	0.0491	16	2264	3.64	9.50	2.61	1.91	0.005	6.97	19
P53	1.00	2.50	0.00	35	29580399	0.0491	21	2984	3.45	3.50	1.02	2.08	0.005	7.16	72
P54	1.00	2.50	0.00	35	29580399	0.0491	18	2552	3.56	3.50	0.98	2.08	0.005	7.41	67
P55	1.00	2.50	0.00	35	29580399	0.0491	20	2840	3.48	7.50	2.15	1.93	0.005	6.71	30
P56	1.00	2.50	0.00	35	29580399	0.0491	18	2552	3.56	5.50	1.55	2.00	0.005	7.11	43
P57	1.00	2.50	0.00	35	29580399	0.0491	16	2264	3.64	3.50	0.96	2.09	0.005	7.60	64
P58	1.00	2.50	0.00	35	29580399	0.0491	15	2120	3.69	1.50	0.41	2.17	0.005	8.01	101
P59	1.00	2.50	0.00	35	29580399	0.0491	17	2408	3.60	5.50	1.53	2.00	0.005	7.20	43
P60	1.00	2.50	0.00	35	29580399	0.0491	17	2408	3.60	3.50	0.97	2.08	0.005	7.50	65

APPENDIX-H

TABLE 4: COMPUTATION OF LATERAL PILE LOAD CAPACITY (Dia. 1200 mm)

Bore No.	Dia. of pile (m)	Cut-off length (m)	Scour depth (m)	Concrete Grade	Young's Modulus (kN/m^2)	Moment of Inertia (m^4)	Average SPT	Modulus of sub grade (k_1)	Stiffness Factor (T)	Cantilever length	L_1/T	L_f/T	Permissible deflection (m)	Depth of Fixity (m)	Allowable Load capacity of pile(kN)
P41	1.20	2.50	0.00	35	29580399	0.1018	17	2408	4.16	3.50	0.84	2.10	0.005	8.76	98
P42	1.20	2.50	0.00	35	29580399	0.1018	17	2408	4.16	6.50	1.56	2.00	0.005	8.31	56
P43	1.20	2.50	0.00	35	29580399	0.1018	19	2696	4.07	2.50	0.61	2.14	0.005	8.70	129
P44	1.20	2.50	0.00	35	29580399	0.1018	15	2120	4.27	0.50	0.12	2.21	0.005	9.45	183
P45	1.20	2.50	0.00	35	29580399	0.1018	16	2264	4.21	2.50	0.59	2.14	0.005	9.02	118
P46	1.20	2.50	0.00	35	29580399	0.1018	21	2984	3.99	6.50	1.63	1.99	0.005	7.92	60
P47	1.20	2.50	0.00	35	29580399	0.1018	15	2120	4.27	0.50	0.12	2.21	0.005	9.45	183
P48	1.20	2.50	0.00	35	29580399	0.1018	24	3416	3.88	7.50	1.93	1.94	0.005	7.53	53
P49	1.20	2.50	0.00	35	29580399	0.1018	20	2840	4.03	7.50	1.86	1.95	0.005	7.86	50
P50	1.20	2.50	0.00	35	29580399	0.1018	19	2696	4.07	2.50	0.61	2.14	0.005	8.70	129
P51	1.20	2.50	0.00	35	29580399	0.1018	17	2408	4.16	2.50	0.60	2.14	0.005	8.91	122
P52	1.20	2.50	0.00	35	29580399	0.1018	16	2264	4.21	9.50	2.25	1.92	0.005	8.11	33
P53	1.20	2.50	0.00	35	29580399	0.1018	21	2984	3.99	3.50	0.88	2.10	0.005	8.37	108
P54	1.20	2.50	0.00	35	29580399	0.1018	19	2696	4.07	3.50	0.86	2.10	0.005	8.55	103
P55	1.20	2.50	0.00	35	29580399	0.1018	20	2840	4.03	7.50	1.86	1.95	0.005	7.86	50
P56	1.20	2.50	0.00	35	29580399	0.1018	19	2696	4.07	5.50	1.35	2.03	0.005	8.25	69
P57	1.20	2.50	0.00	35	29580399	0.1018	17	2408	4.16	3.50	0.84	2.10	0.005	8.76	98
P58	1.20	2.50	0.00	35	29580399	0.1018	16	2264	4.21	1.50	0.36	2.18	0.005	9.17	149
P59	1.20	2.50	0.00	35	29580399	0.1018	18	2552	4.11	5.50	1.34	2.03	0.005	8.35	68
P60	1.20	2.50	0.00	35	29580399	0.1018	17	2408	4.16	3.50	0.84	2.10	0.005	8.76	98

APPENDIX-H

TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
P41	0.50	SM	35	6	10.35	5.00	5.35	1.00	0.301	1.70	10.20	5.00	1.20	17.24	0.18	1.00	0.219	0.728	Liquefiable
	1.00	SM	35	6	20.70	10.00	10.70	0.99	0.299	1.70	10.20	5.00	1.20	17.24	0.18	1.00	0.219	0.731	Liquefiable
	2.00	CH	63	6	41.40	20.00	21.40	0.98	0.297	1.70	10.20	5.00	1.20	17.24	0.18	1.00	-	-	Non-liquefiable
	3.00	CL	82	14	62.10	30.00	32.10	0.98	0.295	1.70	23.80	5.00	1.20	33.56	0.52	1.00	-	-	Non-liquefiable
	4.00	CL	82	9	82.80	40.00	42.80	0.97	0.293	1.53	13.76	5.00	1.20	21.51	0.24	1.00	-	-	Non-liquefiable
	5.00	SM	29	9	98.00	50.00	48.00	0.96	0.306	1.44	12.99	4.64	1.15	19.53	0.21	1.00	0.250	0.816	Liquefiable
	6.00	SM	29	15	117.60	60.00	57.60	0.95	0.304	1.32	19.76	4.64	1.15	27.29	0.35	1.00	0.414	1.361	Non-liquefiable
	7.00	SM	29	18	137.20	70.00	67.20	0.95	0.301	1.22	21.96	4.64	1.15	29.80	0.45	1.00	0.542	1.799	Non-liquefiable
	9.00	CL-ML	68	24	176.40	90.00	86.40	0.93	0.297	1.08	25.82	5.00	1.20	35.98	0.52	1.00	-	-	Non-liquefiable
	10.00	CL-ML	68	22	196.00	100.00	96.00	0.91	0.289	1.02	22.45	5.00	1.20	31.94	0.52	1.00	-	-	Non-liquefiable
	11.00	CL	86	22	224.40	110.00	114.40	0.88	0.269	0.93	20.57	5.00	1.20	29.68	0.45	1.00	-	-	Non-liquefiable
	12.50	CL	86	26	255.00	125.00	130.00	0.84	0.257	0.88	22.80	5.00	1.20	32.36	0.52	1.00	-	-	Non-liquefiable
	14.00	CL-ML	85	26	292.60	140.00	152.60	0.80	0.239	0.81	21.05	5.00	1.20	30.26	0.49	1.00	-	-	Non-liquefiable
	15.50	CL-ML	79	25	323.95	155.00	168.95	0.76	0.227	0.77	19.23	5.00	1.20	28.08	0.37	0.88	-	-	Non-liquefiable
	17.00	CL	59	25	351.90	170.00	181.90	0.72	0.217	0.74	18.54	5.00	1.20	27.24	0.35	0.82	-	-	Non-liquefiable
	18.50	ML	57	33	382.95	185.00	197.95	0.68	0.205	0.71	23.46	5.00	1.20	33.15	0.52	0.79	0.490	2.387	Non-liquefiable
	20.00	CL	86	33	412.00	200.00	212.00	0.64	0.194	0.69	22.66	5.00	1.20	32.20	0.52	0.79	-	-	Non-liquefiable
	21.50	CL	86	35	442.90	215.00	227.90	0.60	0.182	0.66	23.18	5.00	1.20	32.82	0.52	0.77	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	24.50	CL	84	36	485.10	245.00	240.10	0.56	0.176	0.65	23.23	5.00	1.20	32.88	0.52	0.71	-	-	Non-liquefiable
	26.00	MI	99	36	520.00	260.00	260.00	0.56	0.175	0.62	22.33	5.00	1.20	31.79	0.52	0.89	-	-	Non-liquefiable
	27.50	MI	99	34	550.00	275.00	275.00	0.56	0.175	0.60	20.50	5.00	1.20	29.60	0.44	0.88	-	-	Non-liquefiable
	29.00	CL-ML	69	34	606.10	290.00	316.10	0.56	0.167	0.56	19.12	5.00	1.20	27.95	0.37	0.69	-	-	Non-liquefiable
	30.50	MI	97	38	637.45	305.00	332.45	0.56	0.167	0.55	20.84	5.00	1.20	30.01	0.47	0.67	-	-	Non-liquefiable
	32.00	CL-ML	65	38	617.60	320.00	297.60	0.56	0.181	0.58	22.03	5.00	1.20	31.43	0.52	0.74	-	-	Non-liquefiable
	33.50	ML	54	55	646.55	335.00	311.55	0.56	0.181	0.57	31.16	5.00	1.20	42.39	0.52	0.73	0.453	2.498	Non-liquefiable
	35.00	ML	69	65	675.50	350.00	325.50	0.56	0.181	0.55	36.03	5.00	1.20	48.23	0.52	0.72	0.447	2.464	Non-liquefiable
	36.50	ML	83	77	704.45	365.00	339.45	0.56	0.181	0.54	41.79	5.00	1.20	55.15	0.52	0.72	0.447	2.464	Non-liquefiable
	38.00	CL-CI	83	89	733.40	380.00	353.40	0.56	0.181	0.53	47.34	5.00	1.20	61.81	0.52	0.71	-	-	Non-liquefiable
	40.00	CL-CI	83	100	772.00	400.00	372.00	0.56	0.181	0.52	51.85	5.00	1.20	67.22	0.52	0.70	-	-	Non-liquefiable
P42	0.50	SM	44	10	10.15	5.00	5.15	1.00	0.306	1.70	17.00	5.00	1.20	25.40	0.30	1.00	0.358	1.168	Non-liquefiable
	1.00	CI	83	10	20.30	10.00	10.30	0.99	0.305	1.70	17.00	5.00	1.20	25.40	0.30	1.00	-	-	Non-liquefiable
	2.00	CL	86	10	40.60	20.00	20.60	0.98	0.303	1.70	17.00	5.00	1.20	25.40	0.30	1.00	-	-	Non-liquefiable
	3.00	CL	52	12	60.90	30.00	30.90	0.98	0.300	1.70	20.40	5.00	1.20	29.48	0.44	1.00	-	-	Non-liquefiable
	4.00	CI	93	12	81.20	40.00	41.20	0.97	0.298	1.56	18.70	5.00	1.20	27.43	0.35	1.00	-	-	Non-liquefiable
	5.00	SM	22	16	100.50	50.00	50.50	0.96	0.299	1.41	22.52	3.93	1.09	28.54	0.39	1.00	0.465	1.558	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	6.00	SM	17	14	120.60	60.00	60.60	0.95	0.296	1.28	17.98	3.01	1.06	22.08	0.24	1.00	0.290	0.979	Liquefiable
	8.00	SM	17	13	160.80	80.00	80.80	0.94	0.291	1.11	14.46	3.01	1.06	18.34	0.20	1.00	0.233	0.801	Liquefiable
	9.00	CL	84	11	180.90	90.00	90.90	0.93	0.289	1.05	11.54	5.00	1.20	18.84	0.20	1.00	-	-	Non-liquefiable
	11.00	CL	77	18	221.10	110.00	111.10	0.88	0.273	0.95	17.08	5.00	1.20	25.49	0.30	1.00	-	-	Non-liquefiable
	12.00	CL	89	25	249.60	120.00	129.60	0.85	0.256	0.88	21.96	5.00	1.20	31.35	0.52	1.00	-	-	Non-liquefiable
	14.50	CL	79	17	301.60	145.00	156.60	0.79	0.236	0.80	13.58	5.00	1.20	21.30	0.23	1.00	-	-	Non-liquefiable
	17.50	CL	74	18	357.00	175.00	182.00	0.71	0.216	0.74	13.34	5.00	1.20	21.01	0.23	0.83	-	-	Non-liquefiable
	20.50	CL	69	28	416.15	205.00	211.15	0.63	0.193	0.69	19.27	5.00	1.20	28.12	0.37	0.80	-	-	Non-liquefiable
	22.00	CI	92	28	440.00	220.00	220.00	0.59	0.183	0.67	18.88	5.00	1.20	27.65	0.36	0.81	-	-	Non-liquefiable
	23.50	CI	92	36	474.70	235.00	239.70	0.56	0.173	0.65	23.25	5.00	1.20	32.90	0.52	0.76	-	-	Non-liquefiable
	25.00	CL	85	36	505.00	250.00	255.00	0.56	0.173	0.63	22.54	5.00	1.20	32.05	0.52	0.75	-	-	Non-liquefiable
	26.50	CL	85	56	540.60	265.00	275.60	0.56	0.171	0.60	33.73	5.00	1.20	45.48	0.52	0.72	-	-	Non-liquefiable
	28.00	MI	94	56	571.20	280.00	291.20	0.56	0.171	0.59	32.82	5.00	1.20	44.38	0.52	0.70	-	-	Non-liquefiable
	29.50	SM	35	47	610.65	295.00	315.65	0.56	0.169	0.56	26.45	5.00	1.20	36.75	0.52	0.78	0.484	2.863	Non-liquefiable
	31.00	ML	52	47	641.70	310.00	331.70	0.56	0.169	0.55	25.81	5.00	1.20	35.97	0.52	0.77	0.478	2.826	Non-liquefiable
	32.50	CL-ML	81	56	650.00	325.00	325.00	0.56	0.175	0.55	31.06	5.00	1.20	42.28	0.52	0.64	-	-	Non-liquefiable
	34.00	CL-ML	81	53	680.00	340.00	340.00	0.56	0.175	0.54	28.74	5.00	1.20	39.49	0.52	0.63	-	-	Non-liquefiable
	35.50	CL	74	50	710.00	355.00	355.00	0.56	0.175	0.53	26.54	5.00	1.20	36.84	0.52	0.62	-	-	Non-liquefiable

APPENDIX-H

TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	37.00	CL	74	49	740.00	370.00	370.00	0.56	0.175	0.52	25.47	5.00	1.20	35.57	0.52	0.61	-	-	Non-liquefiable
	38.50	CL	65	47	770.00	385.00	385.00	0.56	0.175	0.51	23.95	5.00	1.20	33.74	0.52	0.60	-	-	Non-liquefiable
	40.00	CL	65	50	800.00	400.00	400.00	0.56	0.175	0.50	25.00	5.00	1.20	35.00	0.52	0.59	-	-	Non-liquefiable
P43	0.50	SM	45	6	9.70	5.00	4.70	1.00	0.321	1.70	10.20	0.50	1.20	12.74	0.14	1.00	0.165	0.514	Liquefiable
	1.00	CL	65	6	19.40	10.00	9.40	0.99	0.319	1.70	10.20	0.50	1.20	12.74	0.14	1.00	-	-	Non-liquefiable
	2.00	CL	72	6	38.80	20.00	18.80	0.98	0.317	1.70	10.20	0.50	1.20	12.74	0.14	1.00	-	-	Non-liquefiable
	3.00	SM	45	6	58.20	30.00	28.20	0.98	0.315	1.70	10.20	5.00	1.20	17.24	0.18	1.00	0.219	0.696	Liquefiable
	5.00	SM	35	12	97.00	50.00	47.00	0.96	0.310	1.46	17.50	5.00	1.20	26.00	0.31	1.00	0.374	1.207	Non-liquefiable
	6.00	SM	35	12	116.40	60.00	56.40	0.95	0.307	1.33	15.98	5.00	1.20	24.17	0.28	1.00	0.330	1.073	Non-liquefiable
	7.00	CL-ML	73	12	135.80	70.00	65.80	0.95	0.305	1.23	14.79	5.00	1.20	22.75	0.25	1.00	-	-	Non-liquefiable
	8.00	CL	81	13	163.20	80.00	83.20	0.94	0.287	1.10	14.25	5.00	1.20	22.10	0.24	1.00	-	-	Non-liquefiable
	9.00	CL	81	16	183.60	90.00	93.60	0.93	0.285	1.03	16.54	5.00	1.20	24.85	0.29	1.00	-	-	Non-liquefiable
	11.00	CL	81	27	224.40	110.00	114.40	0.88	0.269	0.93	25.24	5.00	1.20	35.29	0.52	1.00	-	-	Non-liquefiable
	12.00	CL	89	31	242.40	120.00	122.40	0.85	0.264	0.90	28.02	5.00	1.20	38.62	0.52	1.00	-	-	Non-liquefiable
	14.50	CL	89	14	292.90	145.00	147.90	0.79	0.243	0.82	11.51	5.00	1.20	18.81	0.20	1.00	-	-	Non-liquefiable
	17.50	CL	91	18	360.50	175.00	185.50	0.71	0.214	0.73	13.22	5.00	1.20	20.86	0.23	0.83	-	-	Non-liquefiable
	20.50	CL-ML	62	22	416.15	205.00	211.15	0.63	0.193	0.69	15.14	5.00	1.20	23.17	0.26	0.82	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	22.00	CL	81	22	446.60	220.00	226.60	0.59	0.180	0.66	14.61	5.00	1.20	22.54	0.25	0.80	-	-	Non-liquefiable
	23.50	CL	62	31	479.40	235.00	244.40	0.56	0.171	0.64	19.83	5.00	1.20	28.80	0.40	0.76	-	-	Non-liquefiable
	26.50	CL	83	49	540.60	265.00	275.60	0.56	0.171	0.60	29.52	5.00	1.20	40.42	0.52	0.73	-	-	Non-liquefiable
	29.50	CL	88	39	601.80	295.00	306.80	0.56	0.171	0.57	22.27	5.00	1.20	31.72	0.52	0.70	-	-	Non-liquefiable
	32.50	SM	45	67	682.50	325.00	357.50	0.56	0.167	0.53	35.44	5.00	1.20	47.52	0.52	0.68	0.422	2.529	Non-liquefiable
	34.00	SM	45	58	666.40	340.00	326.40	0.56	0.178	0.55	32.10	5.00	1.20	43.52	0.52	0.70	0.434	2.435	Non-liquefiable
	35.50	SM	45	48	695.80	355.00	340.80	0.56	0.178	0.54	26.00	5.00	1.20	36.20	0.52	0.69	0.428	2.400	Non-liquefiable
	37.00	CL-ML	53	48	725.20	370.00	355.20	0.56	0.178	0.53	25.47	5.00	1.20	35.56	0.52	0.69	-	-	Non-liquefiable
	38.50	CL-ML	53	50	781.55	385.00	396.55	0.56	0.172	0.50	25.11	5.00	1.20	35.13	0.52	0.61	-	-	Non-liquefiable
	40.00	CL-ML	59	57	812.00	400.00	412.00	0.56	0.172	0.49	28.08	5.00	1.20	38.70	0.52	0.60	-	-	Non-liquefiable
P44	0.50	SM	48	6	10.35	5.00	5.35	1.00	0.301	1.70	10.20	5.00	1.20	17.24	0.18	1.00	0.219	0.728	Liquefiable
	1.00	MI	83	6	20.70	10.00	10.70	0.99	0.299	1.70	10.20	5.00	1.20	17.24	0.18	1.00	-	-	Non-liquefiable
	2.00	ML	55	6	41.40	20.00	21.40	0.98	0.297	1.70	10.20	5.00	1.20	17.24	0.18	1.00	0.219	0.736	Liquefiable
	3.00	SM	40	17	62.10	30.00	32.10	0.98	0.295	1.70	28.90	5.00	1.20	39.68	0.52	1.00	0.620	2.103	Non-liquefiable
	5.00	SM	18	14	103.50	50.00	53.50	0.96	0.290	1.37	19.14	3.23	1.07	23.64	0.27	1.00	0.319	1.099	Non-liquefiable
	6.00	SM	44	16	116.40	60.00	56.40	0.95	0.307	1.33	21.30	5.00	1.20	30.57	0.51	1.00	0.612	1.992	Non-liquefiable
	7.00	CL-ML	56	16	135.80	70.00	65.80	0.95	0.305	1.23	19.72	5.00	1.20	28.67	0.40	1.00	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	8.00	CL-ML	56	12	160.80	80.00	80.80	0.94	0.291	1.11	13.35	5.00	1.20	21.02	0.23	1.00	-	-	Non-liquefiable
	9.00	CL	76	12	180.90	90.00	90.90	0.93	0.289	1.05	12.59	5.00	1.20	20.10	0.22	1.00	-	-	Non-liquefiable
	11.00	CL	90	15	221.10	110.00	111.10	0.88	0.273	0.95	14.23	5.00	1.20	22.08	0.24	1.00	-	-	Non-liquefiable
	12.00	CL	85	16	228.00	120.00	108.00	0.85	0.281	0.96	15.40	5.00	1.20	23.48	0.26	1.00	-	-	Non-liquefiable
	14.50	CL	86	14	275.50	145.00	130.50	0.79	0.259	0.88	12.26	5.00	1.20	19.71	0.21	1.00	-	-	Non-liquefiable
	17.50	CL	84	18	360.50	175.00	185.50	0.71	0.214	0.73	13.22	5.00	1.20	20.86	0.23	0.80	-	-	Non-liquefiable
	20.50	CL	74	29	422.30	205.00	217.30	0.63	0.190	0.68	19.67	5.00	1.20	28.61	0.39	0.75	-	-	Non-liquefiable
	23.50	CL-ML	58	22	474.70	235.00	239.70	0.56	0.173	0.65	14.21	5.00	1.20	22.05	0.24	0.74	-	-	Non-liquefiable
	25.00	CL	85	22	505.00	250.00	255.00	0.56	0.173	0.63	13.78	5.00	1.20	21.53	0.24	0.72	-	-	Non-liquefiable
	26.50	CL-ML	78	35	545.90	265.00	280.90	0.56	0.170	0.60	20.88	5.00	1.20	30.06	0.47	0.70	-	-	Non-liquefiable
	28.00	SM-SC	45	35	576.80	280.00	296.80	0.56	0.170	0.58	20.32	5.00	1.20	29.38	0.43	0.68	0.348	2.052	Non-liquefiable
	29.50	ML	51	52	581.15	295.00	286.15	0.56	0.177	0.59	30.74	5.00	1.20	41.89	0.52	0.68	0.422	2.378	Non-liquefiable
	31.00	SM-SC	47	45	610.70	310.00	300.70	0.56	0.177	0.58	25.95	5.00	1.20	36.14	0.52	0.67	0.416	2.343	Non-liquefiable
	32.50	ML	55	50	640.25	325.00	315.25	0.56	0.177	0.56	28.16	5.00	1.20	38.79	0.52	0.66	0.409	2.308	Non-liquefiable
	34.00	CL-ML	60	51	669.80	340.00	329.80	0.56	0.177	0.55	28.08	5.00	1.20	38.70	0.52	0.65	-	-	Non-liquefiable
	35.50	SM-SC	42	50	699.35	355.00	344.35	0.56	0.177	0.54	26.94	5.00	1.20	37.33	0.52	0.64	0.397	2.238	Non-liquefiable
	37.00	SM-SC	42	53	728.90	370.00	358.90	0.56	0.177	0.53	27.98	5.00	1.20	38.57	0.52	0.63	0.391	2.203	Non-liquefiable
	38.50	ML	54	51	758.45	385.00	373.45	0.56	0.177	0.52	26.39	5.00	1.20	36.67	0.52	0.63	0.391	2.203	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	40.00	SM	48	48	788.00	400.00	388.00	0.56	0.177	0.51	24.37	5.00	1.20	34.24	0.52	0.62	0.385	2.168	Non-liquefiable
P45	0.50	CL-ML	55	7	9.75	5.00	4.75	1.00	0.319	1.70	11.90	5.00	1.20	19.28	0.21	1.00	-	-	Non-liquefiable
	2.00	CL	77	7	39.00	20.00	19.00	0.98	0.315	1.70	11.90	5.00	1.20	19.28	0.21	1.00	-	-	Non-liquefiable
	3.00	CL	77	6	58.50	30.00	28.50	0.98	0.313	1.70	10.20	5.00	1.20	17.24	0.18	1.00	-	-	Non-liquefiable
	4.00	SM	35	6	78.00	40.00	38.00	0.97	0.310	1.62	9.73	5.00	1.20	16.68	0.18	1.00	0.212	0.682	Liquefiable
	5.00	SM	37	16	98.00	50.00	48.00	0.96	0.306	1.44	23.09	5.00	1.20	32.71	0.52	1.00	0.620	2.025	Non-liquefiable
	6.00	SM	37	14	117.60	60.00	57.60	0.95	0.304	1.32	18.45	5.00	1.20	27.14	0.34	1.00	0.408	1.343	Non-liquefiable
	8.00	SM	36	13	156.80	80.00	76.80	0.94	0.299	1.14	14.83	5.00	1.20	22.80	0.25	1.00	0.303	1.013	Non-liquefiable
	9.00	SM	36	19	177.30	90.00	87.30	0.93	0.295	1.07	20.34	5.00	1.20	29.40	0.43	1.00	0.514	1.741	Non-liquefiable
	10.00	CL	86	19	197.00	100.00	97.00	0.91	0.287	1.02	19.29	5.00	1.20	28.15	0.37	1.00	-	-	Non-liquefiable
	11.00	CL	86	23	222.20	110.00	112.20	0.88	0.272	0.94	21.71	5.00	1.20	31.06	0.52	1.00	-	-	Non-liquefiable
	12.00	CL	86	21	242.40	120.00	122.40	0.85	0.264	0.90	18.98	5.00	1.20	27.78	0.36	1.00	-	-	Non-liquefiable
	14.50	CL	88	23	292.90	145.00	147.90	0.79	0.243	0.82	18.91	5.00	1.20	27.69	0.36	1.00	-	-	Non-liquefiable
	17.50	CL	86	38	357.00	175.00	182.00	0.71	0.216	0.74	28.17	5.00	1.20	38.80	0.52	0.83	-	-	Non-liquefiable
	20.50	CL	87	43	422.30	205.00	217.30	0.63	0.190	0.68	29.17	5.00	1.20	40.00	0.52	0.77	-	-	Non-liquefiable
	23.50	CL	90	45	481.75	235.00	246.75	0.56	0.171	0.64	28.65	5.00	1.20	39.38	0.52	0.74	-	-	Non-liquefiable
	26.50	ML	72	42	540.60	265.00	275.60	0.56	0.171	0.60	25.30	5.00	1.20	35.36	0.52	0.71	0.441	2.574	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	28.00	MI	92	42	574.00	280.00	294.00	0.56	0.171	0.58	24.49	5.00	1.20	34.39	0.52	0.92	-	-	Non-liquefiable
	29.50	MI	92	62	601.80	295.00	306.80	0.56	0.171	0.57	35.40	5.00	1.20	47.48	0.52	0.91	-	-	Non-liquefiable
	31.00	MI	92	55	632.40	310.00	322.40	0.56	0.171	0.56	30.63	5.00	1.20	41.76	0.52	0.91	-	-	Non-liquefiable
	32.50	CL-ML	80	45	663.00	325.00	338.00	0.56	0.171	0.54	24.48	5.00	1.20	34.37	0.52	0.91	-	-	Non-liquefiable
	35.50	CL-ML	70	60	724.20	355.00	369.20	0.56	0.171	0.52	31.23	5.00	1.20	42.47	0.52	0.90	-	-	Non-liquefiable
	37.00	ML	56	56	743.70	370.00	373.70	0.56	0.174	0.52	28.97	5.00	1.20	39.76	0.52	0.90	0.557	3.206	Non-liquefiable
	38.50	ML	56	46	773.85	385.00	388.85	0.56	0.174	0.51	23.33	5.00	1.20	32.99	0.52	0.90	0.555	3.195	Non-liquefiable
	40.00	CL-ML	58	54	804.00	400.00	404.00	0.56	0.174	0.50	26.87	5.00	1.20	37.24	0.52	0.89	-	-	Non-liquefiable
P46	0.50	SM	44	5	9.70	5.00	4.70	1.00	0.321	1.70	8.50	5.00	1.20	15.20	0.16	1.00	0.193	0.603	Liquefiable
	1.00	SM-SC	45	5	19.40	10.00	9.40	0.99	0.319	1.70	8.50	5.00	1.20	15.20	0.16	1.00	0.193	0.605	Liquefiable
	2.00	SM-SC	47	5	38.80	20.00	18.80	0.98	0.317	1.70	8.50	5.00	1.20	15.20	0.16	1.00	0.193	0.610	Liquefiable
	3.00	SM-SC	47	9	58.20	30.00	28.20	0.98	0.315	1.70	15.30	5.00	1.20	23.36	0.26	1.00	0.313	0.996	Liquefiable
	4.00	SM	25	9	77.60	40.00	37.60	0.97	0.312	1.63	14.68	4.29	1.12	20.65	0.22	1.00	0.267	0.855	Liquefiable
	5.00	SM	25	6	100.00	50.00	50.00	0.96	0.300	1.41	8.49	4.29	1.12	13.75	0.15	1.00	0.176	0.587	Liquefiable
	6.00	SM	25	8	120.00	60.00	60.00	0.95	0.298	1.29	10.33	4.29	1.12	15.80	0.17	1.00	0.201	0.674	Liquefiable
	8.00	SM	17	12	160.00	80.00	80.00	0.94	0.293	1.12	13.42	3.01	1.06	17.23	0.18	1.00	0.219	0.747	Liquefiable
	9.00	CL	65	17	171.00	90.00	81.00	0.93	0.307	1.11	18.89	5.00	1.20	27.67	0.36	1.00	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	11.00	CL	69	19	209.00	110.00	99.00	0.88	0.290	1.01	19.10	5.00	1.20	27.91	0.37	1.00	-	-	Non-liquefiable
	12.00	CL	69	22	242.40	120.00	122.40	0.85	0.264	0.90	19.89	5.00	1.20	28.86	0.40	1.00	-	-	Non-liquefiable
	14.50	CL	91	31	292.90	145.00	147.90	0.79	0.243	0.82	25.49	5.00	1.20	35.59	0.52	1.00	-	-	Non-liquefiable
	16.00	CL-ML	64	31	326.40	160.00	166.40	0.75	0.229	0.78	24.03	5.00	1.20	33.84	0.52	0.84	-	-	Non-liquefiable
	17.50	CL-ML	64	28	353.50	175.00	178.50	0.71	0.218	0.75	20.96	5.00	1.20	30.15	0.48	0.83	-	-	Non-liquefiable
	19.00	CL	72	28	383.80	190.00	193.80	0.67	0.206	0.72	20.11	5.00	1.20	29.14	0.42	0.80	-	-	Non-liquefiable
	20.50	CL	94	39	414.10	205.00	209.10	0.63	0.194	0.69	26.97	5.00	1.20	37.36	0.52	0.78	-	-	Non-liquefiable
	23.50	CL-ML	67	55	474.70	235.00	239.70	0.56	0.173	0.65	35.52	5.00	1.20	47.63	0.52	0.76	-	-	Non-liquefiable
	25.00	CL	85	49	507.50	250.00	257.50	0.56	0.172	0.62	30.54	5.00	1.20	41.64	0.52	0.74	-	-	Non-liquefiable
	26.50	CL	85	56	537.95	265.00	272.95	0.56	0.172	0.61	33.90	5.00	1.20	45.68	0.52	0.73	-	-	Non-liquefiable
	28.00	CL	93	61	568.40	280.00	288.40	0.56	0.172	0.59	35.92	5.00	1.20	48.10	0.52	0.71	-	-	Non-liquefiable
	29.50	SM-SC	49	65	598.85	295.00	303.85	0.56	0.172	0.57	37.29	5.00	1.20	49.75	0.52	0.70	0.436	2.532	Non-liquefiable
	31.00	SM-SC	49	68	629.30	310.00	319.30	0.56	0.172	0.56	38.05	5.00	1.20	50.67	0.52	0.69	0.429	2.492	Non-liquefiable
	32.50	SM	19	57	659.75	325.00	334.75	0.56	0.172	0.55	31.15	3.43	1.07	36.86	0.52	0.68	0.423	2.455	Non-liquefiable
	35.50	SM	18	52	720.65	355.00	365.65	0.56	0.172	0.52	27.19	3.23	1.07	32.23	0.52	0.58	0.362	2.100	Non-liquefiable
	38.50	SM	17	55	835.45	385.00	450.45	0.56	0.162	0.47	25.91	3.01	1.06	30.48	0.51	0.53	0.322	1.990	Non-liquefiable
	40.00	SM	21	59	868.00	400.00	468.00	0.56	0.162	0.46	27.27	3.78	1.09	33.40	0.52	0.53	0.326	2.014	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
P47	0.50	SM	44	2	9.45	5.00	4.45	1.00	0.330	1.70	3.40	5.00	1.20	9.08	0.11	1.00	0.125	0.380	Liquefiable
	1.00	CL	71	2	18.90	10.00	8.90	0.99	0.329	1.70	3.40	5.00	1.20	9.08	0.11	1.00	-	-	Non-liquefiable
	2.00	ML	55	2	37.80	20.00	17.80	0.98	0.326	1.70	3.40	5.00	1.20	9.08	0.11	1.00	0.125	0.384	Liquefiable
	3.00	CL-ML	80	9	56.70	30.00	26.70	0.98	0.324	1.70	15.30	5.00	1.20	23.36	0.26	1.00	-	-	Non-liquefiable
	4.00	SM	35	11	75.60	40.00	35.60	0.97	0.321	1.68	18.44	5.00	1.20	27.12	0.34	1.00	0.408	1.270	Non-liquefiable
	6.00	SM	25	16	113.40	60.00	53.40	0.95	0.316	1.37	21.90	4.29	1.12	28.70	0.40	1.00	0.473	1.497	Non-liquefiable
	7.00	SM	25	21	132.30	70.00	62.30	0.95	0.314	1.27	26.61	4.29	1.12	33.95	0.52	1.00	0.620	1.978	Non-liquefiable
	9.00	SM	36	17	170.10	90.00	80.10	0.93	0.308	1.12	18.99	5.00	1.20	27.79	0.36	1.00	0.432	1.402	Non-liquefiable
	10.00	SM	36	19	193.00	100.00	93.00	0.91	0.294	1.04	19.70	5.00	1.20	28.64	0.39	1.00	0.470	1.602	Non-liquefiable
	11.00	CL	89	19	212.30	110.00	102.30	0.88	0.285	0.99	18.79	5.00	1.20	27.54	0.35	1.00	-	-	Non-liquefiable
	12.50	CL	89	28	252.50	125.00	127.50	0.84	0.260	0.89	24.80	5.00	1.20	34.76	0.52	1.00	-	-	Non-liquefiable
	14.00	SM	34	28	282.80	140.00	142.80	0.80	0.247	0.84	23.43	4.93	1.19	32.77	0.52	1.00	0.620	2.509	Non-liquefiable
	15.50	CL-ML	81	20	313.10	155.00	158.10	0.76	0.235	0.80	15.91	5.00	1.20	24.09	0.27	0.88	-	-	Non-liquefiable
	17.00	CL	81	20	343.40	170.00	173.40	0.72	0.222	0.76	15.19	5.00	1.20	23.23	0.26	0.81	-	-	Non-liquefiable
	18.50	CL	81	34	375.55	185.00	190.55	0.68	0.209	0.72	24.63	5.00	1.20	34.56	0.52	0.78	-	-	Non-liquefiable
	21.50	CL	88	37	436.45	215.00	221.45	0.60	0.184	0.67	24.86	5.00	1.20	34.84	0.52	0.77	-	-	Non-liquefiable
	24.50	CL	92	52	494.90	245.00	249.90	0.56	0.173	0.63	32.89	5.00	1.20	44.47	0.52	0.72	-	-	Non-liquefiable
	26.00	ML	61	41	533.00	260.00	273.00	0.56	0.171	0.61	24.81	5.00	1.20	34.78	0.52	0.70	0.434	2.546	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	27.50	ML	61	45	563.75	275.00	288.75	0.56	0.171	0.59	26.48	5.00	1.20	36.78	0.52	0.69	0.426	2.496	Non-liquefiable
	29.00	CL	90	45	594.50	290.00	304.50	0.56	0.171	0.57	25.79	5.00	1.20	35.95	0.52	0.67	-	-	Non-liquefiable
	30.50	SM	28	48	616.10	305.00	311.10	0.56	0.173	0.57	27.21	4.56	1.14	35.54	0.52	0.66	0.411	2.376	Non-liquefiable
	33.50	SM	32	51	676.70	335.00	341.70	0.56	0.173	0.54	27.59	4.83	1.17	37.14	0.52	0.64	0.397	2.297	Non-liquefiable
	36.50	SM	38	60	762.85	365.00	397.85	0.56	0.167	0.50	30.08	5.00	1.20	41.10	0.52	0.60	0.371	2.214	Non-liquefiable
	38.00	SM	40	56	790.40	380.00	410.40	0.56	0.168	0.49	27.64	5.00	1.20	38.17	0.52	0.59	0.367	2.179	Non-liquefiable
	40.00	SM	40	62	832.00	400.00	432.00	0.56	0.168	0.48	29.83	5.00	1.20	40.80	0.52	0.58	0.360	2.138	Non-liquefiable
P48	0.50	ML	57	3	10.05	5.00	5.05	1.00	0.309	1.70	5.10	5.00	1.20	11.12	0.12	1.00	0.147	0.475	Liquefiable
	1.00	CL	84	3	20.10	10.00	10.10	0.99	0.308	1.70	5.10	5.00	1.20	11.12	0.12	1.00	-	-	Non-liquefiable
	2.00	SM-SC	41	3	40.20	20.00	20.20	0.98	0.306	1.70	5.10	5.00	1.20	11.12	0.12	1.00	0.147	0.480	Liquefiable
	3.00	CL-ML	84	11	60.30	30.00	30.30	0.98	0.303	1.70	18.70	5.00	1.20	27.44	0.35	1.00	-	-	Non-liquefiable
	4.00	SM	47	12	80.40	40.00	40.40	0.97	0.301	1.57	18.88	5.00	1.20	27.66	0.36	1.00	0.427	1.419	Non-liquefiable
	6.00	SM	37	10	120.60	60.00	60.60	0.95	0.296	1.28	12.85	5.00	1.20	20.42	0.22	1.00	0.263	0.888	Liquefiable
	7.00	SM	37	12	140.00	70.00	70.00	0.95	0.295	1.20	14.34	5.00	1.20	22.21	0.25	1.00	0.292	0.990	Liquefiable
	9.00	ML	62	9	180.00	90.00	90.00	0.93	0.291	1.05	9.49	5.00	1.20	16.38	0.17	1.00	0.208	0.716	Liquefiable
	10.00	CL	78	13	200.00	100.00	100.00	0.91	0.283	1.00	13.00	5.00	1.20	20.60	0.22	1.00	-	-	Non-liquefiable
	12.50	CL	88	31	250.00	125.00	125.00	0.84	0.262	0.89	27.73	5.00	1.20	38.27	0.52	1.00	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	14.00	CI	87	31	282.80	140.00	142.80	0.80	0.247	0.84	25.94	5.00	1.20	36.13	0.52	1.00	-	-	Non-liquefiable
	15.50	CL	82	27	319.30	155.00	164.30	0.76	0.230	0.78	21.06	5.00	1.20	30.28	0.49	0.83	-	-	Non-liquefiable
	17.00	CI	70	27	350.20	170.00	180.20	0.72	0.218	0.74	20.11	5.00	1.20	29.14	0.42	0.80	-	-	Non-liquefiable
	18.50	CL	73	36	373.70	185.00	188.70	0.68	0.210	0.73	26.21	5.00	1.20	36.45	0.52	0.79	-	-	Non-liquefiable
	21.50	CL-ML	75	45	434.30	215.00	219.30	0.60	0.185	0.68	30.39	5.00	1.20	41.46	0.52	0.75	-	-	Non-liquefiable
	23.00	SM	44	45	476.10	230.00	246.10	0.56	0.169	0.64	28.69	5.00	1.20	39.42	0.52	0.73	0.453	2.679	Non-liquefiable
	24.50	SM	48	45	507.15	245.00	262.15	0.56	0.169	0.62	27.79	5.00	1.20	38.35	0.52	0.71	0.440	2.606	Non-liquefiable
	26.00	CL-ML	61	45	538.20	260.00	278.20	0.56	0.169	0.60	26.98	5.00	1.20	37.38	0.52	0.70	-	-	Non-liquefiable
	27.50	MI	88	50	561.00	275.00	286.00	0.56	0.171	0.59	29.57	5.00	1.20	40.48	0.52	0.70	-	-	Non-liquefiable
	29.00	CL-ML	82	50	591.60	290.00	301.60	0.56	0.171	0.58	28.79	5.00	1.20	39.55	0.52	0.69	-	-	Non-liquefiable
	30.50	ML	58	51	622.20	305.00	317.20	0.56	0.171	0.56	28.64	5.00	1.20	39.36	0.52	0.68	0.422	2.462	Non-liquefiable
	33.50	CL-ML	74	56	683.40	335.00	348.40	0.56	0.171	0.54	30.00	5.00	1.20	41.00	0.52	0.66	-	-	Non-liquefiable
	36.50	CL-ML	79	55	737.30	365.00	372.30	0.56	0.173	0.52	28.50	5.00	1.20	39.21	0.52	0.63	-	-	Non-liquefiable
	40.00	CL	77	63	808.00	400.00	408.00	0.56	0.173	0.50	31.19	5.00	1.20	42.43	0.52	0.61	-	-	Non-liquefiable
P49	0.50	SM	44	5	10.00	5.00	5.00	1.00	0.311	1.70	8.50	5.00	1.20	15.20	0.16	1.00	0.193	0.622	Liquefiable
	1.00	CL-ML	53	5	20.00	10.00	10.00	0.99	0.310	1.70	8.50	5.00	1.20	15.20	0.16	1.00	-	-	Non-liquefiable
	3.00	SM	38	8	60.00	30.00	30.00	0.98	0.305	1.70	13.60	5.00	1.20	21.32	0.23	1.00	0.277	0.910	Liquefiable

APPENDIX-H
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Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	4.00	ML	83	12	80.00	40.00	40.00	0.97	0.302	1.58	18.97	5.00	1.20	27.77	0.36	1.00	0.431	1.426	Non-liquefiable
	6.00	SM	22	14	120.00	60.00	60.00	0.95	0.298	1.29	18.07	3.93	1.09	23.68	0.27	1.00	0.320	1.074	Non-liquefiable
	7.00	SM	22	13	140.00	70.00	70.00	0.95	0.295	1.20	15.54	3.93	1.09	20.91	0.23	1.00	0.271	0.917	Liquefiable
	8.00	ML	70	13	160.00	80.00	80.00	0.94	0.293	1.12	14.53	5.00	1.20	22.44	0.25	1.00	0.296	1.012	Non-liquefiable
	9.00	ML	70	9	172.80	90.00	82.80	0.93	0.303	1.10	9.89	5.00	1.20	16.87	0.18	1.00	0.214	0.706	Liquefiable
	10.00	CL	84	23	192.00	100.00	92.00	0.91	0.295	1.04	23.98	5.00	1.20	33.77	0.52	1.00	-	-	Non-liquefiable
	12.50	CL	87	21	240.00	125.00	115.00	0.84	0.274	0.93	19.58	5.00	1.20	28.50	0.39	1.00	-	-	Non-liquefiable
	15.50	CL	87	17	317.75	155.00	162.75	0.76	0.232	0.78	13.33	5.00	1.20	20.99	0.23	0.86	-	-	Non-liquefiable
	18.50	CL-ML	53	26	375.55	185.00	190.55	0.68	0.209	0.72	18.84	5.00	1.20	27.60	0.36	0.82	-	-	Non-liquefiable
	20.00	CL	69	26	402.00	200.00	202.00	0.64	0.199	0.70	18.29	5.00	1.20	26.95	0.34	0.81	-	-	Non-liquefiable
	21.50	CL	86	41	421.40	215.00	206.40	0.60	0.191	0.70	28.54	5.00	1.20	39.25	0.52	0.81	-	-	Non-liquefiable
	24.50	CL	78	44	480.20	245.00	235.20	0.56	0.178	0.65	28.69	5.00	1.20	39.43	0.52	0.79	-	-	Non-liquefiable
	27.50	SM	46	43	566.50	275.00	291.50	0.56	0.170	0.59	25.19	5.00	1.20	35.22	0.52	0.65	0.403	2.375	Non-liquefiable
	29.00	CL	59	43	597.40	290.00	307.40	0.56	0.170	0.57	24.53	5.00	1.20	34.43	0.52	0.63	-	-	Non-liquefiable
	30.50	SM	47	42	610.00	305.00	305.00	0.56	0.175	0.57	24.05	5.00	1.20	33.86	0.52	0.63	0.391	2.237	Non-liquefiable
	32.00	CL	66	42	640.00	320.00	320.00	0.56	0.175	0.56	23.48	5.00	1.20	33.17	0.52	0.62	-	-	Non-liquefiable
	33.50	CL	66	46	656.60	335.00	321.60	0.56	0.178	0.56	25.65	5.00	1.20	35.78	0.52	0.75	-	-	Non-liquefiable
	36.50	CL-ML	65	49	715.40	365.00	350.40	0.56	0.178	0.53	26.18	5.00	1.20	36.41	0.52	0.74	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	38.00	SM	47	49	744.80	380.00	364.80	0.56	0.178	0.52	25.65	5.00	1.20	35.79	0.52	0.73	0.453	2.539	Non-liquefiable
	40.00	SM	47	55	808.00	400.00	408.00	0.56	0.173	0.50	27.23	5.00	1.20	37.67	0.52	0.72	0.447	2.582	Non-liquefiable
P50	0.50	SM	44	3	10.15	5.00	5.15	1.00	0.306	1.70	5.10	5.00	1.20	11.12	0.12	1.00	0.147	0.479	Liquefiable
	1.00	CL-ML	53	3	20.30	10.00	10.30	0.99	0.305	1.70	5.10	5.00	1.20	11.12	0.12	1.00	-	-	Non-liquefiable
	2.00	CL-ML	53	3	40.60	20.00	20.60	0.98	0.303	1.70	5.10	5.00	1.20	11.12	0.12	1.00	-	-	Non-liquefiable
	3.00	ML	61	7	60.90	30.00	30.90	0.98	0.300	1.70	11.90	5.00	1.20	19.28	0.21	1.00	0.246	0.820	Liquefiable
	4.00	SM	29	7	81.20	40.00	41.20	0.97	0.298	1.56	10.91	4.64	1.15	17.14	0.18	1.00	0.217	0.730	Liquefiable
	5.00	SM	29	14	96.00	50.00	46.00	0.96	0.313	1.47	20.64	4.64	1.15	28.30	0.38	1.00	0.454	1.449	Non-liquefiable
	6.00	SM	34	16	115.20	60.00	55.20	0.95	0.311	1.35	21.54	4.93	1.19	30.52	0.51	1.00	0.607	1.954	Non-liquefiable
	8.00	SM	32	22	153.60	80.00	73.60	0.94	0.306	1.17	25.64	4.83	1.17	34.86	0.52	1.00	0.620	2.029	Non-liquefiable
	9.00	SM	32	25	172.80	90.00	82.80	0.93	0.303	1.10	27.47	4.83	1.17	37.00	0.52	1.00	0.620	2.046	Non-liquefiable
	10.00	CL	81	25	192.00	100.00	92.00	0.91	0.295	1.04	26.06	5.00	1.20	36.28	0.52	1.00	-	-	Non-liquefiable
	11.00	CL	81	24	223.30	110.00	113.30	0.88	0.271	0.94	22.55	5.00	1.20	32.06	0.52	1.00	-	-	Non-liquefiable
	12.00	SM	38	30	243.60	120.00	123.60	0.85	0.262	0.90	26.98	5.00	1.20	37.38	0.52	1.00	0.620	2.363	Non-liquefiable
	13.00	CL	82	30	263.90	130.00	133.90	0.83	0.254	0.86	25.93	5.00	1.20	36.11	0.52	1.00	-	-	Non-liquefiable
	14.50	CL	82	21	294.35	145.00	149.35	0.79	0.242	0.82	17.18	5.00	1.20	25.62	0.30	1.00	-	-	Non-liquefiable
	17.50	CL	82	23	355.25	175.00	180.25	0.71	0.217	0.74	17.13	5.00	1.20	25.56	0.30	0.83	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	19.00	ML	51	23	381.90	190.00	191.90	0.67	0.207	0.72	16.60	5.00	1.20	24.92	0.29	0.81	0.281	1.355	Non-liquefiable
	20.50	CL-ML	71	22	405.90	205.00	200.90	0.63	0.198	0.71	15.52	5.00	1.20	23.63	0.27	0.80	-	-	Non-liquefiable
	23.50	CL-ML	71	28	465.30	235.00	230.30	0.56	0.176	0.66	18.45	5.00	1.20	27.14	0.34	0.77	-	-	Non-liquefiable
	25.00	CL	76	28	495.00	250.00	245.00	0.56	0.176	0.64	17.89	5.00	1.20	26.47	0.32	0.76	-	-	Non-liquefiable
	26.50	CL	79	47	553.85	265.00	288.85	0.56	0.167	0.59	27.65	5.00	1.20	38.19	0.52	0.74	-	-	Non-liquefiable
	29.50	CI	79	47	616.55	295.00	321.55	0.56	0.167	0.56	26.21	5.00	1.20	36.45	0.52	0.71	-	-	Non-liquefiable
	32.50	CL	76	50	679.25	325.00	354.25	0.56	0.167	0.53	26.57	5.00	1.20	36.88	0.52	0.69	-	-	Non-liquefiable
	35.50	ML	51	45	731.30	355.00	376.30	0.56	0.170	0.52	23.20	5.00	1.20	32.84	0.52	0.63	0.391	2.302	Non-liquefiable
	38.50	ML	54	48	793.10	385.00	408.10	0.56	0.170	0.50	23.76	5.00	1.20	33.51	0.52	0.61	0.378	2.229	Non-liquefiable
	40.00	ML	54	56	824.00	400.00	424.00	0.56	0.170	0.49	27.20	5.00	1.20	37.64	0.52	0.57	0.354	2.083	Non-liquefiable
P51	0.50	ML	52	5	9.85	5.00	4.85	1.00	0.316	1.70	8.50	5.00	1.20	15.20	0.16	1.00	0.193	0.612	Liquefiable
	2.00	SM	46	5	39.40	20.00	19.40	0.98	0.312	1.70	8.50	5.00	1.20	15.20	0.16	1.00	0.193	0.620	Liquefiable
	3.00	SM	46	6	59.10	30.00	29.10	0.98	0.310	1.70	10.20	5.00	1.20	17.24	0.18	1.00	0.219	0.707	Liquefiable
	5.00	SM	27	12	98.50	50.00	48.50	0.96	0.305	1.44	17.23	4.48	1.13	23.95	0.27	1.00	0.325	1.067	Non-liquefiable
	6.00	SM	23	14	118.20	60.00	58.20	0.95	0.302	1.31	18.35	4.06	1.10	24.25	0.28	1.00	0.331	1.096	Non-liquefiable
	8.00	SM	17	21	157.60	80.00	77.60	0.94	0.297	1.14	23.84	3.01	1.06	28.28	0.38	1.00	0.453	1.523	Non-liquefiable
	9.00	SM	17	30	177.30	90.00	87.30	0.93	0.295	1.07	32.11	3.01	1.06	37.05	0.52	1.00	0.620	2.102	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	11.00	CL-ML	87	22	216.70	110.00	106.70	0.88	0.279	0.97	21.30	5.00	1.20	30.56	0.51	1.00	-	-	Non-liquefiable
	12.00	CL-ML	87	23	248.40	120.00	128.40	0.85	0.258	0.88	20.30	5.00	1.20	29.36	0.43	1.00	-	-	Non-liquefiable
	13.00	CL	87	23	269.10	130.00	139.10	0.83	0.250	0.85	19.50	5.00	1.20	28.40	0.38	1.00	-	-	Non-liquefiable
	14.50	CL	87	30	297.25	145.00	152.25	0.79	0.240	0.81	24.31	5.00	1.20	34.18	0.52	1.00	-	-	Non-liquefiable
	17.50	CL	85	23	358.75	175.00	183.75	0.71	0.215	0.74	16.97	5.00	1.20	25.36	0.30	0.81	-	-	Non-liquefiable
	19.00	SM	44	23	391.40	190.00	201.40	0.67	0.202	0.70	16.21	5.00	1.20	24.45	0.28	0.77	0.258	1.279	Non-liquefiable
	20.50	SM	47	21	383.35	205.00	178.35	0.63	0.210	0.75	15.72	5.00	1.20	23.87	0.27	0.90	0.291	1.385	Non-liquefiable
	23.50	ML	52	35	439.45	235.00	204.45	0.56	0.188	0.70	24.48	5.00	1.20	34.37	0.52	0.88	0.546	2.907	Non-liquefiable
	26.50	SM	42	39	484.95	265.00	219.95	0.56	0.193	0.67	26.30	5.00	1.20	36.56	0.52	0.87	0.540	2.802	Non-liquefiable
	29.50	SM	45	46	539.85	295.00	244.85	0.56	0.193	0.64	29.40	5.00	1.20	40.28	0.52	0.86	0.533	2.770	Non-liquefiable
	32.50	SM	41	51	598.00	325.00	273.00	0.56	0.191	0.61	30.87	5.00	1.20	42.04	0.52	0.79	0.490	2.561	Non-liquefiable
	35.50	SM	37	50	653.20	355.00	298.20	0.56	0.191	0.58	28.95	5.00	1.20	39.75	0.52	0.78	0.484	2.529	Non-liquefiable
	38.50	SM	38	57	743.05	385.00	358.05	0.56	0.181	0.53	30.12	5.00	1.20	41.15	0.52	0.70	0.434	2.395	Non-liquefiable
	40.00	SM	45	62	756.00	400.00	356.00	0.56	0.185	0.53	32.86	5.00	1.20	44.43	0.52	0.70	0.434	2.341	Non-liquefiable
P52	0.50	SM	43	6	9.70	5.00	4.70	1.00	0.321	1.70	10.20	5.00	1.20	17.24	0.18	1.00	0.219	0.682	Liquefiable
	2.00	SM	47	6	38.80	20.00	18.80	0.98	0.317	1.70	10.20	5.00	1.20	17.24	0.18	1.00	0.219	0.690	Liquefiable
	3.00	SM	36	9	58.20	30.00	28.20	0.98	0.315	1.70	15.30	5.00	1.20	23.36	0.26	1.00	0.313	0.996	Liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	5.00	SM	25	10	97.00	50.00	47.00	0.96	0.310	1.46	14.59	4.29	1.12	20.55	0.22	1.00	0.265	0.857	Liquefiable
	6.00	SM	25	12	116.40	60.00	56.40	0.95	0.307	1.33	15.98	4.29	1.12	22.11	0.24	1.00	0.290	0.946	Liquefiable
	8.00	SM	27	12	155.20	80.00	75.20	0.94	0.302	1.15	13.84	4.48	1.13	20.12	0.22	1.00	0.259	0.856	Liquefiable
	9.00	CL-ML	53	14	175.50	90.00	85.50	0.93	0.298	1.08	15.14	5.00	1.20	23.17	0.26	1.00	-	-	Non-liquefiable
	11.00	ML	55	13	214.50	110.00	104.50	0.88	0.282	0.98	12.72	5.00	1.20	20.26	0.22	1.00	0.261	0.925	Liquefiable
	12.00	CL-ML	64	15	237.60	120.00	117.60	0.85	0.269	0.92	13.83	5.00	1.20	21.60	0.24	1.00	-	-	Non-liquefiable
	13.00	CL	71	15	257.40	130.00	127.40	0.83	0.261	0.89	13.29	5.00	1.20	20.95	0.23	1.00	-	-	Non-liquefiable
	14.50	CL	71	24	291.45	145.00	146.45	0.79	0.244	0.83	19.83	5.00	1.20	28.80	0.40	1.00	-	-	Non-liquefiable
	16.00	CL-ML	81	24	321.60	160.00	161.60	0.75	0.232	0.79	18.88	5.00	1.20	27.66	0.36	0.84	-	-	Non-liquefiable
	17.50	CL-ML	81	22	353.50	175.00	178.50	0.71	0.218	0.75	16.47	5.00	1.20	24.76	0.29	0.81	-	-	Non-liquefiable
	19.00	ML	57	22	383.80	190.00	193.80	0.67	0.206	0.72	15.80	5.00	1.20	23.96	0.27	0.83	0.270	1.312	Non-liquefiable
	20.50	ML	57	33	397.70	205.00	192.70	0.63	0.202	0.72	23.77	5.00	1.20	33.53	0.52	0.83	0.516	2.558	Non-liquefiable
	22.00	SM	34	33	426.80	220.00	206.80	0.59	0.189	0.70	22.95	4.93	1.19	32.20	0.52	0.82	0.509	2.697	Non-liquefiable
	23.50	SM	46	33	460.60	235.00	225.60	0.56	0.178	0.67	21.97	5.00	1.20	31.36	0.52	0.80	0.497	2.789	Non-liquefiable
	26.50	MI	93	57	519.40	265.00	254.40	0.56	0.178	0.63	35.74	5.00	1.20	47.88	0.52	0.78	-	-	Non-liquefiable
	28.00	SM	44	52	548.80	280.00	268.80	0.56	0.178	0.61	31.72	5.00	1.20	43.06	0.52	0.76	0.474	2.660	Non-liquefiable
	29.50	SM	44	59	578.20	295.00	283.20	0.56	0.178	0.59	35.06	5.00	1.20	47.07	0.52	0.75	0.468	2.622	Non-liquefiable
	31.00	SM	35	76	607.60	310.00	297.60	0.56	0.178	0.58	44.06	5.00	1.20	57.87	0.52	0.74	0.461	2.587	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	32.50	SM	35	60	637.00	325.00	312.00	0.56	0.178	0.57	33.97	5.00	1.20	45.76	0.52	0.73	0.456	2.554	Non-liquefiable
	34.00	SM	27	62	666.40	340.00	326.40	0.56	0.178	0.55	34.32	4.48	1.13	43.27	0.52	0.73	0.450	2.523	Non-liquefiable
	35.50	ML	55	61	695.80	355.00	340.80	0.56	0.178	0.54	33.04	5.00	1.20	44.65	0.52	0.72	0.445	2.494	Non-liquefiable
	37.00	CL-ML	65	61	725.20	370.00	355.20	0.56	0.178	0.53	32.37	5.00	1.20	43.84	0.52	0.71	-	-	Non-liquefiable
	38.50	CL-ML	65	58	754.60	385.00	369.60	0.56	0.178	0.52	30.17	5.00	1.20	41.20	0.52	0.70	-	-	Non-liquefiable
	40.00	SM	48	65	784.00	400.00	384.00	0.56	0.178	0.51	33.17	5.00	1.20	44.80	0.52	0.69	0.431	2.415	Non-liquefiable
P53	0.50	SM	46	6	9.80	5.00	4.80	1.00	0.317	1.70	10.20	5.00	1.20	17.24	0.18	1.00	0.219	0.690	Liquefiable
	1.00	SM-SC	49	6	19.60	10.00	9.60	0.99	0.316	1.70	10.20	5.00	1.20	17.24	0.18	1.00	0.219	0.692	Liquefiable
	2.00	SM-SC	49	6	39.20	20.00	19.20	0.98	0.314	1.70	10.20	5.00	1.20	17.24	0.18	1.00	0.219	0.698	Liquefiable
	3.00	SM-SC	49	7	58.80	30.00	28.80	0.98	0.311	1.70	11.90	5.00	1.20	19.28	0.21	1.00	0.246	0.792	Liquefiable
	4.00	SM	27	7	78.40	40.00	38.40	0.97	0.309	1.61	11.30	4.48	1.13	17.25	0.18	1.00	0.219	0.709	Liquefiable
	5.00	SM	23	10	96.00	50.00	46.00	0.96	0.313	1.47	14.74	4.06	1.10	20.28	0.22	1.00	0.261	0.834	Liquefiable
	6.00	SM	23	13	115.20	60.00	55.20	0.95	0.311	1.35	17.50	4.06	1.10	23.31	0.26	1.00	0.312	1.006	Non-liquefiable
	8.00	SM	21	28	153.60	80.00	73.60	0.94	0.306	1.17	32.64	3.78	1.09	39.23	0.52	1.00	0.620	2.029	Non-liquefiable
	9.00	CL	82	23	172.80	90.00	82.80	0.93	0.303	1.10	25.28	5.00	1.20	35.33	0.52	1.00	-	-	Non-liquefiable
	10.00	CL-ML	72	23	192.00	100.00	92.00	0.91	0.295	1.04	23.98	5.00	1.20	33.77	0.52	1.00	-	-	Non-liquefiable
	11.00	CL-ML	72	37	217.80	110.00	107.80	0.88	0.277	0.96	35.64	5.00	1.20	47.76	0.52	1.00	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	12.00	CL-ML	90	33	237.60	120.00	117.60	0.85	0.269	0.92	30.43	5.00	1.20	41.52	0.52	1.00	-	-	Non-liquefiable
	13.00	CL	76	33	257.40	130.00	127.40	0.83	0.261	0.89	29.24	5.00	1.20	40.08	0.52	1.00	-	-	Non-liquefiable
	14.50	CL	76	33	295.80	145.00	150.80	0.79	0.241	0.81	26.87	5.00	1.20	37.25	0.52	1.00	-	-	Non-liquefiable
	17.50	CL	70	33	357.00	175.00	182.00	0.71	0.216	0.74	24.46	5.00	1.20	34.35	0.52	0.80	-	-	Non-liquefiable
	19.00	CL-ML	64	33	383.80	190.00	193.80	0.67	0.206	0.72	23.70	5.00	1.20	33.45	0.52	0.81	-	-	Non-liquefiable
	20.50	CL	84	45	410.00	205.00	205.00	0.63	0.196	0.70	31.43	5.00	1.20	42.72	0.52	0.79	-	-	Non-liquefiable
	22.00	CL-ML	76	45	440.00	220.00	220.00	0.59	0.183	0.67	30.34	5.00	1.20	41.41	0.52	0.80	-	-	Non-liquefiable
	23.50	CL-ML	76	60	460.60	235.00	225.60	0.56	0.178	0.67	39.95	5.00	1.20	52.94	0.52	0.80	-	-	Non-liquefiable
	25.00	SM	26	40	490.00	250.00	240.00	0.56	0.178	0.65	25.82	4.39	1.12	33.37	0.52	0.78	0.486	2.728	Non-liquefiable
	26.50	SM	26	35	519.40	265.00	254.40	0.56	0.178	0.63	21.94	4.39	1.12	29.02	0.41	0.77	0.379	2.123	Non-liquefiable
	28.00	MI	90	35	548.80	280.00	268.80	0.56	0.178	0.61	21.35	5.00	1.20	30.62	0.52	0.82	-	-	Non-liquefiable
	29.50	SM	28	50	610.65	295.00	315.65	0.56	0.169	0.56	28.14	4.56	1.14	36.59	0.52	0.79	0.491	2.904	Non-liquefiable
	32.50	SM	30	60	672.75	325.00	347.75	0.56	0.169	0.54	32.17	4.71	1.15	41.85	0.52	0.78	0.481	2.847	Non-liquefiable
	34.00	SM	25	63	717.40	340.00	377.40	0.56	0.166	0.51	32.43	4.29	1.12	40.45	0.52	0.76	0.473	2.850	Non-liquefiable
	35.50	SM	32	72	749.05	355.00	394.05	0.56	0.166	0.50	36.27	4.83	1.17	47.30	0.52	0.76	0.469	2.825	Non-liquefiable
	37.00	SM	32	60	780.70	370.00	410.70	0.56	0.166	0.49	29.61	4.83	1.17	39.50	0.52	0.75	0.465	2.801	Non-liquefiable
	38.50	SM	46	58	812.35	385.00	427.35	0.56	0.166	0.48	28.06	5.00	1.20	38.67	0.52	0.74	0.461	2.779	Non-liquefiable
	40.00	SM	46	67	844.00	400.00	444.00	0.56	0.166	0.47	31.80	5.00	1.20	43.16	0.52	0.74	0.458	2.757	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
P54	0.50	SM	38	5	9.70	5.00	4.70	1.00	0.321	1.70	8.50	5.00	1.20	15.20	0.16	1.00	0.193	0.603	Liquefiable
	1.00	ML	52	5	19.40	10.00	9.40	0.99	0.319	1.70	8.50	5.00	1.20	15.20	0.16	1.00	0.193	0.605	Liquefiable
	2.00	ML	52	5	38.80	20.00	18.80	0.98	0.317	1.70	8.50	5.00	1.20	15.20	0.16	1.00	0.193	0.610	Liquefiable
	3.00	ML	60	7	58.20	30.00	28.20	0.98	0.315	1.70	11.90	5.00	1.20	19.28	0.21	1.00	0.246	0.783	Liquefiable
	5.00	ML	53	9	97.00	50.00	47.00	0.96	0.310	1.46	13.13	5.00	1.20	20.75	0.23	1.00	0.268	0.867	Liquefiable
	6.00	ML	53	15	116.40	60.00	56.40	0.95	0.307	1.33	19.97	5.00	1.20	28.97	0.41	1.00	0.488	1.587	Non-liquefiable
	7.00	SM	42	15	135.80	70.00	65.80	0.95	0.305	1.23	18.49	5.00	1.20	27.19	0.34	1.00	0.410	1.346	Non-liquefiable
	8.00	SM	42	21	155.20	80.00	75.20	0.94	0.302	1.15	24.22	5.00	1.20	34.06	0.52	1.00	0.620	2.052	Non-liquefiable
	9.00	CL-ML	81	23	174.60	90.00	84.60	0.93	0.300	1.09	25.01	5.00	1.20	35.01	0.52	1.00	-	-	Non-liquefiable
	10.00	SM	29	23	194.00	100.00	94.00	0.91	0.292	1.03	23.72	4.64	1.15	31.83	0.52	1.00	0.620	2.124	Non-liquefiable
	11.00	CL	85	21	209.00	110.00	99.00	0.88	0.290	1.01	21.11	5.00	1.20	30.33	0.49	1.00	-	-	Non-liquefiable
	12.00	CL	85	19	228.00	120.00	108.00	0.85	0.281	0.96	18.28	5.00	1.20	26.94	0.34	1.00	-	-	Non-liquefiable
	13.00	SM	21	19	247.00	130.00	117.00	0.83	0.272	0.92	17.57	3.78	1.09	22.86	0.25	1.00	0.304	1.116	Non-liquefiable
	14.50	CL	78	22	278.40	145.00	133.40	0.79	0.256	0.87	19.05	5.00	1.20	27.86	0.36	1.00	-	-	Non-liquefiable
	17.50	CL	60	34	336.00	175.00	161.00	0.71	0.230	0.79	26.80	5.00	1.20	37.15	0.52	0.90	-	-	Non-liquefiable
	20.50	CL	80	36	422.30	205.00	217.30	0.63	0.190	0.68	24.42	5.00	1.20	34.31	0.52	0.78	-	-	Non-liquefiable
	22.00	SM	25	36	453.20	220.00	233.20	0.59	0.178	0.65	23.57	4.29	1.12	30.57	0.51	0.76	0.466	2.619	Non-liquefiable

APPENDIX-H

TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	23.50	ML	57	43	448.85	235.00	213.85	0.56	0.183	0.68	29.40	5.00	1.20	40.29	0.52	0.74	0.459	2.504	Non-liquefiable
	25.00	CL	80	43	477.50	250.00	227.50	0.56	0.183	0.66	28.51	5.00	1.20	39.21	0.52	0.73	-	-	Non-liquefiable
	26.50	CL	80	34	537.95	265.00	272.95	0.56	0.172	0.61	20.58	5.00	1.20	29.70	0.45	0.74	-	-	Non-liquefiable
	28.00	CI	90	34	568.40	280.00	288.40	0.56	0.172	0.59	20.02	5.00	1.20	29.02	0.41	0.72	-	-	Non-liquefiable
	29.50	CL	85	38	566.40	295.00	271.40	0.56	0.182	0.61	23.07	5.00	1.20	32.68	0.52	0.95	-	-	Non-liquefiable
	32.50	CL	84	44	624.00	325.00	299.00	0.56	0.182	0.58	25.45	5.00	1.20	35.54	0.52	0.95	-	-	Non-liquefiable
	35.50	CL	85	47	681.60	355.00	326.60	0.56	0.182	0.55	26.01	5.00	1.20	36.21	0.52	0.94	-	-	Non-liquefiable
	38.50	CL	80	55	777.70	385.00	392.70	0.56	0.173	0.50	27.75	5.00	1.20	38.31	0.52	0.64	-	-	Non-liquefiable
	40.00	CL	80	60	808.00	400.00	408.00	0.56	0.173	0.50	29.70	5.00	1.20	40.65	0.52	0.63	-	-	Non-liquefiable
P55	0.50	SM	45	8	9.85	5.00	4.85	1.00	0.316	1.70	13.60	5.00	1.20	21.32	0.23	1.00	0.277	0.879	Liquefiable
	1.00	ML	51	8	19.70	10.00	9.70	0.99	0.314	1.70	13.60	5.00	1.20	21.32	0.23	1.00	0.277	0.882	Liquefiable
	2.00	SM	41	8	39.40	20.00	19.40	0.98	0.312	1.70	13.60	5.00	1.20	21.32	0.23	1.00	0.277	0.889	Liquefiable
	3.00	SM	32	6	59.10	30.00	29.10	0.98	0.310	1.70	10.20	4.83	1.17	16.77	0.18	1.00	0.213	0.687	Liquefiable
	5.00	SM	25	11	98.50	50.00	48.50	0.96	0.305	1.44	15.80	4.29	1.12	21.90	0.24	1.00	0.287	0.942	Liquefiable
	6.00	SM	25	13	114.60	60.00	54.60	0.95	0.312	1.35	17.59	4.29	1.12	23.91	0.27	1.00	0.324	1.038	Non-liquefiable
	8.00	SM	22	15	152.80	80.00	72.80	0.94	0.307	1.17	17.58	3.93	1.09	23.14	0.26	1.00	0.309	1.006	Non-liquefiable
	9.00	SM	22	14	171.00	90.00	81.00	0.93	0.307	1.11	15.56	3.93	1.09	20.93	0.23	1.00	0.271	0.884	Liquefiable

APPENDIX-H

TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	10.00	CL-ML	82	14	190.00	100.00	90.00	0.91	0.299	1.05	14.76	5.00	1.20	22.71	0.25	1.00	-	-	Non-liquefiable
	11.00	CL-ML	66	16	221.10	110.00	111.10	0.88	0.273	0.95	15.18	5.00	1.20	23.22	0.26	1.00	-	-	Non-liquefiable
	12.00	CL	92	19	241.20	120.00	121.20	0.85	0.265	0.91	17.26	5.00	1.20	25.71	0.31	1.00	-	-	Non-liquefiable
	14.50	CL	88	29	291.45	145.00	146.45	0.79	0.244	0.83	23.96	5.00	1.20	33.76	0.52	1.00	-	-	Non-liquefiable
	17.50	ML	53	32	350.00	175.00	175.00	0.71	0.221	0.76	24.19	5.00	1.20	34.03	0.52	0.81	0.505	2.290	Non-liquefiable
	19.00	CL	82	32	385.70	190.00	195.70	0.67	0.205	0.71	22.87	5.00	1.20	32.45	0.52	0.84	-	-	Non-liquefiable
	20.50	CL-ML	68	39	401.80	205.00	196.80	0.63	0.200	0.71	27.80	5.00	1.20	38.36	0.52	0.84	-	-	Non-liquefiable
	23.50	CL-ML	68	43	460.60	235.00	225.60	0.56	0.178	0.67	28.63	5.00	1.20	39.35	0.52	0.76	-	-	Non-liquefiable
	25.00	MI	92	43	497.50	250.00	247.50	0.56	0.176	0.64	27.33	5.00	1.20	37.80	0.52	0.84	-	-	Non-liquefiable
	26.50	MI	92	54	540.60	265.00	275.60	0.56	0.171	0.60	32.53	5.00	1.20	44.03	0.52	0.83	-	-	Non-liquefiable
	28.00	MI	92	53	571.20	280.00	291.20	0.56	0.171	0.59	31.06	5.00	1.20	42.27	0.52	0.82	-	-	Non-liquefiable
	29.50	CL-ML	63	56	601.80	295.00	306.80	0.56	0.171	0.57	31.97	5.00	1.20	43.37	0.52	0.81	-	-	Non-liquefiable
	31.00	CL-ML	63	57	632.40	310.00	322.40	0.56	0.171	0.56	31.75	5.00	1.20	43.09	0.52	0.80	-	-	Non-liquefiable
	32.50	CL-ML	60	57	663.00	325.00	338.00	0.56	0.171	0.54	31.00	5.00	1.20	42.20	0.52	0.80	-	-	Non-liquefiable
	34.00	CL	84	64	693.60	340.00	353.60	0.56	0.171	0.53	34.03	5.00	1.20	45.84	0.52	0.79	-	-	Non-liquefiable
	35.50	CL	77	69	724.20	355.00	369.20	0.56	0.171	0.52	35.91	5.00	1.20	48.09	0.52	0.78	-	-	Non-liquefiable
	37.00	CL	77	68	754.80	370.00	384.80	0.56	0.171	0.51	34.67	5.00	1.20	46.60	0.52	0.78	-	-	Non-liquefiable
	38.50	CL-ML	71	69	785.40	385.00	400.40	0.56	0.171	0.50	34.48	5.00	1.20	46.38	0.52	0.77	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	40.00	CL-ML	71	78	816.00	400.00	416.00	0.56	0.171	0.49	38.24	5.00	1.20	50.89	0.52	0.77	-	-	Non-liquefiable
P56	0.50	ML	51	4	9.75	5.00	4.75	1.00	0.319	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.531	Liquefiable
	1.00	SM-SC	43	4	19.50	10.00	9.50	0.99	0.318	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.533	Liquefiable
	2.00	SM-SC	43	4	39.00	20.00	19.00	0.98	0.315	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.537	Liquefiable
	3.00	SM	40	8	58.50	30.00	28.50	0.98	0.313	1.70	13.60	5.00	1.20	21.32	0.23	1.00	0.277	0.887	Liquefiable
	5.00	SM	36	9	97.50	50.00	47.50	0.96	0.308	1.45	13.06	5.00	1.20	20.67	0.22	1.00	0.267	0.867	Liquefiable
	6.00	SM	36	8	115.80	60.00	55.80	0.95	0.309	1.34	10.71	5.00	1.20	17.85	0.19	1.00	0.227	0.734	Liquefiable
	8.00	CL	84	12	154.40	80.00	74.40	0.94	0.304	1.16	13.91	5.00	1.20	21.69	0.24	1.00	-	-	Non-liquefiable
	9.00	CL	84	14	173.70	90.00	83.70	0.93	0.301	1.09	15.30	5.00	1.20	23.36	0.26	1.00	-	-	Non-liquefiable
	11.00	CL	75	12	212.30	110.00	102.30	0.88	0.285	0.99	11.86	5.00	1.20	19.24	0.21	1.00	-	-	Non-liquefiable
	12.50	CL	89	14	250.00	125.00	125.00	0.84	0.262	0.89	12.52	5.00	1.20	20.03	0.22	1.00	-	-	Non-liquefiable
	14.50	CL	91	41	290.00	145.00	145.00	0.79	0.245	0.83	34.05	5.00	1.20	45.86	0.52	1.00	-	-	Non-liquefiable
	17.50	CL	85	37	351.75	175.00	176.75	0.71	0.219	0.75	27.83	5.00	1.20	38.40	0.52	0.82	-	-	Non-liquefiable
	20.50	CL	78	42	418.20	205.00	213.20	0.63	0.192	0.68	28.76	5.00	1.20	39.52	0.52	0.74	-	-	Non-liquefiable
	23.50	CL	91	48	477.05	235.00	242.05	0.56	0.172	0.64	30.85	5.00	1.20	42.02	0.52	0.75	-	-	Non-liquefiable
	26.50	MI	94	64	543.25	265.00	278.25	0.56	0.171	0.60	38.37	5.00	1.20	51.04	0.52	0.71	-	-	Non-liquefiable
	28.00	MI	94	53	574.00	280.00	294.00	0.56	0.171	0.58	30.91	5.00	1.20	42.09	0.52	0.70	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	29.50	MI	94	40	604.75	295.00	309.75	0.56	0.171	0.57	22.73	5.00	1.20	32.27	0.52	0.69	-	-	Non-liquefiable
	31.00	CL	92	40	635.50	310.00	325.50	0.56	0.171	0.55	22.17	5.00	1.20	31.61	0.52	0.68	-	-	Non-liquefiable
	32.50	CL	84	59	659.75	325.00	334.75	0.56	0.172	0.55	32.25	5.00	1.20	43.70	0.52	0.67	-	-	Non-liquefiable
	34.00	CL	90	57	690.20	340.00	350.20	0.56	0.172	0.53	30.46	5.00	1.20	41.55	0.52	0.66	-	-	Non-liquefiable
	35.50	CL	90	65	720.65	355.00	365.65	0.56	0.172	0.52	33.99	5.00	1.20	45.79	0.52	0.65	-	-	Non-liquefiable
	37.00	CL	90	57	751.10	370.00	381.10	0.56	0.172	0.51	29.20	5.00	1.20	40.04	0.52	0.64	-	-	Non-liquefiable
	38.50	CL	88	67	781.55	385.00	396.55	0.56	0.172	0.50	33.65	5.00	1.20	45.37	0.52	0.64	-	-	Non-liquefiable
	40.00	CL	88	55	812.00	400.00	412.00	0.56	0.172	0.49	27.10	5.00	1.20	37.52	0.52	0.63	-	-	Non-liquefiable
P57	0.50	SM-SC	46	3	9.80	5.00	4.80	1.00	0.317	1.70	5.10	5.00	1.20	11.12	0.12	1.00	0.147	0.463	Liquefiable
	2.00	SM-SC	40	3	39.20	20.00	19.20	0.98	0.314	1.70	5.10	5.00	1.20	11.12	0.12	1.00	0.147	0.468	Liquefiable
	3.00	SM-SC	36	4	58.80	30.00	28.80	0.98	0.311	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.545	Liquefiable
	5.00	SM	30	9	98.00	50.00	48.00	0.96	0.306	1.44	12.99	4.71	1.15	19.70	0.21	1.00	0.253	0.824	Liquefiable
	6.00	SM	34	12	117.60	60.00	57.60	0.95	0.304	1.32	15.81	4.93	1.19	23.72	0.27	1.00	0.320	1.054	Non-liquefiable
	8.00	SM	38	17	156.80	80.00	76.80	0.94	0.299	1.14	19.40	5.00	1.20	28.28	0.38	1.00	0.453	1.515	Non-liquefiable
	9.00	CL	91	20	186.30	90.00	96.30	0.93	0.281	1.02	20.38	5.00	1.20	29.46	0.43	1.00	-	-	Non-liquefiable
	11.00	CL	92	19	227.70	110.00	117.70	0.88	0.266	0.92	17.51	5.00	1.20	26.02	0.31	1.00	-	-	Non-liquefiable
	12.00	CL	92	21	243.60	120.00	123.60	0.85	0.262	0.90	18.89	5.00	1.20	27.67	0.36	1.00	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	13.00	CL-ML	88	21	263.90	130.00	133.90	0.83	0.254	0.86	18.15	5.00	1.20	26.78	0.33	1.00	-	-	Non-liquefiable
	14.50	CL-ML	88	31	295.80	145.00	150.80	0.79	0.241	0.81	25.24	5.00	1.20	35.29	0.52	1.00	-	-	Non-liquefiable
	16.00	CL	58	31	326.40	160.00	166.40	0.75	0.229	0.78	24.03	5.00	1.20	33.84	0.52	0.82	-	-	Non-liquefiable
	17.50	CL	58	36	360.50	175.00	185.50	0.71	0.214	0.73	26.43	5.00	1.20	36.72	0.52	0.79	-	-	Non-liquefiable
	19.00	SM-SC	48	36	391.40	190.00	201.40	0.67	0.202	0.70	25.37	5.00	1.20	35.44	0.52	0.81	0.500	2.472	Non-liquefiable
	20.50	CL-ML	76	37	401.80	205.00	196.80	0.63	0.200	0.71	26.37	5.00	1.20	36.65	0.52	0.81	-	-	Non-liquefiable
	22.50	CL	80	37	441.00	225.00	216.00	0.57	0.183	0.68	25.18	5.00	1.20	35.21	0.52	0.78	-	-	Non-liquefiable
	23.50	CL	80	42	474.70	235.00	239.70	0.56	0.173	0.65	27.13	5.00	1.20	37.55	0.52	0.75	-	-	Non-liquefiable
	25.00	SM	28	42	505.00	250.00	255.00	0.56	0.173	0.63	26.30	4.56	1.14	34.50	0.52	0.74	0.458	2.648	Non-liquefiable
	26.50	SM	28	58	535.30	265.00	270.30	0.56	0.173	0.61	35.28	4.56	1.14	44.71	0.52	0.72	0.450	2.599	Non-liquefiable
	28.00	CL	75	60	565.60	280.00	285.60	0.56	0.173	0.59	35.50	5.00	1.20	47.60	0.52	0.71	-	-	Non-liquefiable
	29.50	CL	75	61	595.90	295.00	300.90	0.56	0.173	0.58	35.17	5.00	1.20	47.20	0.52	0.70	-	-	Non-liquefiable
	31.00	CL	79	56	626.20	310.00	316.20	0.56	0.173	0.56	31.49	5.00	1.20	42.79	0.52	0.69	-	-	Non-liquefiable
	32.50	CL	79	58	656.50	325.00	331.50	0.56	0.173	0.55	31.86	5.00	1.20	43.23	0.52	0.68	-	-	Non-liquefiable
	34.00	SM	29	58	686.80	340.00	346.80	0.56	0.173	0.54	31.15	4.64	1.15	40.33	0.52	0.60	0.375	2.167	Non-liquefiable
	35.50	SM	32	52	752.60	355.00	397.60	0.56	0.165	0.50	26.08	4.83	1.17	35.37	0.52	0.57	0.355	2.145	Non-liquefiable
	38.50	SM	34	49	816.20	385.00	431.20	0.56	0.165	0.48	23.60	4.93	1.19	32.97	0.52	0.55	0.343	2.076	Non-liquefiable
	40.00	SM	34	50	848.00	400.00	448.00	0.56	0.165	0.47	23.62	4.93	1.19	33.00	0.52	0.54	0.338	2.044	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
P58	0.50	SM	50	2	10.05	5.00	5.05	1.00	0.309	1.70	3.40	5.00	1.20	9.08	0.11	1.00	0.125	0.405	Liquefiable
	1.00	SM	50	2	20.10	10.00	10.10	0.99	0.308	1.70	3.40	5.00	1.20	9.08	0.11	1.00	0.125	0.407	Liquefiable
	2.00	CL-ML	56	2	40.20	20.00	20.20	0.98	0.306	1.70	3.40	5.00	1.20	9.08	0.11	1.00	-	-	Non-liquefiable
	3.00	SM	45	4	60.30	30.00	30.30	0.98	0.303	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.559	Liquefiable
	4.00	SM	45	10	80.40	40.00	40.40	0.97	0.301	1.57	15.73	5.00	1.20	23.88	0.27	1.00	0.324	1.075	Non-liquefiable
	6.00	SM	48	17	120.60	60.00	60.60	0.95	0.296	1.28	21.84	5.00	1.20	31.21	0.52	1.00	0.620	2.094	Non-liquefiable
	7.00	SM	48	20	138.60	70.00	68.60	0.95	0.298	1.21	24.15	5.00	1.20	33.98	0.52	1.00	0.620	2.079	Non-liquefiable
	9.00	SM	29	15	178.20	90.00	88.20	0.93	0.293	1.06	15.97	4.64	1.15	22.94	0.26	1.00	0.305	1.041	Non-liquefiable
	10.00	SM	29	17	194.00	100.00	94.00	0.91	0.292	1.03	17.53	4.64	1.15	24.73	0.29	1.00	0.342	1.171	Non-liquefiable
	11.00	ML	66	17	213.40	110.00	103.40	0.88	0.283	0.98	16.72	5.00	1.20	25.06	0.29	1.00	0.350	1.233	Non-liquefiable
	12.50	CL	91	19	252.50	125.00	127.50	0.84	0.260	0.89	16.83	5.00	1.20	25.19	0.30	1.00	-	-	Non-liquefiable
	15.50	CL	90	22	313.10	155.00	158.10	0.76	0.235	0.80	17.50	5.00	1.20	26.00	0.31	0.87	-	-	Non-liquefiable
	17.00	SM	44	22	345.10	170.00	175.10	0.72	0.221	0.76	16.63	5.00	1.20	24.95	0.29	0.87	0.302	1.366	Non-liquefiable
	18.50	SM	44	32	357.05	185.00	172.05	0.68	0.220	0.76	24.40	5.00	1.20	34.28	0.52	0.88	0.543	2.466	Non-liquefiable
	20.00	ML	55	32	386.00	200.00	186.00	0.64	0.207	0.73	23.46	5.00	1.20	33.16	0.52	0.86	0.534	2.575	Non-liquefiable
	21.50	CL	87	57	423.55	215.00	208.55	0.60	0.190	0.69	39.47	5.00	1.20	52.36	0.52	0.84	-	-	Non-liquefiable
	23.00	CL	87	60	453.10	230.00	223.10	0.56	0.177	0.67	40.17	5.00	1.20	53.20	0.52	0.82	-	-	Non-liquefiable

APPENDIX-H
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Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	24.50	CL	87	47	482.65	245.00	237.65	0.56	0.177	0.65	30.49	5.00	1.20	41.59	0.52	0.81	-	-	Non-liquefiable
	27.50	MI	96	62	541.75	275.00	266.75	0.56	0.177	0.61	37.96	5.00	1.20	50.55	0.52	0.76	-	-	Non-liquefiable
	29.00	CL	87	43	591.60	290.00	301.60	0.56	0.171	0.58	24.76	5.00	1.20	34.71	0.52	0.73	-	-	Non-liquefiable
	30.50	SM	43	100	622.20	305.00	317.20	0.56	0.171	0.56	56.15	5.00	1.20	72.38	0.52	0.72	0.448	2.616	Non-liquefiable
	32.00	CL-ML	60	100	652.80	320.00	332.80	0.56	0.171	0.55	54.82	5.00	1.20	70.78	0.52	0.71	-	-	Non-liquefiable
	33.50	SM	38	74	683.40	335.00	348.40	0.56	0.171	0.54	39.65	5.00	1.20	52.57	0.52	0.70	0.437	2.548	Non-liquefiable
	35.00	SM	38	62	714.00	350.00	364.00	0.56	0.171	0.52	32.50	5.00	1.20	44.00	0.52	0.70	0.431	2.517	Non-liquefiable
	36.50	SM	38	65	744.60	365.00	379.60	0.56	0.171	0.51	33.36	5.00	1.20	45.03	0.52	0.69	0.426	2.488	Non-liquefiable
	38.00	SM	27	71	775.20	380.00	395.20	0.56	0.171	0.50	35.71	4.48	1.13	44.85	0.52	0.68	0.421	2.460	Non-liquefiable
	40.00	SM	27	78	816.00	400.00	416.00	0.56	0.171	0.49	38.24	4.48	1.13	47.70	0.52	0.67	0.415	2.424	Non-liquefiable
P59	0.50	SM	44	4	9.70	5.00	4.70	1.00	0.321	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.528	Liquefiable
	1.00	ML	51	4	19.40	10.00	9.40	0.99	0.319	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.530	Liquefiable
	2.00	ML	51	4	38.80	20.00	18.80	0.98	0.317	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.534	Liquefiable
	3.00	SM	27	5	58.20	30.00	28.20	0.98	0.315	1.70	8.50	4.48	1.13	14.09	0.15	1.00	0.180	0.573	Liquefiable
	4.00	MI	93	5	77.60	40.00	37.60	0.97	0.312	1.63	8.15	5.00	1.20	14.78	0.16	1.00	-	-	Non-liquefiable
	5.00	MI	93	7	96.50	50.00	46.50	0.96	0.311	1.47	10.27	5.00	1.20	17.32	0.18	1.00	-	-	Non-liquefiable
	6.00	MI	93	10	115.80	60.00	55.80	0.95	0.309	1.34	13.39	5.00	1.20	21.06	0.23	1.00	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	7.00	SM	28	10	135.10	70.00	65.10	0.95	0.306	1.24	12.39	4.56	1.14	18.67	0.20	1.00	0.238	0.776	Liquefiable
	8.00	SM	28	16	152.00	80.00	72.00	0.94	0.309	1.18	18.86	4.56	1.14	26.02	0.31	1.00	0.374	1.210	Non-liquefiable
	9.00	SM	28	18	171.00	90.00	81.00	0.93	0.307	1.11	20.00	4.56	1.14	27.32	0.35	1.00	0.415	1.352	Non-liquefiable
	10.00	CL-ML	79	18	190.00	100.00	90.00	0.91	0.299	1.05	18.97	5.00	1.20	27.77	0.36	1.00	-	-	Non-liquefiable
	11.00	CL	91	15	221.10	110.00	111.10	0.88	0.273	0.95	14.23	5.00	1.20	22.08	0.24	1.00	-	-	Non-liquefiable
	12.00	CL	91	20	241.20	120.00	121.20	0.85	0.265	0.91	18.17	5.00	1.20	26.80	0.33	1.00	-	-	Non-liquefiable
	14.50	CL	88	22	291.45	145.00	146.45	0.79	0.244	0.83	18.18	5.00	1.20	26.82	0.33	1.00	-	-	Non-liquefiable
	17.50	CL	80	27	355.25	175.00	180.25	0.71	0.217	0.74	20.11	5.00	1.20	29.13	0.42	0.85	-	-	Non-liquefiable
	19.00	SM	44	27	376.20	190.00	186.20	0.67	0.210	0.73	19.79	5.00	1.20	28.74	0.40	0.83	0.396	1.884	Non-liquefiable
	20.50	SM	44	33	399.75	205.00	194.75	0.63	0.201	0.72	23.65	5.00	1.20	33.38	0.52	0.82	0.510	2.539	Non-liquefiable
	23.50	CL-ML	84	64	458.25	235.00	223.25	0.56	0.179	0.67	42.83	5.00	1.20	56.40	0.52	0.79	-	-	Non-liquefiable
	25.00	CL-ML	84	55	487.50	250.00	237.50	0.56	0.179	0.65	35.69	5.00	1.20	47.83	0.52	0.77	-	-	Non-liquefiable
	26.50	CL-ML	77	59	516.75	265.00	251.75	0.56	0.179	0.63	37.18	5.00	1.20	49.62	0.52	0.76	-	-	Non-liquefiable
	28.00	MI	96	60	546.00	280.00	266.00	0.56	0.179	0.61	36.79	5.00	1.20	49.15	0.52	0.75	-	-	Non-liquefiable
	29.50	CL	66	47	575.25	295.00	280.25	0.56	0.179	0.60	28.08	5.00	1.20	38.69	0.52	0.74	-	-	Non-liquefiable
	31.00	SM-SC	50	47	604.50	310.00	294.50	0.56	0.179	0.58	27.39	5.00	1.20	37.87	0.52	0.70	0.435	2.429	Non-liquefiable
	32.50	SM-SC	50	50	653.25	325.00	328.25	0.56	0.174	0.55	27.60	5.00	1.20	38.12	0.52	0.68	0.420	2.418	Non-liquefiable
	34.00	CL-ML	57	50	683.40	340.00	343.40	0.56	0.174	0.54	26.98	5.00	1.20	37.38	0.52	0.65	-	-	Non-liquefiable

APPENDIX-H
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Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	35.50	SM	45	57	720.65	355.00	365.65	0.56	0.172	0.52	29.81	5.00	1.20	40.77	0.52	0.64	0.394	2.289	Non-liquefiable
	37.00	SM	45	59	751.10	370.00	381.10	0.56	0.172	0.51	30.22	5.00	1.20	41.27	0.52	0.63	0.388	2.256	Non-liquefiable
	38.50	SM	47	60	781.55	385.00	396.55	0.56	0.172	0.50	30.13	5.00	1.20	41.16	0.52	0.62	0.383	2.225	Non-liquefiable
	40.00	SM	47	64	812.00	400.00	412.00	0.56	0.172	0.49	31.53	5.00	1.20	42.84	0.52	0.61	0.378	2.195	Non-liquefiable
P60	0.50	SM	35	6	10.35	5.00	5.35	1.00	0.301	1.70	10.20	5.00	1.20	17.24	0.18	1.00	0.219	0.728	Liquefiable
	1.00	SM	35	6	20.70	10.00	10.70	0.99	0.299	1.70	10.20	5.00	1.20	17.24	0.18	1.00	0.219	0.731	Liquefiable
	2.00	CH	63	6	41.40	20.00	21.40	0.98	0.297	1.70	10.20	5.00	1.20	17.24	0.18	1.00	-	-	Non-liquefiable
	3.00	CL	82	14	62.10	30.00	32.10	0.98	0.295	1.70	23.80	5.00	1.20	33.56	0.52	1.00	-	-	Non-liquefiable
	4.00	CL	82	9	82.80	40.00	42.80	0.97	0.293	1.53	13.76	5.00	1.20	21.51	0.24	1.00	-	-	Non-liquefiable
	5.00	SM	29	9	98.00	50.00	48.00	0.96	0.306	1.44	12.99	4.64	1.15	19.53	0.21	1.00	0.250	0.816	Liquefiable
	6.00	SM	29	15	117.60	60.00	57.60	0.95	0.304	1.32	19.76	4.64	1.15	27.29	0.35	1.00	0.414	1.361	Non-liquefiable
	7.00	SM	29	18	137.20	70.00	67.20	0.95	0.301	1.22	21.96	4.64	1.15	29.80	0.45	1.00	0.542	1.799	Non-liquefiable
	9.00	CL-ML	68	24	176.40	90.00	86.40	0.93	0.297	1.08	25.82	5.00	1.20	35.98	0.52	1.00	-	-	Non-liquefiable
	10.00	CL-ML	68	22	196.00	100.00	96.00	0.91	0.289	1.02	22.45	5.00	1.20	31.94	0.52	1.00	-	-	Non-liquefiable
	11.00	CL	86	22	224.40	110.00	114.40	0.88	0.269	0.93	20.57	5.00	1.20	29.68	0.45	1.00	-	-	Non-liquefiable
	12.50	CL	86	26	255.00	125.00	130.00	0.84	0.257	0.88	22.80	5.00	1.20	32.36	0.52	1.00	-	-	Non-liquefiable
	14.00	CL-ML	85	26	292.60	140.00	152.60	0.80	0.239	0.81	21.05	5.00	1.20	30.26	0.49	1.00	-	-	Non-liquefiable

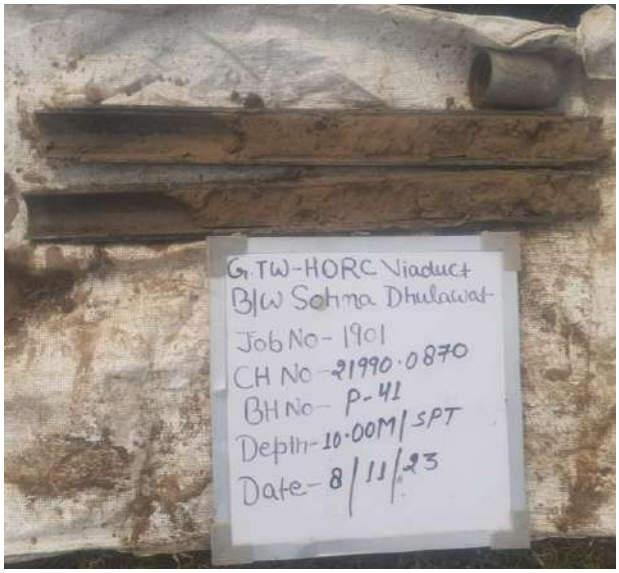
APPENDIX-H

TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	15.50	CL-ML	79	25	323.95	155.00	168.95	0.76	0.227	0.77	19.23	5.00	1.20	28.08	0.37	0.88	-	-	Non-liquefiable
	17.00	CL	59	25	351.90	170.00	181.90	0.72	0.217	0.74	18.54	5.00	1.20	27.24	0.35	0.82	-	-	Non-liquefiable
	18.50	ML	57	33	382.95	185.00	197.95	0.68	0.205	0.71	23.46	5.00	1.20	33.15	0.52	0.79	0.490	2.387	Non-liquefiable
	20.00	CL	86	33	412.00	200.00	212.00	0.64	0.194	0.69	22.66	5.00	1.20	32.20	0.52	0.79	-	-	Non-liquefiable
	21.50	CL	86	35	442.90	215.00	227.90	0.60	0.182	0.66	23.18	5.00	1.20	32.82	0.52	0.77	-	-	Non-liquefiable
	24.50	CL	84	36	485.10	245.00	240.10	0.56	0.176	0.65	23.23	5.00	1.20	32.88	0.52	0.71	-	-	Non-liquefiable
	26.00	MI	99	36	520.00	260.00	260.00	0.56	0.175	0.62	22.33	5.00	1.20	31.79	0.52	0.89	-	-	Non-liquefiable
	27.50	MI	99	34	550.00	275.00	275.00	0.56	0.175	0.60	20.50	5.00	1.20	29.60	0.44	0.88	-	-	Non-liquefiable
	29.00	CL-ML	69	34	606.10	290.00	316.10	0.56	0.167	0.56	19.12	5.00	1.20	27.95	0.37	0.69	-	-	Non-liquefiable
	30.50	MI	97	38	637.45	305.00	332.45	0.56	0.167	0.55	20.84	5.00	1.20	30.01	0.47	0.67	-	-	Non-liquefiable
	32.00	CL-ML	65	38	617.60	320.00	297.60	0.56	0.181	0.58	22.03	5.00	1.20	31.43	0.52	0.74	-	-	Non-liquefiable
	33.50	ML	54	55	646.55	335.00	311.55	0.56	0.181	0.57	31.16	5.00	1.20	42.39	0.52	0.73	0.453	2.498	Non-liquefiable
	35.00	ML	69	65	675.50	350.00	325.50	0.56	0.181	0.55	36.03	5.00	1.20	48.23	0.52	0.72	0.447	2.464	Non-liquefiable
	36.50	ML	83	77	704.45	365.00	339.45	0.56	0.181	0.54	41.79	5.00	1.20	55.15	0.52	0.72	0.447	2.464	Non-liquefiable
	38.00	CL-CI	83	89	733.40	380.00	353.40	0.56	0.181	0.53	47.34	5.00	1.20	61.81	0.52	0.71	-	-	Non-liquefiable
	40.00	CL-CI	83	100	772.00	400.00	372.00	0.56	0.181	0.52	51.85	5.00	1.20	67.22	0.52	0.70	-	-	Non-liquefiable

APPENDIX-I
SITE PHOTOGRAPHS



SPT sample at depth 10.00 m

UDS at depth 7.00 m

SPT at depth 23.50 m

SPT sample at depth 5.00 m

APPENDIX-I
SITE PHOTOGRAPHS

SPT at depth 23.50 m

SPT at depth 6.00 m

SPT sample at depth 26.50 m

UDS at depth 10.00 m

APPENDIX-I
SITE PHOTOGRAPHS

SPT at depth 20.50 m

SPT at depth 6.00 m

SPT at depth 4.00 m

SPT at depth 27.50 m

APPENDIX-I
SITE PHOTOGRAPHS

SPT sample at depth 27.50 m

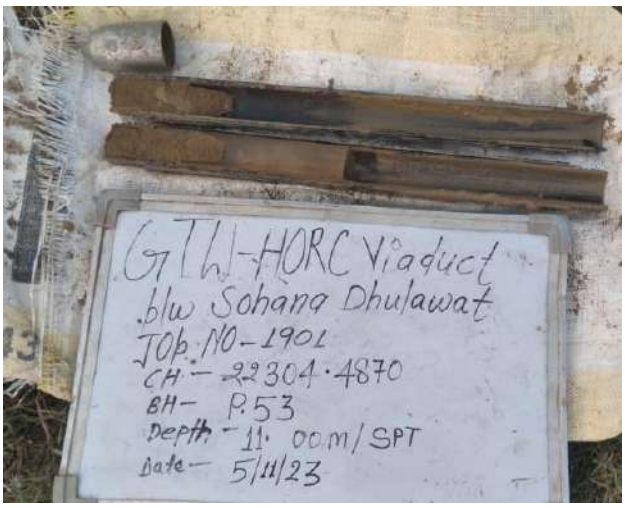
SPT at depth 6.00 m

SPT sample at depth 26.50 m

SPT at depth 20.50 m

APPENDIX-I
SITE PHOTOGRAPHS

SPT at depth 17.50 m



SPT sample at depth 11.00 m

SPT at depth 11.00 m

SPT at depth 33.50 m

APPENDIX-I
SITE PHOTOGRAPHS

SPT at depth 17.50 m

SPT at depth 11.00 m

UDS at depth 1.00 m

SPT at depth 24.50 m

APPENDIX-I
SITE PHOTOGRAPHS

SPT at depth 6.00 m

SPT sample at depth 14.50 m

SPT at depth 3.00 m

SPT sample at depth 24.50 m

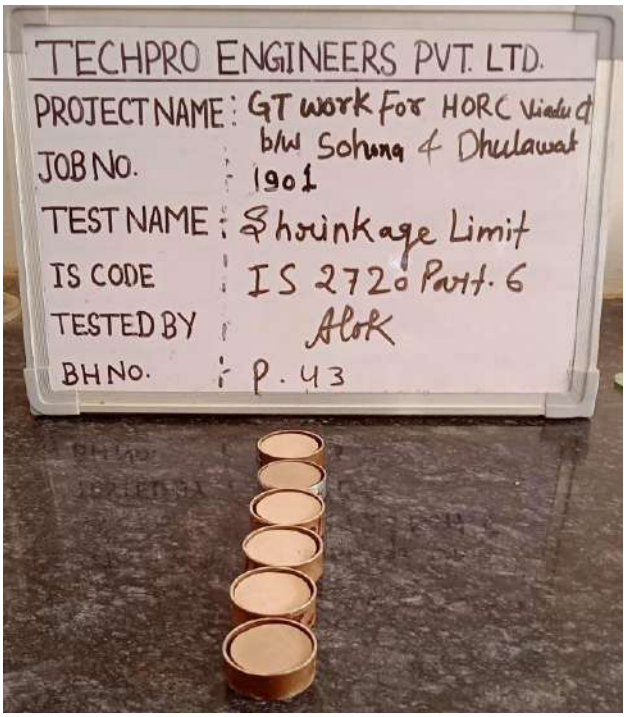
APPENDIX-J
LABORATORY PHOTOGRAPHS

Water content test

Atterbergs' limit test

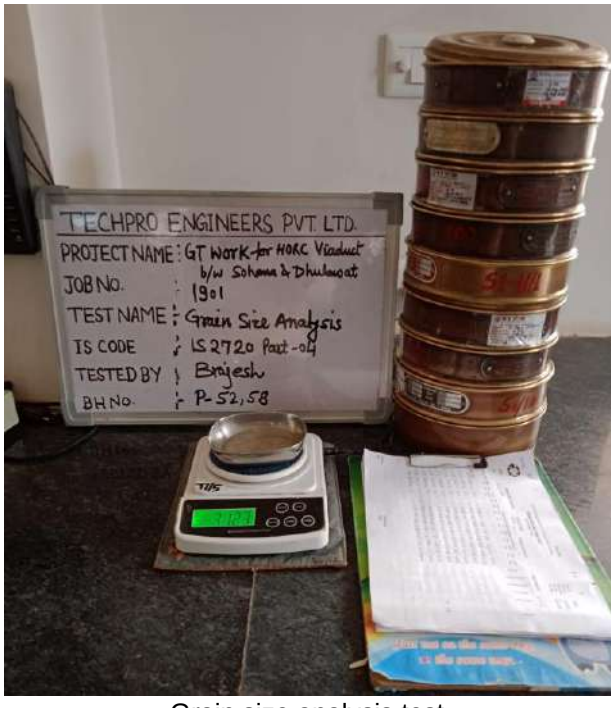
Direct shear test

APPENDIX-J
LABORATORY PHOTOGRAPHS

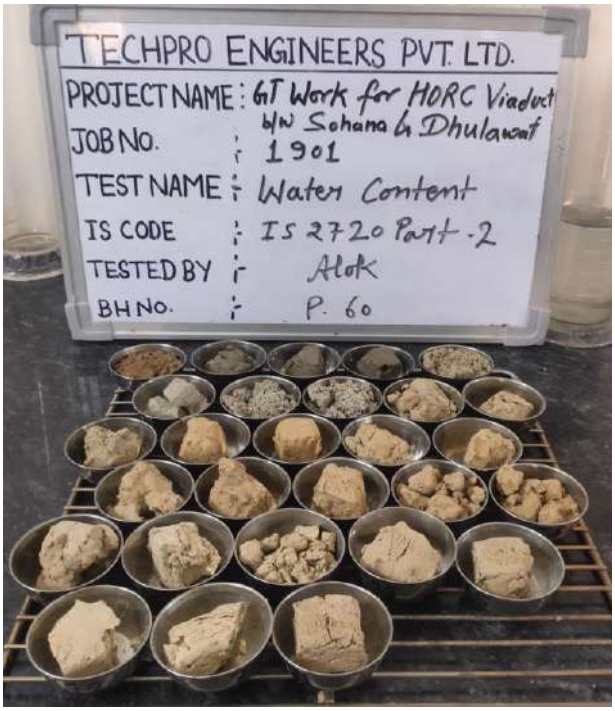


Shrinkage limit test

UCS test soil



Grain size analysis test



Water content test

APPENDIX-K
CHART 1: FIELD BORELOG CHART (P41)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021
Project Name:	NTW-HORC Viaduct blw Sohana Dhulawat Station	Project Code:	1901
Coordinate:	N: 3119138.485 E: 701593.231	Location/ Chainage:	21990.0870
Method of Drilling:	Percussion	Drilling Equipment:	Manual Power launch
Casing Lowered (M):	20.00 Bentonite Used: NO	Standard Sampler:	Yes
Ground Elevation:	R.L-191.144	Date: From 8/11/23 to 10/11/23	

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
8/11/23	0.00	0.50	0.50	DS	SX	collected										cohesive soil
"	1.00	1.45	0.45	DP	"	1	1	2	3							cohesive soil with gravel
"	2.00	2.45	0.45	U	"	Received										—do—
"	3.00	3.45	0.45	DP	"	2	3	4	7							—do—
"	4.00	4.45	0.45	DP	"	3	3	6	9							—do—
"	5.00	5.45	0.45	U	"	Received										Non-cohesive soil
"	6.00	6.45	0.45	DP	"	4	7	9	16							—do—
"	7.00	7.45	0.45	DP	"	4	8	9	17							—do—
"	8.00	8.45	0.45	U	"	Received										—do—
"	9.00	9.45	0.45	DP	"	5	8	10	18							—do—
"	10.00	10.45	0.45	DP	"	4	9	11	20							—do—
"	11.00	11.45	0.45	U	"	Received										cohesive soil with gravel
"	12.50	12.95	0.45	DP	"	6	7	12	19							—do—
"	14.00	14.45	0.45	U	"	Received										—do—
"	15.50	15.95	0.45	DP	"	8	10	13	23							—do—
"	17.00	17.45	0.45	U	"	Received										—do—
"	18.50	18.95	0.45	DP	"	9	12	15	27							Non-cohesive soil
"	20.00	20.45	0.45	U	"	shipped										-do- DS collected
"	21.50	21.95	0.45	DP	"	13	17	20	37							Non-cohesive soil with gravel
"	23.00	23.45	0.45	U	"	shipped										-do- DS collected
9/11/23	24.50	24.95	0.45	DP	"	14	20	22	42							Non-cohesive soil
"	26.00	26.45	0.45	U	"	Received										Non-cohesive soil with gravel
"	27.50	27.95	0.45	DP	"	12	19	21	40							—do—
"	29.00	29.45	0.45	U	"	Received										Non-cohesive soil

Nilesh
Supervisor

E-in-C

Abbreviation Used : U- Undisturbed Sample, C- Core Sample, D- Disturbed Sample, P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 2: FIELD BORELOG CHART (P41)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW-HORC Viaduct b/w Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 3119138.485	E: 701593.231		Location/ Chainage:	21990.087C
Method of Drilling:	Percussion	Drilling Equipment:	Manual Peacock	Bore No.:	P41
Casing Lowered (M):	20.00 Bentonite Used:	NO	Standard Sampler:	Yes	Barrel Type:	N/A
Ground Elevation:	R.L-191.144	Date: From 9/11/23 to 10/11/23		Water Table (M):	1.40

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
9/11/23	30.50	30.95	0.45	DP	SX	15	21	26	47							Non-cohesive soil
11	32.00	32.45	0.45	U	11	slipped										-do- DS collected
11	33.50	33.95	0.45	DP	11	17	20	29	49							Non-cohesive soil
11	35.00	35.45	0.45	U	11	slipped										-do- DS collected
11	36.50	36.95	0.45	DP	11	21	25	29	54							Non-cohesive soil
10/11/23	38.00	38.45	0.45	DP	11	22	25	32	57							—do—
11	40.00	40.45	0.45	DP	11	26	29	35	64							—do—

Supervisor

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

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APPENDIX-K
CHART 3: FIELD BORELOG CHART (P42)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTL for Horc viaduct Sohana-Dhulawat Station			Project Code:	1901
Coordinate:	N: 3119152.207	E: 701570.762		Location/ Chainage:	22016.2870
Method of Drilling:	Percussion	Drilling Equipment:	Power Drill	Bore No.:	P-42
Casing Lowered (M):	19.00	Bentonite Used:	Not	Standard Sampler:	Yes	Barrel Type:	NA
Ground Elevation:	R.L-191.252.	Date: From	16/10/23 to 17/10/23	Water Table (M):	1.20

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
14 10/23	0.00	0.50	0.50	DP	8x	Collected				-	-	-	-	-	-	Non Cohesive Soil
"	1.00	1.45	0.45	U	"	Received				-	-	-	-	-	-	-do-
"	2.00	2.45	0.45	DP	"	4	4	6	10	-	-	-	-	-	-	-do-
14 10/23	3.00	3.45	0.45	DP	"	2	4	8	12	-	-	-	-	-	-	-do-
"	4.00	4.45	0.45	U	"	Received				-	-	-	-	-	-	-do-
"	5.00	5.45	0.45	DP	"	5	7	9	16	-	-	-	-	-	-	-do-
"	6.00	6.45	0.45	DP	"	3	5	9	14	-	-	-	-	-	-	-do-
"	7.00	7.45	0.45	U	"	Slipped				-	-	-	-	-	-	-do-
"	8.00	8.45	0.45	DP	"	4	5	8	13	-	-	-	-	-	-	-do-
"	9.00	9.45	0.45	DP	"	3	4	7	11	-	-	-	-	-	-	-do-
"	10.00	10.45	0.45	U	"	Received				-	-	-	-	-	-	Cohesive Soil
"	11.00	11.45	0.45	DP	"	5	7	11	18	-	-	-	-	-	-	-do-
"	12.00	12.45	0.45	DP	"	6	11	14	25	-	-	-	-	-	-	-do-
"	13.00	13.45	0.45	U	"	Received				-	-	-	-	-	-	Cohesive Soil with
"	14.50	14.95	0.45	DP	"	4	7	10	17	-	-	-	-	-	-	Gravel
"	16.00	16.45	0.45	U	"	Received				-	-	-	-	-	-	-do-
"	17.50	17.95	0.45	DP	"	4	7	11	18	-	-	-	-	-	-	-do-
16 10/23	19.00	19.45	0.45	U	"	Received				-	-	-	-	-	-	-do-
"	20.50	20.95	0.45	DP	"	3	7	9	16	-	-	-	-	-	-	-do-
"	22.00	22.45	0.45	U	"	Received				-	-	-	-	-	-	-do-
"	23.50	23.95	0.45	DP	"	6	13	19	32	-	-	-	-	-	-	-do-
"	25.00	25.45	0.45	U	"	Received				-	-	-	-	-	-	-do-
"	26.50	26.95	0.45	DP	"	17	27	29	56	-	-	-	-	-	-	-do-
"	28.00	28.45	0.45	U	"	Received				-	-	-	-	-	-	-do-

Supervisor

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

E - in - C

APPENDIX-K
CHART 4: FIELD BORELOG CHART (P42)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW for horc viaduct Sohana dhulawat station			Project Code:	1901
Coordinate:	N: 3119152.203	E: 701570.762		Location/ Chainage:	22016.2870
Method of Drilling:	Percussion	Drilling Equipment:	Powerwinch	Bore No.:	P.U2
Casing Lowered (M):	19.00	Bentonite Used:	Not	Standard Sampler:	Yes	Barrel Type:	N3
Ground Elevation:	R.L-191.252	Date: From 14/10/23 to 17/10/23		Water Table (M):	1.28

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
"	29.50	29.95	0.45	DP	8x	13	18	29	47	-	-	-	-	-	-	Cohesive soil with
"	31.00	31.45	0.45	U	"	Received				-	-	-	-	-	-	gravel
"	32.50	32.95	0.45	DP	"	17	26	30	56	-	-	-	-	-	-	— do —
16/10/23	34.00	34.45	0.45	DP	"	16	24	29	53	-	-	-	-	-	-	Non Cohesive soil
"	35.50	35.95	0.45	DP	"	16	18	32	50	-	-	-	-	-	-	— do —
17/10/23	37.00	37.45	0.45	DP	"	12	14	35	49	-	-	-	-	-	-	— do —
"	38.50	38.95	0.45	DP	"	14	20	27	47	-	-	-	-	-	-	— do —
"	40.00	40.45	0.45	DP	"	16	21	29	50	-	-	-	-	-	-	— do —

Lab/ev/ex/ [signature]

Supervisor

Abbreviation Used: U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

E - in - C

APPENDIX-K
CHART 5: FIELD BORELOG CHART (P43)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW- HORC Viaduct Btw Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 2119166.393	E: 701548.586	Location/ Chainage:	22042.4870	
Method of Drilling:	Percussion	Drilling Equipment:	Powermach	Bore No.:	P.43
Casing Lowered (M):	20.00 Bentonite Used: NO	Standard Sampler :	YES	Barrel Type :	NA
Ground Elevation:	R.L-191.241	Date: From 20/10/22 to 22/10/22		Water Table (M):	1.30

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
20/10/22	0.00	0.50	0.50	DS	SK	Collected				-	-	-	-	-	-	Non Cohesive Soil
"	1.00	1.45	0.45	U	"	Skipped				-	-	-	-	-	-	- do -
"	2.00	2.45	0.45	DP	"	1	2	4	6	-	-	-	-	-	-	- do -
"	3.00	3.45	0.45	DP	"	2	3	3	6	-	-	-	-	-	-	- do -
"	4.00	4.45	0.45	U	"	Received				-	-	-	-	-	-	- do -
"	5.00	5.45	0.45	DP	"	4	4	8	12	-	-	-	-	-	-	- do -
"	6.00	6.45	0.45	DP	"	3	5	7	12	-	-	-	-	-	-	- do -
"	7.00	7.45	0.45	U	"	Received				-	-	-	-	-	-	- do -
"	8.00	8.45	0.45	DP	"	4	6	7	13	-	-	-	-	-	-	- do -
"	9.00	9.45	0.45	DP	"	5	7	9	16	-	-	-	-	-	-	- do -
"	10.00	10.45	0.45	U	"	Received				-	-	-	-	-	-	Cohesive Soil with gravel
"	11.00	11.45	0.45	DP	"	8	12	15	27	-	-	-	-	-	-	- do -
"	12.00	12.45	0.45	DP	"	10	13	18	31	-	-	-	-	-	-	- do -
"	13.00	13.45	0.45	U	"	Received				-	-	-	-	-	-	- do -
"	14.50	14.95	0.45	DP	"	4	6	8	14	-	-	-	-	-		Non Cohesive Soil
21/10/22	16.00	16.45	0.45	U	"	Received				-	-	-	-	-	-	
"	17.50	17.95	0.45	DP	"	4	8	10	18	-	-	-	-	-	-	
"	19.00	19.45	0.45	U	"	Skipped				-	-	-	-	-	-	
"	20.50	20.95	0.45	DP	"	7	8	14	22	-	-	-	-	-	-	
"	22.00	22.45	0.45	U	"	Received				-	-	-	-	-	-	Cohesive Soil with
"	23.50	23.95	0.45	DP	"	13	15	16	31	-	-	-	-	-	-	- do - gravel
"	25.00	25.45	0.45	U	"	Skipped				-	-	-	-	-	-	Non Cohesive Soil
"	26.50	26.95	0.45	DP	"	9	17	32	49	-	-	-	-	-	-	- do -
"	28.00	28.45	0.45	U	"	Skipped				-	-	-	-	-	-	- do -

Techpro Engineers P...

Supervisor Laldev yadav

E-in-C

Abbreviation Used : U- Undisturbed Sample, C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (SPT) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 6: FIELD BORELOG CHART (P43)

Auto Trip Hammer

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW - HORC Viaduct B/W Sohana Dhulawat station			Project Code:	1901
Coordinate:	N: 3119166.393	E: 701548.586		Location/ Chainage:	22042.4870
Method of Drilling:	Percussion	Drilling Equipment:	Powerwinch	Bore No.:	P.43
Casing Lowered (M):	20.00	Bentonite Used: NO	Standard Sampler: Yes	Barrel Type:	NA
Ground Elevation:	R.L-191.241	Date: From 20/10/23 to 22/10/23		Water Table (M):	1.30

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
21/10/23	29.50	29.95	0.45	DP	Sx	13	17	22	39	–	–	–	–	–	–	- do -
"	31.00	31.45	0.45	U	"	Received				–	–	–	–	–	–	- do -
"	32.50	32.95	0.45	DP	"	28	32	35	67	–	–	–	–	–	–	- do -
22/10/23	34.00	34.45	0.45	U/DP	"	20	28	30	58	–	–	–	–	–	–	- do -
22/10/23	35.50	35.95	0.45	DP	"	17	20	28	48	–	–	–	–	–	–	Non Cohesive soil
"	37.00	37.45	0.45	U	"	Slipped				–	–	–	–	–	–	- do - DS collected
"	38.50	38.95	0.45	DP	"	16	20	30	50	–	–	–	–	–	–	Non cohesive soil
"	40.00	40.45	0.45	DP	"	15	24	33	57	–	–	–	–	–	–	- do -

Supervisor Lalaleyyadiv

Techpro Engineers Pvt. Ltd. Jaipur

E - in - C

Abbreviation Used : U- Undisturbed Sample, C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N > 100), Sampler means SPT sampler

APPENDIX-K
CHART 7: FIELD BORELOG CHART (P44)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW-Hore viaduct b/w Sohana Dhulawat station	Project Code:	1901
Coordinate:	N: 311981.037 E: 701526.726	Location/ Chainage:	22068.6870
Method of Drilling:	Percussion	Drilling Equipment:	Auto Trip/ Power winch
Bore No.:	P.44		
Casing Lowered (M):	19	Bentonite Used:	NO
Standard Sampler:	yes	Barrel Type:	NA
Ground Elevation:	R.L-191.27	Date: From 17/10/23 to 19/10/23	Water Table (M): 1.20

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
17/10/23	0.00	0.50	0.50	DS	SX	Collected				–	–	–	–	–	–	Non Cohesive Soil
"	1.00	1.45	0.45	U	"	Received				–	–	–	–	–	–	– do –
"	2.00	2.45	0.45	DP	"	2	3	3	6	–	–	–	–	–	–	– do –
"	3.00	3.45	0.45	DP	"	4	7	10	17	–	–	–	–	–	–	– do –
"	4.00	4.45	0.45	U	"	Received				–	–	–	–	–	–	– do –
"	5.00	5.45	0.45	DP	"	5	6	8	14	–	–	–	–	–	–	– do –
"	6.00	6.45	0.45	DP	"	5	7	9	16	–	–	–	–	–	–	– do –
"	7.00	7.45	0.45	U	"	Received				–	–	–	–	–	–	– do –
"	8.00	8.45	0.45	DP	"	3	5	7	12	–	–	–	–	–	–	– do –
"	9.00	9.45	0.45	DP	"	3	4	8	12	–	–	–	–	–	–	– do –
"	10.00	10.45	0.45	U	"	Received				–	–	–	–	–	–	Cohesive Soil with
"	11.00	11.45	0.45	DP	"	5	6	9	15	–	–	–	–	–	–	Gravel
"	12.00	12.45	0.45	DP	"	5	7	9	16	–	–	–	–	–	–	– do –
18/10/23	13.00	13.45	0.45	U	"	Received				–	–	–	–	–	–	– do –
"	14.00	14.95	0.45	DP	"	3	6	8	14	–	–	–	–	–	–	– do –
"	16.00	16.45	0.45	U	"	Slipped				–	–	–	–	–	–	– do –
"	17.50	17.95	0.45	DP	"	4	6	12	18	–	–	–	–	–	–	– do –
"	19.00	19.45	0.45	U	"	Received				–	–	–	–	–	–	– do –
"	20.50	20.95	0.45	DP	"	6	11	18	29	–	–	–	–	–	–	– do –
"	22.00	22.45	0.45	U	"	Slipped				–	–	–	–	–	–	Cohesive Soil with gravel
"	23.50	23.95	0.45	DP	"	7	8	14	22	–	–	–	–	–	–	– do –
"	25.00	25.45	0.45	U	"	Received				–	–	–	–	–	–	– do –
"	26.50	26.95	0.45	DP	"	8	12	23	35	–	–	–	–	–	–	– do –
"	28.00	28.45	0.45	[illegible]	"	Received				–	–	–	–	–	–	– do –

Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 8: FIELD BORELOG CHART (P44)

TECHPRO ENGINEERS PVT. LTD. — **BORE/ DRILL LOG**

Doc. No.	GT/003
Date of Issue	01.04.2018
Rev. No.	R03
Rev. Date	28.12.2021

Project Name:	GTW. Horc Viaduct b/w Sohana Dhulawat station			Project Code:	1901
Coordinate:	N: 3119181.037	E: 701526.726		Location/ Chainage:	22018.6870
Method of Drilling:	Percussion	Drilling Equipment:	Auto Trip Power Winch	Bore No.:	P-44
Casing Lowered (M):	19	Bentonite Used: NO	Standard Sampler:	Barrel Type:	NA
Ground Elevation:	R.L-191.27	Date: From 17/10/22 to 19/10/22		Water Table (M):	1.20

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
"	29.50	29.95	0.45	DP	SY	12	24	28	52	-	-	-	-	-	-	Cohesive soil with
"	31.00	31.50	0.45	DP	"	15	18	27	45	-	-	-	-	-	-	- do - gravel
19/10	32.50	32.95	0.45	DP	"	18	22	28	50	-	-	-	-	-	-	- do -
"	34.00	34.50	0.45	DP	"	19	25	26	51	-	-	-	-	-	-	- do -
"	35.50	35.95	0.45	DP	"	20	28	22	50	-	-	-	-	-	-	- do -
"	37.00	37.45	0.45	DP	"	14	24	29	53	-	-	-	-	-	-	- do -
"	38.50	38.95	0.45	DP	"	13	23	28	51	-	-	-	-	-	-	- do -
"	40.00	40.45	0.45	DP	"	14	21	27	48	-	-	-	-	-	-	- do -

Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 9: FIELD BORELOG CHART (P45)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW FOR HORC viaduct Blw Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 8119196.164	E: 701505.144		Location/ Chainage:	92094.8870
Method of Drilling:	Percussion	Drilling Equipment	Auto trip Power winch	Bore No.:	P.45
Casing Lowered (M):	18.00 Bentonite Used: NIO	Standard Sampler :	Yes	Barrel Type :	NA
Ground Elevation:	R.L-191.379	Date: From 8/11/23 to	10/11/23	Water Table (M):	1.50

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
8/11/23	0.0	0.50	0.50	DS	8x	Collected			-							Non Cohesive Soil
"	1.00	1.45	0.45	U	"	Received										do
"	2.00	2.45	0.45	DP	"	2	3	4	7							do
"	3.00	3.45	0.45	DP	"	2	2	4	6							do
"	4.00	4.45	0.45	U	"	Received										do
"	5.00	5.45	0.45	DP	"	5	7	9	16							do
"	6.00	6.45	0.45	DP	"	4	6	8	14							do
"	7.00	7.45	0.45	U	"	Received										do
"	8.00	8.45	0.45	DP	"	3	5	8	13							do
"	9.00	9.45	0.45	DP	"	5	7	12	19							do
"	10.00	10.45	0.45	U	"	Received										Non Cohesive Soil with
"	11.00	11.45	0.45	DP	"	5	9	14	23							do Gravel
"	12.00	12.45	0.45	DP	"	6	8	13	21							do
"	13.00	12.45	0.45	U	"	Received										do
"	14.00	14.45	0.45	DP	"	5	9	14	23							do
"	16.00	16.45	0.45	U	"	Received										do
"	17.50	17.95	0.45	DP	"	9	14	24	38							Non Cohesive Soil
"	19.00	19.45	0.45	U	"	Received										do
"	20.50	20.95	0.45	DP	"	11	17	26	43							do
"	22.00	22.45	0.45	U	"	Received										Non Cohesive Soil-
"	23.50	23.95	0.45	DP	"	8	18	27	45							do - with gravel
9/11/23	25.00	25.45	0.45	U	"	Received			-							do
"	26.50	26.95	0.45	DP	"	12	17	25	42							do
"	28.00	28.45	0.45	U	"	Received										Cohesive Soil

Techpro Engineers Pvt. Ltd. Rohtak

Supervisor Laddewyadav

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100). Sampler means SPT sampler

APPENDIX-K
CHART 10: FIELD BORELOG CHART (P45)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW FOR HORC viaduct B/W Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 3119196.164	E: 701505.144		Location/ Chainage:	22094.8870
Method of Drilling:	Percussion	Drilling Equipment	Powerwinch	Bore No.:	P.45
Casing Lowered (M):	18.00	Bentonite Used:	Not	Standard Sampler :	Yes	Barrel Type :	NA
Ground Elevation:	R.L-191.379	Date: From 8/11/23 to 10/11/23		Water Table (M):	1.50

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
9/11/23	29.50	29.95	0.45	DP	8x	18	27	35	62							Cohesive soil
"	31.00	31.45	0.45	DP	"	17	22	33	55							do
"	32.50	32.95	0.45	DP	"	13	20	25	45							Non Cohesive Soil
"	34.00	34.45	0.45	U	"	slipped										do
10/11/23	35.50	35.95	0.45	DP	"	14	25	35	60							do
"	37.00	37.45	0.45	DP	"	16	28	28	56							do
"	38.50	38.95	0.45	DP	"	13	21	25	46							do
"	40.00	40.45	0.45	DP	"	14	22	32	54							do

Supervisor Lalderyadar

Techpro Engineers Pvt. Ltd. Haryana

S.E. Civil

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 11: FIELD BORELOG CHART (P46)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW FOR HORC B/w Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 3119211.716	E: 701483.921		Location/ Chainage:	22121.0870
Method of Drilling:	Percussion	Drilling Equipment	Auto-trip Power winch	Bore No.:	P46
Casing Lowered (M):	20.0m Bentonite Used: NA	Standard Sampler :	Yes	Barrel Type :	NA
Ground Elevation:	R.L-191.386	Date: From 6/11/2023 to 9/11/2023		Water Table (M):	160.m

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	CR (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
6/11/23	0.00	0.50	0.50	D	SX	collected				—	—	—	—	—	—	Non cohesive soil
"	1.00	1.45	0.45	U	"	Recovered				—	—	—	—	—	—	do
"	2.00	2.45	0.45	DP	"	1	2	3	5	—	—	—	—	—	—	do
"	3.00	3.45	0.45	DP	"	3	3	6	9	—	—	—	—	—	—	do
"	4.00	4.45	0.45	U/D	"	Slipped				—	—	—	—	—	—	Non cohesive soil
"	5.00	5.45	0.45	DP	"	2	2	4	6	—	—	—	—	—	—	do
"	6.00	6.45	0.45	DP	"	2	3	5	8	—	—	—	—	—	—	do
"	7.00	7.45	0.45	U	"	Recovered				—	—	—	—	—	—	Non cohesive soil with Gravel
"	8.00	8.45	0.45	DP	"	3	5	7	12	—	—	—	—	—	—	do
"	9.00	9.45	0.45	DP	"	5	8	9	17	—	—	—	—	—	—	cohesive soil with Gravel
"	10.00	10.45	0.45	U	"	Recovered				—	—	—	—	—	—	do
"	11.00	11.45	0.45	DP	"	4	8	11	19	—	—	—	—	—	—	do
"	12.00	12.45	0.45	DP	"	6	10	12	22	—	—	—	—	—	—	do
7/11/23	13.00	13.45	0.45	U	"	Recovered				—	—	—	—	—	—	do
"	14.50	14.95	0.45	DP	"	8	14	17	31	—	—	—	—	—	—	do
"	16.00	16.45	0.45	U	"	Recovered				—	—	—	—	—	—	cohesive soil
"	17.50	17.95	0.45	DP	"	6	12	16	28	—	—	—	—	—	—	do
"	19.00	19.45	0.45	U	"	Recovered				—	—	—	—	—	—	cohesive soil with Gravel
8/11/23	20.50	20.95	0.45	DP	"	9	17	22	39	—	—	—	—	—	—	do
"	22.00	22.45	0.45	U	"	Recovered				—	—	—	—	—	—	do
"	23.50	23.95	0.45	DP	"	18	24	31	55	—	—	—	—	—	—	Non cohesive soil
"	25.00	25.45	0.45	DP	"	15	20	29	49	—	—	—	—	—	—	do
"	26.50	26.95	0.45	DP	"	15	24	32	56	—	—	—	—	—	—	cohesive soil with Gravel
"	28.00	28.45	0.45	DP	"	17	28	33	61	—	—	—	—	—	—	do

Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 12: FIELD BORELOG CHART (P46)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name: GTW FOR HORC B/w Sohana Dhulawat Stations				Project Code:	1901
Coordinate:	N: 3119221.716	E: 701483.921	Location/ Chainage:	22121.0870	
Method of Drilling:	Percussion	Drilling Equipment:	Mechanical Rig	Bore No.:	P-46
Casing Lowered (M):	20.m	Bentonite Used: NA	Standard Sampler:	Yes	Barrel Type: NA
Ground Elevation:	R.L-191.306	Date: From 6/11/2023 to 9/11/2023		Water Table (M):	160.m

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
11	29.50	29.95	0.45	DP	SX	20	31	34	65	—	—	—	—	—	-	Non cohenve soil
11	31.00	31.45	0.45	DP	11	22	34	34	68	—	—	—	—	—	—	do
11	32.50	32.95	0.45	DP	11	19	28	29	57	—	—	—	—	—	—	do
11	34.00	34.45	0.45	U/D	11	silipped				—	—	—	—	—	—	do
11	35.50	35.95	0.45	DP	11	16	25	27	52	—	—	—	—	—	—	do
11	37.00	37.45	0.45	U/D	11	silipped				—	—	—	—	—	—	do
11	38.50	38.95	0.45	DP	11	17	26	29	55	—	—	—	—	—	-	do
11	40.00	40.45	0.45	DP	11	20	28	31	59	—	—	—	—	—	—	do

Supervisor

Techpro Engineers Pvt. Ltd.

E - In - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 13: FIELD BORELOG CHART (P47)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name: G.T.W. for HORC Viaduct B/w Sohana Dhulawat station				Project Code:	1901
Coordinate:	N: 3119227.711	E: 7014631.03		Location/ Chainage:	22147.2870
Method of Drilling:	Percussion	Drilling Equipment:	Auto trip Power winch	Bore No.:	P-47
Casing Lowered (M):	20.m	Bentonite Used: NO	Standard Sampler : YES	Barrel Type :	N/A
Ground Elevation:	R.L-191.466	Date: From 5/11/2023 to 8/11/2023		Water Table (M):	160.m

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
5/11/23	0.00	0.50	0.50	D	SX	Collected				—	—	—	—	—	—	Non cohesive soil
11	1.00	1.45	0.45	DP	—	1	1	1	2	—	—	—	—	—	—	— do —
11	2.00	2.45	0.45	U	—	Slipped				—	—	—	—	—	—	— do —
11	3.00	3.45	0.45	DP	—	2	4	5	9	—	—	—	—	—	—	— do —
11	4.00	4.45	0.45	DP	—	4	5	6	11	—	—	—	—	—	—	— do —
11	5.00	5.45	0.45	U	—	Received				—	—	—	—	—	—	— do —
11	6.00	6.45	0.45	DP	—	5	7	9	16	—	—	—	—	—	—	— do —
11	7.00	7.45	0.45	DP	—	5	10	11	21	—	—	—	—	—	—	— do —
11	8.00	8.45	0.45	U	—	Received				—	—	—	—	—	—	Non cohesive Soil
11	9.00	9.43	0.45	DP	—	4	8	9	17	—	—	—	—	—	—	— do —
11	10.00	10.45	0.45	DP	—	5	8	11	19	—	—	—	—	—	—	— do —
6/11/23	11.00	11.45	0.45	U	—	Received				—	—	—	—	—	—	cohesive Soil
11	12.50	12.95	0.45	DP	—	8	13	15	28	—	—	—	—	—	—	— do —
11	14.00	14.45	0.45	U	—	Slipped				—	—	—	—	—	—	Non cohesive soil
11	15.50	15.95	0.45	DP	—	5	9	11	20	—	—	—	—	—	—	— do —
11	17.00	17.45	0.45	U	—	Received				—	—	—	—	—	—	
7/11/23	18.50	18.95	0.45	DP	—	9	14	20	34	—	—	—	—	—	—	cohesive soil with gravel
11	20.00	20.45	0.45	U	—	Received				—	—	—	—	—	—	— do —
11	21.50	21.95	0.45	DP	—	8	15	22	37	—	—	—	—	—	—	— do —
11	23.00	23.45	0.45	U	—	Received				—	—	—	—	—	—	— do —
11	24.50	24.95	0.45	DP	—	12	22	30	52	—	—	—	—	—	—	— do —
11	26.00	26.45	0.45	DP	—	9	17	24	41	—	—	—	—	—	—	(Non) Cohesive Soil
11	27.50	27.95	0.45	DP	—	11	20	25	45	—	—	—	—	—	—	— do —
11	29.00	29.45	0.45	U	—	Received				—	—	—	—	—	—	— do —

Techpro Engineers Pvt. Ltd.

Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample, C- Core Sample, D- Disturbed Sample, P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 14: FIELD BORELOG CHART (P47)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	G.T.W. for HORC Viaduct B/w Sohana Dhullawat Station			Project Code:	1901
Coordinate:	N: 3119227.711	E: 701463.03		Location/ Chainage:	22147.2870
Method of Drilling:	Percussion	Drilling Equipment	Autotrip Powerwinch	Bore No.:	P 47
Casing Lowered (M):	20.00	Bentonite Used: NO	Standard Sampler : Yes	Barrel Type :	N/A
Ground Elevation:	R.L-191.466	Date: From 5/11/2023 to 8/11/2023		Water Table (M):	160.00

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
11	30.50	30.95	0.45	DP	SX	13	22	26	48	–	–	–	–	–	–	Non cohesive soil
11	32.00	32.45	0.45	U	–	Silpped				–	–	–	–	–	–	–do–
11	33.50	33.95	0.45	DP	–	15	24	27	51	–	–	–	–	–	–	–do–
11	35.00	35.45	0.45	U	–	Silpped				–	–	–	–	–	–	–do–
11	36.50	36.95	0.45	DP	–	16	28	32	60	–	–	–	–	–	–	–do–
11	38.00	38.45	0.45	DP	–	18	25	31	56	–	–	–	–	–	–	–do–
11	40.00	40.45	0.45	DP	–	21	29	33	62	–	–	–	–	–	–	Non cohesive soil

Supervisor

Techpro Engineers Pvt. Ltd.

E-In-C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 15: FIELD BORELOG CHART (P48)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	NTL-HORC Viaduct blw Sohana Dhulawat Station	Project Code:	1901
Coordinate:	N: 3119944.143 E: 701442.481	Location/ Chainage:	22173.4870
Method of Drilling:	Percussion	Drilling Equipment:	Auto Trip/ Rope winch
Bore No.:	P48		
Casing Lowered (M):	18.00 Bentonite Used: NO	Standard Sampler:	Yes
Barrel Type:	N/A		
Ground Elevation:	R.L – 191.219	Date: From 12/10/23 to 15/10/23	Water Table (M): 1.70

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
12/10/23	0.00	0.50	0.50	DS	SX	collected										Non-cohesive soil
"	1.00	1.45	0.45	DP	"	1	1	2	3							do
"	2.00	2.45	0.45	U	"	Received										do
"	3.00	3.45	0.45	DP	"	3	5	6	11							do
"	4.00	4.45	0.45	DP	"	3	5	7	12							do
"	5.00	5.45	0.45	U	"	slipped										do-DS collected
13/10/23	6.00	6.45	0.45	DP	"	3	4	6	10							Non cohesive soil
"	7.00	7.45	0.45	DP	"	4	5	7	12							do
"	8.00	8.45	0.45	U	"	slipped										do
"	9.00	9.45	0.45	DP	"	3	4	5	9							do
"	10.00	10.45	0.45	DP	"	3	6	7	13							cohesive soil with gravel
"	11.00	11.45	0.45	U	"	Received										do
"	12.50	12.95	0.45	DP	"	8	14	17	31							do
"	14.00	14.45	0.45	U	"	Received										do
"	15.50	15.95	0.45	DP	"	6	12	15	27							do
"	17.00	17.45	0.45	U	"	Received										do
14/10/23	18.50	18.95	0.45	DP	"	8	17	19	36							do
"	20.00	20.45	0.45	U	"	Received										do
"	21.50	21.95	0.45	DP	"	12	20	25	45							Non-cohesive soil with gravel
"	23.00	23.45	0.45	U	"	slipped										do
"	24.50	24.95	0.45	DP	"	9	18	27	45							do
"	26.00	26.45	0.45	U	"	Received										do
"	27.50	27.95	0.45	DP	"	8	21	29	50							Non-cohesive soil with gravel
"	29.00	29.45	0.45	U	"	slipped										do DS collected

Nitesh
Supervisor

Techpro Engineers Pvt. Ltd. Haryana

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 16: FIELD BORELOG CHART (P48)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW-HORC Viaduct blw Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 3119244.143	E: 701442.481		Location/ Chainage:	29173.4870
Method of Drilling:	Percussion	Drilling Equipment	Auto Trip Winch	Bore No.:	P48
Casing Lowered (M):	18.00	Bentonite Used: NO	Standard Sampler :	Yes	Barrel Type :	N/A
Ground Elevation:	R.L-191.215	Date: From 12/10/23 to 15/10/23			Water Table (M):	1.70

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
14/10/23	30.50	30.95	0.45	DP	SX	10	20	31	51							Non-cohesive soil with Gravel
11	33.00	33.45	0.45	U	11	slipped										-do- D.S collected
11	33.50	33.95	0.45	DP	11	11	23	33	56							Non-cohesive soil with Gravel
15/10/23	35.00	35.45	0.45	U	11	slipped										Non-cohesive soil
11	36.50	36.95	0.45	DP	11	12	25	30	55							— do —
11	38.00	38.45	0.45	U	11	slipped										— do —
11	40.00	40.45	0.45	DP	11	13	27	36	63							— do —

Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 17: FIELD BORELOG CHART (P49)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW-HORC Viaduct b/w Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 3119261.003	E: 701422.282		Location/ Chainage:	23199.6870
Method of Drilling:	Percussion	Drilling Equipment:	Auto Trip Rope Winch	Bore No.:	P49
Casing Lowered (M):	18.00	Bentonite Used: NO	Standard Sampler:	Yes	Barrel Type:	N/A
Ground Elevation:	RL-191.249	Date: From 18/10/23 to 20/10/23			Water Table (M):	1.20

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
18/10/23	0.00	0.50	0.50	DS	SX	collected										Non-cohesive soil
	1.00	1.45	0.45	DP	"	1	2	3	5							— do —
"	2.00	2.45	0.45	U	"	slipped										-do-DS collected
"	3.00	3.45	0.45	DP	"	2	3	5	8							Non-cohesive soil
"	4.00	4.45	0.45	DP	"	3	5	7	12							— do —
"	5.00	5.45	0.45	U	"	slipped										-do-DS collected
"	6.00	6.45	0.45	DP	"	3	6	8	14							Non-cohesive soil
"	7.00	7.45	0.45	DP	"	5	6	7	13							— do —
"	8.00	8.45	045	U	"	slipped										-do-DS collected
"	9.00	9.45	0.45	DP	"	4	4	5	9							Non-cohesive soil
"	10.00	10.45	0.45	DP	"	5	8	15	23							— do —
"	11.00	11.45	0.45	U	"	Received										Non-cohesive soil with gravel
"	12.50	12.95	0.45	DP	"	6	7	14	21							cohesive soil
"	14.00	14.45	0.45	U	"	Received										— do —
19/10/23	15.50	15.95	0.45	DP	"	5	7	10	17							— do —
"	17.00	17.45	0.45	U	"	Received										cohesive soil with gravel
"	18.50	18.95	0.45	DP	"	7	11	15	26							— do —
"	20.00	20.45	0.45	U	"	Received										— do —
"	21.50	21.95	0.45	DP	"	10	19	22	41							— do —
"	23.00	23.45	0.45	U	"	Received										— do —
"	24.50	24.95	0.45	DP	"	10	17	27	44							— do —
"	26.00	26.45	0.45	U	"	slipped										-do-DS collected
"	27.50	27.95	0.45	DP	"	9	15	28	43							cohesive soil with gravel
"	29.00	29.45	0.45	U	"	Received										— do —

Supervisor

Techpro Engineers Pvt. Ltd. Gurgaon

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 18: FIELD BORELOG CHART (P49)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW-HORC Viaduct blw Sohana Dhulawat stretch			Project Code:	1901
Coordinate:	N: 3119261.063	E: 7014222.282		Location/ Chainage:	22199.6870
Method of Drilling:	Percussion	Drilling Equipment:	Auto Trip Powerwinch	Bore No.:	P49
Casing Lowered (M):	18.00	Bentonite Used: NO	Standard Sampler: Yes	Barrel Type:	N/A
Ground Elevation:	R.L-191.249	Date: From 18/10/23 to 20/10/23		Water Table (M):	1.80

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
M/C	30.50	30.95	0.45	DP	SX	10	16	26	42							Non-cohesive soil
20/10/23	32.00	32.45	0.45	U	11	Received										— do —
11	33.50	33.95	0.45	DP	11	12	18	28	46							— do —
11	35.00	35.45	0.45	U	11	Slipped										— do — DS collected
20/10/23	36.50	36.95	0.45	DP	11	14	19	30	49							Non-cohesive soil
11	38.00	38.45	0.45	U	11	Slipped										— do — DS collected
11	40.00	40.45	0.45	DP	11	16	22	33	55							Non-cohesive soil

Supervisor

Techpro Engineers Pvt. Ltd. Rampur

E-in-C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 19: FIELD BORELOG CHART (P50)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW-HORC Viaduct blw Sohana Station & Dhulawat			Project Code:	1901
Coordinate:	N: 3119278.301	E: 701402.424		Location/ Chainage:	29225-9870
Method of Drilling:	Percussion	Drilling Equipment:	Automatic/ Powerswivel	Bore No.:	P50
Casing Lowered (M):	18.00 Bentonite Used: NO	Standard Sampler:	Yes	Barrel Type:	N/A
Ground Elevation:	R.L-191.295	Date: From 16/11/22 to 18/11/22		Water Table (M):	1.60

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
16/11/22	0.00	0.50	0.50	D.S	SX	collected										Non-cohesive soil
23	1.00	1.45	0.45	U	11	Received										Non-cohesive soil with Gravel
11	2.00	2.45	0.45	DP	11	1	1	2	3							— do —
11	3.00	3.45	0.45	DP	11	2	3	4	7							— do —
11	4.00	4.45	0.45	U	11	slipped										— do — D.S collected
11	5.00	5.45	0.45	DP	11	4	6	8	14							Non-cohesive soil
11	6.00	6.45	0.45	DP	11	5	7	9	16							— do —
11	7.00	7.45	0.45	U	11	slipped										— do —
11	8.00	8.45	0.45	DP	11	7	9	13	22							— do —
11	9.00	9.45	0.45	DP	11	7	10	15	25							— do —
11	10.00	10.45	0.45	U	11	Received										— do —
11	11.00	11.45	0.45	DP	11	5	9	15	24							— do —
11	12.00	12.45	0.45	DP	11	7	13	17	30							— do —
11	13.00	13.45	0.45	U	11	Received										Cohesive soil with Gravel,
11	14.50	14.95	0.45	DP	11	6	9	12	21							Cohesive soil with Gravel
11	16.00	16.45	0.45	U	11	Received										— do —
11	17.50	17.95	0.45	DP	11	5	10	13	23							— do —
11	19.00	19.45	0.45	U	11	Received										— do —
11	20.50	20.95	0.45	DP	11	4	8	14	22							— do —
11	22.00	22.45	0.45	U	11	slipped										— do — D.S collected
19/11	23.50	23.95	0.45	DP	11	6	11	17	28							Cohesive soil with Gravel
23	25.00	25.45	0.45	U	11	slipped										— do — D.S collected
11	26.50	26.95	0.45	DP	11	12	19	28	47							Cohesive soil with Gravel
11	28.00	28.45	0.45	U	11	slipped										— do — D.S collected

Techpro Engineers Pvt. Ltd.

Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 20: FIELD BORELOG CHART (P50)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW-HORC Viaduct b/w Sohana Dhulawat station			Project Code:	1901
Coordinate:	N: 3119278.301	E: 701402.424		Location/ Chainage:	22225.8870
Method of Drilling:	Percussion	Drilling Equipment:	Auto Trip/ Pocket winch	Bore No.:	P50
Casing Lowered (M):	18.00	Bentonite Used: NO	Standard Sampler: Yes	Barrel Type:	N/A
Ground Elevation:	R.L-191.295	Date: From 16/10/23 to 18/10/23		Water Table (M):	1.60

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
17/10/23	29.50	29.95	0.45	DP	SX	11	20	27	47							Cohesive soil with Gravel
"	31.00	31.45	0.45	U	"	Received										— do —
"	32.50	32.45	0.45	DP	"	12	22	28	50							— do —
"	34.00	34.45	0.45	U	"	slipped										-do- D.S collected
18/10/23	35.50	35.95	0.45	DP	"	11	20	25	45							Non-cohesive soil
"	37.00	37.45	0.45	U	"	slipped										-do- D.S collected
"	38.50	38.95	0.45	DP	"	14	21	27	48							Non-cohesive soil
"	40.00	40.45	0.45	DP	"	17	25	31	56							— do —

Nifon
Supervisor

Techpro Engineers Pvt. Ltd.

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 21: FIELD BORELOG CHART (P51)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW-HORC Viaduct btw Sohana Dhulawat Station	Project Code:	1901
Coordinate:	N: 3119295.948 E: 701383.039	Location/ Chainage:	22252.0870
Method of Drilling:	Percussion	Drilling Equipment:	Auto trip Power winch
Bore No.:	P51		
Casing Lowered (M):	21.00 Bentonite Used: NO	Standard Sampler:	Yes
Barrel Type:	N/A		
Ground Elevation:	R.L-191.293	Date: From 20/10/23 to 22/10/23	Water Table (M): 1.60

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
20/10/23	0.00	0.50	0.50	DS	SX	collected										Non-cohesive soil
"	1.00	1.45	0.45	U	"	slipped										-do- DS collected
"	2.00	2.45	0.45	DP	"	1	2	3	5							Non-cohesive soil
"	3.00	3.45	0.45	DP	"	2	2	4	6							—do—
"	4.00	4.45	0.45	U	"	slipped										-do- DS collected
"	5.00	5.45	0.45	DP	"	3	5	7	12							Non-cohesive soil
"	6.00	6.45	0.45	DP	"	3	6	8	14							—do—
"	7.00	7.45	0.45	U	"	slipped										-do- DS collected
"	8.00	8.45	0.45	DP	"	6	9	12	21							Non-cohesive soil
"	9.00	9.45	0.45	DP	"	10	13	17	30							—do—
"	10.00	10.45	0.45	U	"	Received										Non-cohesive soil with gravel
"	11.00	11.45	0.45	DP	"	5	9	13	22							cohesive soil with gravel
"	12.00	12.45	0.45	DP	"	4	8	15	23							—do—
"	13.00	13.45	0.45	U	"	Received										—do—
"	14.50	14.95	0.45	DP	"	9	14	16	30							—do—
20/10/23	16.00	16.45	0.45	U	"	Received										—do—
21/10/23	17.50	17.95	0.45	DP	"	6	9	14	23							—do—
21/10/23	19.00	19.45	0.45	U	"	Received										Non-cohesive soil
"	20.50	20.95	0.45	DP	"	6	8	13	21							—do—
"	22.00	22.45	0.45	U	"	slipped										-do- DS collected
"	23.50	23.95	0.45	DP	"	10	15	20	35							Non-cohesive soil with gravel
"	25.00	25.45	0.45	U	"	slipped										Non-cohesive soil
"	26.50	26.95	0.45	DP	"	12	17	22	39							—do—
"	28.00	28.45	0.45	U	"	Received										—do—

Techpro Engineers Pvt. Ltd. Haryana

Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 22: FIELD BORELOG CHART (P51)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW-HORC Viaduct btw Sohana Dhulawat station			Project Code:	1901
Coordinate:	N: 3119295.948	E: 701383.032		Location/ Chainage:	92252.0870
Method of Drilling:	Percussion	Drilling Equipment:	Autotrip/ Rope winch	Bore No.:	P51
Casing Lowered (M):	21.00 Bentonite Used:	NO	Standard Sampler:	Yes	Barrel Type:	N/A
Ground Elevation:	R.L-191.393	Date: From 20/10/22 to 25/10/22			Water Table (M):	1.60

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
21/10/22	29.50	29.95	0.45	DP	SX	14	20	26	46							Non-cohesive soil
11	31.00	31.45	0.45	U	11	slipped										-do- DS collected
11	32.50	32.95	0.45	DP	11	16	22	29	51							Non-cohesive soil
22/10/22	34.00	34.45	0.45	U	11	Received										— do —
11	35.50	35.95	0.45	DP	11	16	24	26	50							— do —
11	37.00	37.45	0.45	U	11	slipped										-do- DS collected
11	38.50	38.95	0.45	DP	11	18	27	30	57							Non-cohesive soil
11	40.00	40.45	0.45	DP	11	20	29	33	62							— do —

Techpro Engineers Pvt. Ltd. Rohini

Nitesh
Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 23: FIELD BORELOG CHART (P52)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW FOR HORC Viaduct Btw Sohana Dhulawat station			Project Code:	1901
Coordinate:	N: 3119314.08	E: 701363.889		Location/ Chainage:	22278.2870
Method of Drilling:	Percussion	Drilling Equipment	Auto trip Rope winch	Bore No.:	P.52
Casing Lowered (M):	18.00 Bentonite Used: NO	Standard Sampler :	Yes	Barrel Type :	NA
Ground Elevation:	RL-191.228	Date: From 5/11/23 to 7/11/23		Water Table (M):	1.50

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	CR (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
5/11/23	0.00	0.50	0.50	DS	8x	Collected										Non Cohesive Soil
"	1.00	1.45	0.45	U	"	Received										do
"	2.00	2.45	0.45	DP	"	2	3	3	6							do
"	3.00	3.45	0.45	DP	4	2	4	5	9							do
"	4.00	4.45	0.45	U	"	Received										do
"	5.00	5.45	0.45	DP	"	3	4	6	10							do
"	6.00	6.45	0.45	DP	"	6	5	7	12							do
"	7.00	7.45	0.45	U	"	Received										do
"	8.00	8.45	0.45	DP	"	4	5	7	12							Non Cohesive Soil
"	9.00	9.45	0.45	DP	"	4	6	8	14							with Gravel
"	10.00	10.45	0.45	U	"	Received										do
"	11.00	11.45	0.45	DP	"	3	5	8	13							Non Cohesive Soil
"	12.00	12.45	0.45	DP	"	4	6	9	15							do
"	13.00	13.45	0.45	U	"	Received										do
"	14.50	14.95	0.45	DP	"	8	11	13	24							do
"	16.00	16.45	0.45	U	"	Received										do
6/11/23	17.50	17.95	0.45	DP	"	6	10	12	22							do
"	19.00	19.45	0.45	U	"	Received										do
"	20.50	20.95	0.45	DP	"	8	15	18	33							do
"	22.00	22.45	0.45	U	"	Received										do
"	23.50	23.95	0.45	DP	"	8	14	19	33							Non Cohesive Soil
"	25.00	25.45	0.45	U	"	Slipped										with Gravel
"	26.50	26.95	0.45	DP	"	18	24	33	57							Cohesive Soil with gravel
"	28.00	28.45	0.45	DP	"	15	20	32	52							Non Cohesive Soil

Supervisor

Techpro Engineers Pvt. Ltd.

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N Value)), Sampler means SPT sampler

APPENDIX-K
CHART 24: FIELD BORELOG CHART (P52)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTCO FOR HORC Viaduct B/W Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 3119314.08	E: 701363.889		Location/ Chainage:	22278.2870
Method of Drilling:	Percussion	Drilling Equipment	Auto trip Powerwinch	Bore No.:	P.52
Casing Lowered (M):	18.00 Bentonite Used: NO	Standard Sampler :	Yes	Barrel Type :	NA
Ground Elevation:	R.L-191.228	Date: From 5/11/23 to 7/11/23		Water Table (M):	1.50

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
6 11/23	29.50	29.95	0.45	DP	3X	12	27	32	59							Non Cohesive soil
"	31.00	31.45	0.45	DP		17	26	50	76							Non Cohesive Soil
7 11/23	32.50	32.95	0.45	DP		18	25	35	60							with Gravel
"	34.00	34.45	0.45	DP		17	30	32	62							do
"	35.50	35.95	0.45	DP		15	28	33	61							do
"	37.00	37.45	0.45	DP		14	23	38	61							do
"	38.50	38.95	0.45	DP		17	26	32	58							do
"	40.00	40.45	0.45	DP		18	30	35	65							do -
																do

Techpro Engineers Pvt. Ltd.

Supervisor Lakhwinder

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 25: FIELD BORELOG CHART (P53)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No: GT/003
		Date of Issue: 01.04.2018
		Rev. No.: R03
		Rev. Date: 28.12.2021

Project Name: GTW FOR HORC Viaduct Blw Sohana Dhulawat Station				Project Code:	1901
Coordinate:	N: 3119332.567	E: 701345.19		Location/ Chainage:	92304.4870
Method of Drilling:	Percussion	Drilling Equipment	Manual Power winch	Bore No.:	P-53
Casing Lowered (M):	18.00 Bentonite Used: NO	Standard Sampler :	Yes	Barrel Type :	NA
Ground Elevation:	R.L-192.054	Date: From 5/11/23 to 8/11/23		Water Table (M):	1.00

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
5/11/23	0.0	0.50	0.50	DS	8"	Collected										Non Cohesive Soil
	1.00	1.45	0.45	U	"	Received										do
	2.00	2.45	0.45	DP	"	3	3	3	6							do
	3.00	3.45	0.45	DP	"	2	3	4	7							do
	4.00	4.45	0.45	U	"	Received										do
	5.00	5.45	0.45	DP	"	3	4	6	10							do
	6.00	6.45	0.45	DP	"	3	5	8	13							do
	7.00	7.45	0.45	U	"	Slipped										Non Cohesive Soil
	8.00	8.45	0.45	DP	"	8	12	16	28							do
	9.00	9.45	0.45	DP	"	6	9	14	23							Cohesive soil with gravel
	10.00	10.45	0.45	U	"	Received										do
	11.00	11.45	0.45	DP	"	10	17	20	37							do
	12.00	12.45	0.45	DP	"	8	15	18	33							do
	13.00	13.45	0.45	U	"	Received										do
	14.50	14.95	0.45	DP	"	7	12	21	33							do
	16.00	16.45	0.45	U	"	Received										do
	17.50	17.95	0.45	DP	"	11	14	19	33							Non Cohesive Soil -
	19.00	19.45	0.45	U	"	Received										with gravel
6/11/23	20.50	20.95	0.45	DP	"	14	20	25	45							Non Cohesive Soil
	22.00	22.45	0.45	U	"	Received										do
	23.50	23.95	0.45	DP	"	20	28	32	60							Non Cohesive Soil -
7/11/23	25.00	25.45	0.45	DP	"	12	18	22	40							do - with gravel
	26.50	26.95	0.45	DP	"	16	15	20	35							do
	28.00	28.45	0.45	U	"	Received										Cohesive Soil

Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample, C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) = 100), Sampler means SPT sampler

APPENDIX-K
CHART 26: FIELD BORELOG CHART (P53)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW FOR HORC Viaduct B/W Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 3119332.567	E: 701345.19		Location/ Chainage:	22304.4870
Method of Drilling:	Percussion	Drilling Equipment	manual Powerwinch	Bore No.:	P.53
Casing Lowered (M):	18.00	Bentonite Used: NO	Standard Sampler : Yes	Barrel Type :	NA
Ground Elevation:	R.L-192.054	Date: From 5/11/23 to 8/11/23		Water Table (M):	1.40

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
7/11/23	29.50	29.95	0.45	DP	SV	8	22	28	50							Non Cohesive Soil
"	31.00	31.45	0.45	U	"	Slipped										do
"	32.50	32.95	0.45	DP	"	18	28	32	60							Non Cohesive Soil
"	34.00	34.45	0.45	DP	"	20	28	35	63							do with gravel
"	35.50	35.95	0.45	DP	"	25	32	40	72							do
8/11/23	37.00	37.45	0.45	DP	"	20	28	32	60							do
"	38.50	38.95	0.45	DP	"	18	23	35	58							do
"	40.00	40.45	0.45	DP	"	21	32	35	67							do

Supervisor Lakhenyadav

Techpro Engineers Pvt. Ltd.

E-in-C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (Nos. 100), Sampler means SPT sampler

APPENDIX-K
CHART 27: FIELD BORELOG CHART (P54)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	G.T. for HORC viaduct b/w Sohana Dhulawat stations			Project Code:	1901
Coordinate:	N: 3119351.461	E: 701326.868		Location/ Chainage:	22330.6870
Method of Drilling:	Percussion		Drilling Equipment	Powerwinch	Bore No.: P 54
Casing Lowered (M):	20.00	Bentonite Used: NO	Standard Sampler :	Yes	Barrel Type : N/A
Ground Elevation:	R.L-191.242.	Date: From 12/10/23 to 14/10/23			Water Table (M): 1.20 M

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
12/10/23	0.0	0.50	0.50	DS	SX	Received										NON cohesvie soil
11	1.00	1.45	0.45	U	11	Slipped										— do —
11	2.00	2.45	0.45	DP	11	1	2	3	5							— do —
11	3.00	3.45	0.45	DP	11	2	3	4	7							— do —
11	4.00	4.45	0.45	U	11	Slipped										— do —
11	5.00	5.45	0.45	DP	11	2	3	6	9							— do —
11	6.00	6.45	0.45	DP	11	4	7	8	15							— do —
11	7.00	7.45	0.45	U	11	Slipped										— do —
11	8.00	8.45	0.45	DP	11	4	10	11	21							— do —
11	9.00	9.45	0.45	DP	11	5	11	12	23							NON cohesvie soil
11	10.00	10.45	0.45	U	11	Received										— do —
11	11.00	11.45	0.45	DP	11	5	8	13	21							— do —
11	12.0	12.45	0.45	DP	11	4	7	12	19							— do —
11	13.00	13.45	0.45	U	11	Received										cohesvie soil
11	14.50	14.95	0.45	DP	11	5	9	13	22							— do —
11	16.00	16.45	0.45	U	11	Received										— do —
11	17.50	17.95	0.45	DP	11	9	13	21	34							— do —
13/10/23	19.00	19.45	0.45	U	11	Slipped										NON cohesvie soil
11	20.50	20.95	0.45	DP	11	8	16	20	36							— do —
11	22.00	22.45	0.45	U	11	Slipped										— do —
11	23.50	23.95	0.45	DP	11	9	17	26	43							— do —
11	25.00	25.45	0.45	U	11	Received										— do —
11	26.50	26.95	0.45	DP	11	10	14	20	34							— do —
11	28.00	28.45	0.45	U	11	Received										— do —

Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 28: FIELD BORELOG CHARTS (P54)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date:	28.12.2021

Project Name:	GTL for HORC Viaduct Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 3119351.461	E: 701326.868		Location/ Chainage:	29330.6870
Method of Drilling:	Percussion	Drilling Equipment	Powermech	Bore No.:	P54
Casing Lowered (M):	20.00	Bentonite Used:	NC	Standard Sampler:	Yes	Barrel Type:	N/A
Ground Elevation:	R.L- 191.242	Date: From 12/10/23 to 14/10/23				Water Table (M):	1.20 M

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
13/10/23	29.50	29.95	0.45	DP	SV	12	16	22	38							Non cohesive soil with gravel
"	31.00	31.45	0.45	U	"	Slipped			-							— do —
"	32.50	32.95	0.45	DP	"	14	18	26	44							— do —
"	34.00	34.45	0.45	U	"	Slipped			-							— do —
"	35.50	35.95	0.45	DP	"	16	19	28	47							— do —
14/10/23	37.00	37.45	0.45	U	"	Slipped			-							— do —
"	38.50	38.95	0.45	DP	"	18	23	32	55							— do —
"	40.00	40.45	0.45	DP	"	17	24	36	60							— do —

Supervisor

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

E - in - C

APPENDIX-K
CHART 29: FIELD BORELOG CHART (P55)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW FOR HORC Viaduct-B/W Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 3119370.719	E: 701308.964		Location/ Chainage:	92356.8870
Method of Drilling:	Percussion	Drilling Equipment	Autotrip Powerwinch	Bore No.:	P.55
Casing Lowered (M):	2.00	Bentonite Used:	No	Standard Sampler :	Yes	Barrel Type :	NA
Ground Elevation:	R.L-191.309	Date: From 3/11/23 to 6/11/23		Water Table (M):	1.40

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
3/11/23	0.00	0.50	0.50	DS	Sx	Collected-										Non Cohesive Soil
"	1.00	1.45	0.45	U	"	Received										do
"	2.00	2.45	0.45	DP	"	2	3	5	8							do
"	3.00	3.45	0.45	DP	"	2	3	3	6							do
4/11/23	4.00	4.45	0.45	U	"	Received										Non Cohesive Soil
"	5.00	5.45	0.45	DP	"	3	5	6	11							do
"	6.00	6.45	0.45	DP	"	3	5	8	13							do
"	7.00	7.45	0.45	U	"	slipped										do
"	8.00	8.45	0.45	DP	"	5	6	9	15							Non Cohesive soil
"	9.00	9.45	0.45	DP	"	4	6	8	14							do with gravel
"	10.00	10.45	0.45	U	"	Received-										Cohesive soil with gravel
"	11.00	11.45	0.45	DP	"	5	7	9	16							do
"	12.00	12.45	0.45	DP	"	6	8	11	19							do
"	13.00	13.45	0.45	U	"	Received-										Non Cohesive soil
"	14.50	14.95	0.45	DP	"	8	12	17	29							do
"	16.00	16.45	0.45	U	"	Received-										Non Cohesive Soil
"	17.50	17.95	0.45	DP	"	5	13	19	32							do with gravel
"	19.00	19.45	0.45	U	"	Received										do
"	20.50	20.95	0.45	DP	"	11	17	22	39							do
"	22.00	22.45	0.45	U	"	Received-										Non Cohesive soil
"	23.50	23.95	0.45	DP	"	12	18	25	43							Cohesive soil with
5/11/23	25.00	25.45	0.45	U	"	Received										do gravel
"	26.50	26.95	0.45	DP	"	18	22	32	54							do
"	28.00	28.45	0.45	DP	"	16	18	35	53							do

Supervisor [signature]

Techpro Engineers Pvt. Ltd. Haryana

S.E. Civil
E - In - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N = 100), Sampler means SPT sampler

APPENDIX-K
CHART 30: FIELD BORELOG CHART (P55)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW FOR HORC Viaduct B/W Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 3119370.719	E: 701308.964		Location/ Chainage:	22356.8870
Method of Drilling:	Percussion	Drilling Equipment	Auto trip Powerwinch	Bore No.:	P.55
Casing Lowered (M):	22.00	Bentonite Used: NO	Standard Sampler : Yes	Barrel Type :	NA
Ground Elevation:	R.L-191.309	Date: From 3/11/23 to 6/11/23		Water Table (M):	1.40

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
5/11/23	29.50	29.95	0.45	DP	SX	14	24	32	56							Cohesive soil with gravel
"	31.00	31.45	0.45	DP	"	16	25	32	57							do
"	32.50	32.95	0.45	DP	"	18	22	35	57							do
"	34.00	34.45	0.45	U/DP	"	21	28	36	64							do
"	35.50	35.95	0.45	DP	"	20	31	38	69							do
6/11/23	37.00	37.45	0.45	U/DP	"	25	32	36	68							Non Cohesive soil with gravel
"	38.50	38.95	0.45	DP	"	20	31	38	69							do
"	40.00	40.45	0.45	DP	"	22	36	42	78							do

Supervisor [signature]

Techpro Engineers Pvt. Ltd. Jaipur

[signature] S.E. Civil

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 31: FIELD BORELOG CHART (P56)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTG for HORC Viaduct Blw Sohana Dhulawat station			Project Code:	1901
Coordinate:	N: 3119390.395	E: 7801291.429		Location/ Chainage:	22383.0870
Method of Drilling:	Percussion	Drilling Equipment	manual Rope pulley	Bore No.:	P.56
Casing Lowered (M):	18.00 Bentonite Used: NO	Standard Sampler :	Yes	Barrel Type :	NA
Ground Elevation:	R.L-191.384	Date: From 3/11/23 to 5/11/23		Water Table (M):	1.40

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
3/11/23	0.00	0.50	0.50	DS	9"	Collected										Non Cohesive soil
	1.00	1.45	0.45	U	"	Received										- do -
	2.00	2.45	0.45	DP	"	2	2	2	4							- do -
	3.00	3.45	0.45	DP	"	2	3	5	8							- do -
	4.00	4.45	0.45	U	"	Received										- do -
	5.00	5.45	0.45	DP	"	3	5	4	9							- do -
	6.00	6.45	0.45	DP	"	2	4	4	8							- do -
	7.00	7.45	0.45	U	"	Received										- do -
	8.00	8.45	0.45	DP	"	3	5	7	12							Cohesive Soil with
	9.00	9.45	0.45	DP	"	4	6	8	14							- do - gravel
	10.00	10.45	0.45	U	"	Received										- do -
	11.00	11.45	0.45	DP	"	3	5	7	12							Non Cohesive soil
	12.00	12.45	0.45	DP	"	4	6	8	14							- do -
	13.00	13.45	0.45	U	"	Received										- do -
	14.50	14.95	0.45	DP	"	9	17	24	41							- do -
	16.00	16.45	0.45	U	"	Received										- do -
	17.50	17.95	0.45	DP	"	8	15	22	37							- do -
	19.00	19.45	0.45	U	"	Received										- do -
	20.50	20.95	0.45	DP	"	12	17	25	42							- do -
	22.00	22.45	0.45	U	"	Received										- do -
4/11/23	23.50	23.95	0.45	DP	"	15	21	27	48							- do -
	25.00	25.45	0.45	U	"	Slipped										- do -
	26.50	26.95	0.45	DP	"	12	22	42	64							Non Cohesive Soil
	28.00	28.45	0.45	DP	"	11	21	32	53							With gravel

Techpro Engineers Pvt. Ltd. Rampur

Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration [illegible] 100), Sampler means SPT sampler

APPENDIX-K
CHART 32: FIELD BORELOG CHART (P56)

TECHPRO ENGINEERS PVT. LTD.

BORE/ DRILL LOG

Doc No:	GT/ 003
Date of Issue:	01.04.2018
Rev. No.:	R03
Rev. Date.:	28.12.2021

Project Name: GTW HORC Viaduct B/W Sohana Dhulwat Station — Project Code: 1901

Coordinate: N: 3119390.395 E: 7001291.429 — Location/ Chainage: 22385.0870

Method of Drilling: Percussion — Drilling Equipment: manual Powerwinch — Bore No.: P.56

Casing Lowered (M): 18.00 — Bentonite Used: NO — Standard Sampler: Yes — Barrel Type: NA

Ground Elevation: R.L-191.384 — Date: From 3/11/23 to 5/11/23 — Water Table (M): 1.40

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
4/11/23	29.50	29.95	0.45	DP	Sx	8	19	21	40							Non Cohesive Soil
"	31.00	31.45	0.45	U	"	Slipped										with gravel
"	32.50	32.95	0.45	DP	"	18	27	32	59							Cohesive soil
"	34.00	34.45	0.45	DP	"	17	26	31	57							do
"	35.50	35.95	0.45	DP	"	16	30	35	65							do
5/11/23	37.00	37.45	0.45	DP	"	18	25	32	57							do
"	38.50	38.95	0.45	DP	"	19	32	35	67							do
"	40.00	40.45	0.45	DP	"	17	23	32	55							do

Supervisor Lalderwadav

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test NO. 100), Sampler means SPT sampler

Techpro Engineers Pvt. Ltd. Jaipur

Er-in-c

APPENDIX-K
CHART 33: FIELD BORELOG CHART (P57)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name: Geotech. for HORC Viaduct B/w Sohana Dhulawat Station				Project Code:	1901
Coordinate:	N: 3119410.368	E: 701274.37	Location/ Chainage:	22409.2870	
Method of Drilling:	Percusston	Drilling Equipment:	Auto'm Power winch	Bore No.:	P-57
Casing Lowered (M):	20.m Bentonite Used: No	Standard Sampler:	Yes	Barrel Type:	N/A
Ground Elevation:	R.L-191.353	Date: From 31/10/2023 to 02/11/2023		Water Table (M):	1.20.m

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
31/10/23	00	0.50	0.50	D	SX	Collected				—	—	—	—	—	—	Non cohesive soil
11	1.00	1.45	0.45	U	—	Received				—	—	—	—	—	—	Non cohesive soil with gravel
11	2.00	2.45	0.45	DP	—	1	1	2	3	—	—	—	—	—	—	—do—
11	3.00	3.45	0.45	DP	—	1	2	2	4	—	—	—	—	—	—	Non cohesive soil
11	4.00	4.45	0.45	U	—	Slipped				—	—	—	—	—	—	—do— DS collected
11	5.00	5.45	0.45	DP	—	2	3	6	9	—	—	—	—	—	—	Non cohesive soil
11	6.00	6.45	0.45	DP	—	3	5	7	12	—	—	—	—	—	—	—do—
11	7.00	7.45	0.45	U	—	Slipped				—	—	—	—	—	—	—do— DS collected
11	8.00	8.45	0.45	DP	—	5	7	10	17	—	—	—	—	—	—	Non cohesive soil
11	9.00	9.45	0.45	DP	—	5	8	12	20	—	—	—	—	—	—	cohesive soil with gravel
11	10.00	10.45	0.45	U	—	Received				—	—	—	—	—	—	—do—
11	11.00	11.45	0.45	DP	—	7	9	10	19	—	—	—	—	—	—	Cohesive soil
11	12.00	12.45	0.45	DP	—	5	9	12	21	—	—	—	—	—	—	—do—
11	13.00	13.45	0.45	U	—	Received				—	—	—	—	—	—	—do—
11	14.50	14.95	0.45	DP	—	8	13	18	31	—	—	—	—	—	—	—do—
11	16.00	16.45	0.45	U	—	Received				—	—	—	—	—	—	—do—
11	17.50	17.95	0.45	DP	—	9	15	21	36	—	—	—	—	—	—	—do—
11	19.00	19.45	0.45	U	—	Received				—	—	—	—	—	—	—do—
11	20.50	20.95	0.45	DP	—	7	16	21	37	—	—	—	—	—	—	cohesive soil with gravel
11	22.50	22.95	0.45	U	—	Received				—	—	—	—	—	—	—do—
11	23.50	23.95	0.45	DP	—	10	19	23	42	—	—	—	—	—	—	—do—
01/11/23	25.45	25.45	0.45	U	—	Slipped				—	—	—	—	—	—	Non cohesive soil
11	26.50	26.95	0.45	DP	—	14	28	30	58	—	—	—	—	—	—	Non cohesive soil
11	28.00	28.45	0.45	DP	—	13	27	33	60	—	—	—	—	—	—	Cohesive Soil

Supervisor

S.E. (Civil) E-in-C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 34: FIELD BORELOG CHART (P57)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	G.T.W. for HORC Viaduct B/w Sohana Dhulawat station			Project Code:	1901
Coordinate:	N: 3119910.368	E: 701274.37		Location/ Chainage:	22409.287
Method of Drilling:	Percussion	Drilling Equipment:	Auto trip Rig	Bore No.:	P. 57
Casing Lowered (M):	20.m Bentonite Used: No	Standard Sampler:	Yes	Barrel Type:	N/A
Ground Elevation:	R.L-191.353	Date: From 31/10/2023 to 2/11/2023		Water Table (M):	1.20 m

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
31/10/23	29.50	29.95	0.45	DP	SX	16	27	32	61	—	—	—	—	—	—	cohesive soil
11	31.00	31.45	0.45	DP	—	14	26	30	56	—	—	—	—	—	—	— do —
11	32.50	32.95	0.45	DP	—	15	27	31	58	—	—	—	—	—	—	— do —
11	34.00	34.95	0.45	U	—	Slipped				—	—	—	—	—	—	Non cohesive soil
11	35.50	35.95	0.45	DP	—	15	25	27	52	—	—	—	—	—	—	— do —
11	37.00	37.45	0.45	U	—	Slipped				—	—	—	—	—	—	— do —
1/11/23	38.50	38.95	0.45	DP	—	13	24	25	49	—	—	—	—	—	—	— do —
11	40.00	40.45	0.45	DP	—	16	23	27	50	—	—	—	—	—	—	Non cohesive soil

Supervisor

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

E-in-C

APPENDIX-K
CHART 35: FIELD BORELOG CHART (P58)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev No.:	R03
		Rev Date.:	28.12.2021

Project Name:	C.T.W. for HORC Viaduct B/w Sohana paulawat station					Project Code:	1901
Coordinate:	N: 3119430.729	E: 7012577.706			Location/ Chainage:	22435.0870	
Method of Drilling:	Percussion		Drilling Equipment:	Hydraulic Power Unit		Bore No.:	P-58
Casing Lowered (M):	20.m	Bentonite Used: No	Standard Sampler:	Yes		Barrel Type:	N/A
Ground Elevation:	R.L-191.433	Date: From 2/11/2023 to 5/11/2023				Water Table (M):	1.40 m

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
2/11/23	0.00	0.50	0.50	D	SX	Collected				-	-	-	-	-	-	Non cohesive Soil
"	1.00	1.45	0.45	DP	-	1	1	1	2	-	-	-	-	-	-	— do —
"	2.00	2.45	0.45	U	-	Received				-	-	-	-	-	-	cohesive Soil with Gravel
"	3.00	3.45	0.45	DP	-	1	2	2	4	-	-	-	-	-	-	Non cohesive Soil
"	4.00	4.45	0.45	DP	-	3	4	6	10	-	-	-	-	-	-	— do —
"	5.00	5.45	0.45	U	-	Received				-	-	-	-	-	-	— do —
"	6.00	6.45	0.45	DP	-	5	8	9	17	-	-	-	-	-	-	— do —
"	7.00	7.45	0.45	DP	-	6	9	11	20	-	-	-	-	-	-	— do —
3/11/23	8.00	8.45	0.45	U	-	Received				-	-	-	-	-	-	Non cohesive soil
"	9.00	9.45	0.45	DP	-	4	7	8	15	-	-	-	-	-	-	— do —
"	10.00	10.45	0.45	DP	-	5	7	10	17	-	-	-	-	-	-	— do —
"	11.00	11.45	0.45	U	-	Received				-	-	-	-	-	-	Non cohesive soil with Gravel
"	12.50	12.95	0.45	DP	-	6	8	11	19	-	-	-	-	-	-	cohesive Soil with Gravel
"	14.00	14.45	0.45	U	-	Received				-	-	-	-	-	-	— do —
"	15.50	15.95	0.45	DP	-	8	10	12	22	-	-	-	-	-	-	cohesive Soil
"	12.00	13.95	0.45	U	-	Received				-	-	-	-	-	-	Non cohesive Soil with Gravel
"	18.50	18.95	0.45	DP	-	9	14	18	32	-	-	-	-	-	-	— do —
"	20.00	20.45	0.45	U	-	Received				-	-	-	-	-	-	cohesive soil
"	21.50	21.95	0.45	DP	-	12	27	30	57	-	-	-	-	-	-	cohesive Soil with Gravel
"	23.00	23.45	0.45	DP	-	15	29	31	60	-	-	-	-	-	-	— do —
"	24.50	24.95	0.45	DP	-	11	21	26	47	-	-	-	-	-	-	cohesive soil
"	26.00	26.45	0.45	U	-	Received				-	-	-	-	-	-	— do —
4/11/23	27.50	27.95	0.45	DP	-	17	23	35	62	-	-	-	-	-	-	— do —
"	29.00	29.45	0.45	DP	-	13	20	23	43	-	-	-	-	-	-	cohesive soil with Gravel

Techpro Engineers Pvt. Ltd.

Supervisor

E - In - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 36: FIELD BORELOG CHART (P58)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	C/T.W. for HORC Viaduct B/w Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 3119430.229	E: 701257.706		Location/ Chainage:	22435.4870
Method of Drilling:	Percussion	Drilling Equipment:	Auto Trip Power Winch	Bore No.:	P-58
Casing Lowered (M):	20.m Bentonite Used: No	Standard Sampler:	Yes	Barrel Type:	N/A
Ground Elevation:	R.L-191.933	Date: From 2/11/2023 to 5/11/2023		Water Table (M):	1.40.m

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
4/11/23	30.5	30.69	0.19	DP	SX	19	80	R		—	—	—	—	—	—	Noncohesive soil
11	32.70	32.95	0.25	DP	—	43	100	R		—	—	—	—	—	—	Non Cohesive soil with gravel
11	33.50	33.95	0.45	DP	—	30	36	38	74	—	—	—	—	—	—	— do —
11	35.00	35.45	0.45	DP	—	27	30	32	62	—	—	—	—	—	—	— do —
11	36.50	36.95	0.45	DP	—	28	29	36	65	—	—	—	—	—	—	— do —
5/11/23	38.00	38.45	0.45	DP	—	29	33	38	71	—	—	—	—	—	—	— do —
11	40.00	40.45	0.45	DP	—	30	38	40	78	—	—	—	—	—	—	Noh cohesive soil with gravel

Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 37: FIELD BORELOG CHART (P59)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	G.T.W. for HORC for Viaduct B/w Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 3119459.473	E: 701241.448		Location/ Chainage:	22461.6870
Method of Drilling:	Percussion	Drilling Equipment:	Autowipt Powerwinch	Bore No.:	P-59
Casing Lowered (M):	21.m	Bentonite Used:	NC	Standard Sampler:	YES
Barrel Type:	N/A				
Ground Elevation:	R.L- 191.466	Date: From 3/11/2023 to 5/11/2023		Water Table (M):	1.50 m

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
3/11/23	00	05	0.50	D	SX	Collected				–	–	–	–	–	–	Non cohesive soil
"	1.00	1.45	0.45	U	–	Received				–	–	–	–	–	–	– do –
"	2.00	2.45	0.45	DP	–	1	2	2	4	–	–	–	–	–	–	cohesive soil
"	3.00	3.45	0.45	DP	–	1	2	3	5	–	–	–	–	–	–	Non cohesive soil
"	4.00	4.45	0.45	U	–	Silpped				–	–	–	–	–	–	– do – DS collected
"	5.00	5.45	0.45	DP	–	3	3	4	7	–	–	–	–	–	–	cohesive soil
"	6.00	6.45	0.45	DP	–	4	5	5	10	–	–	–	–	–	–	– do –
"	7.00	7.45	0.45	U	–	Received				–	–	–	–	–	–	Non cohesive soil
"	8.00	8.45	0.45	DP	–	6	7	9	16	–	–	–	–	–	–	– do –
"	9.00	9.45	0.45	DP	–	5	8	10	18	–	–	–	–	–	–	– do –
"	10.00	10.45	0.45	U	–	Received				–	–	–	–	–	–	cohesive soil with gravel
"	11.00	11.45	0.45	DP	–	3	6	9	15	–	–	–	–	–	–	– do –
"	12.00	12.45	0.45	DP	–	5	8	12	20	–	–	–	–	–	–	– do –
"	13.00	13.45	0.45	U	–	Received				–	–	–	–	–	–	– do –
"	14.50	14.95	0.45	DP	–	5	9	13	22	–	–	–	–	–	–	– do –
"	16.00	16.45	0.45	U	–	Received				–	–	–	–	–	–	– do –
"	17.50	17.95	0.45	DP	–	7	12	15	27	–	–	–	–	–	–	– do –
"	19.00	19.45	0.45	U	–	Received				–	–	–	–	–	–	Non cohesive soil
"	20.50	20.95	0.45	DP	–	9	15	18	33	–	–	–	–	–	–	– do –
"	22.00	22.45	0.45	U	–	Silpped				–	–	–	–	–	–	– do – DS collected
4/11/23	23.50	23.95	0.45	DP	–	17	26	38	64	–	–	–	–	–	–	cohesive soil with gravel
"	25.00	25.45	0.45	DP	–	14	23	32	55	–	–	–	–	–	–	– do –
"	26.50	26.95	0.45	DP	–	16	28	31	59	–	–	–	–	–	–	– do –
"	28.00	28.45	0.45	DP	–	18	27	33	60	–	–	–	–	–	–	cohesive soil

Supervisor

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

E - in - C

APPENDIX-K
CHART 38: FIELD BORELOG CHART (P59)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW for for HORC Viaduct B/w Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 3119459.473	E: 701241.448		Location/ Chainage:	22461.6840
Method of Drilling:	Percussion	Drilling Equipment:	Autotript Powerwinch	Bore No.:	P-59
Casing Lowered (M):	21.m	Bentonite Used: NO	Standard Sampler: YES	Barrel Type:	N/A
Ground Elevation:	R.L-191.466	Date: From 3/11/2023 to 5/11/2023		Water Table (M):	150.m

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
11	29.50	29.95	0.45	DP	SX	14	18	29	47	—	—	—	—	—	—	cohesive soil with gravel
11	31.00	31.45	0.45	U	—	Received				—	—	—	—	—	—	Non cohesive soil
11	32.50	32.95	0.45	DP	—	12	20	30	50	—	—	—	—	—	—	cohesive soil
11	34.00	34.45	0.45	U	—	Received				—	—	—	—	—	—	Non cohesive soil
11	35.50	35.95	0.45	DP	—	15	25	32	57	—	—	—	—	—	—	— do —
11	37.00	37.45	0.45	DP	—	17	26	33	59	—	—	—	—	—	—	— do —
5/11/23	38.50	38.95	0.45	DP	—	20	25	35	60	—	—	—	—	—	—	— do —
11	40.00	40.45	0.45	DP	—	22	26	38	64	—	—	—	—	—	—	Non cohesive soil

Supervisor

Techpro Engineers Pvt. Ltd. Rampur

S.E-CRW

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 39: FIELD BORELOG CHART (P60)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GT FOR HORC Viaduct Between Sohana Dhulawat Stations			Project Code:	1901
Coordinate:	N: 7119472.497	E: 701225.673		Location/ Chainage:	22487.8870
Method of Drilling:	Percussion		Drilling Equipment:	Rotary with	Bore No.: P-60
Casing Lowered (M):	2.850	Bentonite Used: NA	Standard Sampler:	Yes	Barrel Type: NA
Ground Elevation:	R.L-191.483	Date: From 27/09/23 to 02/10/2023			Water Table (M): 1.65

Day/Date	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
27/9/23	0.00	0.30	0.30	DS	SX	collected										Non cohesive soil
"	1.00	1.45	0.45	DP	"	2	3	3	6							do
"	2.00	2.45	0.45	U	"	Received										do
"	3.00	3.45	0.45	DP	"	3	5	9	14							cohesive soil
28/9/23	4.00	4.45	0.45	DP	SX	3	4	5	9							do
"	5.00	5.45	0.45	U	"	Received										Non cohesive soil
"	6.00	6.45	0.45	DP	"	5	7	8	15							do
"	7.00	7.45	0.45	DP	"	6	8	10	18							do
"	8.00	8.45	0.45	UDS	"	Slipped										DS collect Non cohesive soil
"	9.00	9.45	0.45	DP	"	7	9	15	24							cohesive soil
"	10.00	10.45	0.45	DP	"	6	10	12	22							do
29/9/23	11.00	11.45	0.45	U	SX	Received										cohesive soil
"	12.00	12.45	0.45	DP	"	7	11	15	26							do
"	14.00	14.45	0.45	U	"	Received										do
"	15.50	15.95	0.45	DP	"	7	12	13	25							do
"	17.00	17.45	0.45	U	"	Received										Non cohesive soil
"	18.50	18.95	0.45	DP	"	7	14	19	33							do
"	20.00	20.45	0.45	U	"	Received										cohesive soil
"	21.50	21.95	0.45	DP	"	9	15	20	35							do
"	23.00	23.45	0.45	U	"	Received										Non cohesive soil
"	24.50	24.95	0.45	DP	"	12	17	19	36							do
"	26.00	26.45	0.45	U	"	Received										do
1/10/23	27.50	27.95	0.45	DP	SX	10	15	19	34							cohesive soil
"	29.00	29.45	0.45	U	"	Received										do

Supervisor

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

E - in - C

APPENDIX-K
CHART 40: FIELD BORELOG CHART (P60)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GT For HORC Viaduct Between Sohana & Dhulawat Stations			Project Code:	1901
Coordinate:	N: 7119492.497	E: 761725.673		Location/ Chainage:	22487.8870
Method of Drilling:	Percussion	Drilling Equipment:	Rotary Rig	Bore No.:	P-60
Casing Lowered (M):	28.50	Bentonite Used:	Not	Standard Sampler:	Yes	Barrel Type:	NA
Ground Elevation:	R.L-191.483	Date: From 27/9/23 to 02/10/2023				Water Table (M):	1.65

Day/Date	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
1/10/23	30.50	30.95	0.45	DP	SX	11	17	21	38							cohesive soil-
2 "	32.00	32.45	0.45	U	"	Received										do
"	33.50	33.95	0.45	DP	"	10	22	33	55							Non cohesive soil
"	35.00	35.45	0.45	DP	"	13	28	37	65							Cohesive soil.
"	36.50	36.95	0.45	DP	"	19	35	42	77							Non cohesive soil
"	38.00	38.95	0.45	DP	"	25	39	50	89							cohesive soil.
"	40.00	40.37	0.37	DP	"	22	66	34	100							cohesive soil with Gravels.

Supervisor

E - In - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

End of Report

Report No: 1901-HORC-IV

Report No.: 1901-HORC-IV

Date: Nov 2nd; 2023

GEOTECHNICAL INVESTIGATION REPORT

ULR No.: TC916923000000032P
REVISION-R2

AT THE SITE FOR

HORC VIADUCT BETWEEN SOHANA & DHULAWAT STATIONS OF HARYANA ORBITAL RAIL CORRIDOR (HORC) PROJECT, HARYANA

FROM BOREHOLES P61 TO P80

CLIENT

HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LTD.

Plot No. 143, 5th floor RailTel tower, Sector-44,
Gurugram, Haryana 122003

GENERAL CONSULTANTS

RITES-SMEC JV

Gurugram, Haryana

GEOTECHNICAL CONSULTANTS

TECHPRO ENGINEERS PVT. LTD.

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e-mail: info@techproindia.com

TC-9169

REVISION NOTES

REVISION NO.	DATE	DESCRIPTION
R1	09.12.23	• Vertical and Lateral pile load capacity in Table 1 to 4 of Appendix-H and recommendations revised. • Field bore log charts added in Appendix-K.
R2	14.12.23	• Lithological profile added in Appendix-C

REPORT FORMAT

Report No.	Bore included	Total Number of Bores
1901-HORC-I	A1 to P20	21
1901-HORC-II	P21 to P40	20
1901-HORC-III	P41 to P60	20
1901-HORC-IV	P61 to P80	20
1901-HORC-V	P81 to P100	20
1901-HORC-VI	P101 to P113	13
1901-HORC-VII	P114A to P133A	20
1901-HORC-VIII	P134A to A2A	16
1901-HORC-IX	P114B to P133B	20
1901-HORC-X	P134B to A2B	16

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This certificate remains valid for the Scope of Accreditation as specified in the annexure subject to continued satisfactory compliance to the above standard & the relevant requirements of NABL.
(To see the scope of accreditation of this laboratory, you may also visit NABL website www.nabl-india.org)

Name of Legal Identity : Techpro Engineers Private Limited

Signed for and on behalf of NABL

N. Venkateswaran
Chief Executive Officer

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Nov 2nd; 2023

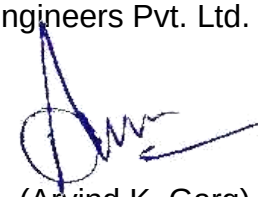
ACKNOWLEDGEMENTS

We are pleased to submit the part-4 of the report of Geotechnical investigation, conducted for the boreholes P61 to P80 for the design of foundations for HORC Viaduct between Sohana & Dhulawat stations of Haryana Orbital Rail Corridor (HORC) project in the state of Haryana, India.

We hereby, convey our sincere thanks to Mr. Neeraj Bhandari (CPM/South) and Mr. Raju Solanki (DGM/C/South), HRIDCL for trust and support during the investigation. We also acknowledge our thanks to Mr. Uma Maheshwara Rao B, DGM/C/West, HRIDCL for awarding the said work to us. We are also grateful Mr. Ravindra Dutta Upadhyay (Geotech Expert), Mr. PS Gautam & Mr. Jitender Parashar, Site Engineer from the RITES- SMEC JV and Mohd. Ishak (Executive/Civil) from HRIDCL, for their help rendered during and prior to the investigation work.

We are also thankful to our staff members for conducting field and laboratory test, preparing sketches, and typing the report.

for Techpro Engineers Pvt. Ltd.



(Arvind K. Garg)
B.Tech. (Civil), M.Tech.
Principal Consultant &
Managing Director

1. INTRODUCTION:

Haryana Rail Infrastructure Development Corporation Ltd. (HRIDC) and Ministry of Railways, Govt. of India has come together to form a new company namely Haryana Orbital Rail Corporation Limited (HORCL), to design and construction of new BG line from Palwal to Sonipat named Haryana Orbital Rail Corridor (HORC), in the state of Haryana, India. In this connection, a Geotechnical investigation has been planned for the design of foundations of Viaduct between Sohana & Dhulawat stations of Haryana Orbital Rail Corridor (HORC) Project in the state of Haryana. The work of conducting the detailed Geotechnical Investigation has been awarded to us by HRIDC, through work order No. HRIDC/HORC/GTI/211/2023-2024/Vol-0 dated 02-09-2023, which includes investigation in field, laboratory testing of disturbed and undisturbed samples, collected from the field, and submission of the geotechnical **investigation** test report.

A geotechnical investigation was carried out, with the locations, planned by the client. Purpose of the investigation is to determine the nature and properties of soil and rock strata across the bore holes and representing them through log sections showing the levels, nature, and properties of various strata up to a sufficient depth below the founding level, proneness of site to artesian conditions, seismic disturbance and other engineering properties of soil and rock strata.

This part -4 of the report includes the detailed methodology of investigation, collection of samples, field and laboratory test result including their interpretation/ analysis, recommendations on the properties of soils and rock required for design of foundation and suggesting suitable type and depth of foundation with allowable bearing capacity for safe and strong foundations for the Bore Hole numbers P61 to P80.

2. SCOPE OF WORK:

For the design of foundation of viaduct, it is required to determine the allowable bearing capacity together with necessary engineering characteristics of underlying soil & rock strata. In general, the geotechnical investigation has been planned as per IS:1892-2021 and further extended to IS: 1904, IS:2911 (part-1/Sec 2) & IRC 78:2014 for planning the laboratory testing and computing the allowable bearing capacity, hence the scope of work is as follows:

2.1. Mobilisation of all tools & plants along with accessories, materials, labours etc. at site of work for drilling and testing work, including setting up boring and shifting to different bore holes point etc.

2.2. Exploratory drilling of 150 mm diameter bore holes through soil deposits and 75 mm in rock within the proposed alignment upto the required depth.

2.3. Collection of disturbed soil samples at an interval of 3.00 meter in all the bore holes.

2.4. Collection of undisturbed soil samples at every 3.00 m interval or at change of stratum from all the boreholes.

2.5. To conduct Standard Penetration Test (SPT) at an interval of 3.00 m or noticeable change of stratum in soil deposits in all bore holes.

2.6. Collection of rock core samples and preserving them in core boxes.

2.7. To collect ground water sample on completion of bore holes.

2.8. To record the ground water table in all the bore holes.

2.9. Transporting all the disturbed, undisturbed soil and rock core samples collected during the field investigation to our NABL accredited Geotech Engineering laboratory at Kanpur.

2.10. To conduct the laboratory tests on all the soil and rock core samples collected during field investigation for determination of their engineering characteristics.

2.11. To compile of field and laboratory test results, working out the allowable bearing capacity and preparing the report including detailed recommendations and necessary precautions.

3. GEOLOGICAL INFORMATION OF THE REGION:

3.1. Geography:

The project location is in the bordering area of Gurugram and Nuh (recent old name-Mewat), districts in the Indian state of Haryana. The stretch of the alignment of the proposed corridor starts from southmost part of Gurugram in the town of Sohna and ends at Dhulawat, which is a village lying at the north of Nuh district.

Haryana is a state located in the northern part of India. Gurugram is among one

of the districts in Haryana which is also the part of National Capital Region (30km south of New Delhi). It lies at an elevation of 217 m above msl. Sohna is a small town located 25km in the south of Gurugram. Sohna is well known for its hot water springs and famous Shiva temple. Sohna is located in between 28°15' N latitude and 77°40' E longitude at the elevation of 212.14m above msl. Mewat district is located at 28 °12′ N latitude, 77 °3′ E longitude, at the south of Gurugram at an elevation of 199 m above msl. The location is bordered by Rewari district on west and Faridabad & Palwal district on the east.

3.2. Geology:

The Gurugram district is having of almost flat topography, however, in the north-eastern part small isolated hillocks of Precambrian rocks are exposed. Small hill ranges which are part of the Aravali and Mangar Bani ranges exists in the district. The major part of district is underlain by Quaternary alluvium consisting of sand, clay and silt. The alluvial plain is formed by the Sahibi river which is a tributary of River Yamuna. Soils of the Gurgaon district is classified as tropical and brown soils, existing in the north western extreme, northern and north eastern parts of the district and water logged and salt affected soils in the southern parts of the district. The soils are medium textured loamy sand is the average texture in Gurgaon and Sohna blocks.

3.3. Rainfall and Climate:

The area has hot semi-arid type of climate characterising extreme dryness of the air except in the monsoon season. Intense hot summer and cold winters. The total annual rainfall in the region is about 596 mm, of which 75 to 80% is because of the south-west monsoon.

3.4. Seismicity:

The site under consideration exists in the district of Gurugram and Mewat which lies in the Seismic Zone IV (high damage risk zone), as per the current seismic zonation map of India (IS 1893-2016): RA 2021 and have a zone factor of 0.24 for design basis earthquake. The region is surrounded by many in-homogeneities in the form of faults and ridges like Sohna Fault, Moradabad Fault, Delhi-Moradabad Fault, Delhi-Haridwar ridge, junction of Aravalli and Alluvium near Delhi. The Sohna fault line lies between the Delhi ridge and Sohna town and falls between the Arjangarh and

Manesar outcrops. All the developed area in Gurugram comes within 200 km of the fault line. The Sohna fault line is located at the junction between the hard rock terrain of the Aravalli hills and the sandy formation of the Yamuna River and is currently inactive from several years and is capable of a disastrous earthquake.

The project location has been marked in Fig.1 Seismic zone map of India.

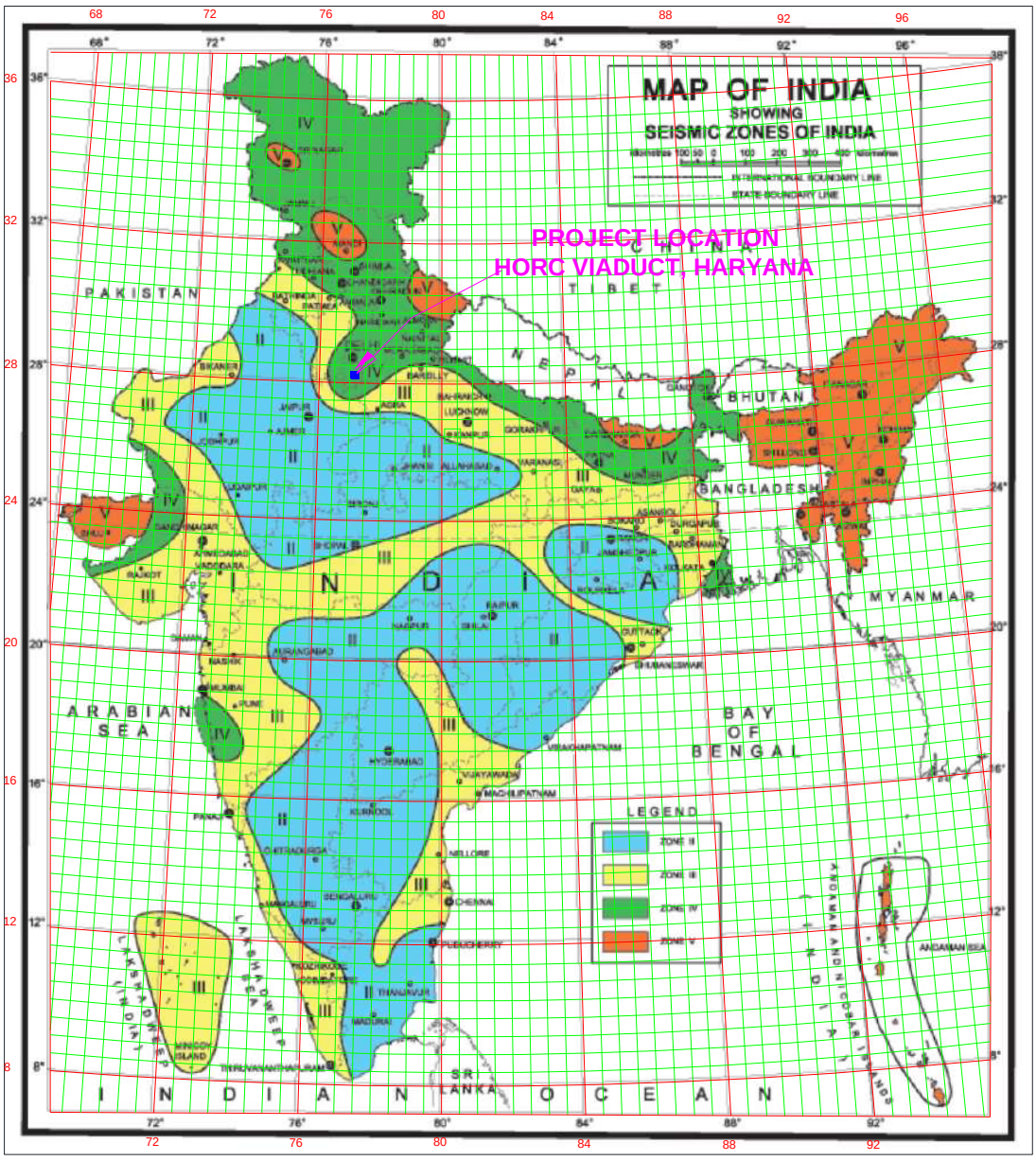


Fig.1: Seismic Zone Map of India

4. FIELD INVESTIGATION:

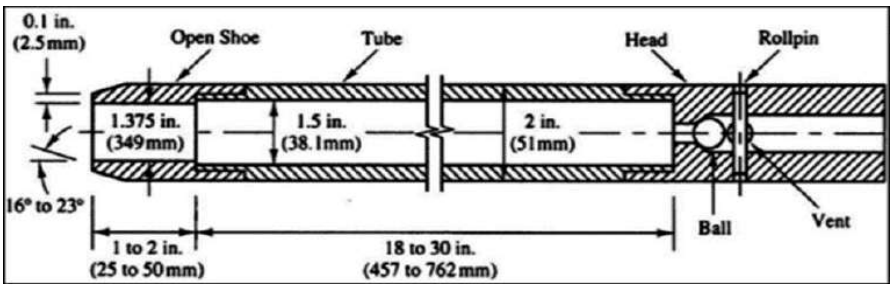
The field investigation work at this site was carried out from Sep 27th; 2023 to Oct 09th; 2023, Oct 21st; 2023 to Oct 24th; 2023 & Nov 03rd; 2023 to Nov 07th;

2023. The following investigation work was carried out:

4.1. **Twenty number** of **boreholes** (marked as P61 to P80) of diameter 150 mm in soil were made within the proposed alignment for conducting Standard Penetration Test and collection of disturbed and undisturbed samples. The boreholes were progressed using power operated winch and hydraulic rig machine under **percussion** and **rotary** method of drilling respectively. Casing was used to keep the borehole stable, and Bentonite was also used as drilling mud to help prevent wall collapse of boreholes at deeper depth. The records of achieved depth of bore holes have been given in Para No. 6, the details of drilled bores along with depth of casing used have been reported in Appendix B. Locations of boreholes have been reported in "TEST LOCATION PLAN" in Appendix A.

4.2. **Standard Penetration Tests** were conducted at 1.00 to 2.00 metre interval upto the depth of 12.00 meter and 3.00 metre interval, beyond 12.00 metre depth, as per the procedure in IS: 2131-1981-(RA: 2021) in all the bore holes. The **standard SPT sampler** (without liner and with no space for liner) and **auto-trip and rope-pulley driven hammer** of standard weight of 63.50 kg have been used to perform the test.

For conducting the test, the bottom of the borehole was properly cleaned, and split spoon sampler was properly seated in position in the borehole. The split spoon sampler resting on the bottom of borehole was allowed to sink under its own weight; then the sampler was allowed to penetrate 15 cm with the blows of the hammer 63.50 kg weight falling free through 75cm, thereafter the split spoon sampler was further driven by another 15 cm. For the 3rd and final drive, the sampler was further allowed to penetrate 15 cm. The number of blows required to get each 15 cm of penetration, was recorded. The first 15 cm of drive is seating drive.



Structure of SPT Sampler

The total blows of penetration for the second and third 15 cm of penetration is

termed the penetration resistance N. The N' values are indicative of the compactness/ relative density of cohesion less soils and consistency of cohesive soils.

In case the blows count of SPT in soil (including the number of blows of seating) exceeds 100, the corresponding penetration was recorded and this particular test at that depth stopped. If the total penetration is more than the seating penetration of 15 cm, then breakup of blow counts for 15 cm seating penetration and for remaining portion of penetration is also given.

SPT 'N' values are correlated with non-cohesive stratum as per BS: 5930 (1999) – for sandy strata and with consistency of cohesive stratum.

Correlation For Clay/Plastic Silt		**Correlation For Sand/Non-Plastic Silt**	
Consistency of clays	**Penetration Value**	**Relative Density of sand**	**Penetration Value**
Very Soft	0 to 2 Blows	Very loose	0 to 4 Blows
Soft	3 to 4 Blows	Loose	5 to 10 Blows
Medium Stiff	5 to 8 Blows	Medium	11 to 30 Blows
Stiff	9 to 16 Blows	Dense	31 to 50 Blows
Very Stiff	17 to 32 Blows	Very Dense	Above 50
Hard	Above 32		

In this method, the sampler acts as a probe and the driving energy is supplied by the fall of the drop weight. The values of 'N' depend on the compactness or relative density of the material. In hard formations, the testing is discontinued if 'N' value is found to be more than 100. It is termed as 'Refusal'. Refusal is also recorded when SPT blow count records 50 or more for any of the single drive of 15 cm.

'N' value depends upon degree of saturation and over burden pressure of the formation. Silty fine sand and fine sand below the water table develop pore water pressure depending on the in-situ void ratio which in turn affects the effective stress. This change in effective stress influences the 'N' value considerably.

Depth of overburden affects the SPT values in none to low cohesive soils and hence need correction. The SPT value after the overburden correction, N' is as follows:

$$N' = 0.77x \log (2000/q) \times N$$

Where, q= Overburden Pressure (kN/m^2) and N = observed SPT value

N' is corrected further for dilatancy in case of saturated fine sands and silts for the values of N' greater than 15.

Modified value after dilatancy correction N" = 15+ (N'-15)/2

Soil samples obtained from split spoon sampler were collected in the polythene bags of suitable size. These samples were property sealed, labelled, and carefully transported to the laboratory for testing. The results have been reported in Table 1 to 20 of Appendix B under the title "SUMMARY OF TEST RESULTS".

4.3. **Disturbed soil samples** were collected at 0.50 metre, then at 1.00 to 2.00 metre interval upto the depth of 12.00 meter and 3.00 metre interval, beyond 12.00 metre depth and at significant change of stratum. Soil from cutting edge of SPT samplers and retained in split spoon, used for Standard Penetration Tests was taken as disturbed samples. These samples were placed without delay in adequately sealed polythene bags. Where the collection of disturbed soil samples could not be collected from SPT samples, Shelby tubes were driven and retained soil samples were obtained. The laboratory tests were conducted on the collected soil samples and reported in Table 1 to 20 of Appendix-B under the title "SUMMARY OF TEST RESULTS".

4.4. **Undisturbed soil samples** were collected in accordance with IS: 2132-1986-(RA: 2021) at an interval of 3.00 metre or at change of stratum, starting from the depth of 1.00 or 2.00 m, by using 100 mm dia. and 450 mm long MS tubes provided with sampler head with ball check arrangement. However, the some of the samples could not be extracted due to the partial penetration or slippage during the evacuation.

Moreover, collection of Undisturbed samples in very hard cohesive soils/ dense granular soils/gravels/ cobbles/ pebbles/ boulders, refusal strata is practically not possible and such collected samples will not truly represent the undisturbed conditions.

Immediately after taking undisturbed sample in the tube, the adopter head was removed along with the disturbed material. The visible ends of the samples shall then be trimmed off any wet disturbed soil. The ends will then be coated alternately with four layers of molten wax. More molten wax will then be added to give a total thickness

of not less than 25 mm. The laboratory test results have been reported in Table 1 to 20 of Appendix-B.

4.5. The **ground water table** in the borehole was allowed to stabilize and measured after 8, 16, 24 and 48 hours after completion of the bore hole. It was ensured that last two reading were identical. The records of ground water table have been given in Para No.6.

4.6. **Ground water samples** were collected from borehole as per IS: 6935-1973-(RA:2019) for chemical analysis to determine aggressiveness in relation to attack on concrete / reinforcement including determination of pH value.

5. LABORATORY TESTS:

The following laboratory tests were conducted to determine the engineering characteristics of sub-soils:

5.1. **Field moisture contents** were determined by oven drying method as per IS: 2720 (part II)-1973-(RA: 2020). The results have been reported in Table 1 to 20: "SUMMARY OF TEST RESULTS" of Appendix B.

5.2. **Bulk density** of soil strata was obtained using Shelby tubes in accordance with IS 2720 (part XXIX)-1975-(RA: 2020). The results have been reported in Table 1 to 20: "SUMMARY OF TEST RESULTS" of Appendix B.

5.3. **Mechanical sieve analysis** test was performed in accordance with IS: 2720 (Part IV) – 1985-(RA: 2020), for the purpose of identification by grain size analysis, on coarse part of the soil samples and the results have been reported in Table 1 to 20: "SUMMARY OF TEST RESULTS" of Appendix B.

5.4. **Particle size analysis** test by **Hydrometer method** were performed in accordance with IS: 2720 (Part IV) -1985-(RA: 2020) on the part of soil samples obtained after the sieve analysis. The results have been reported in Table 1 to 20: "SUMMARY OF TEST RESULTS" of Appendix B.

5.5. **Atterbergs' limits tests** were performed in accordance with IS: 2720 (part V)-1985-(RA: 2020) and results have been reported in Table 1 to 20: "SUMMARY OF TEST RESULTS" of Appendix B.

5.6. **Specific gravity tests** were performed in accordance with IS 2720 (part III-sec. 1) -1980-(RA: 2021) and the results have been reported in Table 1 to 20: “SUMMARY OF TEST RESULTS” of Appendix B.

5.7. **Consolidation tests** were performed on cohesive soil samples in accordance with IS: 2720 (part XV)-1965-(RA: 2021). The results have been reported in Table 1 to 20: “SUMMARY OF TEST RESULTS” of Appendix B.

5.8. **Direct shear tests** were performed as per IS: 2720 (part XIII)-1986-(RA: 2021), on the undisturbed soil samples obtained during the field investigation. The results and the density of samples have been reported in Table 1 to 20: “SUMMARY OF TEST RESULTS” of Appendix B.

5.9. **Tri-axial Compression Test** under Unconsolidated Un-drained (UU) condition as per IS: 2720 (Part-XI)-1993-(RA: 2021) were performed on the selected undisturbed soil samples, obtained during the field investigation. The results have been reported in Table 1 to 20: “SUMMARY OF TEST RESULTS” of Appendix B.

5.10. **Unconfined Compressive strength tests** were performed in accordance with IS 2720 (Part-X) -1991-(RA:2020) on selected undisturbed soil samples and the results have been reported in Table 23 of Appendix B

5.11. **Shrinkage Limit tests** were performed in accordance with IS 2720 (part-VI) -1972-(RA: 2021) and the results have been reported in Table 1 to 20: “SUMMARY OF TEST RESULTS” of Appendix B.

5.12. **Free Swell Index** were performed in accordance with IS 2720 (part-XL) -1977-(RA: 2021) and the results have been reported in Table 1 to 20: “SUMMARY OF TEST RESULTS” of Appendix B.

5.13. **Chemical analysis on soil samples** was performed in accordance with IS: 2720 (Part-XXVI)-1987-(RA: 2021) for pH value, IS: 2720 (Part-XXVII)-1977-(RA: 2020) for Sulphate & BS:1377-3-2018 for chlorides and results have been reported in Table 21 “CHEMICAL TEST ON SOIL SAMPLES” of Appendix B.

5.14. **Chemical analysis on Ground Water sample** was performed in accordance with IS: 3025 (Part-XI)-2022 for pH value, IS: 3025 (Part-XXIV: Sec-1)-2022 for Sulphate & IS: 3025-(Part-XXXII)-1988-(RA: 2019) for chlorides and results have been reported in

Table 22 “CHEMICAL TEST ON GROUND WATER SAMPLES” of Appendix B.

6. GROUND WATER TABLE:

The water table at this site was encountered during the drilling operation up to the depth of investigation.

Borehole No.	Chainage	Global Co-ordinates (UTM format)		Reduced level (m)	Depth of Borehole (m)	Water table (m)
		Easting	Northing			
P61	22514.0870	701210.312	3119493.892	191.635	40.00	1.52
P62	22540.2870	701195.421	3119515.583	191.610	40.00	1.50
P63	22566.4870	701180.991	3119537.582	191.645	40.00	1.50
P64	22592.6870	701167.064	3119559.818	191.728	40.00	1.60
P65	22618.8870	701153.570	3119582.405	191.825	40.00	1.60
P66	22645.0870	701140.518	3119605.336	191.818	40.00	1.50
P67	22671.2870	701127.988	3119628.472	191.985	40.00	1.80
P68	22697.4870	701115.947	3119651.866	191.917	40.00	1.60
P69	22723.6870	701104.421	3119675.469	191.999	40.00	1.70
P70	22749.8870	701093.375	3119699.349	192.161	40.00	1.60
P71	22776.0870	701082.834	3119723.456	192.287	40.00	1.70
P72	22802.2870	701072.794	3119747.802	192.289	40.00	1.60
P73	22828.4870	701063.285	3119772.310	192.387	40.00	1.85
P74	22854.6870	701054.272	3119797.076	192.472	40.00	2.45
P75	22880.8870	701045.810	3119821.943	192.565	40.00	1.80
P76	22907.0870	701037.860	3119847.024	192.717	40.00	2.55
P77	22933.2870	701030.427	3119872.310	192.676	40.00	2.62
P78	22959.4870	701023.541	3119897.704	192.731	40.00	2.60
P79	22985.6870	701017.190	3119923.237	192.898	40.00	2.20
P80	23011.8870	701011.378	3119948.898	193.042	40.00	2.35

7. DESCRIPTION OF STRATA:

The classification of soil stratum has been done with the help of soil characteristics obtained in laboratory tests as per IS 1498-1970-(RA:2021). The classification of rock masses has been done based on RMR as per IS: 4464-1985, IS:

13365-1. The detailed nature of the strata has been reported in Table 1 to 20: "SUMMARY OF TEST RESULTS" of Appendix-B and represented through Lithological plots in Appendix-C.

The strata exhibited in all the bore hole, is predominantly comprising of inorganic silty clays of low plasticity and inorganic silts of non to low plastic category. Silty sands were encountered at variable depth and thickness in all of the boreholes. Inorganic silts and clays of intermediate plasticity were also found at varying depths and thickness in some of the boreholes. Some lenses of silty sands with clay binders were found as exception in some of the borehole such as P72, P75, etc.

8. SAFE BEARING CAPACITY COMPUTATIONS:

For the construction of viaducts, deep foundation **(Bored Cast-In-Situ RCC piles)** have been considered for computation of load bearing capacity of the underlying soil strata. The computation of load bearing capacity of bored cast-in-situ RCC piles have been done as per IS 2911 (part-1, section-2)-2010-(RA: 2020) with due consideration of effects of liquefaction.

8.1. Design Parameters:

Factor of safety in Compression	=	2.50
Factor of safety in Tension	=	3.00
Depth of critical water table	=	0.00 m
Diameter of pile	=	1.00 & 1.20 m
Cut off length	=	2.50 m
Type of pile head consider	=	Fixed

8.2. Computation of friction along pile stem:

$$Q_{uf} = \sum K_i . P_{di} . \tan\delta_i . A_{si}$$

where,

Q_{uf} = Ultimate shaft friction (kN/m^2)

K_i = Coefficient of earth pressure at mid-depth of ith layer

P_{di} = Effective overburden pressure at mid-depth of ith layer (kN/m^2)

A_{si} = Surface area of pile stem in i^{th} layer (m^2)

δ_i = Angle of wall friction between pile and soil of ith layer (= ϕ) (degree)

ϕ_i = Angle of internal friction of soil in i^{th} layer (degree)

$\sum$ = Sum of all layers up to i^{th} layer

8.3. Computation of Cohesion along the stem of pile:

$$Q_{uc} = \sum \alpha_i . c_i . A_{si}$$

Where,

c_i = Cohesion in i^{th} layer

A_{si} = Surface area of pile stem in i^{th} layer (m^2)

α_i = Adhesion factor for i^{th} layer of soil depending of consistency of soils

$\sum$ = Sum of cohesion of all layers considered

8.4. Computation of end bearing resistance:

$$Q_{ub} = A_p (c.Nc + q.Nq + 0.5.\ \gamma.B.N\gamma)$$

Where,

A_p = Area of the pile toe (m^2)

c = cohesion of soils at pile toe (kN/m^2)

γ = Effective Unit weight of soils at pile toe (kN/m^3)

B = Diameter of pile (m)

q = Effective overburden pressure at pile toe (kN/m^2)

N_c = Bearing Capacity Factor (Recommended equal to 9)

Nq, $N\gamma$ = Bearing Capacity Factor

8.5. Lateral load capacity of piles in soils:

$$Q_u = 12.E.I.\delta/(L_1+L_f)^3$$

where,

Q_u = Ultimate lateral load capacity of pile (kN)

δ = Permissible deflection (m) = 5 mm

E = Young Modulus of pile material (kN/m^2)

I = Moment of Inertia of the pile cross section (m^4)

L_1 = Cantilever Length of pile (m)

L_f = Length of fixity (m)

Detailed calculations of pile load carrying capacity in compression & uplift in soil have been reported in **Table-1 to 2** of **Appendix-H.**

Pile lateral Load capacity has been given in **Table-3 to 4** of **Appendix-H**.

9. LIQUEFACTION ANALYSIS:

Liquefaction is the sudden loss of shear strength of the loose fine sands due to earthquake-induced vibration under saturated conditions. Liquefaction generally takes place in loose fine sands (fines < 10 %, D_{60}= 0.20 mm to 1.0 mm and C_u between 2 to 5) with N value less than 15. In case of soil strata having N>15, liquefaction of soil will not take place normally.

The present site falls in **seismic zone – IV.** Considering the history of past earthquakes and available seismic data, an earthquake of **magnitude 7.0** having peak ground acceleration **a_{max}= 0.24 g** is considered in the present analysis.

Preliminary assessment of liquefaction potential of foundation strata is made by simplified approach proposed by IS: 1893 (part-1)-2016-(RA: 2021) from the data obtained in Standard Penetration Test.

In this method, cyclic shear stress likely to be induced in the foundation strata by Design Basis Earthquake is first evaluated. Next threshold cyclic shear stress, which is good enough to cause liquefaction, is determined from SPT data and the empirical relations. Finally, comparison of these two stresses is used in the estimation of liquefaction susceptibility of the foundation strata.

Cyclic Stress Ratio (CSR):

The equivalent average of shear stress likely to be induced in the foundation material due to an earthquake is calculated by using the equations.

Cyclic Resistance Ratio (CRR):

It expresses capacity of soil to resist liquefaction. CRR is determined using correlation between corrected blow count $(N_1)_{60}$ and CRR for

earthquake of magnitude 7.5. $(N_1)_{60}$ is the SPT blow count corrected to an effective overburden pressure of 100 kPa and to hammer energy efficiency of 60 %.

Following variable have been adopted in calculation of N_{60} (SPT value for 60% efficiency)

Energy correction to SPT values:

C_{60} = 1.00 (Energy correction factor)

Design Earthquake Base:

Earthquake zone	= IV
Magnitude of earthquake	= 7
Seismic Zone factor	= 0.24

Status of Liquefaction:

The value of CSR and CRR are computed at different depth and then the ratio of CRR to CSR to get the factor of safety towards the susceptibility of the stratum towards liquefaction potential.

If factor of safety:

< 1.00 : Stratum is to be considered as liquefiable

> 1.20 : Non-Liquefiable

The detailed calculations of liquefaction have been reported in **Table-5** of **Appendix-H.**

10. RECOMMENDATIONS:

Keeping in mind, the field test results, laboratory test results and IS codes of practice the following recommendations are hereby made:

10.1. **Bored Cast-In-Situ RCC Piles** of diameter 1000 and 1200 mm have been adopted for SBC computations of foundation for Viaduct.

10.2. **Cut off length** of piles have been considered as 2.50 m from the existing ground level for the purpose of computation of SBC.

10.3. **Pile length** recommended in the table below, shall be measured **after the cut-off depth.**

10.4. **Allowable load carrying capacity** of pile corresponding to the length and diameter of

pile shall be read from the tables below:

10.4.1. For Pile diameter = 1000 mm

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
P61	25.00	1750	1400	35
	27.50	2250	1650	
	30.00	2350	1850	
	32.50	2650	2050	
	35.00	2850	2300	
P62	25.00	2100	1650	190
	27.50	2300	1850	
	30.00	3000	2050	
	32.50	2950	2200	
	35.00	2950	2400	
P63	25.00	2350	1850	135
	27.50	2600	2050	
	30.00	2850	2250	
	32.50	3100	2450	
	35.00	3250	2650	
P64	25.00	2100	1700	145
	27.50	2900	1850	
	30.00	2550	2100	
	32.50	2800	2250	
	35.00	3000	2450	
P65	25.00	2050	1650	80
	27.50	2400	1850	
	30.00	2650	2100	
	32.50	2900	2300	
	35.00	3100	2500	
P66	25.00	1950	1500	45
	27.50	2150	1700	
	30.00	2400	1900	
	32.50	2650	2100	

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
	35.00	2900	2300	
P67	25.00	2200	1750	65
	27.50	2650	1950	
	30.00	3100	2100	
	32.50	2950	2350	
	35.00	3750	2550	
P68	25.00	2300	1750	145
	27.50	2500	2000	
	30.00	2750	2200	
	32.50	3400	2400	
	35.00	3250	2600	
P69	25.00	2300	1800	130
	27.50	2500	2000	
	30.00	2750	2200	
	32.50	3050	2450	
	35.00	3250	2650	
P70	25.00	1900	1500	30
	27.50	2150	1700	
	30.00	2500	1900	
	32.50	3150	2150	
	35.00	3050	2350	
P71	25.00	2000	1500	35
	27.50	2250	1750	
	30.00	2500	1950	
	32.50	2800	2200	
	35.00	3050	2450	
P72	25.00	1800	1400	25
	27.50	2200	1550	
	30.00	2300	1750	
	32.50	2500	1950	
	35.00	2750	2200	
P73	25.00	1600	1300	30

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
	27.50	2250	1450	
	30.00	2500	1650	
	32.50	2250	1850	
	35.00	2550	2000	
P74	25.00	1550	1150	10
	27.50	1850	1400	
	30.00	2050	1600	
	32.50	2100	1700	
	35.00	2350	1900	
P75	25.00	2150	1700	130
	27.50	2900	1900	
	30.00	3150	2100	
	32.50	3000	2350	
	35.00	3800	2600	
P76	25.00	2550	2000	130
	27.50	2800	2200	
	30.00	3100	2350	
	32.50	3250	2550	
	35.00	3550	2750	
P77	25.00	2500	1750	175
	27.50	2650	1950	
	30.00	2750	2150	
	32.50	3100	2350	
	35.00	3150	2500	
P78	25.00	2450	1700	65
	27.50	3200	1950	
	30.00	3400	2200	
	32.50	3500	2450	
	35.00	3650	2700	
P79	25.00	2250	1700	120
	27.50	2900	1950	
	30.00	3050	2100	

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
	32.50	3300	2300	
	35.00	3100	2500	
P80	25.00	2100	1600	85
	27.50	2500	1800	
	30.00	2500	2000	
	32.50	2900	2200	
	35.00	3200	2450	

** Indicates Grade of Concrete*

10.4.2. Pile diameter = 1200 mm

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
P61	25.00	2300	1800	60
	27.50	3100	2100	
	30.00	3100	2350	
	32.50	3450	2650	
	35.00	3700	2950	
P62	25.00	2700	2050	265
	27.50	3000	2350	
	30.00	4200	2600	
	32.50	4000	2900	
	35.00	3950	3150	
P63	25.00	3000	2300	190
	27.50	3350	2600	
	30.00	3650	2850	
	32.50	4000	3150	
	35.00	4150	3350	
P64	25.00	2800	2200	210
	27.50	4250	2450	
	30.00	3400	2750	
	32.50	3750	3000	
	35.00	4000	3250	

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
P65	25.00	2750	2150	120
	27.50	3150	2450	
	30.00	3500	2700	
	32.50	3800	3000	
	35.00	4100	3300	
P66	25.00	2650	2000	70
	27.50	2950	2250	
	30.00	3250	2550	
	32.50	3600	2800	
	35.00	3900	3050	
P67	25.00	2850	2250	95
	27.50	3550	2500	
	30.00	4200	2700	
	32.50	3900	3000	
	35.00	5100	3350	
P68	25.00	2950	2200	195
	27.50	3200	2500	
	30.00	3500	2800	
	32.50	4700	3050	
	35.00	4200	3350	
P69	25.00	3000	2300	175
	27.50	3300	2550	
	30.00	3650	2850	
	32.50	4000	3150	
	35.00	4250	3400	
P70	25.00	2500	1900	50
	27.50	2800	2150	
	30.00	3300	2450	
	32.50	4400	2800	
	35.00	4150	3050	
P71	25.00	2700	2000	60
	27.50	3000	2300	

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
	30.00	3300	2600	
	32.50	3700	2900	
	35.00	4000	3200	
P72	25.00	2400	1800	40
	27.50	3150	2100	
	30.00	3300	2350	
	32.50	3500	2650	
	35.00	3800	2950	
P73	25.00	2250	1750	50
	27.50	3500	2000	
	30.00	3850	2250	
	32.50	3200	2500	
	35.00	3550	2750	
P74	25.00	2050	1450	20
	27.50	2450	1800	
	30.00	2650	2050	
	32.50	2750	2200	
	35.00	3050	2400	
P75	25.00	2850	2250	180
	27.50	4150	2500	
	30.00	4450	2800	
	32.50	4050	3150	
	35.00	5400	3450	
P76	25.00	3350	2550	160
	27.50	3600	2850	
	30.00	4150	3050	
	32.50	4350	3300	
	35.00	4750	3550	
P77	25.00	3550	2350	235
	27.50	3650	2600	
	30.00	3750	2850	
	32.50	4300	3150	

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
	35.00	4300	3400	
P78	25.00	3300	2150	95
	27.50	4400	2550	
	30.00	4700	2850	
	32.50	4750	3200	
	35.00	4950	3500	
P79	25.00	2950	2200	170
	27.50	4050	2500	
	30.00	4250	2750	
	32.50	4650	3050	
	35.00	4200	3350	
P80	25.00	2850	2100	130
	27.50	3500	2400	
	30.00	3400	2700	
	32.50	4000	2950	
	35.00	4400	3250	

***** *Indicates Grade of Concrete*

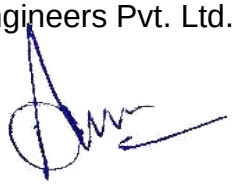
10.5. Liquefaction Potential: All the bore holes have been analysed for Liquefaction potential as per IS: 1893 (part-1)-2016-(RA: 2021) with Seismic Zone IV, earthquake intensity of 7.0 on Richter scale and critical ground water table at existing ground level. Out of which several boreholes show the potential at various depths mentioned in the table below:

Bore No.	Liquefiable depth zone (meter)
P61	Top 1.00 & 8.00 to 9.00
P62	Top 1.00
P63	Top 1.00
P64	Top 1.00 & 2.00 to 3.00
P65	Top 1.00, 2.00 to 3.00 & 4.00 to 5.00
P66	3.00 to 4.00 & 7.00 to 8.00
P67	Top 1.00 & 3.00 to 6.00

Bore No.	Liquefiable depth zone (meter)
P68	Top 1.00 & 2.00 to 3.00
P69	Top 1.00 & 2.00 to 3.00
P70	Top 1.00 & 4.00 to 9.00
P71	Top 2.00 & 5.00 to 9.00
P72	2.00 to 4.00 & 9.00 to 10.00
P73	Top 1.00 & 9.00 to 10.00
P74	Top 1.00, 2.00 to 3.00 & 14.00 to 15.50
P75	Top 1.00 & 2.00 to 3.00
P76	Top 2.00
P77	Top 2.00
P78	Top 3.00 & 4.00 to 6.00
P79	Top 1.00
P80	3.00 to 5.00

10.6. Type of cement to be used: Chemical content in the soil samples is slightly higher but still within the permissible limits. So, Ordinary Portland Cement or Portland Pozzolana Cement may be used for all civil constructions.

for Techpro Engineers Pvt. Ltd.



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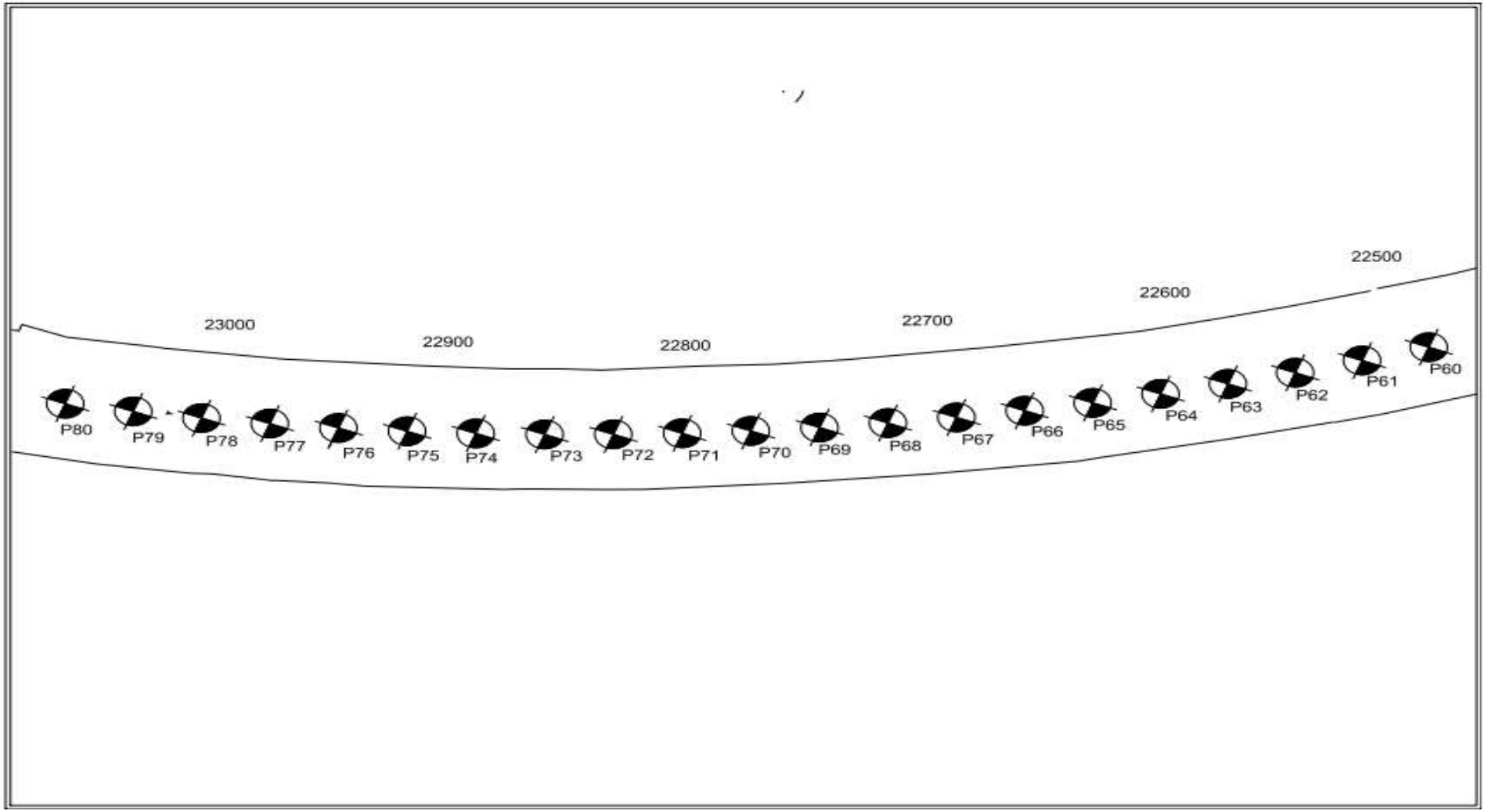
APPENDIX-A
TEST LOCATION PLAN



APPENDIX "B"
TABLE 1: SUMMARY OF TEST RESULTS

Bore No: P61	**Ground Elevation: RL 191.635 m**	**Method of drilling: Percussion**	**Depth of Water-table: 1.52 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 27/09/2023**	**SPT Sampler: Standard**
Location / Chainage: 22514.087	**Casing Lowered: 28.00 m**	**Ending Date: 30/09/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	0.50	D	1	-	-	-	-	-	SM	1	1	1	55	42	0	13.06	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	1.00	U	2	-	-	-	-	-	CI	0	1	0	32	46	21	19.79	2.12	1.77	37.5	17.5	20.0	2.68	UU	66.0	6.4	-	0.514	-	25	15	-	Inorganic clays of Intermediate plasticity										
	2.00	D	3	3	3	2	5	5.00	-	-	-	-	-	-	-	20.66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	3.00	D	4	3	3	3	6	6.00	CL	3	2	3	16	65	11	19.14	-	-	32.0	21.0	11.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	4.00	U	5	-	-	-	-	-	CL	7	2	2	11	66	12	19.11	2.12	1.78	33.5	23.5	10.0	2.68	-	-	-	-	0.506	-	-	-	-										
	5.00	D	6	5	7	8	15	15.86	SM	0	0	1	62	37	0	21.72	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	6.00	D	7	6	8	13	21	18.70	-	-	-	-	-	-	-	24.39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	7.00	U	8	-	-	-	-	-	SM	0	1	1	82	16	0	22.02	1.85	1.52	Non-Plastic			2.64	DST	3.0	26.9	-	0.737	-	-	-	-										
	8.00	D	9	5	6	9	15	15.03	-	-	-	-	-	-	-	23.57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	9.00	D	10	9	11	14	25	19.70	CL	1	1	1	7	82	8	18.69	-	-	27.0	20.0	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	10.00	U	11	-	-	-	-	-	CL-ML	0	0	1	5	88	6	21.57	2.01	1.65	25.5	19.0	6.5	2.64	DST	13.0	24.7	-	0.600	-	-	-	-	Inorganic Silty Clays of low plasticity										
	11.00	D	12	7	11	13	24	18.53	-	-	-	-	-	-	-	19.92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	12.00	D	13	8	13	15	28	20.01	-	-	-	-	-	-	-	20.82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	13.00	U	14	-	-	-	-	-	CL	7	4	3	7	71	8	16.16	2.04	1.76	27.5	20.0	7.5	2.66	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	14.50	D	15	9	15	17	32	32.00	-	-	-	-	-	-	-	18.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	16.00	U	16	-	-	-	-	-	CL	0	1	2	28	55	14	16.85	2.10	1.80	28.0	17.5	10.5	2.67	UU	52.0	11.2	0.140	0.483	-	9	17	-										
	17.50	D	17	7	11	14	25	17.18	CL	0	0	1	18	74	7	20.88	-	-	26.0	19.0	7.0	-	-	-	-	-	-	-	-	-	-										

APPENDIX "B"
TABLE 1: SUMMARY OF TEST RESULTS

Bore No: P61	**Ground Elevation: RL 191.635 m**	**Method of drilling: Percussion**	**Depth of Water-table: 1.52 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 27/09/2023**	**SPT Sampler: Standard**
Location / Chainage: 22514.087	**Casing Lowered: 28.00 m**	**Ending Date: 30/09/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	19.00	U	18	-	-	-	-	-	CL-ML	5	3	3	15	66	8	18.89	2.11	1.78	27.0	21.5	5.5	2.66	UU	43.0	8.1	-	0.496	-	-	19	-	Inorganic Silty Clays of low plasticity										
	20.50	D	19	11	20	32	52	26.27	-	-	-	-	-	-	-	19.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	22.00	U	20	-	-	-	-	-	CL	3	1	1	25	58	12	21.07	2.07	1.71	27.0	19.0	8.0	2.67	DST	18.0	23.7	-	0.561	-	-	16	-	Inorganic clays of low plasticity										
	23.50	D	21	12	23	35	58	58.00	-	-	-	-	-	-	-	15.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	25.00	U	22	-	-	-	-	-	ML	1	0	1	9	89	0	24.46	2.02	1.62	Non-Plastic			2.64	-	-	-	-	0.630	-	-	-	-	Inorganic Silts of low plasticity										
	26.50	D	23	12	23	27	50	23.55	-	-	-	-	-	-	-	23.14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	28.00	U	24	-	-	-	-	-	MI	3	1	2	1	71	22	27.46	2.10	1.65	48.5	28.5	20.0	2.70	UU	72.0	8.5	-	0.636	-	-	24	-	Inorganic Silts of Intermediate plasticity										
	29.50	D	25	18	32	36	68	28.11	ML	0	0	1	45	54	0	18.85	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity										
	31.00	D	26	17	35	39	74	29.31	CL	4	2	3	18	66	7	12.61	-	-	27.0	20.0	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	32.50	D	27	18	28	33	61	25.10	-	-	-	-	-	-	-	16.90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	34.00	D	28	17	35	50	85	31.50	CL	2	1	2	22	67	6	17.75	-	-	26.0	19.0	7.0	-	-	-	-	-	-	-	-	-	-										
	35.50	D	29	12	27	37	64	25.18	-	-	-	-	-	-	-	20.95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	37.00	D	30	15	31	52	83	83.00	CL	0	1	1	14	73	11	18.90	-	-	31.0	20.0	11.0	-	-	-	-	-	-	-	-	-	-										
	38.50	D	31	17	34	55	89	89.00	CL	1	2	4	8	75	10	16.23	-	-	32.0	21.0	11.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	40.00	D	32	25	65	36	101	100.00	-	-	-	-	-	-	-	16.28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 2: SUMMARY OF TEST RESULTS

Bore No: P62	**Ground Elevation: RL 191.61 m**	**Method of drilling: Percussion**	**Depth of Water-table: 1.50 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 28/09/2023**	**SPT Sampler: Standard**
Location / Chainage: 22540.287	**Casing Lowered: 21.00 m**	**Ending Date: 01/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen												
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL												
	0.50	D	1	-	-	-	-	-	SM	0	0	1	60	39	0	5.75	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Silty Sands			
	1.00	D	2	1	2	3	5	5.00	CI	2	1	1	10	69	17	22.85	-	-	38.0	21.0	17.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Inorganic clays of Intermediate plasticity			
	2.00	U	3	-	-	-	-	-	CL	0	0	2	33	47	18	20.15	1.98	1.65	33.0	18.5	14.5	2.67	UU	46.0	7.5	0.182	0.618	-	17	15	-	Inorganic clays of low plasticity											
	3.00	D	4	4	6	10	16	17.68	CL	1	1	2	26	63	7	14.90	-	-	26.0	19.0	7.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	4.00	D	5	7	11	14	25	22.58	SM	0	0	1	68	31	0	22.15	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Silty Sands			
	5.00	U	6	-	-	-	-	-	SM	0	0	0	71	29	0	21.34	1.90	1.57	Non-Plastic			2.63	DST	5.0	29.9	-	0.679	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	6.00	D	7	9	14	16	30	24.15	-	-	-	-	-	-	-	24.19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	7.00	D	8	8	17	19	36	26.78	-	-	-	-	-	-	-	23.40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	8.00	D	9	-	-	-	-	-	SM	0	0	1	65	34	0	24.69	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	9.00	D	10	5	8	11	19	17.02	ML	5	1	1	8	81	4	20.68	-	-	23.0	19.0	4.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity			
	10.00	D	11	7	10	15	25	19.70	-	-	-	-	-	-	-	19.90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	11.00	U	12	-	-	-	-	-	CL-ML	1	1	1	20	71	6	19.71	1.81	1.51	26.0	20.0	6.0	2.66	DST	11.0	25.2	-	0.762	-	-	-	-	Inorganic Silty Clays of low plasticity											
	12.50	D	13	6	11	17	28	20.36	-	-	-	-	-	-	-	18.28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	14.00	U	14	-	-	-	-	-	CL	2	1	2	25	59	11	27.00	1.94	1.53	26.5	19.0	7.5	2.68	UU	40.0	8.1	-	0.752	-	9	19	-	Inorganic clays of low plasticity											
	15.50	D	15	8	15	18	33	21.56	CL-ML	3	2	3	20	65	7	18.81	-	-	25.0	19.0	6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity			
	17.00	U	16	-	-	-	-	-	CL	5	1	3	30	53	8	15.46	2.10	1.82	26.5	19.0	7.5	2.66	-	-	-	-	0.462	-	9	-	-	Inorganic clays of low plasticity											

APPENDIX "B"
TABLE 2: SUMMARY OF TEST RESULTS

Bore No: P62	**Ground Elevation: RL 191.61 m**	**Method of drilling: Percussion**	**Depth of Water-table: 1.50 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 28/09/2023**	**SPT Sampler: Standard**
Location / Chainage: 22540.287	**Casing Lowered: 21.00 m**	**Ending Date: 01/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																
				SPT Test Result							Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen										
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	18.50	D	17	9	17	19	36	36.00	-	-	-	-	-	-	-	17.60	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	20.00	U	18	-	-	-	-	-	CL	3	1	2	25	62	7	13.93	2.08	1.83	26.0	18.5	7.5	-	-	-	-	-	-	-	-	-	-												
	21.50	D	19	9	18	21	39	39.00	-	-	-	-	-	-	-	17.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	23.00	U	20	-	-	-	-	-	CL	1	0	1	26	60	12	23.51	1.85	1.50	29.5	18.5	11.0	2.67	UU	45.0	9.6	-	0.780	-	12	16	-												
	24.50	D	21	11	29	33	62	62.00	-	-	-	-	-	-	-	16.26	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	26.00	U	22	-	-	-	-	-	ML	1	0	1	26	72	0	23.79	1.92	1.55	Non-Plastic			2.65	DST	14.0	25.7	-	0.710	-	-	-	-	Inorganic Silts of low plasticity										
	27.50	D	23	10	23	27	50	50.00	CL	0	0	1	18	69	12	24.70	-	-	34.0	22.0	12.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	29.00	D	24	-	-	-	-	-	-	-	-	-	-	-	-	20.91	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	30.50	D	25	13	25	31	56	25.23	SM	9	2	4	36	49	0	16.60	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	32.00	D	26	-	-	-	-	-	-	-	-	-	-	-	-	20.43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	33.50	D	27	15	28	34	62	26.25	ML	1	1	6	40	52	0	18.04	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity										
	35.00	D	28	-	-	-	-	-	-	-	-	-	-	-	-	20.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	36.50	D	29	19	32	37	69	27.39	CL-ML	0	0	1	30	65	4	22.37	-	-	24.0	19.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	38.00	D	30	-	-	-	-	-	ML	0	0	1	45	54	0	19.76	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity										
	40.00	D	31	20	29	33	62	62.00	CL	0	4	5	8	75	8	17.47	-	-	30.0	20.0	10.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed samples.

APPENDIX "B"
TABLE 3: SUMMARY OF TEST RESULTS

Bore No: P63	**Ground Elevation: RL 191.645 m**	**Method of drilling: Percussion**	**Depth of Water-table: 1.50 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 02/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 22566.487	**Casing Lowered: 22.00 m**	**Ending Date: 03/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	ML	0	0	2	20	78	0	4.71	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	1.00	U	2	-	-	-	-	-	CI	2	2	1	27	48	20	22.48	1.78	1.45	43.0	21.0	22.0	2.70	-	-	-	-	0.862	-	-	-	-	Inorganic clays of Intermediate plasticity											
	2.00	D	3	1	1	2	3	3.00	-	-	-	-	-	-	-	19.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	3.00	D	4	2	2	4	6	6.00	-	-	-	-	-	-	-	20.26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	4.00	U	5	-	-	-	-	-	CI	1	2	7	26	43	21	19.50	1.82	1.52	39.0	17.5	21.5	2.69	UU	54.0	9.1	0.210	0.770	-	15	14	-												
	5.00	D	6	3	5	7	12	12.00	-	-	-	-	-	-	-	19.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	6.00	D	7	3	7	11	18	17.92	SM	0	1	1	50	48	0	13.67	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	7.00	D	8	-	-	-	-	-	SM	0	0	1	80	19	0	24.21	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	8.00	D	9	5	10	16	26	21.44	SP-ML	4	3	28	54	11	0	19.16	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Poorly Graded Sands with inorganic Silts of low plasticity											
	9.00	D	10	7	12	19	31	23.57	-	-	-	-	-	-	-	16.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	10.00	U	11	-	-	-	-	-	CL-ML	1	2	3	9	79	6	19.87	1.92	1.60	25.0	19.0	6.0	2.66	DST	12.0	25.0	-	0.663	-	-	-	-	Inorganic Silty Clays of low plasticity											
	11.00	D	12	8	15	22	37	25.53	-	-	-	-	-	-	-	18.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	12.00	D	13	7	18	23	41	26.92	-	-	-	-	-	-	-	19.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	13.00	U	14	-	-	-	-	-	CL	1	1	2	18	68	10	14.36	1.91	1.67	28.0	19.0	9.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	14.50	D	15	9	15	17	32	32.00	-	-	-	-	-	-	-	15.96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	16.00	U	16	-	-	-	-	-	CL	1	2	3	24	64	6	16.05	2.04	1.76	26.5	19.5	7.0	2.66	UU	50.0	13.4	-	0.511	-	0	17	-												
	17.50	D	17	8	20	24	44	44.00	CL	1	1	1	14	73	10	16.29	-	-	28.0	19.0	9.0	-	-	-	-	-	-	-	-	-	-												

APPENDIX "B"
TABLE 3: SUMMARY OF TEST RESULTS

Bore No: P63	**Ground Elevation: RL 191.645 m**	**Method of drilling: Percussion**	**Depth of Water-table: 1.50 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 02/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 22566.487	**Casing Lowered: 22.00 m**	**Ending Date: 03/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen												
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	19.00	U	18	-	-	-	-	-	ML	1	2	3	38	56	0	17.90	1.87	1.59	Non-Plastic			-	DST	22.0	25.3	-	-	-	-	-	-	Inorganic Silts of low plasticity										
	20.50	D	19	11	19	30	49	26.45	CL	0	0	1	14	78	7	17.96	-	-	26.0	19.0	7.0	-	-	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity									
	22.00	U	20	-	-	-	-	-	CL	0	1	3	13	70	13	20.00	2.11	1.76	32.0	20.0	12.0	2.67	UU	52.0	9.5	-	0.517	-	7	17	-											
	23.50	D	21	9	17	25	42	42.00	-	-	-	-	-	-	-	15.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	25.00	U	22	-	-	-	-	-	CL	1	0	2	17	70	10	17.02	2.09	1.79	28.0	19.0	9.0	2.67	UU	51.0	10.7	-	0.492	-	-	-	-											
	26.50	D	23	11	20	26	46	46.00	-	-	-	-	-	-	-	16.19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	28.00	U	24	-	-	-	-	-	ML	1	1	1	42	55	0	17.11	1.78	1.52	Non-Plastic			2.64	DST	7.0	27.6	-	0.737	-	-	-	-	Inorganic Silts of low plasticity										
	29.50	D	25	10	21	28	49	49.00	MI	2	1	3	9	70	15	19.48	-	-	43.0	28.5	14.5	-	-	-	-	-	-	-	-	25	-	Inorganic Silts of Intermediate plasticity										
	31.00	D	26	13	22	30	52	52.00	-	-	-	-	-	-	-	31.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	32.50	D	27	15	25	32	57	57.00	-	-	-	-	-	-	-	25.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	34.00	D	28	-	-	-	-	-	CL-ML	1	1	3	32	58	5	19.92	-	-	25.0	19.0	6.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	35.50	D	29	12	28	30	58	24.66	CL-ML	1	1	4	32	56	6	18.26	-	-	26.5	20.5	6.0	-	-	-	-	-	-	-	-	-	-											
	37.00	D	30	-	-	-	-	-	MI	0	0	1	10	81	8	28.88	-	-	37.0	28.0	9.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of Intermediate plasticity										
	38.50	D	31	10	27	33	60	60.00	-	-	-	-	-	-	-	28.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	40.00	D	32	12	28	37	65	65.00	CL	0	1	2	14	74	9	25.32	-	-	31.5	21.0	10.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 4: SUMMARY OF TEST RESULTS

Bore No: P64	**Ground Elevation: RL 191.728 m**	**Method of drilling: Percussion**	**Depth of Water-table: 1.60 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 28/09/2023**	**SPT Sampler: Standard**
Location / Chainage: 22592.687	**Casing Lowered: 22.00 m**	**Ending Date: 30/09/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	ML	0	0	1	44	55	0	11.03	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	1.00	D	2	2	2	2	4	4.00	CL	0	1	2	34	48	15	20.55	-	-	33.0	19.5	13.5	-	-	-	-	-	-	-	8	15	-	Inorganic clays of low plasticity											
	2.00	U	3	-	-	-	-	-	ML	9	7	14	16	54	0	17.12	2.10	1.79	Non-Plastic			2.66	DST	0.0	23.1	-	0.486	-	-	-	-	Inorganic Silts of low plasticity											
	3.00	D	4	6	6	7	13	15.57	ML	0	0	1	43	56	0	19.65	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	4.00	D	5	7	9	11	20	19.23	SM	5	2	2	60	31	0	18.84	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	5.00	D	6	-	-	-	-	-	-	-	-	-	-	-	-	28.49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	6.00	D	7	3	5	8	13	13.99	-	-	-	-	-	-	-	29.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	7.00	D	8	4	6	9	15	15.30	SM	0	1	1	68	30	0	25.03	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	8.00	U	9	-	-	-	-	-	SM	5	7	11	42	35	0	13.76	1.92	1.69	Non-Plastic			2.64	DST	7.0	26.7	-	0.562	-	-	-	-												
	9.00	D	10	9	10	14	24	24.00	CL	2	2	3	9	76	8	17.79	-	-	26.5	19.0	7.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	10.00	D	11	10	14	17	31	31.00	-	-	-	-	-	-	-	19.66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	11.00	U	12	-	-	-	-	-	CL	5	3	4	8	71	9	20.63	1.96	1.62	27.0	19.0	8.0	-	DST	16.0	23.2	-	-	-	-	-	-												
	12.50	D	13	6	12	15	27	27.00	-	-	-	-	-	-	-	19.67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	14.00	U	14	-	-	-	-	-	CL	3	1	2	12	73	9	19.61	1.98	1.66	27.5	20.0	7.5	2.67	UU	41.0	11.1	0.141	0.613	-	8	17	-												
	15.50	D	15	8	14	18	32	32.00	-	-	-	-	-	-	-	18.88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	17.00	U	16	-	-	-	-	-	SM	0	1	1	53	45	0	17.23	1.81	1.54	Non-Plastic			2.65	DST	5.0	26.8	-	0.716	-	-	-	-	Silty Sands											
	18.50	D	17	6	13	16	29	18.80	CL-ML	0	0	1	38	55	6	17.52	-	-	25.0	20.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											

APPENDIX "B"
TABLE 4: SUMMARY OF TEST RESULTS

Bore No: P64	**Ground Elevation: RL 191.728 m**	**Method of drilling: Percussion**	**Depth of Water-table: 1.60 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 28/09/2023**	**SPT Sampler: Standard**
Location / Chainage: 22592.687	**Casing Lowered: 22.00 m**	**Ending Date: 30/09/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	20.00	U	18	-	-	-	-	-	CL	1	1	3	12	73	10	19.20	1.98	1.66	29.0	19.0	10.0	2.67	UU	46.0	11.2	-	0.608	-	9	-	-	Inorganic clays of low plasticity										
	21.50	D	19	9	14	19	33	33.00	-	-	-	-	-	-	-	19.19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	23.00	U	20	-	-	-	-	-	CL	2	1	2	15	71	9	20.27	1.92	1.60	29.0	20.5	8.5	2.66	UU	42.0	12.5	-	0.663	-	-	16	-										
	24.50	D	21	10	24	42	66	66.00	-	-	-	-	-	-	-	19.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	26.00	D	22	-	-	-	-	-	CL-ML	0	0	1	38	57	4	19.75	-	-	24.0	19.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	27.50	D	23	12	26	30	56	25.89	CL-ML	1	1	1	12	78	7	18.30	-	-	26.0	20.0	6.0	-	-	-	-	-	-	-	-	-	-										
	29.00	U	24	-	-	-	-	-	SM	3	2	4	46	45	0	16.91	1.96	1.68	Non-Plastic			2.64	DST	4.0	28.9	-	0.571	-	-	-	-	Silty Sands										
	30.50	D	25	10	26	33	59	25.90	-	-	-	-	-	-	-	16.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	32.00	D	26	-	-	-	-	-	CL-ML	0	0	1	18	76	5	20.36	-	-	24.0	19.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	33.50	D	27	12	28	35	63	63.00	CL	3	0	2	9	76	10	9.69	-	-	28.0	20.0	8.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	35.00	D	28	-	-	-	-	-	-	-	-	-	-	-	-	19.73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	36.50	D	29	10	29	38	67	67.00	-	-	-	-	-	-	-	13.10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	38.00	D	30	-	-	-	-	-	CL	1	1	2	11	76	9	16.11	-	-	28.0	19.0	9.0	-	-	-	-	-	-	-	-	-	-										
	40.00	D	31	14	32	51	83	30.25	CL-ML	0	0	1	20	74	5	19.32	-	-	24.0	19.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 5: SUMMARY OF TEST RESULTS

Bore No: P65	**Ground Elevation: RL 191.825 m**	**Method of drilling: Percussion**	**Depth of Water-table: 1.60 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 01/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 22618.887	**Casing Lowered: 20.00 m**	**Ending Date: 02/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen												
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK																				Classification of SOIL
	0.50	D	1	-	-	-	-	-	ML	0	0	1	40	59	0	11.40	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-											Inorganic Silts of low plasticity
	1.00	U	2	-	-	-	-	-	CL	2	2	2	42	38	14	20.68	2.01	1.67	34.0	19.0	15.0	2.67	-	-	-	-	0.603	-	11	16	-											Inorganic clays of low plasticity
	2.00	D	3	2	2	3	5	6.71	SM	0	1	0	57	42	0	12.71	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-											Silty Sands
	3.00	D	4	2	5	5	10	10.00	CL	0	1	1	44	45	9	20.77	-	-	28.0	19.5	8.5	-	-	-	-	-	-	-	-	-	-											Inorganic clays of low plasticity
	4.00	U	5	-	-	-	-	-	SM	1	2	1	78	18	0	18.61	1.91	1.61	Non-Plastic			2.62	DST	0.0	32.7	-	0.627	-	-	-	-											
	5.00	D	6	3	7	8	15	16.11	-	-	-	-	-	-	-	18.49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	6.00	D	7	4	9	11	20	18.54	-	-	-	-	-	-	-	27.41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											Silty Sands
	7.00	U	8	-	-	-	-	-	SM	4	3	5	68	20	0	10.92	2.00	1.80	Non-Plastic			2.63	DST	0.0	30.5	-	0.461	-	-	-	-											
	8.00	D	9	6	10	15	25	20.30	-	-	-	-	-	-	-	23.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	9.00	D	10	4	7	9	16	15.42	ML	0	0	1	22	72	5	22.01	-	-	24.0	20.0	4.0	-	-	-	-	-	-	-	-	-	-											
	10.00	U	11	-	-	-	-	-	ML	2	2	2	7	81	6	22.59	1.96	1.60	29.5	23.5	6.0	2.66	DST	12.0	25.3	0.138	0.663	-	0	18	-											Inorganic Silts of low plasticity
	11.00	D	12	5	6	10	16	14.93	-	-	-	-	-	-	-	23.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	12.00	D	13	5	6	11	17	15.22	CL	1	1	2	9	80	7	18.81	-	-	29.0	22.0	7.0	-	-	-	-	-	-	-	-	-	-											
	13.00	U	14	-	-	-	-	-	CL	1	2	4	8	76	9	18.07	2.01	1.70	27.0	19.0	8.0	2.67	DST	12.0	25.9	-	0.571	-	-	-	-											
	14.50	D	15	6	12	18	30	20.25	CL	2	1	2	11	78	6	21.11	-	-	26.0	19.0	7.0	-	-	-	-	-	-	-	-	-	-											Inorganic clays of low plasticity
	16.00	D	16	-	-	-	-	-	-	-	-	-	-	-	-	17.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	17.50	D	17	6	10	13	23	16.67	-	-	-	-	-	-	-	18.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											

APPENDIX "B"
TABLE 5: SUMMARY OF TEST RESULTS

Bore No: P65	**Ground Elevation: RL 191.825 m**	**Method of drilling: Percussion**	**Depth of Water-table: 1.60 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 01/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 22618.887	**Casing Lowered: 20.00 m**	**Ending Date: 02/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen												
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK																				Classification of SOIL
	19.00	D	18	-	-	-	-	-	CL	0	2	2	9	76	11	14.28	-	-	28.0	20.0	8.0	-	-	-	-	-	-	-	-	-												
	20.50	D	19	6	11	16	27	27.00	-	-	-	-	-	-	-	22.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-												Inorganic clays of low plasticity
	22.00	U	20	-	-	-	-	-	CL	4	7	7	10	62	10	17.18	1.99	1.70	28.0	19.0	9.0	2.67	UU	47.0	12.5	-	0.571	-	-	-	-												
	23.50	D	21	10	22	30	52	52.00	-	-	-	-	-	-	-	16.90	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	25.00	U	22	-	-	-	-	-	-	-	-	-	-	-	-	20.66	2.10	1.74	-	-	-	2.68	-	-	-	-	0.540	-	-	-												
	26.50	D	23	11	17	24	41	21.06	ML	3	0	0	24	73	0	21.89	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												Inorganic Silts of low plasticity
	28.00	U	24	-	-	-	-	-	CL	0	0	1	27	64	8	16.96	2.08	1.78	27.5	17.0	10.5	2.67	UU	59.0	10.6	-	0.500	-	-	-	-												
	29.50	D	25	6	10	12	22	22.00	-	-	-	-	-	-	-	17.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	31.00	U	26	-	-	-	-	-	CL	5	8	8	25	46	8	16.26	2.10	1.81	26.5	19.5	7.0	2.66	UU	54.0	10.6	-	0.470	-	-	-	-												
	32.50	D	27	10	21	29	50	22.26	-	-	-	-	-	-	-	16.96	-	-	-	-	-	-	-	-	-	-	-	-	-	-												Inorganic clays of low plasticity
	34.00	D	28	-	-	-	-	-	-	-	-	-	-	-	-	17.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	35.50	D	29	13	26	33	59	59.00	CL	1	1	1	18	69	10	12.75	-	-	28.0	19.0	9.0	-	-	-	-	-	-	-	-	-	-												
	37.00	D	30	-	-	-	-	-	-	-	-	-	-	-	-	17.90	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	38.50	D	31	9	16	28	44	19.45	ML	0	1	1	29	63	6	19.78	-	-	24.0	20.0	4.0	-	-	-	-	-	-	-	-	-	-												Inorganic Silts of low plasticity
	40.00	D	32	10	21	35	56	22.40	CL-ML	0	0	1	22	71	6	19.07	-	-	24.5	19.5	5.0	-	-	-	-	-	-	-	-	-	-												Inorganic Silty Clays of low plasticity

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 6: SUMMARY OF TEST RESULTS

Bore No: P66	**Ground Elevation: RL 191.818 m**	**Method of drilling: Percussion**	**Depth of Water-table: 1.50 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 28/09/2023**	**SPT Sampler: Standard**
Location / Chainage: 22645.087	**Casing Lowered: 19.50 m**	**Ending Date: 30/09/2023**	**Hammer type: Rope-pulley**

FIELD TEST RESULT										LABORATORY TEST RESULT																																
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	0.50	D	1	-	-	-	-	-	ML	0	1	1	45	53	0	10.35	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity										
	1.00	U	2	-	-	-	-	-	SM	0	0	1	63	36	0	14.89	1.93	1.68	Non-Plastic			2.64	-	-	-	-	0.571	-	-	-	-	Silty Sands										
	2.00	D	3	1	2	4	6	8.20	ML	2	5	8	33	47	5	17.75	-	-	24.0	20.0	4.0	-	-	-	-	-	-	-	-	18	-	Inorganic Silts of low plasticity										
	3.00	D	4	1	2	2	4	5.14	-	-	-	-	-	-	-	17.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	4.00	U	5	-	-	-	-	-	CL	0	1	2	44	41	12	19.74	2.03	1.70	27.5	18.5	9.0	2.67	UU	34.0	8.1	0.132	0.575	-	0	17	-	Inorganic clays of low plasticity										
	5.00	D	6	8	6	8	14	15.58	SM	1	1	1	76	21	0	24.14	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	6.00	D	7	3	2	6	8	8.83	-	-	-	-	-	-	-	23.58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	7.00	D	8	-	-	-	-	-	SP-ML	1	1	3	86	9	0	19.49	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Poorly Graded Sands with inorganic Silts of low plasticity										
	8.00	D	9	10	18	28	46	31.28	SM	3	5	15	62	15	0	15.81	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	9.00	D	10	3	7	8	15	14.97	CL	7	6	4	9	67	7	18.13	-	-	27.0	20.0	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	10.00	U	11	-	-	-	-	-	ML	3	2	3	12	76	4	23.87	2.03	1.64	24.0	20.0	4.0	2.65	DST	17.0	25.3	-	0.616	-	-	18	-	Inorganic Silts of low plasticity										
	11.00	D	12	8	10	13	23	18.26	-	-	-	-	-	-	-	2.62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	12.00	D	13	7	8	14	22	22.00	CL	2	1	1	6	81	9	20.40	-	-	27.0	19.0	8.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	13.00	U	14	-	-	-	-	-	-	-	-	-	-	-	-	19.28	2.01	1.69	-	-	-	2.67	UU	48.0	7.5	-	0.585	-	-	-	-										
	14.50	D	15	4	6	8	14	14.00	-	-	-	-	-	-	-	20.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	16.00	U	16	-	-	-	-	-	CL	2	1	1	31	57	8	17.30	2.16	1.84	27.0	20.0	7.0	2.66	DST	16.0	25.5	-	0.446	-	-	-	-	Inorganic clays of low plasticity										
	17.50	D	17	11	25	32	57	29.83	-	-	-	-	-	-	-	21.89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										

APPENDIX "B"
TABLE 6: SUMMARY OF TEST RESULTS

Bore No: P66	**Ground Elevation: RL 191.818 m**	**Method of drilling: Percussion**	**Depth of Water-table: 1.50 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 28/09/2023**	**SPT Sampler: Standard**
Location / Chainage: 22645.087	**Casing Lowered: 19.50 m**	**Ending Date: 30/09/2023**	**Hammer type: Rope-pulley**

FIELD TEST RESULT										LABORATORY TEST RESULT																														
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen										
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	19.00	U	18	-	-	-	-	-	CL-ML	2	4	7	35	45	7	18.82	2.14	1.80	25.5	19.5	6.0	2.66	DST	15.0	24.5	-	0.478	-	-	-	-	Inorganic Silty Clays of low plasticity										
	20.50	D	19	18	30	34	64	30.82	-	-	-	-	-	-	-	18.43	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	22.00	D	20	10	27	31	58	27.93	ML	0	2	1	42	55	0	18.74	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity										
	23.50	D	21	15	30	33	63	63.00	CL	1	1	1	12	76	9	20.21	-	-	28.0	19.0	9.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	25.00	U	22	-	-	-	-	-	CL	3	1	2	35	52	7	16.00	2.02	1.74	27.0	20.0	7.0	2.67	UU	39.0	12.1	-	0.534	-	-	-	-											
	26.50	D	23	10	12	40	52	52.00	CL	0	1	1	10	79	9	31.20	-	-	29.0	21.0	8.0	-	-	-	-	-	-	-	-	-	-											
	28.00	D	24	-	-	-	-	-	-	-	-	-	-	-	-	31.66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	29.50	D	25	9	13	36	49	49.00	CL	0	1	2	16	68	13	20.06	-	-	29.0	18.0	11.0	-	-	-	-	-	-	-	-	-	-											
	31.00	U	26	-	-	-	-	-	CL	3	2	4	23	56	12	17.29	1.96	1.67	28.0	19.0	9.0	2.68	UU	49.0	11.2	-	0.605	-	-	-	-											
	32.50	D	27	8	29	30	59	24.79	CL-ML	2	1	2	27	61	7	18.66	-	-	25.5	19.0	6.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	34.00	D	28	-	-	-	-	-	CL-ML	1	2	3	24	63	7	19.16	-	-	26.0	20.0	6.0	-	-	-	-	-	-	-	-	-	-											
	35.50	D	29	14	26	31	57	23.50	CL-ML	3	3	5	31	52	6	17.60	-	-	25.0	19.0	6.0	-	-	-	-	-	-	-	-	-	-											
	37.00	D	30	-	-	-	-	-	-	-	-	-	-	-	-	17.49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	38.50	D	31	17	27	33	60	60.00	CL	2	1	1	18	67	11	18.89	-	-	28.0	19.0	9.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	40.00	D	32	17	33	40	73	73.00	-	-	-	-	-	-	-	19.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"

TABLE 7: SUMMARY OF TEST RESULTS

Bore No: P67	**Ground Elevation: RL 191.985 m**	**Method of drilling: Percussion**	**Depth of Water-table: 1.80 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 30/09/2023**	**SPT Sampler: Standard**
Location / Chainage: 22671.287	**Casing Lowered: 17.00 m**	**Ending Date: 02/10/2023**	**Hammer type: Rope-pulley/ Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	ML	0	0	1	45	54	0	7.82	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	1.00	D	2	2	3	5	8	12.31	CL	0	1	2	34	56	7	18.18	-	-	26.0	19.0	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	2.00	U	3	-	-	-	-	-	CL-ML	3	4	8	29	49	7	17.24	2.01	1.71	25.0	19.0	6.0	2.65	DST	12.0	27.5	-	0.549	-	0	17	-	Inorganic Silty Clays of low plasticity											
	3.00	D	4	1	2	3	5	6.23	ML	1	1	2	27	64	5	16.57	-	-	24.0	20.0	4.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	4.00	D	5	2	3	4	7	8.28	SM	0	0	0	82	18	0	25.08	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	5.00	D	6	-	-	-	-	-	-	-	-	-	-	-	-	24.93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	6.00	D	7	5	9	11	20	18.32	-	-	-	-	-	-	-	26.49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	7.00	D	8	6	10	12	22	18.97	SM	0	0	1	84	15	0	22.85	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	8.00	D	9	-	-	-	-	-	-	-	-	-	-	-	-	26.49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	9.00	D	10	5	6	8	14	14.00	CL	3	1	2	10	78	6	17.83	-	-	26.0	18.5	7.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	10.00	D	11	7	9	12	21	21.00	-	-	-	-	-	-	-	21.51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	11.00	U	12	-	-	-	-	-	CL-ML	0	0	1	24	70	5	22.00	2.00	1.64	25.0	19.0	6.0	2.66	DST	16.0	24.8	-	0.622	-	-	-	-	Inorganic Silty Clays of low plasticity											
	12.50	D	13	5	7	11	18	15.51	-	-	-	-	-	-	-	18.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	14.00	U	14	-	-	-	-	-	CL	2	2	1	13	73	9	18.56	2.07	1.75	28.5	20.0	8.5	2.67	UU	54.0	14.3	0.148	0.526	-	9	17	-	Inorganic clays of low plasticity											
	15.50	D	15	8	10	15	25	25.00	-	-	-	-	-	-	-	21.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	17.00	U	16	-	-	-	-	-	CL	3	2	2	24	60	9	14.78	2.06	1.80	27.0	19.0	8.0	2.66	DST	16.0	23.8	-	0.481	-	-	-	-												
	18.50	D	17	7	10	17	27	17.81	ML	1	1	1	42	55	0	20.58	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											

APPENDIX "B"
TABLE 7: SUMMARY OF TEST RESULTS

Bore No: P67	**Ground Elevation: RL 191.985 m**	**Method of drilling: Percussion**	**Depth of Water-table: 1.80 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 30/09/2023**	**SPT Sampler: Standard**
Location / Chainage: 22671.287	**Casing Lowered: 17.00 m**	**Ending Date: 02/10/2023**	**Hammer type: Rope-pulley/ Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen													
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	20.00	D	18	-	-	-	-	-	SM	1	0	1	83	15	0	10.29	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	21.50	D	19	8	16	20	36	36.00	CL	2	1	3	10	73	11	20.00	-	-	29.0	18.5	10.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	23.00	U	20	-	-	-	-	-	CL	3	4	4	19	60	10	16.23	2.08	1.79	28.0	18.0	10.0	2.67	UU	46.0	12.2	-	0.492	-	-	-	-											
	24.50	D	21	8	18	33	51	24.61	CL	1	1	1	16	74	7	19.67	-	-	26.0	19.0	7.0	-	-	-	-	-	-	-	-	-	-											
	26.00	D	22	-	-	-	-	-	CL	0	1	1	10	78	10	17.75	-	-	28.0	19.0	9.0	-	-	-	-	-	-	-	-	-	-											
	27.50	D	23	10	21	36	57	25.51	ML	0	0	0	4	90	6	28.32	-	-	31.0	24.0	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity										
	29.00	U	24	-	-	-	-	-	CL	7	1	3	23	57	9	17.03	2.12	1.81	27.0	19.0	8.0	2.67	DST	14.0	24.0	-	0.475	-	-	-	-	Inorganic clays of low plasticity										
	30.50	D	25	12	27	38	65	26.89	CL-ML	1	1	1	18	74	5	17.86	-	-	25.0	19.0	6.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	32.00	D	26	-	-	-	-	-	SM	1	1	3	70	25	0	19.08	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	33.50	D	27	21	33	40	73	28.34	-	-	-	-	-	-	-	18.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	35.00	D	28	23	36	43	79	79.00	CL	2	7	9	19	54	9	14.76	-	-	28.0	19.0	9.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	36.50	D	29	27	39	47	86	31.08	SM	0	1	5	62	32	0	15.74	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	38.00	D	30	23	37	51	88	31.15	-	-	-	-	-	-	-	16.40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	40.00	D	31	29	38	54	92	31.58	-	-	-	-	-	-	-	15.86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 8: SUMMARY OF TEST RESULTS

Bore No: P68	**Ground Elevation: RL 191.917 m**	**Method of drilling: Rotary**	**Depth of Water-table: 1.60 m**
Diameter of Bore Hole: 150 m	**Bore Retained using: Casing**	**Starting Date: 03/11/2023**	**SPT Sampler: Standard**
Location / Chainage: 22697.487	**Casing Lowered: 0.00 m**	**Ending Date: 06/11/2023**	**Hammer type: Rope pulley**

FIELD TEST RESULT										LABORATORY TEST RESULT																																
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Correct N)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	0.50	D	1	-	-	-	-	-	SM	2	1	3	55	39	0	5.56	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	1.00	D	2	2	2	3	5	7.74	CL-ML	0	0	1	47	47	5	16.90	-	-	25.0	20.5	4.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	2.00	U	3	-	-	-	-	-	SM-SC	0	0	1	52	43	4	11.12	1.96	1.76	24.0	19.0	5.0	2.66	DST	5.0	26.5	-	0.511	-	-	-	-	Silty Sands with clay binder										
	3.00	D	4	3	5	7	12	15.13	SM	3	1	1	56	39	0	18.31	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	4.00	D	5	5	8	8	16	17.15	-	-	-	-	-	-	-	21.59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	5.00	D	6	-	-	-	-	-	SM	14	0	0	62	24	0	16.61	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-										
	6.00	D	7	4	9	11	20	18.51	SM	4	0	0	72	24	0	25.15	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-										
	7.00	D	8	5	8	10	18	17.05	-	-	-	-	-	-	-	15.49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	8.00	U	9	-	-	-	-	-	SM	10	3	3	65	19	0	17.20	1.93	1.65	Non-Plastic			2.61	DST	0.0	30.2	-	0.582	-	-	-	-										
	9.00	D	10	6	9	11	20	17.44	SM	0	0	0	76	24	0	23.68	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-										
	10.00	D	11	6	7	9	16	15.22	-	-	-	-	-	-	-	23.56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	11.00	U	12	-	-	-	-	-	CL	1	1	2	12	76	8	23.61	2.02	1.63	26.0	19.0	7.0	2.67	UU	44.0	11.4	0.128	0.634	-	9	18	-	Inorganic clays of low plasticity										
	12.50	D	13	8	10	17	27	19.60	-	-	-	-	-	-	-	21.93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	14.00	U	14	-	-	-	-	-	CL	7	3	3	7	69	11	20.03	2.04	1.70	29.0	21.0	8.0	2.67	UU	57.0	9.7	-	0.571	-	-	-	-										
	15.50	D	15	9	12	16	28	28.00	CL	0	0	1	5	84	10	17.73	-	-	30.0	22.0	8.0	-	-	-	-	-	-	-	-	-	-										
	17.00	U	16	-	-	-	-	-	CL	4	1	2	9	72	12	17.61	2.02	1.72	29.0	19.0	10.0	2.68	UU	60.0	8.1	-	0.558	-	-	-	-										

APPENDIX "B"
TABLE 8: SUMMARY OF TEST RESULTS

Bore No: P68	**Ground Elevation: RL 191.917 m**	**Method of drilling: Rotary**	**Depth of Water-table: 1.60 m**
Diameter of Bore Hole: 150 m	**Bore Retained using: Casing**	**Starting Date: 03/11/2023**	**SPT Sampler: Standard**
Location / Chainage: 22697.487	**Casing Lowered: 0.00 m**	**Ending Date: 06/11/2023**	**Hammer type: Rope pulley**

FIELD TEST RESULT										LABORATORY TEST RESULT																											
				SPT Test Result							Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen									
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Correct N)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL									
	18.50	D	17	11	17	20	37	37.00	-	-	-	-	-	-	-	14.22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	20.00	U	18	-	-	-	-	-	CL	3	1	2	16	69	9	19.13	2.03	1.70	28.0	19.0	9.0	2.67	UU	52.0	10.5	-	0.571	-	-	-	-										
	21.50	D	19	8	15	17	32	32.00	CL	3	0	1	5	79	12	16.96	-	-	32.0	20.5	11.5	-	-	-	-	-	-	-	-	-	-										
	23.00	U	20	-	-	-	-	-	CL	2	1	2	6	79	10	22.63	2.06	1.68	30.0	20.5	9.5	2.68	UU	62.0	7.8	-	0.595	-	-	-	-										
	24.50	D	21	9	19	20	39	39.00	-	-	-	-	-	-	-	20.80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	26.00	U	22	-	-	-	-	-	CL	0	1	2	6	79	12	23.64	2.03	1.64	31.0	21.0	10.0	2.68	UU	57.0	9.3	-	0.634	-	-	-	-										
	27.50	D	23	11	25	27	52	52.00	-	-	-	-	-	-	-	23.40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	29.00	D	24	13	24	30	54	54.00	CL	2	1	1	4	78	14	17.62	-	-	34.0	21.0	13.0	-	-	-	-	-	-	-	-	-	-										
	30.50	D	25	14	26	35	61	61.00	-	-	-	-	-	-	-	23.84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	32.00	D	26	17	30	37	67	67.00	-	-	-	-	-	-	-	24.44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	33.50	D	27	19	32	40	72	28.45	SM-SC	2	1	2	52	38	5	18.81	-	-	23.0	19.0	4.0	-	-	-	-	-	-	-	-	-	-										
	35.00	D	28	21	35	42	77	29.51	-	-	-	-	-	-	-	8.26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	36.50	D	29	17	25	27	52	52.00	CL	0	0	1	22	69	8	20.47	-	-	28.0	20.5	7.5	-	-	-	-	-	-	-	-	-	-										
	38.00	D	30	23	29	35	64	64.00	-	-	-	-	-	-	-	21.98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	40.00	D	31	29	101	-	R	-	CL	4	1	2	14	68	11	14.73	-	-	30.0	20.5	9.5	-	-	-	-	-	-	-	-	-	-										

Inorganic clays of low plasticity	Silty Sands with clay binder	Inorganic clays of low plasticity

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 9: SUMMARY OF TEST RESULTS

Bore No: P69	**Ground Elevation: RL 191.999 m**	**Method of drilling: Rotary**	**Depth of Water-table: 1.70 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date : 03/11/2023**	**SPT Sampler: Standard**
Location / Chainage: 22723.6870	**Casing Lowered: 0.00 m**	**Ending Date: 06/11/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic				Shrinkage		Test on Rock Specimen														
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Correct N)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	SM	0	0	1	52	47	0	6.78	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	1.00	D	2	1	2	2	4	6.20	CL-ML	0	0	1	42	50	7	20.78	-	-	27.0	21.0	6.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	2.00	U	3	-	-	-	-	-	SM	0	0	1	53	46	0	20.86	1.94	1.60	Non-Plastic			2.64	DST	4.0	27.2	-	0.645	-	-	-	-	Silty Sands										
	3.00	D	4	3	4	6	10	12.68	CL-ML	4	3	7	22	57	7	14.59	-	-	27.0	21.0	6.0	-	-	-	-	-	-	-	-	6	18	-	Inorganic Silty Clays of low plasticity										
	4.00	D	5	4	5	7	12	14.45	-	-	-	-	-	-	-	16.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	5.00	U	6	-	-	-	-	-	SM	0	0	1	68	31	0	18.45	1.93	1.63	Non-Plastic			2.63	DST	0.0	29.1	-	0.613	-	-	-	-	Silty Sands										
	6.00	D	7	3	6	9	15	15.80	SM	0	0	0	72	28	0	20.29	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-											
	7.00	D	8	4	8	9	17	16.56	-	-	-	-	-	-	-	20.91	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	8.00	U	9	-	-	-	-	-	SM	0	1	1	62	36	0	19.57	1.96	1.64	Non-Plastic			2.61	DST	0.0	28.8	-	0.591	-	-	-	-											
	9.00	D	10	4	6	9	15	14.94	CL-ML	0	1	1	14	77	7	18.95	-	-	27.0	20.5	6.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	10.00	D	11	4	5	7	12	11.59	-	-	-	-	-	-	-	19.95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	11.00	U	12	-	-	-	-	-	CL	2	0	1	10	79	8	20.73	2.02	1.67	28.0	21.0	7.0	2.67	UU	47.0	11.8	-	0.599	-	-	-	-	Inorganic clays of low plasticity										
	12.50	D	13	5	7	11	18	15.57	-	-	-	-	-	-	-	20.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	14.00	U	14	-	-	-	-	-	CL	4	2	1	8	73	12	20.53	2.04	1.69	30.0	21.5	8.5	2.68	UU	57.0	10.2	-	0.586	-	14	17	-											
	15.50	D	15	7	12	15	27	27.00	-	-	-	-	-	-	-	18.86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	17.00	U	16	-	-	-	-	-	CL-ML	2	1	1	32	58	6	21.20	1.96	1.62	26.0	20.0	6.0	2.66	DST	8.0	24.7	-	0.642	-	-	-	-	Inorganic Silty Clays of low plasticity										

APPENDIX "B"
TABLE 9: SUMMARY OF TEST RESULTS

Bore No: P69	**Ground Elevation: RL 191.999 m**	**Method of drilling: Rotary**	**Depth of Water-table: 1.70 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date : 03/11/2023**	**SPT Sampler: Standard**
Location / Chainage: 22723.6870	**Casing Lowered: 0.00 m**	**Ending Date: 06/11/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																													
				SPT Test Result							Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic				Shrinkage		Test on Rock Specimen									
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Correct N)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL									
	18.50	D	17	11	20	24	44	44.00	CL	4	1	3	11	69	12	16.20	-	-	29.0	20.5	8.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity									
	20.00	U	18	-	-	-	-	-	CL	1	0	1	14	74	10	16.19	2.01	1.73	28.0	20.5	7.5	2.67	UU	48.0	12.0	-	0.543	-	-	-	-										
	21.50	D	19	7	14	21	35	35.00	-	-	-	-	-	-	-	16.70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	23.00	U	20	-	-	-	-	-	CL-ML	2	1	1	24	65	7	19.44	2.03	1.70	26.0	20.0	6.0	2.66	UU	44.0	11.3	-	0.565	-	-	-	-	Inorganic Silty Clays of low plasticity									
	24.50	D	21	14	20	23	43	43.00	CL	0	1	1	12	75	11	17.87	-	-	28.0	19.0	9.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity									
	26.00	U	22	-	-	-	-	-	MI	0	1	1	7	77	14	25.92	2.04	1.62	36.0	27.0	9.0	2.69	UU	65.0	8.2	-	0.660	-	-	-	-	Inorganic Silts of Intermediate plasticity									
	27.50	D	23	17	23	28	51	51.00	-	-	-	-	-	-	-	26.22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	29.00	D	24	19	25	35	60	26.37	CL-ML	1	1	2	24	65	7	19.09	-	-	26.0	21.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity									
	30.50	D	25	25	35	38	73	73.00	CL	0	0	2	14	74	10	19.19	-	-	28.0	20.5	7.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity									
	32.00	D	26	15	25	39	64	64.00	CI	1	0	0	5	74	20	27.22	-	-	38.0	24.0	14.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of Intermediate plasticity									
	33.50	D	27	19	29	38	67	67.00	CL	4	2	2	8	72	12	12.08	-	-	32.0	21.5	10.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity									
	35.00	D	28	21	32	43	75	75.00	CL	0	0	2	14	75	9	14.80	-	-	28.0	20.5	7.5	-	-	-	-	-	-	-	-	-	-										
	36.50	D	29	27	42	50	92	92.00	-	-	-	-	-	-	-	20.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	38.00	D	30	24	39	45	84	84.00	CL	0	1	1	7	79	12	16.64	-	-	30.0	20.5	9.5	-	-	-	-	-	-	-	-	-	-										
	40.00	D	31	20	39	74	R	-	-	-	-	-	-	-	-	15.93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 10: SUMMARY OF TEST RESULTS

Bore No : P70	**Ground Elevation : RL 192.161 m**	**Method of drilling :Percussion**	**Depth of Water-table: 1.60 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 03/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 22749.887	**Casing Lowered : 20.00 m**	**Ending Date : 05/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m²)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm²)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	ML	0	0	1	30	65	4	12.40	-	-	20.0	16.0	4.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	1.00	U	2	-	-	-	-	-	CL	1	0	1	37	54	7	19.94	2.04	1.70	27.5	20.5	7.0	2.66	DST	7.0	24.5	0.146	0.565	-	-	-	-	Inorganic clays of low plasticity											
	2.00	D	3	1	1	2	3	3.00	CL	0	1	1	34	56	8	20.71	-	-	29.0	20.0	9.0	-	-	-	-	-	-	-	-	-	-												
	3.00	D	4	2	3	4	7	8.77	CL-ML	0	2	2	36	55	5	20.75	-	-	24.0	19.5	4.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	4.00	U	5	-	-	-	-	-	SM	0	0	1	60	39	0	11.73	1.86	1.66	Non-Plastic			2.63	DST	3.0	28.5	-	0.580	-	-	-	-	Silty Sands											
	5.00	D	6	3	4	6	10	11.49	SM	0	0	1	66	33	0	25.31	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	6.00	D	7	3	3	5	8	8.86	-	-	-	-	-	-	-	24.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	7.00	D	8	-	-	-	-	-	SM	0	0	0	62	38	0	25.17	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	8.00	D	9	5	6	8	14	14.45	SM	0	0	0	74	26	0	23.68	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	9.00	D	10	5	7	10	17	15.97	-	-	-	-	-	-	-	21.96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	10.00	U	11	-	-	-	-	-	ML	0	0	1	27	66	6	22.02	2.04	1.67	29.5	24.0	5.5	2.65	DST	8.0	25.8	-	0.587	-	-	-	-	Inorganic Silts of low plasticity											
	11.00	D	12	4	7	11	18	15.91	-	-	-	-	-	-	-	22.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	12.00	D	13	3	6	9	15	13.60	-	-	-	-	-	-	-	24.92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	13.00	U	14	-	-	-	-	-	CL	0	1	2	11	74	12	18.00	2.06	1.75	31.5	20.0	11.5	2.67	UU	46.0	8.1	-	0.529	-	17	16	-	Inorganic clays of low plasticity											
	14.50	D	15	3	5	10	15	15.00	ML	0	0	0	11	79	10	19.95	-	-	34.0	26.0	8.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	16.00	U	16	-	-	-	-	-	CL	1	1	1	46	44	7	17.12	2.06	1.76	26.5	19.0	7.5	2.67	UU	48.0	9.6	-	0.518	-	-	-	-	Inorganic clays of low plasticity											
	17.50	D	17	5	8	10	18	14.13	CL	1	2	2	28	59	8	19.34	-	-	27.0	20.0	7.0	-	-	-	-	-	-	-	-	-	-												

APPENDIX "B"
TABLE 10: SUMMARY OF TEST RESULTS

Bore No : P70	**Ground Elevation : RL 192.161 m**	**Method of drilling :Percussion**	**Depth of Water-table: 1.60 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 03/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 22749.887	**Casing Lowered : 20.00 m**	**Ending Date : 05/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m²)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm²)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	19.00	U	18	-	-	-	-	-	SC	6	4	6	34	42	8	16.22	2.07	1.78	28.0	20.5	7.5	2.67	-	-	-	-	0.500	-	8	17	-	Clayey Sands											
	20.50	D	19	7	9	11	20	20.00	CL	9	6	5	21	52	7	20.58	-	-	29.0	21.0	8.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	22.00	U	20	-	-	-	-	-	CL	1	1	2	11	74	11	20.45	1.99	1.65	30.0	19.0	11.0	2.68	UU	56.0	9.5	-	0.624	-	-	-	-												
	23.50	D	21	8	12	15	27	27.00	CL	2	1	2	12	73	10	21.24	-	-	29.0	18.0	11.0	-	-	-	-	-	-	-	-	-	-												
	25.00	U	22	-	-	-	-	-	CL	1	1	4	15	69	10	18.20	2.03	1.72	30.5	21.0	9.5	2.67	UU	59.0	10.2	-	0.552	-	8	15	-												
	26.50	D	23	10	14	17	31	31.00	MI	0	0	0	3	84	13	23.46	-	-	36.0	27.0	9.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of Intermediate plasticity											
	28.00	U	24	-	-	-	-	-	CI	5	4	4	3	70	14	19.00	2.04	1.71	36.0	24.0	12.0	2.68	UU	54.0	8.2	-	0.564	-	-	-	-	Inorganic clays of Intermediate plasticity											
	29.50	D	25	9	12	16	28	28.00	-	-	-	-	-	-	-	21.93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	31.00	D	26	-	-	-	-	-	CL	0	1	0	25	64	10	20.28	-	-	29.5	19.0	10.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	32.50	D	27	11	15	21	36	36.00	CL	0	0	1	26	62	11	20.28	-	-	32.5	19.5	13.0	-	-	-	-	-	-	-	-	-	-												
	34.00	D	28	-	-	-	-	-	SM	0	0	2	49	49	0	20.25	1.96	1.63	Non-Plastic			2.63	RDST	0.0	27.4	-	0.613	-	-	-	-	Silty Sands											
	35.50	D	29	12	23	32	55	22.95	-	-	-	-	-	-	-	20.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	37.00	D	30	-	-	-	-	-	ML	0	1	1	36	58	4	19.13	-	-	24.0	20.0	4.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	38.50	D	31	15	30	35	65	24.99	ML	1	1	2	38	58	0	19.61	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	40.00	D	32	17	32	40	72	26.49	-	-	-	-	-	-	-	17.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"

TABLE 11: SUMMARY OF TEST RESULTS

Bore No : P71	**Ground Elevation : RL 192.287 m**	**Method of drilling :Percussion**	**Depth of Water-table: 1.70 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 03/11/2023**	**SPT Sampler: Standard**
Location / Chainage : 22776.087	**Casing Lowered : 12.00 m**	**Ending Date : 05/11/2023**	**Hammer type: Rope pulley**

FIELD TEST RESULT										LABORATORY TEST RESULT																													
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen									
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Correct N)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL									
	0.50	D	1	-	-	-	-	-	ML	0	0	1	44	55	0	3.95	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity									
	1.00	D	2	1	1	2	3	4.69	ML	0	0	1	48	47	4	11.05	-	-	24.0	20.0	4.0	-	-	-	-	-	-	-	-	-	-									
	2.00	D	3	-	-	-	-	-	CL-ML	0	1	1	18	74	6	21.41	1.86	1.53	27.0	21.0	6.0	2.66	RUU	41.0	11.2	-	0.739	-	-	-	-	Inorganic Silty Clays of low plasticity									
	3.00	D	4	2	2	3	5	5.00	CL	5	2	1	12	71	9	21.26	-	-	28.0	20.5	7.5	-	-	-	-	-	-	-	-	17	-	Inorganic clays of low plasticity									
	4.00	D	5	3	4	5	9	9.00	-	-	-	-	-	-	-	19.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	5.00	D	6	-	-	-	-	-	SM	0	0	0	64	36	0	23.83	2.01	1.62	Non Plastic			-	RDST	0.0	28.4	-	-	-	-	-	-	Silty Sands									
	6.00	D	7	3	3	4	7	7.80	-	-	-	-	-	-	-	25.97	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	7.00	D	8	4	4	6	10	10.70	-	-	-	-	-	-	-	22.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	8.00	U	9	-	-	-	-	-	SM	0	0	1	68	31	0	21.14	1.94	1.60	Non Plastic			2.61	DST	0.0	28.6	-	0.631	-	-	-	-									
	9.00	D	10	6	9	10	19	19.00	CL	3	1	2	8	76	10	21.50	-	-	28.0	20.5	7.5	-	-	-	-	-	-	-	-	19	-	Inorganic clays of low plasticity									
	10.00	D	11	7	10	12	22	22.00	-	-	-	-	-	-	-	21.64	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	11.00	U	12	-	-	-	-	-	ML	2	1	1	18	74	4	21.23	1.99	1.64	26.0	22.0	4.0	2.66	DST	11.0	24.8	-	0.622	-	-	-	-	Inorganic Silts of low plasticity									
	12.50	D	13	10	12	15	27	19.69	-	-	-	-	-	-	-	21.41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	14.00	U	14	-	-	-	-	-	CL	3	2	2	7	75	11	24.04	2.10	1.69	29.5	21.0	8.5	-	UU	58.0	9.2	-	-	-	-	-	-	Inorganic clays of low plasticity									
	15.50	D	15	10	14	17	31	31.00	-	-	-	-	-	-	-	20.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	17.00	U	16	-	-	-	-	-	ML	2	1	2	42	53	0	14.70	1.96	1.71	Non Plastic			2.62	DST	2.0	27.2	-	0.532	-	-	-	-	Inorganic Silts of low plasticity									

APPENDIX "B"

TABLE 11: SUMMARY OF TEST RESULTS

Bore No : P71	**Ground Elevation : RL 192.287 m**	**Method of drilling :Percussion**	**Depth of Water-table: 1.70 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 03/11/2023**	**SPT Sampler: Standard**
Location / Chainage : 22776.087	**Casing Lowered : 12.00 m**	**Ending Date : 05/11/2023**	**Hammer type: Rope pulley**

FIELD TEST RESULT										LABORATORY TEST RESULT																												
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen									
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Correct N)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL									
	18.50	D	17	12	17	21	38	22.26	CL-ML	4	5	7	18	59	7	15.21	-	-	27.0	20.5	6.5	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity									
	20.00	D	18	-	-	-	-	-	CL	2	1	1	11	75	10	20.65	2.06	1.71	28.5	21.5	7.0	2.67	RUU	51.0	10.3	-	0.561	-	-	-	-	Inorganic clays of low plasticity									
	21.50	D	19	12	16	23	39	21.66	-	-	-	-	-	-	-	21.57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	23.00	D	20	-	-	-	-	-	ML	3	2	2	34	54	5	20.43	-	-	24.0	20.0	4.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity									
	24.50	D	21	16	22	20	42	21.91	CL-ML	1	1	0	16	75	7	21.22	-	-	27.0	21.5	5.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity									
	26.00	U	22	-	-	-	-	-	CL-ML	2	1	1	30	61	5	18.77	1.97	1.66	25.0	20.0	5.0	2.65	DST	7.0	26.2	-	0.596	-	-	-	-									
	27.50	D	23	19	23	31	54	54.00	MI	0	0	1	7	77	15	31.57	-	-	39.0	26.5	12.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of Intermediate plasticity									
	29.00	D	24	20	24	32	56	56.00	-	-	-	-	-	-	-	29.58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	30.50	D	25	20	25	30	55	55.00	CL	2	1	1	13	75	8	19.45	-	-	29.0	21.5	7.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity									
	32.00	D	26	23	26	33	59	59.00	-	-	-	-	-	-	-	20.13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	33.50	D	27	22	25	33	58	58.00	CI	0	0	1	8	77	14	25.98	-	-	36.0	23.0	13.0	2.67	-	-	-	-	-	-	-	-	-	Inorganic clays of Intermediate plasticity									
	35.00	D	28	24	29	32	61	61.00	CL	0	1	2	11	74	12	22.41	-	-	34.0	23.5	10.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity									
	36.50	D	29	23	27	35	62	62.00	-	-	-	-	-	-	-	20.94	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	38.00	D	30	25	28	33	61	61.00	CL	0	0	1	15	74	10	23.41	-	-	30.5	22.0	8.5	-	-	-	-	-	-	-	-	-	-									
	40.00	D	31	25	29	37	66	66.00	-	-	-	-	-	-	-	20.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"

TABLE 12: SUMMARY OF TEST RESULTS

Bore No : P72	**Ground Elevation : RL 192.289 m**	**Method of drilling: Percussion**	**Depth of Water-table: 1.60 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date: 05/11/2023**	**SPT Sampler: Standard**
Location / Chainage : 22802.287	**Casing Lowered : 20.00 m**	**Ending Date: 07/11/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen												
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Correct N)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	CL-ML	1	1	1	34	56	7	6.73	-	-	27.0	21.0	6.0	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	1.00	D	2	1	2	2	4	6.16	-	-	-	-	-	-	-	18.77	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	2.00	U	3	-	-	-	-	-	SM-SC	3	2	2	44	42	7	18.90	2.00	1.68	26.0	20.5	5.5	2.66	DST	11.0	25.4	-	0.583	-	0	18	-	Silty Sands with clay binder										
	3.00	D	4	2	3	4	7	8.83	SM	4	2	2	52	40	0	18.25	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-										
	4.00	D	5	4	6	7	13	15.28	-	-	-	-	-	-	-	23.80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	5.00	U	6	-	-	-	-	-	SM	0	0	0	70	30	0	24.99	1.94	1.55	Non Plastic			2.62	DST	0.0	28.5	-	0.690	-	-	-	-										
	6.00	D	7	5	6	9	15	15.75	-	-	-	-	-	-	-	23.44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Silty Sands										
	7.00	D	8	4	6	11	17	16.51	-	-	-	-	-	-	-	24.44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	8.00	D	9	-	-	-	-	-	SM	0	0	1	75	24	0	25.20	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-										
	9.00	D	10	2	3	3	6	5.96	-	-	-	-	-	-	-	25.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	10.00	D	11	4	7	8	15	14.41	ML	4	0	0	22	68	6	23.29	-	-	25.0	21.0	4.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity										
	11.00	U	12	-	-	-	-	-	CL-ML	2	1	2	12	74	9	23.47	2.02	1.64	27.0	20.5	6.5	2.66	UU	44.0	11.6	0.132	0.622	-	8	18	-	Inorganic Silty Clays of low plasticity										
	12.50	D	13	4	6	6	12	10.71	-	-	-	-	-	-	-	20.96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	14.00	U	14	-	-	-	-	-	CL-ML	2	1	1	14	74	8	20.08	2.02	1.68	26.0	20.0	6.0	2.66	UU	40.0	11.0	-	0.583	-	-	-	-										
	15.50	D	15	6	7	9	16	13.21	-	-	-	-	-	-	-	17.51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	17.00	U	16	-	-	-	-	-	CL	0	1	1	22	67	9	21.32	2.04	1.68	28.0	20.5	7.5	2.67	UU	48.0	10.6	-	0.589	-	-	-	-	Inorganic clays of low plasticity										
	18.50	D	17	7	9	11	20	15.19	ML	1	1	1	44	49	4	22.15	-	-	24.0	20.0	4.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity										

APPENDIX "B"
TABLE 12: SUMMARY OF TEST RESULTS

Bore No : P72	**Ground Elevation : RL 192.289 m**	**Method of drilling: Percussion**	**Depth of Water-table: 1.60 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date: 05/11/2023**	**SPT Sampler: Standard**
Location / Chainage : 22802.287	**Casing Lowered : 20.00 m**	**Ending Date: 07/11/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT									LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Correct N)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	20.00	U	18	-	-	-	-	-	CL	3	1	1	14	71	10	21.13	2.03	1.68	28.0	20.5	7.5	2.68	UU	52.0	9.3	-	0.595	-	-	-	-	Inorganic clays of low plasticity											
	21.50	D	19	8	15	18	33	33.00	CL	10	5	5	17	52	11	17.48	-	-	29.0	20.0	9.0	-	-	-	-	-	-	-	-	-	-												
	23.00	D	20	-	-	-	-	-	SM	0	0	1	53	46	0	19.01	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	24.50	D	21	14	24	28	52	25.18	CL-ML	0	1	1	38	54	6	22.23	-	-	25.0	20.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	26.00	U	22	-	-	-	-	-	CL	4	1	1	16	68	10	24.02	2.01	1.62	28.0	20.5	7.5	2.68	UU	53.0	9.5	-	0.654	-	-	-	-	Inorganic clays of low plasticity											
	27.50	D	23	10	16	18	34	34.00	-	-	-	-	-	-	-	27.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	29.00	D	24	-	-	-	-	-	ML	0	1	1	44	54	0	18.19	2.02	1.71	Non Plastic			2.65	RDST	6.0	27.8	-	0.550	-	-	-	-	Inorganic Silts of low plasticity											
	30.50	D	25	13	23	27	50	22.75	ML	0	1	2	40	57	0	19.45	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-												
	32.00	D	26	-	-	-	-	-	-	-	-	-	-	-	-	18.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	33.50	D	27	15	26	30	56	23.86	CL-ML	1	1	1	32	58	7	16.88	-	-	27.0	20.5	6.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	35.00	D	28	17	27	32	59	24.36	CL	1	0	1	28	62	8	17.70	-	-	28.0	21.0	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	36.50	D	29	14	20	26	46	20.32	-	-	-	-	-	-	-	17.73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	38.00	D	30	-	-	-	-	-	CL-ML	0	0	1	35	58	6	17.73	2.04	1.73	26.0	20.0	6.0	2.66	RDST	10.0	27.1	-	0.538	-	-	-	-	Inorganic Silty Clays of low plasticity											
	40.00	D	31	20	26	34	60	23.31	-	-	-	-	-	-	-	20.15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 13: SUMMARY OF TEST RESULTS

Bore No : P73	**Ground Elevation : RL 192.387 m**	**Method of drilling :Percussion**	**Depth of Water-table: 1.85 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 02/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 22828.487	**Casing Lowered : 29.00 m**	**Ending Date : 04/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m²)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm²)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	ML	1	1	0	36	62	0	14.60	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	1.00	D	2	3	4	5	9	9.00	CL	0	0	1	18	74	7	12.62	-	-	26.5	18.5	8.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	2.00	U	3	-	-	-	-	-	CL	0	0	1	17	74	8	9.04	1.67	1.53	27.5	18.0	9.5	2.67	DST	10.0	21.0	-	0.745	-	9	16	-												
	3.00	D	4	4	5	8	13	13.00	CL	7	3	3	21	55	11	16.78	-	-	32.0	20.0	12.0	-	-	-	-	-	-	-	-	-	-												
	4.00	D	5	5	7	9	16	16.00	-	-	-	-	-	-	-	17.76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	5.00	U	6	-	-	-	-	-	CL	0	1	0	6	86	7	23.69	1.97	1.59	27.0	20.0	7.0	2.67	DST	12.0	24.5	-	0.679	-	8	16	-												
	6.00	D	7	4	5	9	14	15.54	-	-	-	-	-	-	-	27.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	7.00	D	8	3	6	12	18	18.00	CL	0	0	1	5	86	8	20.81	-	-	27.5	20.1	7.5	-	-	-	-	-	-	-	-	-	-												
	8.00	U	9	-	-	-	-	-	SM	0	0	2	78	20	0	26.82	1.94	1.53	Non-Plastic			2.62	DST	0.0	29.0	-	0.712	-	-	-	-	Silty Sands											
	9.00	D	10	4	5	7	12	12.31	SM	0	0	1	62	37	0	20.09	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	10.00	D	11	5	9	10	19	19.00	CL	4	2	3	11	69	11	17.78	-	-	31.0	20.5	10.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	11.00	U	12	-	-	-	-	-	CL	0	0	1	5	84	10	21.33	1.98	1.63	29.5	19.0	10.5	2.67	UU	44.0	9.5	0.154	0.636	-	17	14	-												
	12.50	D	13	3	5	9	14	14.00	-	-	-	-	-	-	-	18.72	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	14.00	U	14	-	-	-	-	-	-	-	-	-	-	-	-	19.20	2.00	1.68	-	-	-	2.67	UU	46.0	9.0	-	0.591	-	-	-	-												
	15.50	D	15	7	11	15	26	26.00	CL	0	1	2	10	76	11	16.40	-	-	30.0	19.0	11.0	-	-	-	-	-	-	-	-	-	-												
	17.00	U	16	-	-	-	-	-	ML	1	0	1	38	60	0	12.71	1.85	1.64	Non-Plastic			2.64	DST	4.0	26.5	-	0.608	-	-	-	-	Inorganic Silts of low plasticity											
	18.50	D	17	9	14	19	33	20.71	-	-	-	-	-	-	-	17.07	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												

APPENDIX "B"

TABLE 13: SUMMARY OF TEST RESULTS

Bore No : P73	**Ground Elevation : RL 192.387 m**	**Method of drilling :Percussion**	**Depth of Water-table: 1.85 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 02/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 22828.487	**Casing Lowered : 29.00 m**	**Ending Date : 04/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen												
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	20.00	U	18	-	-	-	-	-	ML	3	1	1	9	77	9	14.85	1.81	1.58	30.5	23.5	7.0	2.67	UU	42.0	11.5	-	0.694	-	-	-	-												
	21.50	D	19	11	22	32	54	27.99	-	-	-	-	-	-	-	20.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	23.00	D	20	13	24	37	61	61.00	CL	1	1	1	13	74	10	13.22	-	-	30.0	19.5	10.5	-	-	-	-	-	-	-	-	-											Inorganic clays of low plasticity			
	24.50	D	21	15	27	37	64	30.54	SM	0	1	1	51	47	0	18.04	-	-	Non-Plastic			-	-	-	-	-	-	-	-											Silty Sands			
	26.00	D	22	14	28	30	58	27.84	CL-ML	1	0	1	9	84	5	18.52	-	-	25.0	19.0	6.0	-	-	-	-	-	-	-	-	-											Inorganic Silty Clays of low plasticity			
	27.50	D	23	13	25	27	52	25.25	-	-	-	-	-	-	-	25.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-														
	29.00	D	24	10	23	28	51	24.46	SM	0	0	0	71	29	0	21.82	1.94	1.59	Non-Plastic			2.65	RDST	0.0	28.5	-	0.667	-	-	-	-											Silty Sands			
	30.50	D	25	7	25	30	55	55.00	CL	0	0	1	6	82	11	14.70	-	-	30.0	21.0	9.0	-	-	-	-	-	-	-	-	-											Inorganic clays of low plasticity			
	32.00	D	26	11	27	31	58	25.84	SM	0	1	0	55	44	0	17.34	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-											Silty Sands			
	33.50	D	27	12	29	33	62	62.00	CL	2	2	1	10	73	12	15.29	-	-	31.0	20.0	11.0	-	-	-	-	-	-	-	-	-											Inorganic clays of low plasticity			
	35.00	D	28	10	24	35	59	59.00	-	-	-	-	-	-	-	14.75	2.01	1.75	-	-	-	2.67	RUU	53.0	8.5	-	0.526	-	-	-	-														
	36.50	D	29	14	29	35	64	64.00	CL	7	2	1	11	68	11	12.39	-	-	32.0	20.0	12.0	-	-	-	-	-	-	-	-	-														
	38.00	D	30	17	32	40	72	72.00	-	-	-	-	-	-	-	14.22	-	-	-	-	-	-	-	-	-	-	-	-	-	-														
	40.00	D	31	24	60	42	102	100.00	-	-	-	-	-	-	-	15.86	-	-	-	-	-	-	-	-	-	-	-	-	-	-														

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 14: SUMMARY OF TEST RESULTS

Bore No : P74	**Ground Elevation : RL 192.472 m**	**Method of drilling :Rotary**	**Depth of Water-table: 2.45 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 04/11/2023**	**SPT Sampler: Standard**
Location / Chainage : 22854.687	**Casing Lowered : 20.00 m**	**Ending Date : 06/11/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT									LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Correct N)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	SM	1	1	0	53	45	0	5.69	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	1.00	D	2	2	3	3	6	9.28	CL	0	0	1	44	48	7	15.05	-	-	26.0	19.0	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	2.00	U	3	-	-	-	-	-	SM	0	0	0	54	46	0	14.79	1.96	1.71	Non Plastic			2.65	DST	3.0	27.3	-	0.550	-	-	-	-	Silty Sands											
	3.00	D	4	2	2	3	5	6.06	CL-ML	0	0	2	28	65	5	19.14	-	-	25.0	20.5	4.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	4.00	D	5	3	5	6	11	12.72	ML	1	0	0	32	67	0	21.99	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	5.00	U	6	-	-	-	-	-	SM	0	0	0	56	44	0	10.31	1.95	1.77	Non Plastic			2.64	DST	2.0	26.9	-	0.492	-	-	-	-												
	6.00	D	7	5	8	10	18	17.11	SM	0	0	0	68	32	0	25.74	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-												
	7.00	D	8	4	7	12	19	17.30	-	-	-	-	-	-	-	26.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Silty Sands											
	8.00	U	9	-	-	-	-	-	SM	3	0	1	72	24	0	24.60	1.94	1.56	Non Plastic			2.63	DST	0.0	28.9	-	0.686	-	-	-	-												
	9.00	D	10	6	10	13	23	18.64	-	-	-	-	-	-	-	26.39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	10.00	D	11	5	7	10	17	15.50	CL-ML	0	0	0	24	71	5	20.20	-	-	26.0	21.5	4.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	11.00	U	12	-	-	-	-	-	ML	0	0	1	48	47	4	13.70	1.97	1.73	24.0	20.0	4.0	2.65	DST	7.0	26.3	-	0.532	-	-	-	-	Inorganic Silts of low plasticity											
	12.50	D	13	4	6	8	14	12.32	CL-ML	0	0	1	31	62	6	21.43	-	-	26.0	20.5	5.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	14.00	D	14	-	-	-	-	-	SM	0	1	4	56	39	0	20.21	1.98	1.65	Non Plastic			-	RDST	0.0	27.1	-	-	-	-	-	-	Silty Sands											
	15.50	D	15	7	8	13	21	21.00	CL	4	2	1	14	70	9	20.87	-	-	28.0	20.5	7.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	17.00	U	16	-	-	-	-	-	CL	7	2	2	14	67	8	16.73	2.03	1.74	27.0	20.0	7.0	2.67	UU	52.0	11.7	0.135	0.534	-	0	18	-												

APPENDIX "B"

TABLE 14: SUMMARY OF TEST RESULTS

Bore No : P74	**Ground Elevation : RL 192.472 m**	**Method of drilling :Rotary**	**Depth of Water-table: 2.45 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 04/11/2023**	**SPT Sampler: Standard**
Location / Chainage : 22854.687	**Casing Lowered : 20.00 m**	**Ending Date : 06/11/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen												
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Correct N)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	18.50	D	17	10	13	16	29	18.56	SM	0	0	0	55	45	0	21.50	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	20.00	D	18	-	-	-	-	-	CL	3	2	1	12	74	8	21.74	-	-	28.0	20.5	7.5	-	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	21.50	D	19	12	23	32	55	55.00	CL	0	0	1	7	82	10	17.89	-	-	29.0	21.0	8.0	-	-	-	-	-	-	-	-	-	-	-										
	23.00	D	20	11	20	30	50	50.00	-	-	-	-	-	-	-	16.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	24.50	D	21	13	24	35	59	59.00	MI	0	0	1	5	77	17	30.42	-	-	40.0	27.0	13.0	2.68	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of Intermediate plasticity										
	26.00	D	22	9	22	28	50	50.00	-	-	-	-	-	-	-	27.65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	27.50	D	23	10	20	25	45	45.00	-	-	-	-	-	-	-	28.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	29.00	D	24	9	25	30	55	24.80	CL-ML	0	0	1	35	59	5	16.39	-	-	26.0	20.5	5.5	-	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	30.50	D	25	10	22	29	51	23.16	-	-	-	-	-	-	-	21.30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	32.00	D	26	12	25	28	53	53.00	CL	1	1	0	7	79	12	20.97	-	-	30.0	21.0	9.0	2.67	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	33.50	D	27	11	27	31	58	58.00	-	-	-	-	-	-	-	20.56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	35.00	D	28	13	26	34	60	24.67	CL-ML	4	1	1	18	71	5	22.66	-	-	26.0	21.0	5.0	-	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	36.50	D	29	12	25	32	57	57.00	CL	1	1	0	12	78	8	16.86	-	-	28.0	20.5	7.5	-	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	38.00	D	30	15	30	39	69	69.00	-	-	-	-	-	-	-	18.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	40.00	D	31	20	35	40	75	75.00	-	-	-	-	-	-	-	17.67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 15: SUMMARY OF TEST RESULTS

Bore No : P75	**Ground Elevation : RL 192.565 m**	**Method of drilling :Percussion**	**Depth of Water-table: 1.80 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 05/11/2023**	**SPT Sampler: Standard**
Location / Chainage : 22880.887	**Casing Lowered : 18.00 m**	**Ending Date : 07/11/2023**	**Hammer type: Rope pulley**

FIELD TEST RESULT									LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Correct N)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	SM	0	0	1	55	44	0	5.41	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	1.00	D	2	1	1	2	3	4.64	CL-ML	4	2	1	42	44	7	19.54	-	-	27.0	20.5	6.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	2.00	U	3	-	-	-	-	-	SM-SC	7	4	4	36	41	8	17.93	1.97	1.67	28.0	21.0	7.0	2.66	DST	10.0	26.3	-	0.593	-	0	19	-	Silty Sands with clay binder											
	3.00	D	4	2	3	4	7	8.78	CL-ML	1	0	1	18	73	7	19.85	-	-	26.0	21.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	4.00	D	5	4	5	7	12	14.29	CL-ML	0	0	1	28	67	4	22.54	-	-	25.0	20.5	4.5	-	-	-	-	-	-	-	-	-	-												
	5.00	U	6	-	-	-	-	-	ML	0	0	1	35	64	0	25.86	1.98	1.57	Non Plastic			2.65	DST	6.0	25.8	-	0.688	-	-	-	-	Inorganic Silts of low plasticity											
	6.00	D	7	4	6	8	14	15.15	-	-	-	-	-	-	-	24.59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	7.00	D	8	6	8	9	17	16.44	SM	0	0	1	55	44	0	23.19	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	8.00	D	9	-	-	-	-	-	-	-	-	-	-	-	-	25.08	2.09	1.67	-	-	-	-	RDST	2.0	25.7	-	-	-	-	-	-												
	9.00	D	10	5	10	11	21	17.75	CL-ML	1	1	0	18	73	7	20.75	-	-	26.0	20.5	5.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	10.00	D	11	5	11	12	23	18.36	-	-	-	-	-	-	-	21.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	11.00	U	12	-	-	-	-	-	CL-ML	2	0	0	34	59	5	22.24	1.98	1.62	26.5	21.5	5.0	2.66	DST	12.0	24.6	-	0.642	-	-	-	-												
	12.50	D	13	6	8	10	18	15.43	-	-	-	-	-	-	-	21.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	14.00	D	14	-	-	-	-	-	CL	2	1	1	8	77	11	22.05	2.03	1.66	29.0	21.0	8.0	-	RUU	62.0	8.2	-	-	-	6	18	-	Inorganic clays of low plasticity											
	15.50	D	15	7	11	14	25	25.00	-	-	-	-	-	-	-	22.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	17.00	D	16	-	-	-	-	-	SM	0	1	1	52	46	0	14.60	1.95	1.70	Non Plastic			2.65	RDST	3.0	27.6	-	0.559	-	-	-	-	Silty Sands											

APPENDIX "B"

TABLE 15: SUMMARY OF TEST RESULTS

Bore No : P75	**Ground Elevation : RL 192.565 m**	**Method of drilling :Percussion**	**Depth of Water-table: 1.80 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 05/11/2023**	**SPT Sampler: Standard**
Location / Chainage : 22880.887	**Casing Lowered : 18.00 m**	**Ending Date : 07/11/2023**	**Hammer type: Rope pulley**

FIELD TEST RESULT										LABORATORY TEST RESULT																												
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen									
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Correct N)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL									
	18.50	D	17	11	14	16	30	18.99	SM	4	6	11	40	39	0	15.89	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands									
	20.00	D	18	-	-	-	-	-	SM	4	2	0	52	42	0	20.21	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands									
	21.50	D	19	12	17	21	38	38.00	CL	2	0	1	10	76	11	18.08	-	-	30.0	22.0	8.0	-	-	-	-	-	-	-	-	-		-	Inorganic clays of low plasticity									
	23.00	U	20	-	-	-	-	-	CL	7	2	1	12	68	10	18.69	2.04	1.72	29.0	21.0	8.0	2.68	UU	56.0	9.3	-	0.558	-	-	-	-	Inorganic clays of low plasticity									
	24.50	D	21	13	16	20	36	19.67	SM	0	0	1	52	47	0	18.32	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands									
	26.00	D	22	-	-	-	-	-	ML	0	0	0	45	55	0	19.12	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity									
	27.50	D	23	14	19	23	42	20.97	CL-ML	2	1	1	18	71	7	19.00	-	-	26.0	20.5	5.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity									
	29.00	U	24	-	-	-	-	-	SM	0	0	0	56	44	0	19.75	1.96	1.64	Non Plastic			2.64	DST	0.0	28.7	-	0.610	-	-	-	-	Silty Sands									
	30.50	D	25	16	20	24	44	44.00	MI	0	0	1	5	78	16	28.30	-	-	38.0	27.0	11.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of Intermediate plasticity									
	32.00	U	26	-	-	-	-	-	SM	2	1	1	53	43	0	21.11	1.99	1.64	Non Plastic			2.64	DST	0.0	27.6	-	0.610	-	-	-	-	Silty Sands									
	33.50	D	27	20	25	27	52	52.00	CL	1	1	1	7	78	12	21.27	-	-	32.0	21.0	11.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity									
	35.00	D	28	22	26	30	56	23.37	CL-ML	0	0	1	35	58	6	17.60	-	-	26.0	21.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity									
	36.50	D	29	20	24	28	52	21.92	SM	0	1	1	52	46	0	18.72	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands									
	38.00	D	30	25	27	31	58	23.26	-	-	-	-	-	-	-	17.94	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	40.00	D	31	24	29	35	64	24.40	SM	0	1	2	48	49	0	20.04	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-									

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 16: SUMMARY OF TEST RESULTS

Bore No : P76	**Ground Elevation : RL 192.717 m**	**Method of drilling :Percussion**	**Depth of Water-table: 2.55 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 04/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 22907.087	**Casing Lowered : 30.00 m**	**Ending Date : 06/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	ML	1	1	1	44	53	0	11.58	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	1.00	U	2	-	-	-	-	-	SM	0	1	1	48	50	0	7.21	1.61	1.50	Non-Plastic			2.64	DST	4.0	21.3	-	0.760	-	-	-	-	Silty Sands											
	2.00	D	3	1	2	3	5	5.00	CL	5	5	5	25	49	11	17.31	-	-	30.0	19.0	11.0	-	-	-	-	-	-	-	-	-	-												
	3.00	D	4	3	4	6	10	10.00	-	-	-	-	-	-	-	17.94	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	4.00	U	5	-	-	-	-	-	CL	2	1	1	17	70	9	16.95	1.92	1.64	28.5	19.0	9.5	2.67	UU	50.0	12.4	-	0.628	-	0	15	-	Inorganic clays of low plasticity											
	5.00	D	6	2	4	5	9	9.00	-	-	-	-	-	-	-	23.97	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	6.00	D	7	3	5	8	13	14.49	CL-ML	1	1	2	14	74	8	23.19	-	-	25.5	19.0	6.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	7.00	U	8	-	-	-	-	-	CL	6	3	3	7	72	9	19.91	2.03	1.69	30.0	22.0	8.0	2.67	UU	47.0	10.5	0.153	0.577	-	8	17	-												
	8.00	D	9	2	3	5	8	8.00	-	-	-	-	-	-	-	16.73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	9.00	D	10	3	3	7	10	10.00	CL	8	4	5	8	65	10	1636.00	-	-	29.0	20.0	9.0	-	-	-	-	-	-	-	-	-	-												
	10.00	U	11	-	-	-	-	-	CL-ML	2	1	0	7	84	6	21.38	1.96	1.61	25.0	19.5	5.5	2.66	DST	9.0	26.5	-	0.647	-	0	16	-	Inorganic Silty Clays of low plasticity											
	11.00	D	12	6	10	12	22	22.00	CL	0	1	1	24	68	6	19.32	-	-	26.5	19.0	7.5	-	-	-	-	-	-	-	-	-	-												
	12.00	D	13	6	12	13	25	25.00	-	-	-	-	-	-	-	20.46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	13.00	U	14	-	-	-	-	-	CL	3	2	3	36	49	7	15.62	2.03	1.76	26.5	19.0	7.5	2.65	DST	12.0	27.0	-	0.509	-	-	-	-	Inorganic clays of low plasticity											
	14.50	D	15	5	8	14	22	22.00	-	-	-	-	-	-	-	17.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	16.00	U	16	-	-	-	-	-	-	-	-	-	-	-	-	13.42	2.04	1.80	-	-	-	2.65	UU	38.0	12.5	-	0.473	-	-	-	-												
	17.50	D	17	6	11	16	27	18.18	ML	0	0	0	42	58	0	16.45	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											

APPENDIX "B"

TABLE 16: SUMMARY OF TEST RESULTS

Bore No : P76	**Ground Elevation : RL 192.717 m**	**Method of drilling :Percussion**	**Depth of Water-table: 2.55 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 04/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 22907.087	**Casing Lowered : 30.00 m**	**Ending Date : 06/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	19.00	D	18	-	-	-	-	-	CL-ML	0	0	0	16	80	4	20.63	-	-	23.5	18.5	5.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	20.50	D	19	8	15	17	32	19.42	-	-	-	-	-	-	-	19.98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	22.00	D	20	-	-	-	-	-	CL-ML	3	3	4	24	59	7	21.63	-	-	26.0	20.0	6.0	-	-	-	-	-	-	-	-	-	-												
	23.50	D	21	11	20	22	42	22.25	-	-	-	-	-	-	-	17.90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	25.00	U	22	-	-	-	-	-	SM	3	1	1	45	50	0	16.99	1.98	1.69	Non-Plastic			2.64	DST	4.0	28.3	-	0.560	-	-	-	-	Silty Sands											
	26.50	D	23	12	22	39	61	27.76	CL	0	1	2	27	62	8	20.07	-	-	26.5	19.5	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	28.00	U	24	-	-	-	-	-	CL	8	4	6	7	63	12	19.51	2.08	1.74	31.5	19.0	12.5	2.69	UU	54.0	11.2	-	0.546	-	-	-	-												
	29.50	D	25	10	22	29	51	51.00	MI	1	0	3	4	74	18	30.28	-	-	44.0	28.0	16.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of Intermediate plasticity											
	31.00	D	26	15	23	30	53	23.66	ML	1	1	2	36	56	4	18.56	-	-	23.0	19.0	4.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	32.50	D	27	13	25	26	51	22.68	-	-	-	-	-	-	-	12.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	34.00	D	28	15	28	35	63	25.81	ML	3	1	2	37	52	5	17.75	1.95	1.66	24.0	20.0	4.0	2.66	RDST	7.0	23.5	-	0.602	-	-	-	-												
	35.50	D	29	16	33	40	73	28.23	-	-	-	-	-	-	-	18.22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	37.00	D	30	18	35	39	74	74.00	CL	2	2	3	34	52	7	18.71	-	-	27.5	19.5	8.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	38.50	D	31	20	38	45	83	83.00	-	-	-	-	-	-	-	19.56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	40.00	D	32	25	32	55	87	87.00	CL	1	1	0	14	75	9	20.45	-	-	28.5	19.5	9.0	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 17: SUMMARY OF TEST RESULTS

Bore No : P77	Ground Elevation : RL 192.676 m	Method of drilling :Percussion	Depth of Water-table: 2.62 m
Diameter of Bore Hole : 150 mm	Bore Retained using : Casing	Starting Date : 07/10/2023	SPT Sampler: Standard
Location / Chainage : 22933.287	Casing Lowered : 29.00 m	Ending Date : 09/10/2023	Hammer type: Auto-trip

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	ML	0	0	1	42	57	0	8.14	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	1.00	U	2	-	-	-	-	-	-	-	-	-	-	-	-	12.00	1.82	1.63	-	-	-	2.65	DST	6.0	21.7	-	0.631	-	-	-	-												
	2.00	D	3	1	2	3	5	5.00	CL	10	4	5	28	45	8	19.17	-	-	27.5	20.0	7.5	-	-	-	-	-	-	-	8	16	-	Inorganic clays of low plasticity											
	3.00	D	4	3	4	5	9	9.00	CL	3	2	2	18	64	11	25.50	-	-	30.0	18.0	12.0	-	-	-	-	-	-	-	-	-	-												
	4.00	U	5	-	-	-	-	-	MI	3	1	0	2	85	9	21.62	2.00	1.64	36.0	28.0	8.0	2.67	DST	18.0	23.6	0.172	0.624	-	-	-	-	Inorganic Silts of Intermediate plasticity											
	5.00	D	6	5	8	10	18	17.56	ML	0	0	0	30	70	0	24.33	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	6.00	D	7	8	12	16	28	28.00	CL	5	1	2	6	77	9	21.00	-	-	29.0	21.0	8.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	7.00	U	8	-	-	-	-	-	CL	5	2	1	10	75	7	21.40	1.98	1.63	27.5	20.5	7.0	2.66	DST	13.0	25.5	-	0.631	-	-	-	-												
	8.00	D	9	7	9	17	26	20.51	-	-	-	-	-	-	-	17.09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	9.00	D	10	8	13	17	30	30.00	CL	1	1	1	6	84	7	23.54	-	-	28.0	20.0	8.0	-	-	-	-	-	-	-	-	-	-												
	10.00	U	11	-	-	-	-	-	CL-ML	6	1	2	10	75	6	17.77	2.12	1.80	26.0	20.0	6.0	2.66	UU	38.0	12.5	-	0.478	-	8	17	-	Inorganic Silty Clays of low plasticity											
	11.00	D	12	7	10	12	22	22.00	CL	1	1	1	7	79	11	22.28	-	-	29.0	19.5	9.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	12.00	D	13	8	12	15	27	27.00	-	-	-	-	-	-	-	23.64	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	13.00	U	14	-	-	-	-	-	CL	4	0	2	9	75	10	20.03	2.04	1.70	29.0	20.0	9.0	2.66	DST	18.0	24.2	-	0.565	-	-	-	-												
	14.50	D	15	7	13	18	31	20.28	SM	1	0	1	57	41	0	19.14	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	16.00	D	16	-	-	-	-	-	ML	0	0	1	32	63	4	20.22	-	-	25.0	21.0	4.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	17.50	D	17	9	15	20	35	20.98	ML	0	0	1	44	55	0	11.21	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												

APPENDIX "B"
TABLE 17: SUMMARY OF TEST RESULTS

Bore No : P77	**Ground Elevation : RL 192.676 m**	**Method of drilling :Percussion**	**Depth of Water-table: 2.62 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 07/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 22933.287	**Casing Lowered : 29.00 m**	**Ending Date : 09/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen													
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	19.00	U	18	-	-	-	-	-	CL	2	1	1	11	73	12	19.61	2.00	1.67	32.0	20.0	12.0	2.67	UU	56.0	11.6	-	0.597	-	-	-	-	Inorganic clays of low plasticity										
	20.50	D	19	9	16	25	41	22.33	ML	3	2	2	32	57	4	16.60	-	-	24.0	20.0	4.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity										
	22.00	U	20	-	-	-	-	-	CL	8	8	6	19	49	10	18.17	2.06	1.74	27.0	19.0	8.0	2.67	UU	44.0	12.5	-	0.532	-	-	-	-	Inorganic clays of low plasticity										
	23.50	D	21	12	18	27	45	45.00	-	-	-	-	-	-	-	17.78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	25.00	U	22	-	-	-	-	-	SM	1	1	2	51	45	0	18.83	1.93	1.62	Non-Plastic			-	DST	0.0	25.6	-	-	-	-	-	-	Silty Sands										
	26.50	D	23	11	18	26	44	21.72	-	-	-	-	-	-	-	16.86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	28.00	U	24	-	-	-	-	-	MI	3	1	1	9	68	18	28.00	2.06	1.61	45.5	29.0	16.5	2.69	UU	59.0	10.1	-	0.672	-	9	12	-	Inorganic Silts of Intermediate plasticity										
	29.50	D	25	19	40	60	100	100.00	CL	8	4	4	30	45	9	18.15	-	-	27.5	20.0	7.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	31.00	D	26	17	42	55	97	36.38	ML	2	0	1	42	55	0	17.44	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity										
	32.50	D	27	19	40	46	86	86.00	CL	4	0	3	24	58	11	20.15	-	-	31.0	19.5	11.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	34.00	D	28	21	43	52	95	34.39	ML	0	0	1	38	61	0	17.52	2.03	1.73	Non-Plastic			2.65	RDST	0.0	24.3	-	0.532	-	-	-	-	Inorganic Silts of low plasticity										
	35.50	D	29	11	22	41	63	24.90	-	-	-	-	-	-	-	22.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	37.00	D	30	7	14	31	45	19.63	ML	0	0	2	27	67	4	23.12	-	-	24.0	20.0	4.0	-	-	-	-	-	-	-	-	-	-											
	38.50	D	31	14	29	35	64	24.41	-	-	-	-	-	-	-	16.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	40.00	D	32	19	35	58	93	93.00	CL	2	2	1	11	71	13	20.50	-	-	32.0	19.0	13.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 18: SUMMARY OF TEST RESULTS

Bore No : P78	**Ground Elevation : RL 192.731 m**	**Method of drilling :Percussion**	**Depth of Water-table: 2.60 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 06/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 22954.487	**Casing Lowered : 29.50 m**	**Ending Date : 08/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	ML	0	0	1	38	61	0	11.19	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	1.00	D	2	2	3	5	8	12.36	-	-	-	-	-	-	-	6.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	2.00	U	3	-	-	-	-	-	ML	0	0	1	32	62	5	18.91	1.97	1.66	25.0	21.0	4.0	2.66	DST	17.0	22.5	0.131	0.606	-	-	-	-	Inorganic Silts of low plasticity											
	3.00	D	4	3	4	6	10	12.01	-	-	-	-	-	-	-	17.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	4.00	D	5	2	3	6	9	10.32	-	-	-	-	-	-	-	18.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	5.00	U	6	-	-	-	-	-	SM-SC	6	3	5	37	41	8	19.79	1.99	1.66	27.5	20.5	7.0	2.67	DST	16.0	24.2	-	0.607	-	-	-	-	Silty Sands with clay binder											
	6.00	D	7	4	6	8	14	14.81	-	-	-	-	-	-	-	15.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	7.00	D	8	3	5	7	12	12.00	CL	2	2	1	18	68	9	20.90	-	-	28.0	19.0	9.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	8.00	U	9	-	-	-	-	-	CL	11	3	2	14	60	10	20.49	2.05	1.70	28.5	19.5	9.0	2.67	UU	40.0	11.5	-	0.571	-	-	-	-												
	9.00	D	10	12	14	17	31	22.28	CL-ML	0	0	1	8	84	7	19.93	-	-	25.0	19.0	6.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	10.00	D	11	4	6	10	16	16.00	CL	1	1	2	10	76	10	18.42	-	-	27.0	19.5	7.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	11.00	U	12	-	-	-	-	-	CL-ML	0	0	1	17	75	7	21.92	2.02	1.66	26.0	19.5	6.5	2.67	UU	44.0	10.5	-	0.608	-	-	-	-	Inorganic Silty Clays of low plasticity											
	12.50	D	13	5	7	11	18	18.00	CL	4	2	2	6	75	11	20.29	-	-	28.0	19.5	8.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	14.00	U	14	-	-	-	-	-	CL-ML	2	0	1	16	76	5	22.06	1.99	1.63	25.0	20.0	5.0	2.67	DST	13.0	25.2	-	0.638	-	-	-	-												
	15.50	D	15	9	13	15	28	18.74	-	-	-	-	-	-	-	20.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	17.00	U	16	-	-	-	-	-	CL-ML	2	1	1	18	71	7	21.61	2.04	1.68	26.0	19.5	6.5	2.66	DST	15.0	24.6	-	0.586	-	-	-	-												

APPENDIX "B"

TABLE 18: SUMMARY OF TEST RESULTS

Bore No : P78	**Ground Elevation : RL 192.731 m**	**Method of drilling :Percussion**	**Depth of Water-table: 2.60 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 06/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 22954.487	**Casing Lowered : 29.50 m**	**Ending Date : 08/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen												
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	18.50	D	17	11	12	15	27	17.62	-	-	-	-	-	-	-	20.73	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	20.00	U	18	-	-	-	-	-	CL	4	1	3	15	69	8	24.97	1.96	1.57	28.0	20.5	7.5	2.66	UU	48.0	11.0	-	0.696	-	-	-	-	Inorganic clays of low plasticity										
	21.50	D	19	9	15	18	33	19.17	CL	2	1	1	12	77	7	23.90	-	-	28.0	21.0	7.0	-	-	-	-	-	-	-	-	-												
	23.00	D	20	-	-	-	-	-	ML	0	1	1	28	65	5	19.39	-	-	25.0	21.0	4.0	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity										
	24.50	D	21	12	17	20	37	19.87	-	-	-	-	-	-	-	24.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	26.00	U	22	-	-	-	-	-	CL-ML	0	1	1	45	49	4	19.70	1.98	1.65	23.5	19.0	4.5	2.65	DST	7.0	26.0	-	0.602	-	-	-	-	Inorganic Silty Clays of low plasticity										
	27.50	D	23	13	26	29	55	24.95	-	-	-	-	-	-	-	20.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	29.00	D	24	15	27	32	59	25.74	SM	12	1	2	42	43	0	18.56	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	30.50	D	25	11	31	38	69	28.30	CL-ML	0	1	1	36	56	6	15.53	-	-	24.0	19.5	4.5	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	32.00	D	26	13	33	42	75	29.54	ML	0	1	1	47	51	0	18.64	2.01	1.69	Non-Plastic			2.65	RDST	0.0	29.6	-	0.568	-	-	-	-	Inorganic Silts of low plasticity										
	33.50	D	27	9	31	37	68	27.00	-	-	-	-	-	-	-	16.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	35.00	D	28	12	29	35	64	25.41	CL-ML	1	0	2	35	57	5	19.86	-	-	25.0	20.0	5.0	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	36.50	D	29	14	33	39	72	27.21	-	-	-	-	-	-	-	20.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	38.00	D	30	17	35	43	78	28.41	-	-	-	-	-	-	-	19.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	40.00	D	31	19	38	50	88	88.00	CL	2	1	2	25	62	8	20.29	-	-	27.5	18.5	9.0	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 19: SUMMARY OF TEST RESULTS

Bore No : P79	**Ground Elevation : RL 192.898 m**	**Method of drilling :Percussion**	**Depth of Water-table: 2.20 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 03/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 22985.687	**Casing Lowered : 20.00 m**	**Ending Date : 04/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	SM	0	0	0	61	39	0	9.43	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	1.00	U	2	-	-	-	-	-	CL	0	0	1	40	53	6	11.10	1.84	1.66	26.5	18.5	8.0	2.66	DST	9.0	23.5	-	0.602	-	-	-	-	Inorganic clays of low plasticity											
	2.00	D	3	1	2	2	4	4.00	-	-	-	-	-	-	-	16.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	3.00	D	4	2	3	5	8	10.02	CL	1	1	2	18	70	8	17.39	-	-	27.0	20.0	7.0	-	-	-	-	-	-	-	-	-	-												
	4.00	U	5	-	-	-	-	-	CL	1	3	3	6	79	8	20.02	1.96	1.63	28.0	20.0	8.0	2.66	UU	42.0	8.6	-	0.629	-	9	15	-												
	5.00	D	6	2	3	6	9	9.00	-	-	-	-	-	-	-	18.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	6.00	D	7	3	4	8	12	12.00	-	-	-	-	-	-	-	18.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	7.00	U	8	-	-	-	-	-	CL-ML	1	3	3	28	58	7	16.61	2.01	1.72	25.5	19.5	6.0	2.67	UU	51.0	13.0	0.120	0.549	-	-	-	-	Inorganic Silty Clays of low plasticity											
	8.00	D	9	7	11	15	26	26.00	CL	0	1	1	11	79	8	18.16	-	-	27.0	19.5	7.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	9.00	D	10	8	10	13	23	23.00	-	-	-	-	-	-	-	20.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	10.00	U	11	-	-	-	-	-	CL	3	4	3	27	56	7	15.30	1.88	1.63	27.0	20.0	7.0	2.66	DST	21.0	23.8	-	0.631	-	-	-	-												
	11.00	D	12	5	7	9	16	16.00	CL	0	0	1	22	69	8	22.62	-	-	28.5	20.0	8.5	-	-	-	-	-	-	-	-	-	-												
	12.00	D	13	6	8	11	19	19.00	-	-	-	-	-	-	-	21.39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	13.00	U	14	-	-	-	-	-	CL-ML	0	0	0	10	85	5	21.15	1.90	1.57	25.0	19.0	6.0	2.66	UU	38.0	12.5	-	0.696	-	-	-	-	Inorganic Silty Clays of low plasticity											
	14.50	D	15	4	9	13	22	16.90	CL	2	1	2	12	76	7	19.49	-	-	27.0	20.0	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	16.00	U	16	-	-	-	-	-	ML	6	3	2	14	68	7	19.74	2.02	1.69	30.0	23.5	6.5	2.67	-	-	-	-	0.583	-	8	18	-	Inorganic Silts of low plasticity											
	17.50	D	17	8	12	24	36	21.80	ML	0	0	1	44	55	0	21.01	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												

APPENDIX "B"

TABLE 19: SUMMARY OF TEST RESULTS

Bore No : P79	**Ground Elevation : RL 192.898 m**	**Method of drilling :Percussion**	**Depth of Water-table: 2.20 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 03/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 22985.687	**Casing Lowered : 20.00 m**	**Ending Date : 04/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	19.00	U	18	-	-	-	-	-	SM	1	1	1	54	43	0	15.46	1.81	1.57	Non-Plastic			2.64	DST	7.0	26.2	-	0.684	-	-	-	-	Silty Sands											
	20.50	D	19	7	23	28	51	51.00	CL	2	2	2	11	76	7	20.18	-	-	29.5	22.0	7.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	22.00	U	20	-	-	-	-	-	CL	4	2	3	10	70	11	20.14	1.98	1.65	31.0	20.0	11.0	2.68	UU	54.0	12.5	-	0.624	-	-	-	-												
	23.50	D	21	8	15	25	40	40.00	-	-	-	-	-	-	-	19.36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	25.00	U	22	-	-	-	-	-	CL	0	0	1	43	49	7	15.12	1.98	1.72	26.5	19.5	7.0	2.66	UU	40.0	13.4	-	0.547	-	-	-	-												
	26.50	D	23	9	18	20	38	38.00	CL	0	0	1	15	76	8	22.85	-	-	28.5	19.0	9.5	-	-	-	-	-	-	-	-	-	-												
	28.00	D	24	-	-	-	-	-	-	-	-	-	-	-	-	21.36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	29.50	D	25	8	15	23	38	19.64	SM	0	0	1	58	41	0	18.30	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	31.00	D	26	-	-	-	-	-	ML	1	0	2	34	59	4	13.39	-	-	24.0	20.0	4.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	32.50	D	27	15	17	26	43	20.56	CL-ML	0	1	1	24	70	4	22.79	-	-	25.0	19.5	5.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	34.00	D	28	-	-	-	-	-	CL-ML	3	4	6	26	56	5	13.66	1.98	1.74	25.0	19.0	6.0	2.67	RDST	10.0	27.4	-	0.534	-	-	-	-												
	35.50	D	29	19	23	30	53	22.83	CL	0	0	1	22	71	6	17.61	-	-	26.0	19.0	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	37.00	D	30	-	-	-	-	-	-	-	-	-	-	-	-	13.28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	38.50	D	31	16	26	32	58	58.00	CL	1	1	2	11	76	9	14.29	-	-	29.0	19.0	10.0	-	-	-	-	-	-	-	-	-	-												
	40.00	D	32	18	28	36	64	64.00	-	-	-	-	-	-	-	15.66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 20: SUMMARY OF TEST RESULTS

Bore No : P80	**Ground Elevation : RL 193.042 m**	**Method of drilling :Rotary**	**Depth of Water-table: 2.35 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 21/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23011.887	**Casing Lowered : 20.00 m**	**Ending Date : 24/10/2023**	**Hammer type: Rope pulley**

FIELD TEST RESULT									LABORATORY TEST RESULT																							
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen (Core Recovery %, R.Q.D %, Density (gm /cc), Specific gravity, Moisture content (%), Water absorption (%), Point load Index, U.C.S (MPa), Porosity, Hardness, Modulus of Elasticity, Cerchar Abrasive Index)
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Correct N)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Classification of SOIL
																							Classification of ROCK									
	0.50	D	1	-	-	-	-	-	CL-ML	0	0	1	38	55	6	9.39	-	-	27.0	21.5	5.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity
	1.00	U	2	-	-	-	-	-	-	-	-	-	-	-	-	19.54	2.08	1.74	-	-	-	-	-	-	-	-	-	-	-	-	-	
	2.00	D	3	2	2	3	5	5.00	CL	0	0	0	35	57	8	17.39	-	-	28.0	20.5	7.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity
	3.00	D	4	3	3	5	8	9.57	SM	0	2	4	52	42	0	18.69	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands
	4.00	U	5	-	-	-	-	-	-	-	-	-	-	-	-	18.34	1.96	1.66	-	-	-	2.64	DST	2.0	28.4	-	0.590	-	-	-	-	
	5.00	D	6	4	5	9	14	14.00	CL	1	1	0	14	74	10	18.15	-	-	29.0	20.0	9.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity
	6.00	D	7	3	5	8	13	13.74	ML	0	0	1	27	72	0	19.81	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity
	7.00	U	8	-	-	-	-	-	SM	0	0	0	51	49	0	19.81	1.96	1.64	Non Plastic			2.65	DST	2.0	29.2	-	0.616	-	-	-	-	Silty Sands
	8.00	D	9	7	10	14	24	19.36	CL-ML	1	1	0	12	79	7	21.79	-	-	28.0	21.5	6.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity
	9.00	D	10	6	11	24	35	24.28	-	-	-	-	-	-	-	20.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	10.00	U	11	-	-	-	-	-	CL	1	0	0	6	84	9	22.92	2.00	1.63	29.0	21.0	8.0	2.66	UU	42.0	9.5	-	0.632	-	8	19	-	Inorganic clays of low plasticity
	11.00	D	12	7	12	25	37	24.23	ML	0	1	1	14	79	5	20.93	-	-	24.0	20.0	4.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity
	12.00	D	13	8	11	12	23	23.00	CL	2	1	1	7	77	12	22.67	-	-	31.5	21.0	10.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity
	13.00	U	14	-	-	-	-	-	CL	3	1	1	8	76	11	21.51	2.04	1.68	32.0	22.0	10.0	2.67	UU	54.0	8.2	0.152	0.589	-	18	16	-	
	14.50	D	15	8	12	18	30	30.00	-	-	-	-	-	-	-	19.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	16.00	U	16	-	-	-	-	-	SC	12	1	1	39	38	9	16.29	2.01	1.73	28.0	19.5	8.5	2.67	UU	52.0	10.3	-	0.543	-	9	17	-	Clayey Sands
	17.50	D	17	12	20	26	46	46.00	-	-	-	-	-	-	-	16.84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

APPENDIX "B"
TABLE 20: SUMMARY OF TEST RESULTS

Bore No : P80	**Ground Elevation : RL 193.042 m**	**Method of drilling :Rotary**	**Depth of Water-table: 2.35 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 21/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23011.887	**Casing Lowered : 20.00 m**	**Ending Date : 24/10/2023**	**Hammer type: Rope pulley**

RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Correct N)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
FIELD TEST RESULT				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
									LABORATORY TEST RESULT																																		
																							Classification of ROCK									Classification of SOIL											
	19.00	U	18	-	-	-	-	-	SM	1	0	1	58	40	0	20.63	1.96	1.63	Non Plastic			2.63	DST	2.0	27.8	-	0.618	-	-	-	-	Silty Sands											
	20.50	D	19	15	22	27	49	25.25	SM-SC	0	1	1	48	45	5	20.48	-	-	24.0	20.0	4.0	-	-	-	-	-	-	-	-	-	-	Silty Sands with clay binder											
	22.00	U	20	-	-	-	-	-	CL	5	1	0	43	40	11	20.92	1.99	1.65	28.5	20.5	8.0	2.66	UU	47.0	9.5	-	0.617	-	-	-	-	Inorganic clays of low plasticity											
	23.50	D	21	20	30	35	65	65.00	-	-	-	-	-	-	-	19.66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	25.00	D	22	17	35	42	77	33.11	CL-ML	0	1	1	17	74	7	22.92	-	-	27.0	21.0	6.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	26.50	D	23	19	38	47	85	35.07	CL-ML	4	1	2	24	64	5	20.26	-	-	26.0	21.0	5.0	-	-	-	-	-	-	-	-	-	-												
	28.00	D	24	28	45	56	R	-	ML	0	0	1	48	51	0	18.55	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	29.50	D	25	16	24	27	51	23.28	-	-	-	-	-	-	-	18.83	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	31.00	D	26	15	28	35	63	26.54	CL-ML	0	0	1	38	56	5	19.26	-	-	26.0	21.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	32.50	D	27	17	32	40	72	72.00	CL	0	1	0	14	77	8	16.20	-	-	28.0	20.5	7.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	34.00	D	28	22	34	43	77	29.76	ML	0	0	1	35	58	6	20.45	-	-	27.0	22.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	35.50	D	29	20	36	44	80	30.12	CL-ML	2	0	1	42	50	5	19.65	-	-	26.0	21.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	37.00	D	30	23	38	50	88	31.83	-	-	-	-	-	-	-	22.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	38.50	D	31	25	37	48	85	30.48	-	-	-	-	-	-	-	21.29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	40.00	D	32	28	39	52	91	31.58	CL-ML	1	0	1	34	59	5	20.40	-	-	26.0	20.5	5.5	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample

APPENDIX- B
TABLE 21: CHEMICAL TEST ON SOIL SAMPLES

BH No.	DEPTH (m)	SULPHATE CONTENT AS SO_3 (%)	CHLORIDE CONTENT (%)	pH VALUE
P66	4.00	0.103	0.096	8.29
P76	4.00	0.112	0.098	8.16
	13.00	0.110	0.102	8.21

APPENDIX- B
TABLE 22: CHEMICAL TEST ON GROUND WATER SAMPLES

BH No.	SULPHATE CONTENT AS SO_3 (mg/l)	CHLORIDE CONTENT (mg/l)	pH VALUE
P61	154.970	996.711	7.14
P66	168.687	890.724	7.63
P76	171.861	723.589	7.46

APPENDIX-B
TABLE 23: UCS TEST ON SOIL SAMPLES

BH No.	DEPTH (m)	UCS (kg/cm²)
P61	1.00	0.80
	16.00	0.51
	19.00	0.41
P62	2.00	0.41
	14.00	0.41
P63	4.00	0.49
	16.00	0.43
	25.00	0.56
P64	14.00	0.37
	23.00	0.41
P65	22.00	0.63
	28.00	1.01
	31.00	1.06
P66	4.00	0.32
	25.00	0.46
P67	14.00	0.44
	23.00	0.57
P68	11.00	0.49
	14.00	0.64
	17.00	0.69
	20.00	0.59
	23.00	0.72
	26.00	0.67
P69	11.00	0.51
	14.00	0.62
	20.00	0.53
	23.00	0.49
	26.00	0.73
P70	13.00	0.65
	16.00	0.59
	22.00	0.49

APPENDIX-B
TABLE 23: UCS TEST ON SOIL SAMPLES

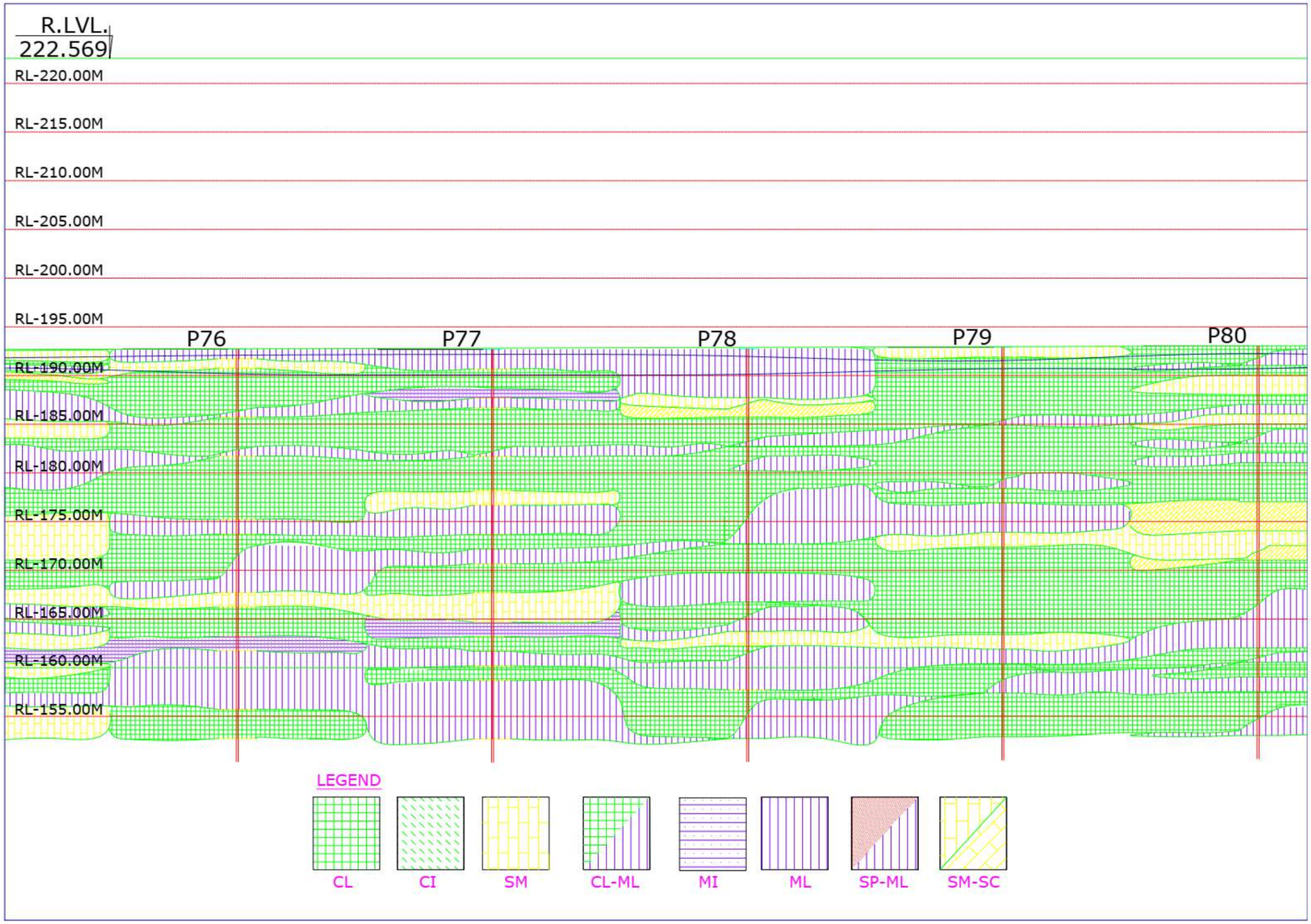
BH No.	DEPTH (m)	UCS (kg/cm²)
	25.00	0.52
	28.00	0.46
P72	11.00	0.47
	14.00	0.43
	17.00	0.52
	20.00	0.59
	26.00	0.61
P73	11.00	0.68
	14.00	0.71
	20.00	0.54
P74	17.00	0.60
P75	23.00	0.66
P76	4.00	0.65
	7.00	0.74
	16.00	0.52
	28.00	0.79
P77	10.00	0.79
	19.00	0.73
	22.00	0.61
	28.00	0.82
P78	8.00	0.59
P79	4.00	0.42
	7.00	0.39
	13.00	0.45
	22.00	0.50
	25.00	0.52
P80	10.00	0.47
	13.00	0.67
	16.00	0.63
	22.00	0.53

APPENDIX-C
PLOT 1: LITHOLOGICAL PROFILE-01

APPENDIX-C
PLOT 2: LITHOLOGICAL PROFILE-02

APPENDIX-C
PLOT 3: LITHOLOGICAL PROFILE-03

APPENDIX-C
PLOT 4: LITHOLOGICAL PROFILE-04



APPENDIX-C
PLOT 5: LITHOLOGICAL PLOTS

BH-P61-22514.0870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Silty Sands	SM		0.50	D		-	-
			1.00	U		-	-
Inorganic clays of Intermediate plasticity	CI		2.00	D	5	-	-
			3.00	D	6	-	-
Inorganic clays of low plasticity	CL		4.00	U		-	-
			5.00	D	15	-	-
			6.00	D	21	-	-
Silty Sands	SM		7.00	U		-	-
			8.00	D	15	-	-
Inorganic clays of low plasticity	CL		9.00	D	25	-	-
			10.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML		11.00	D	24	-	-
			12.00	D	28	-	-
			13.00	U		-	-
			14.50	D	32	-	-
Inorganic clays of low plasticity	CL		16.00	U		-	-
			17.50	D	25	-	-
Inorganic Silty Clays of low plasticity	CL-ML		19.00	U		-	-
			20.00	D	52	-	-

BH-P61-22514.0870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Inorganic Silty Clays of low plasticity	CL-ML		20.50	D	52	-	-
			22.00	U		-	-
Inorganic clays of low plasticity	CL		23.50	D	58	-	-
			25.00	U		-	-
Inorganic Silts of low plasticity	ML		26.50	D	50	-	-
			28.00	U		-	-
Inorganic Silts of Intermediate plasticity	MI		29.50	D	68	-	-
Inorganic Silts of low plasticity	ML		31.00	D	74	-	-
			32.50	D	61	-	-
			34.00	D	85	-	-
Inorganic clays of low plasticity	CL		35.50	D	64	-	-
			37.00	D	83	-	-
			38.50	D	89	-	-
			40.00	D	101	-	-

APPENDIX-C
PLOT 6: LITHOLOGICAL PLOTS

BH-P62-22540.2870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Silty Sands	SM		0.50	D		-	-
Inorganic clays of Intermediate plasticity	CI		1.00	D	5	-	-
			2.00	U		-	-
Inorganic clays of low plasticity	CL		3.00	D	16	-	-
			4.00	D	25	-	-
			5.00	U		-	-
Silty Sands	SM		6.00	D	30	-	-
			7.00	D	36	-	-
			8.00	D		-	-
			9.00	D	19	-	-
Inorganic Silts of low plasticity	ML		10.00	D	25	-	-
			11.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML		12.50	D	28	-	-
			14.00	U		-	-
Inorganic clays of low plasticity	CL		15.50	D	33	-	-
Inorganic Silty Clays of low plasticity	CL-ML		17.00	U		-	-
Inorganic clays of low plasticity	CL		18.50	D	36	-	-
			20.00	U		-	-

BH-P62-22540.2870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			20.00	U		-	-
			21.50	D	39	-	-
Inorganic clays of low plasticity	CL		23.00	U		-	-
			24.50	D	62	-	-
			26.00	U		-	-
Inorganic Silts of low plasticity	ML		27.50	D	50	-	-
Inorganic clays of low plasticity	CL		29.00	D		-	-
			30.50	D	56	-	-
Silty Sands	SM		32.00	D		-	-
			33.50	D	62	-	-
Inorganic Silts of low plasticity	ML		35.00	D		-	-
			36.50	D	69	-	-
Inorganic Silty Clays of low plasticity	CL-ML		38.00	D		-	-
Inorganic Silts of low plasticity	ML		40.00	D	62	-	-

APPENDIX-C
PLOT 7: LITHOLOGICAL PLOTS

BH-P63-22566.4870

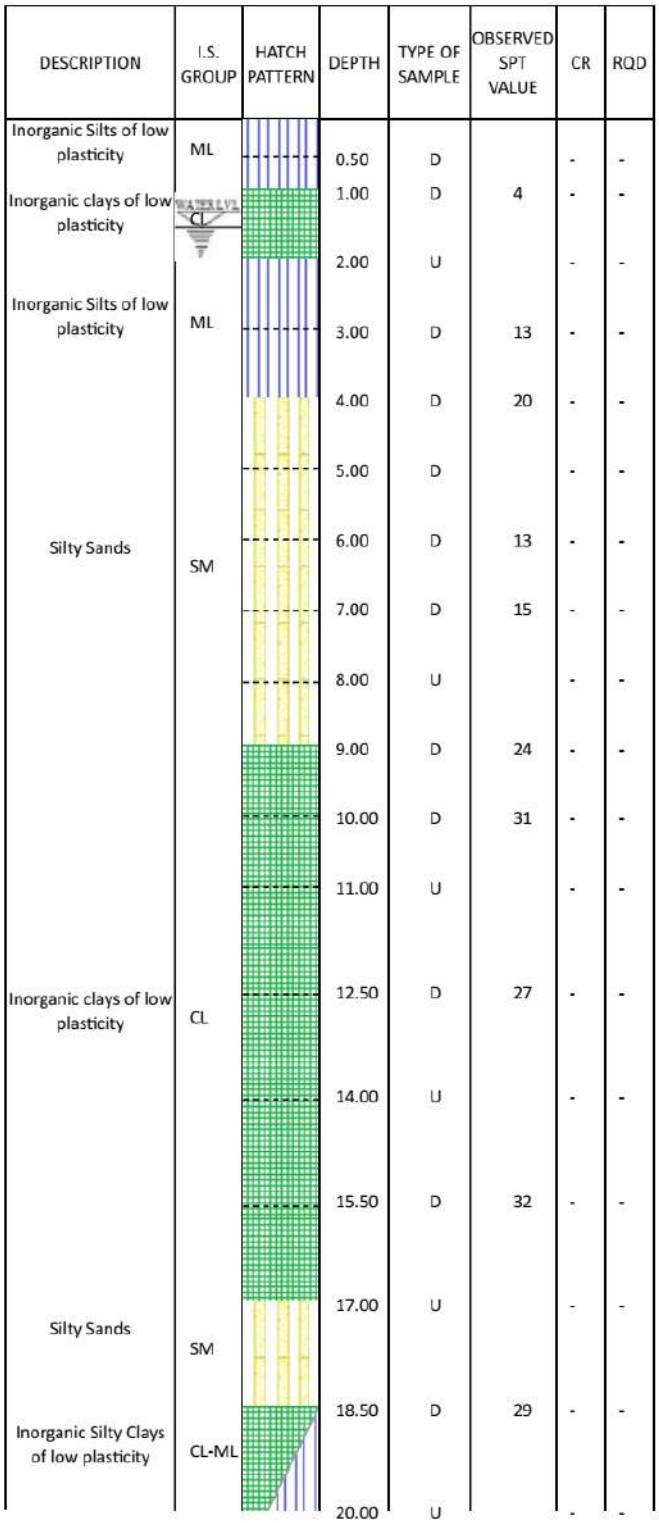
DESCRIPTION	I.S. GROUP	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Inorganic Silts of low plasticity	ML	0.50	D		-	-
		1.00	U		-	-
		2.00	D	3	-	-
Inorganic clays of Intermediate plasticity	CI	3.00	D	6	-	-
		4.00	U		-	-
		5.00	D	12	-	-
		6.00	D	18	-	-
Silty Sands	SM	7.00	D		-	-
		8.00	D	26	-	-
Poorly Graded Sands with inorganic Silts of low plasticity	SP-ML	9.00	D	31	-	-
		10.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML	11.00	D	37	-	-
		12.00	D	41	-	-
		13.00	U		-	-
		14.50	D	32	-	-
Inorganic clays of low plasticity	CL	16.00	U		-	-
		17.50	D	44	-	-
Inorganic Silts of low plasticity	ML	19.00	U		-	-
		20.00	D	49	-	-

BH-P63-22566.4870

DESCRIPTION	I.S. GROUP	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Inorganic Silts of low plasticity	ML	20.50	D	49	-	-
		22.00	U		-	-
Inorganic clays of low plasticity	CL	23.50	D	42	-	-
		25.00	U		-	-
		26.50	D	46	-	-
Inorganic Silts of low plasticity	ML	28.00	U		-	-
		29.50	D	49	-	-
Inorganic Silts of Intermediate plasticity	MI	31.00	D	52	-	-
		32.50	D	57	-	-
		34.00	D		-	-
Inorganic Silty Clays of low plasticity	CL-ML	35.50	D	58	-	-
		37.00	D		-	-
Inorganic Silts of Intermediate plasticity	MI	38.50	D	60	-	-
		40.00	D	65	-	-

APPENDIX-C
PLOT 8: LITHOLOGICAL PLOTS

BH-P64-22592.6870



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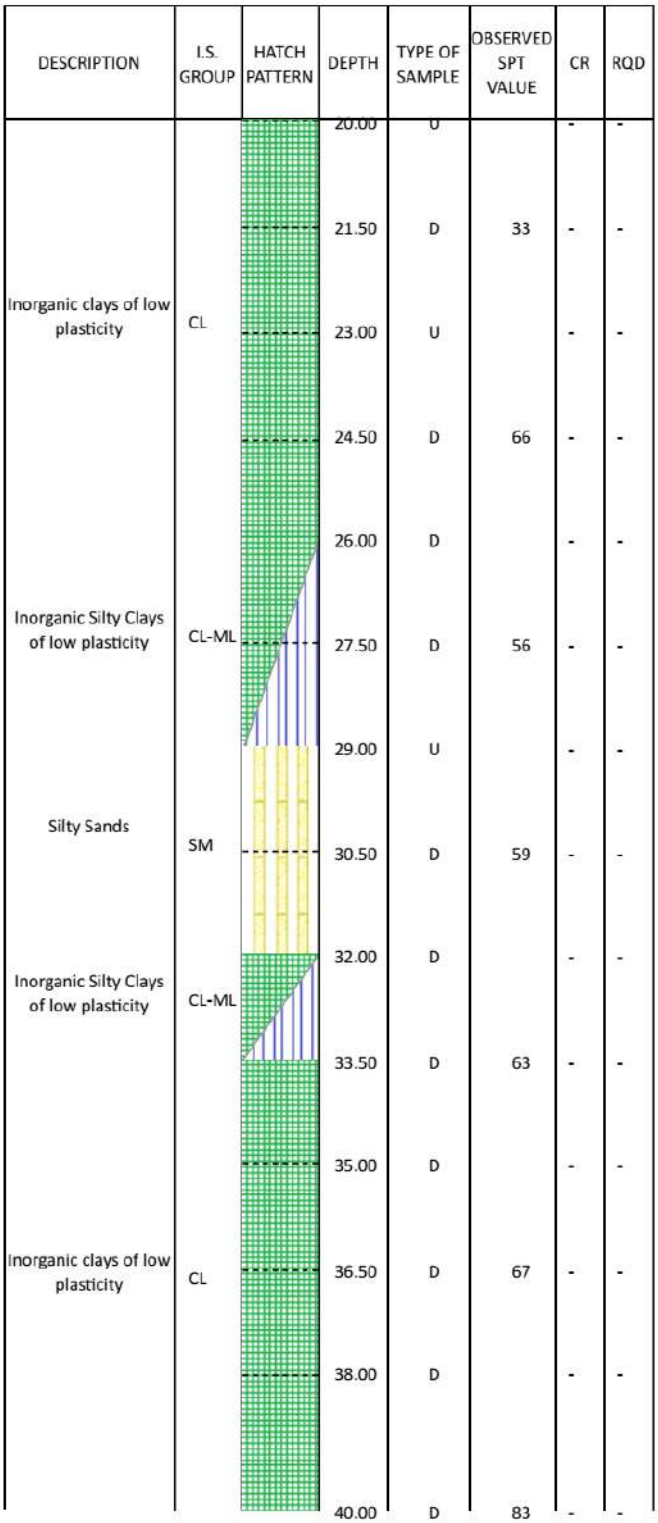


APPENDIX-C
PLOT 9: LITHOLOGICAL PLOTS

BH-P65-22618.8870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Inorganic Silts of low plasticity	ML		0.50	D		-	-
			1.00	U		-	-
Inorganic clays of low plasticity	CL						
Silty Sands	SM		2.00	D	5	-	-
Inorganic clays of low plasticity	CL		3.00	D	10	-	-
			4.00	U		-	-
			5.00	D	15	-	-
Silty Sands	SM		6.00	D	20	-	-
			7.00	U		-	-
			8.00	D	25	-	-
			9.00	D	16	-	-
Inorganic Silts of low plasticity	ML		10.00	U		-	-
			11.00	D	16	-	-
			12.00	D	17	-	-
			13.00	U		-	-
			14.50	D	30	-	-
Inorganic clays of low plasticity	CL		16.00	D		-	-
			17.50	D	23	-	-
			19.00	D		-	-
			20.00	D	27	-	-

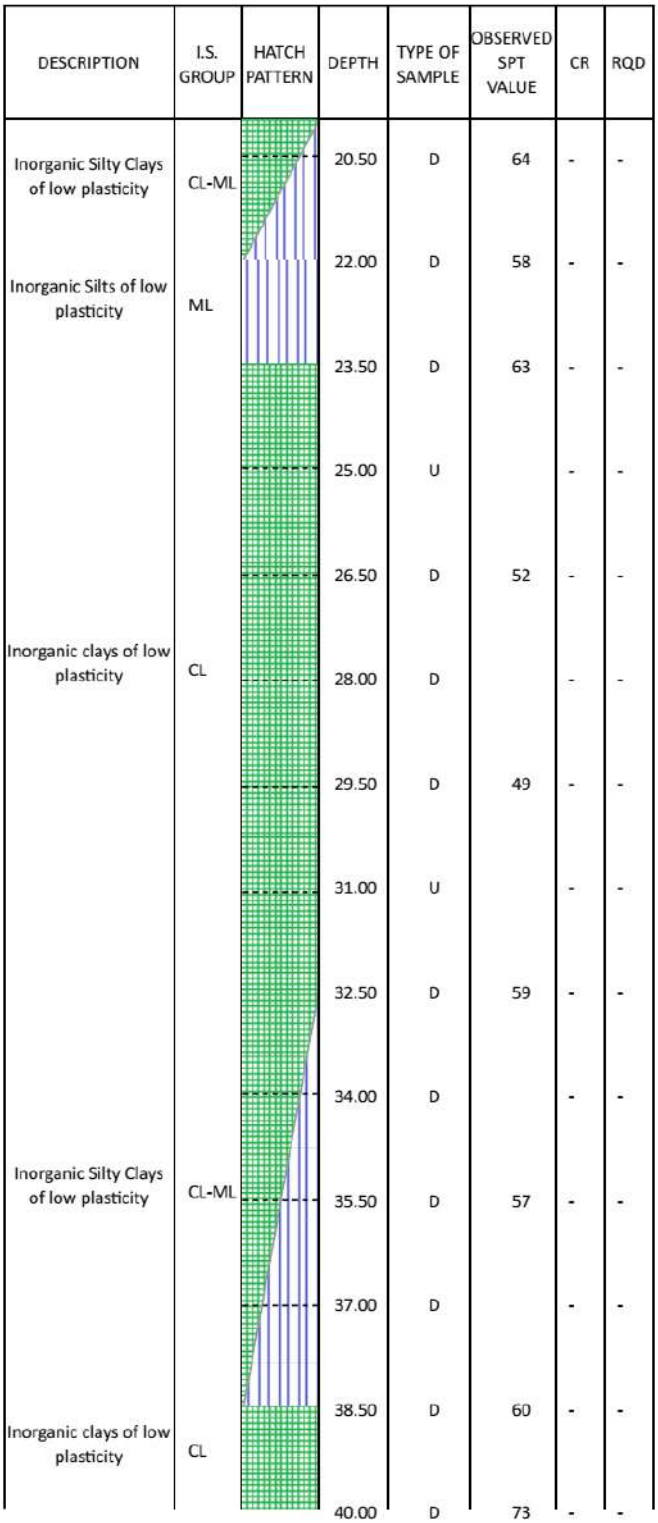
BH-P65-22618.8870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			20.50	D	27	-	-
			22.00	U		-	-
Inorganic clays of low plasticity	CL		23.50	D	52	-	-
			25.00	U		-	-
			26.50	D	41	-	-
Inorganic Silts of low plasticity	ML		28.00	U		-	-
			29.50	D	22	-	-
			31.00	U		-	-
			32.50	D	50	-	-
Inorganic clays of low plasticity	CL		34.00	D		-	-
			35.50	D	59	-	-
			37.00	D		-	-
			38.50	D	44	-	-
Inorganic Silts of low plasticity	ML		40.00	D	56	-	-

APPENDIX-C
PLOT 10: LITHOLOGICAL PLOTS

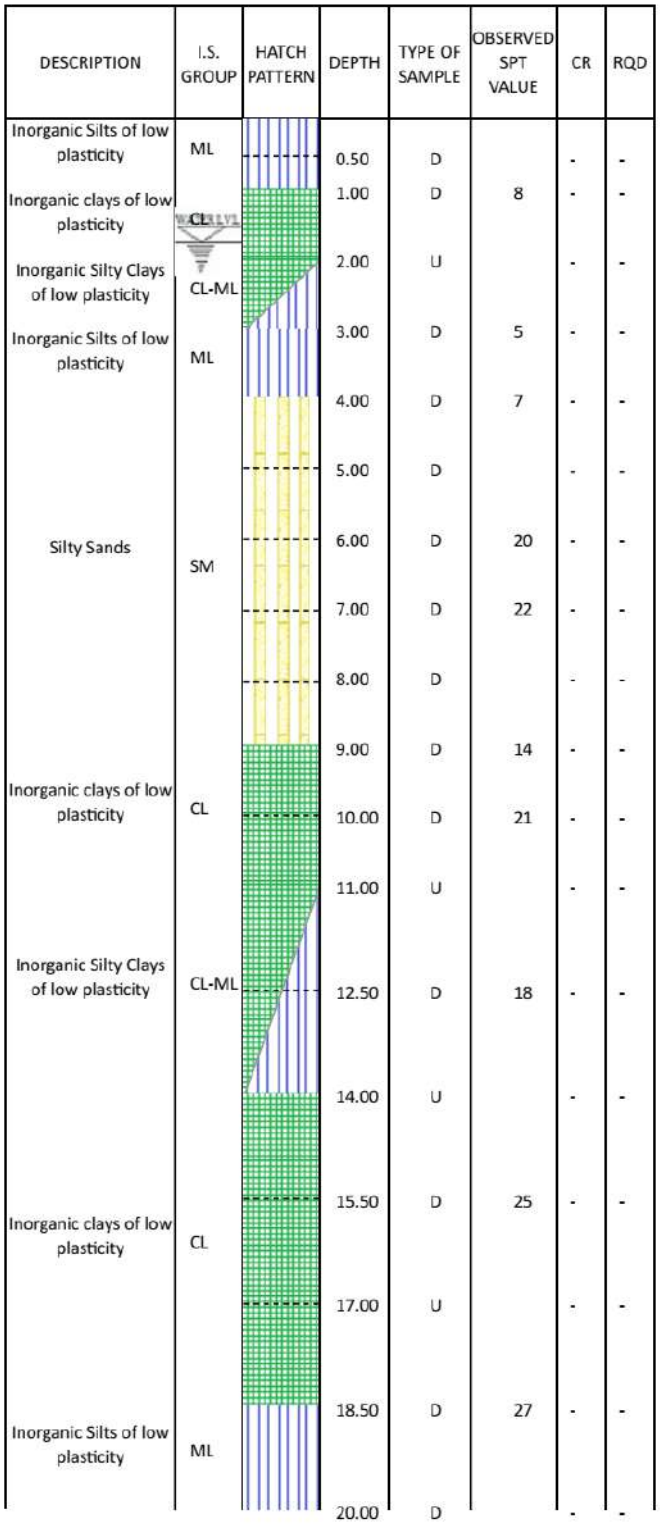
BH-P66-22645.0870

BH-P66-22645.0870



APPENDIX-C
PLOT 11: LITHOLOGICAL PLOTS

BH-P67-22671.2870



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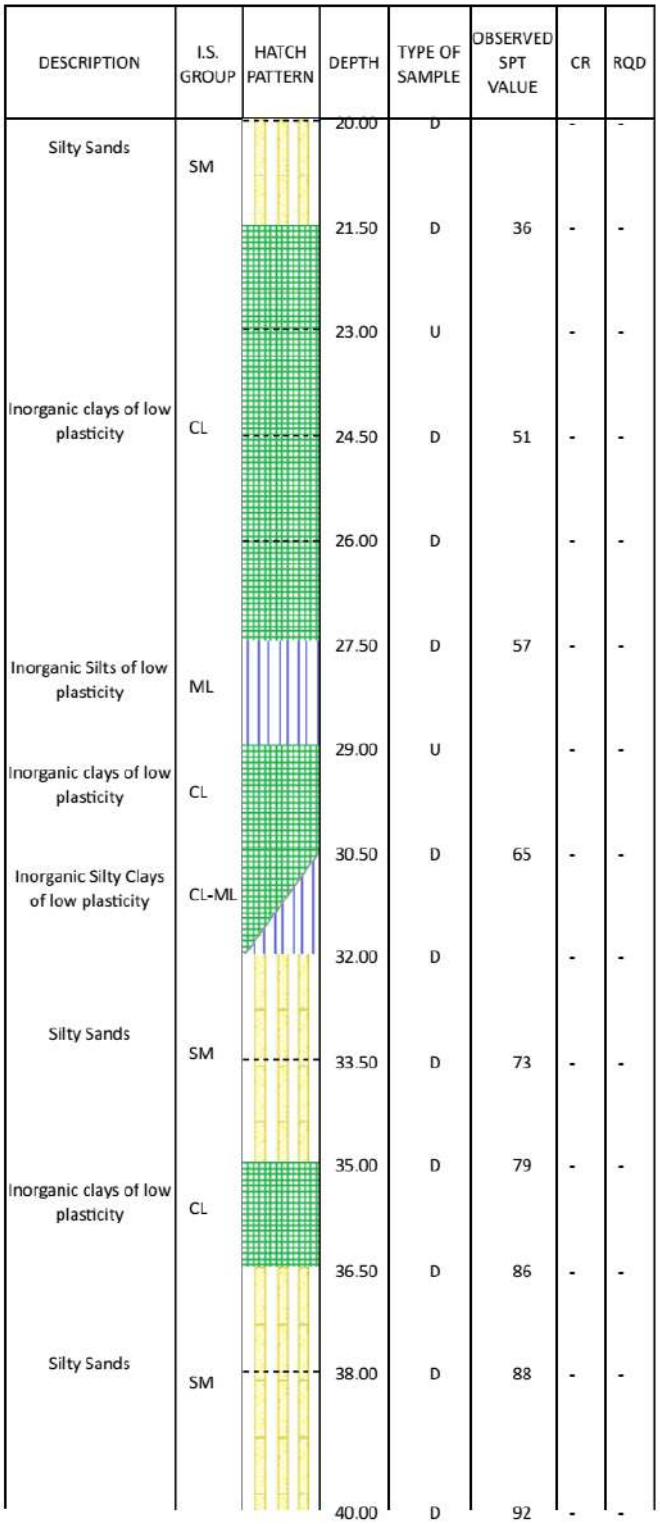


APPENDIX-C
PLOT 12: LITHOLOGICAL PLOTS

BH-P68-22697.487

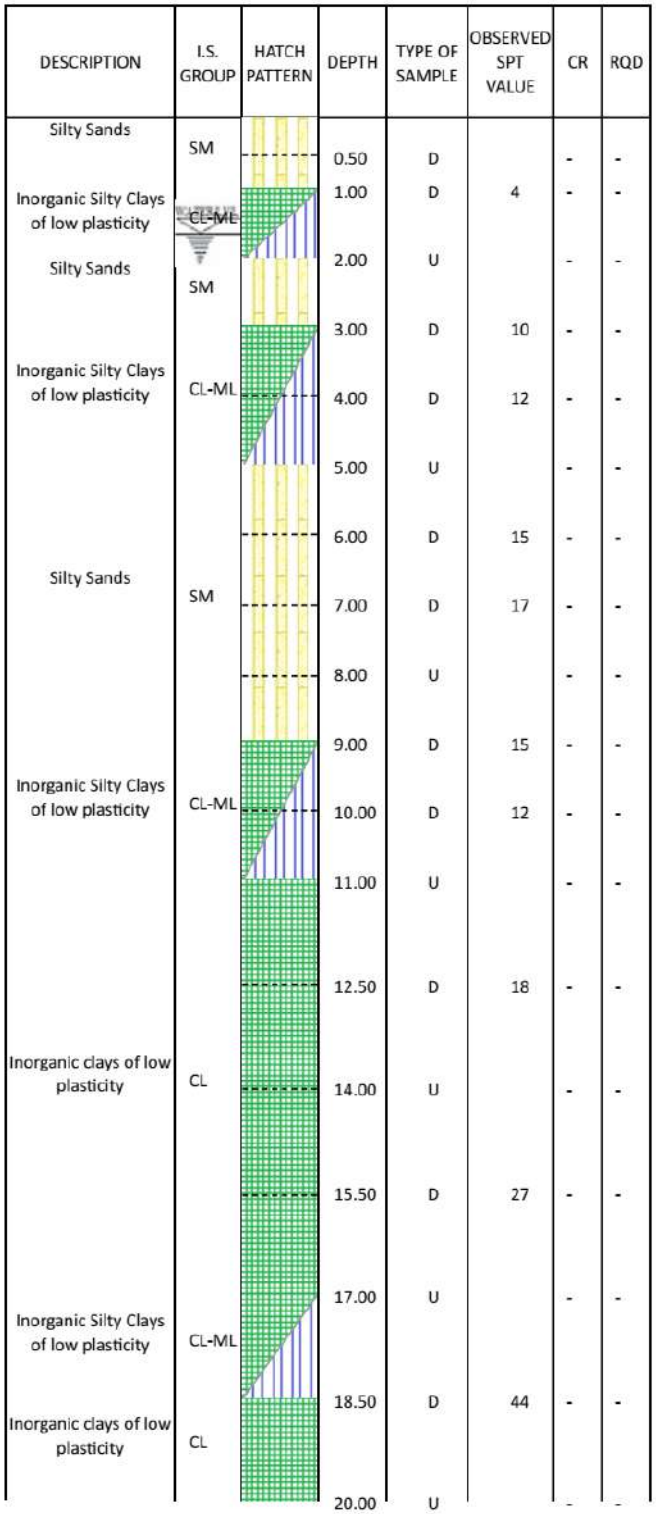
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Silty Sands	SM		0.50	D		-	-
Inorganic Silty Clays of low plasticity	CL-ML		1.00	D	5	-	-
			2.00	U		-	-
Silty Sands with clay binder	SM-SC		3.00	D	12	-	-
			4.00	D	16	-	-
			5.00	D		-	-
			6.00	D	20	-	-
Silty Sands	SM		7.00	D	18	-	-
			8.00	U		-	-
			9.00	D	20	-	-
			10.00	D	16	-	-
			11.00	U		-	-
			12.50	D	27	-	-
			14.00	U		-	-
Inorganic clays of low plasticity	CL		15.50	D	28	-	-
			17.00	U		-	-
			18.50	D	37	-	-
			20.00	U		-	-

BH-P68-22697.487

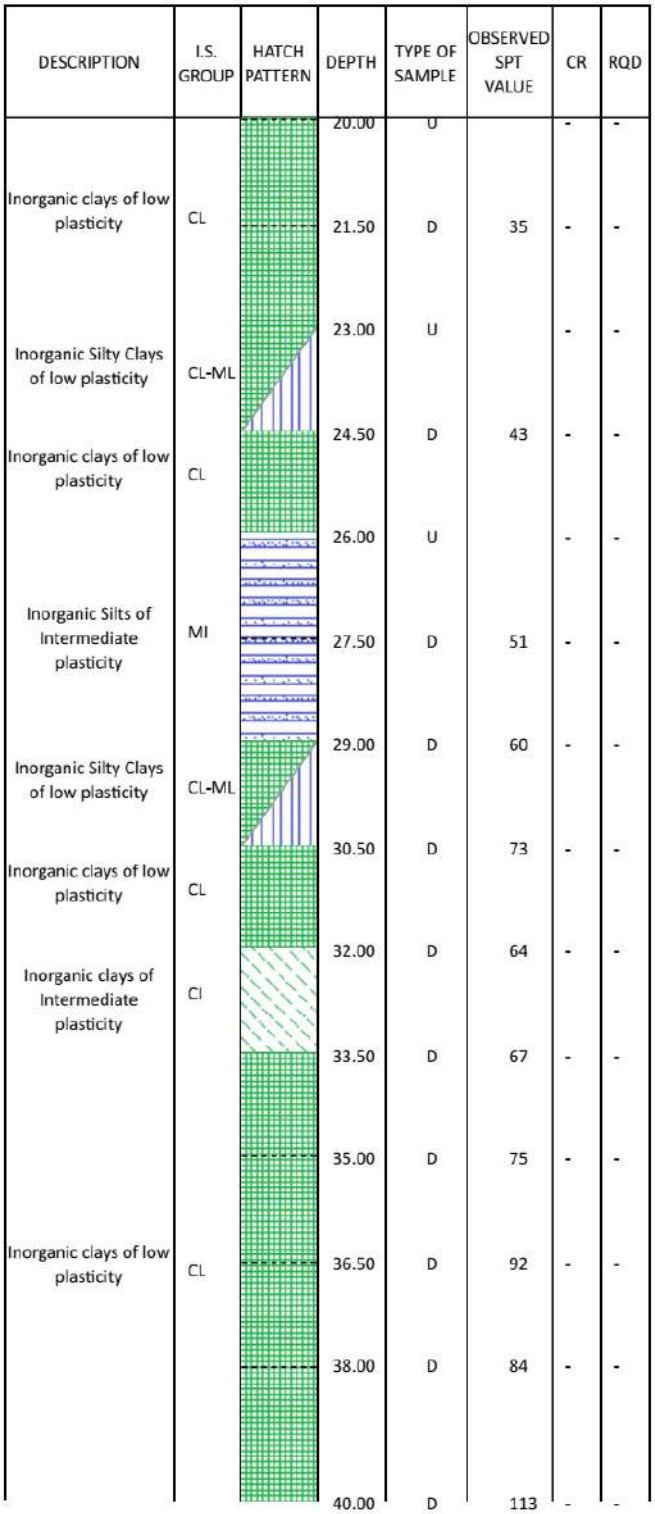
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			20.00	U		-	-
			21.50	D	32	-	-
			23.00	U		-	-
			24.50	D	39	-	-
			26.00	U		-	-
Inorganic clays of low plasticity	CL		27.50	D	52	-	-
			29.00	D	54	-	-
			30.50	D	61	-	-
			32.00	D	67	-	-
			33.50	D	72	-	-
Silty Sands with clay binder	SM-SC		35.00	D	77	-	-
			36.50	D	52	-	-
Inorganic clays of low plasticity	CL		38.00	D	64	-	-
			40.00	D	101	-	-

APPENDIX-C
PLOT 13: LITHOLOGICAL PLOTS

BH-P69-22723.687



BH-P69-22723.687



APPENDIX-C
PLOT 14: LITHOLOGICAL PLOTS

BH-P70-22749.8870

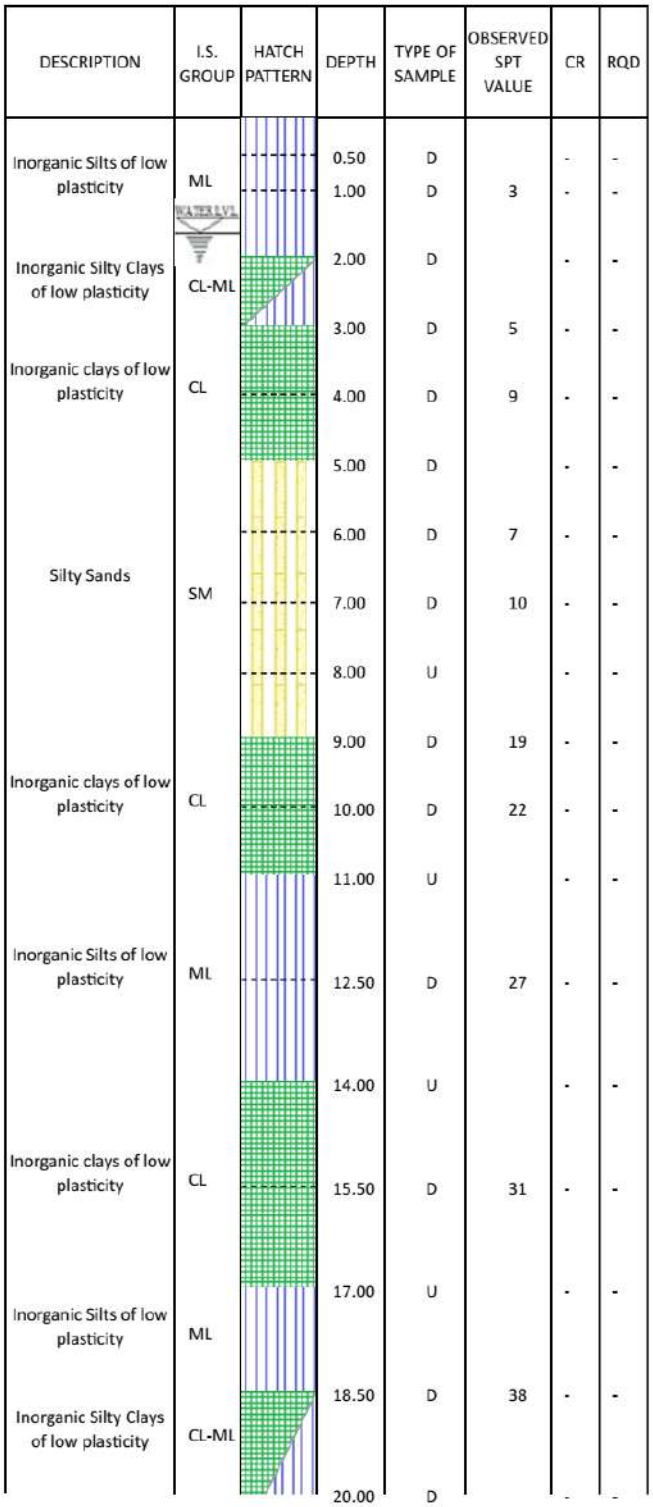
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Inorganic Silts of low plasticity	ML		0.50	D		-	-
			1.00	U		-	-
Inorganic clays of low plasticity	CI		2.00	D	3	-	-
Inorganic Silty Clays of low plasticity	CL-ML		3.00	D	7	-	-
			4.00	U		-	-
			5.00	D	10	-	-
			6.00	D	8	-	-
Silty Sands	SM		7.00	D		-	-
			8.00	D	14	-	-
			9.00	D	17	-	-
			10.00	U		-	-
Inorganic Silts of low plasticity	ML		11.00	D	18	-	-
			12.00	D	15	-	-
			13.00	U		-	-
Inorganic clays of low plasticity	CL		14.50	D	15	-	-
Inorganic Silts of low plasticity	ML		16.00	U		-	-
Inorganic clays of low plasticity	CL		17.50	D	18	-	-
			19.00	U		-	-
Clayey Sands	SC		20.00	D	20	-	-

BH-P70-22749.8870

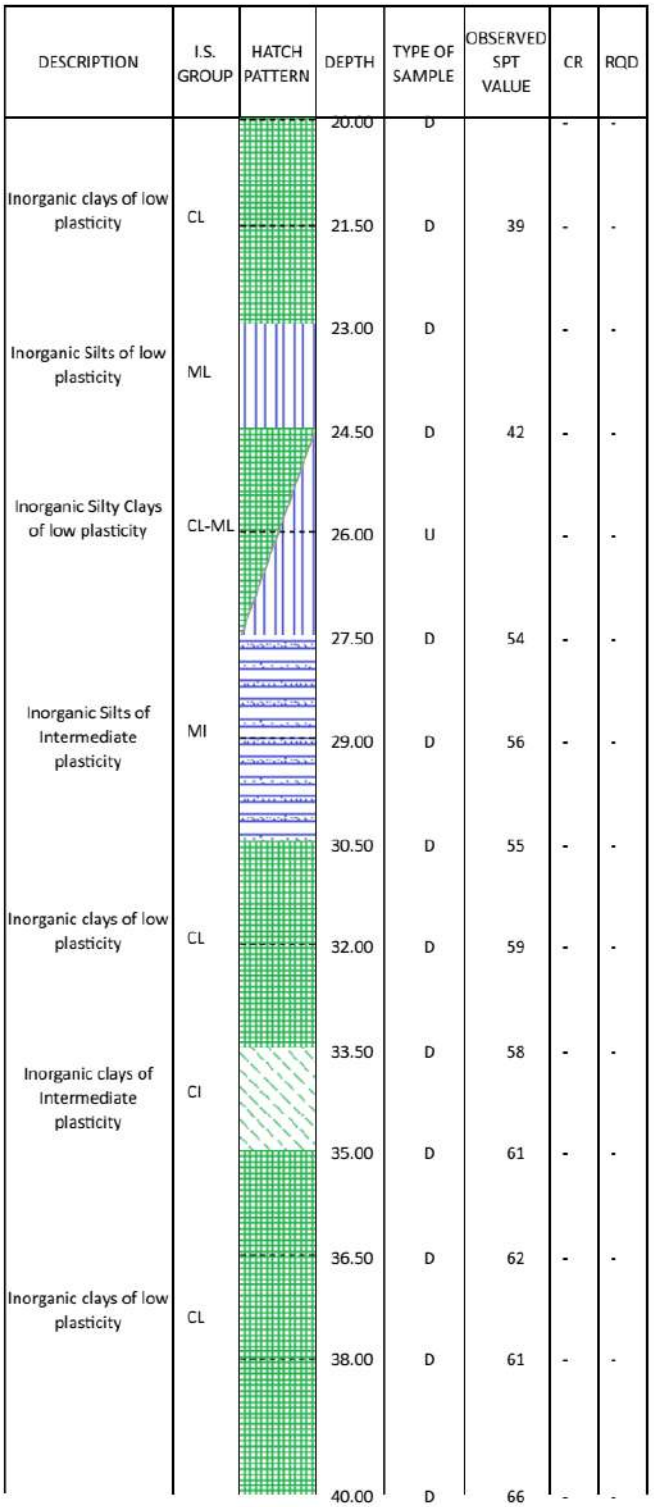
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Clayey Sands	SC		20.50	D	20	-	-
			22.00	U		-	-
Inorganic clays of low plasticity	CL		23.50	D	27	-	-
			25.00	U		-	-
			26.50	D	31	-	-
Inorganic Silts of Intermediate plasticity	MI		28.00	U		-	-
Inorganic clays of Intermediate plasticity	CI		29.50	D	28	-	-
			31.00	D		-	-
Inorganic clays of low plasticity	CL		32.50	D	36	-	-
			34.00	D		-	-
Silty Sands	SM		35.50	D	55	-	-
			37.00	D		-	-
Inorganic Silts of low plasticity	ML		38.50	D	65	-	-
			40.00	D	72	-	-

APPENDIX-C
PLOT 15: LITHOLOGICAL PLOTS

BH-P71-22776.087

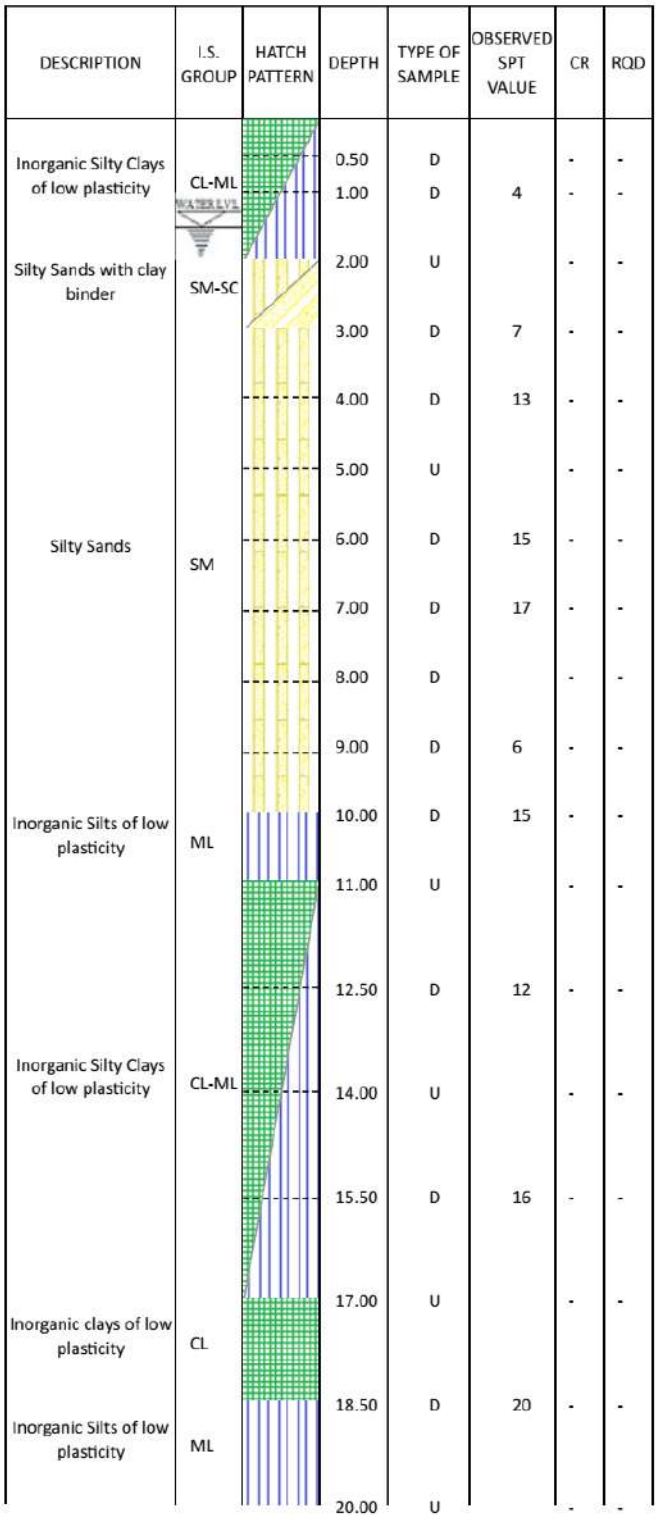


BH-P71-22776.087

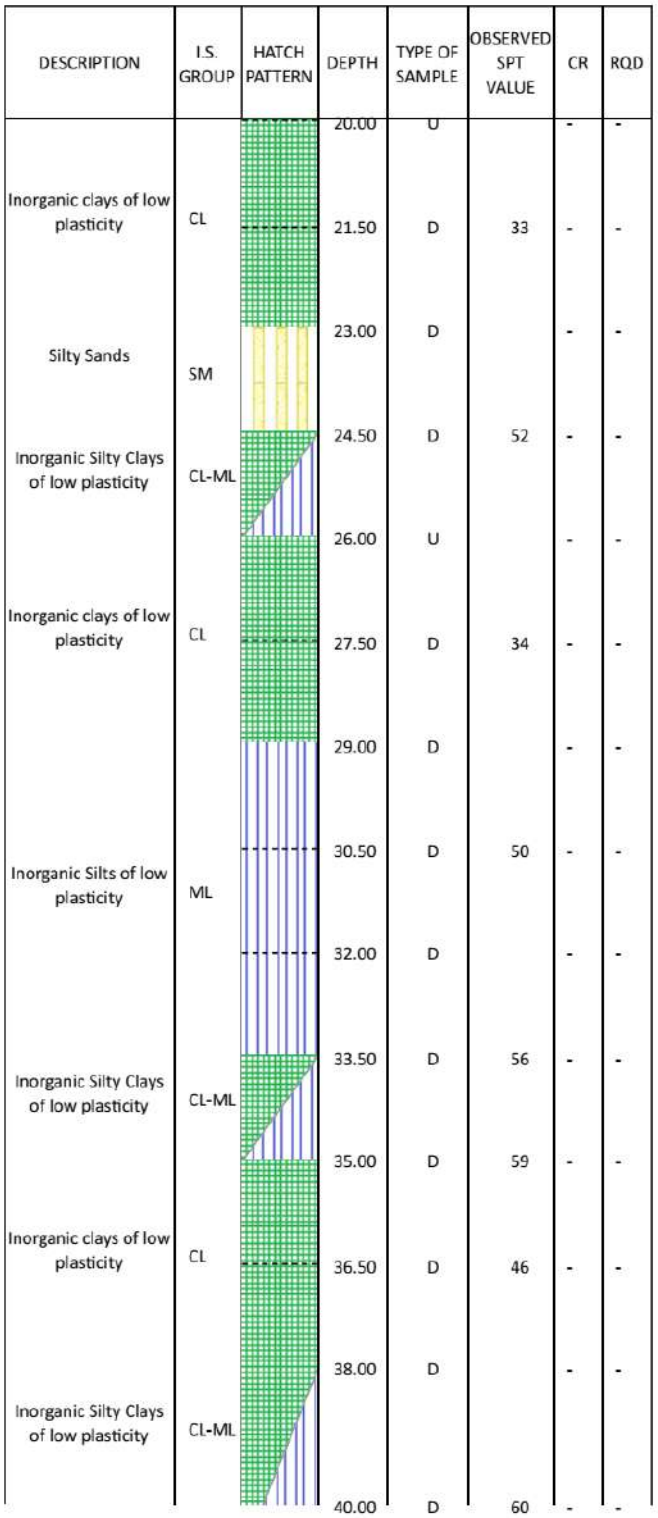


APPENDIX-C
PLOT 16: LITHOLOGICAL PLOTS

BH-P72-22802.287



BH-P72-22802.287



APPENDIX-C
PLOT 17: LITHOLOGICAL PLOTS

BH-P73-22828.4870

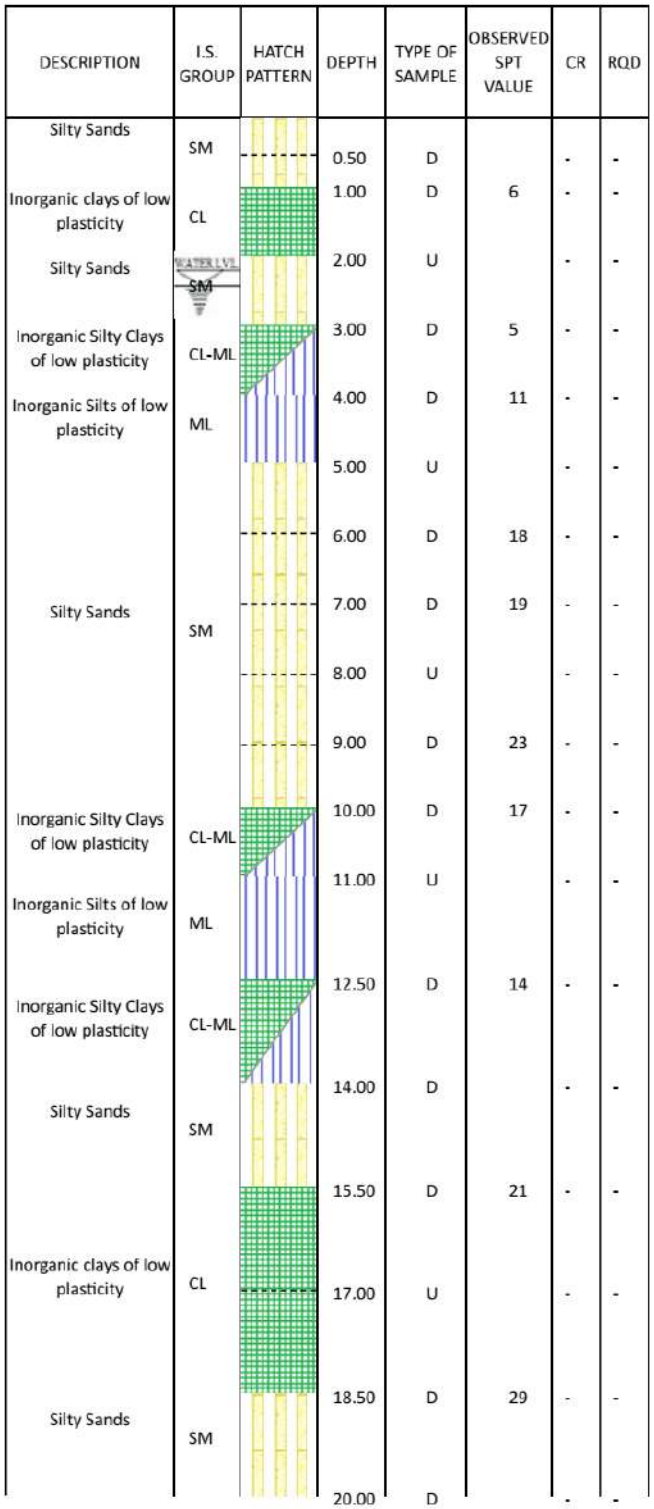
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Inorganic Silts of low plasticity	ML		0.50	D		-	-
			1.00	D	9	-	-
			2.00	U		-	-
			3.00	D	13	-	-
Inorganic clays of low plasticity	CL		4.00	D	16	-	-
			5.00	U		-	-
			6.00	D	14	-	-
			7.00	D	18	-	-
			8.00	U		-	-
Silty Sands	SM		9.00	D	12	-	-
			10.00	D	19	-	-
			11.00	U		-	-
			12.50	D	14	-	-
Inorganic clays of low plasticity	CL		14.00	U		-	-
			15.50	D	26	-	-
			17.00	U		-	-
Inorganic Silts of low plasticity	ML		18.50	D	33	-	-
			20.00	U		-	-

BH-P73-22828.4870

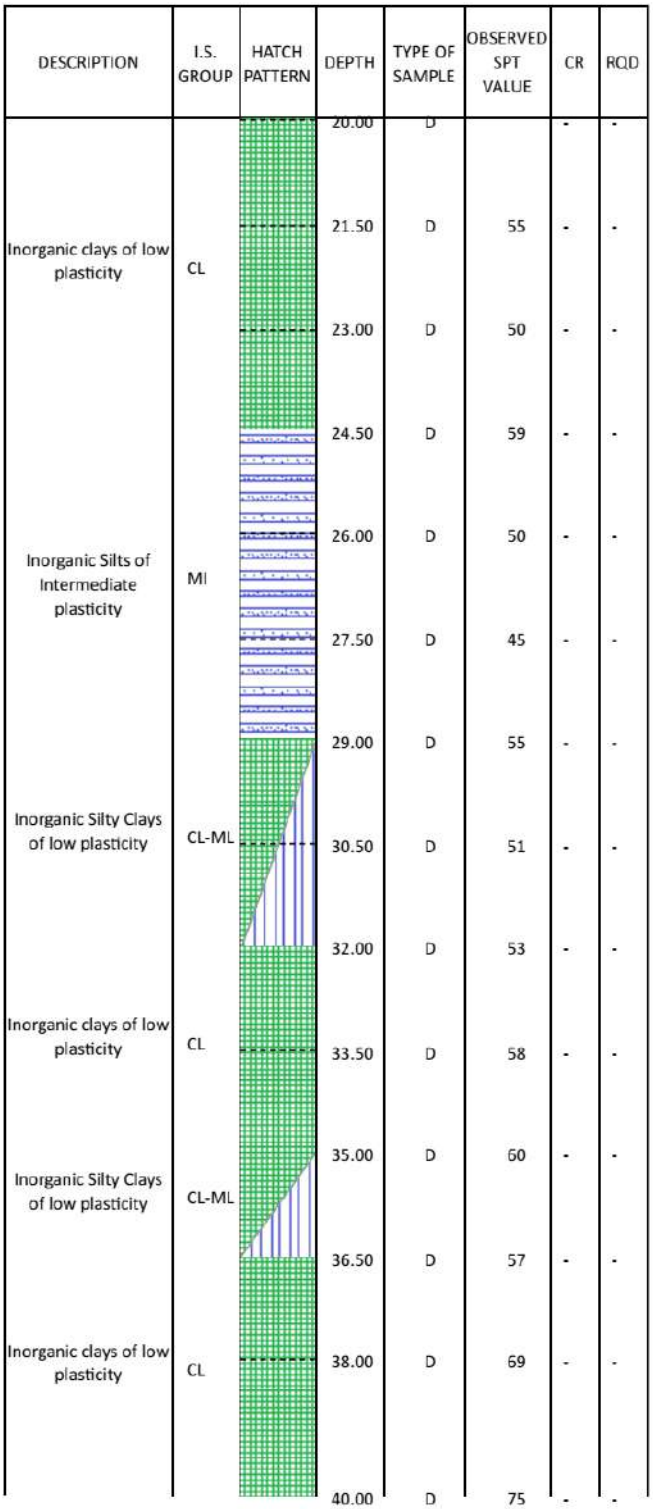
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			20.00	U		-	-
Inorganic Silts of low plasticity	ML		21.50	D	54	-	-
Inorganic clays of low plasticity	CL		23.00	D	61	-	-
Silty Sands	SM		24.50	D	64	-	-
			26.00	D	58	-	-
Inorganic Silty Clays of low plasticity	CL-ML		27.50	D	52	-	-
Silty Sands	SM		29.00	D	51	-	-
Inorganic clays of low plasticity	CL		30.50	D	55	-	-
Silty Sands	SM		32.00	D	58	-	-
			33.50	D	62	-	-
			35.00	D	59	-	-
Inorganic clays of low plasticity	CL		36.50	D	64	-	-
			38.00	D	72	-	-
			40.00	D	102	-	-

APPENDIX-C
PLOT 18: LITHOLOGICAL PLOTS

BH-P74-22854.687

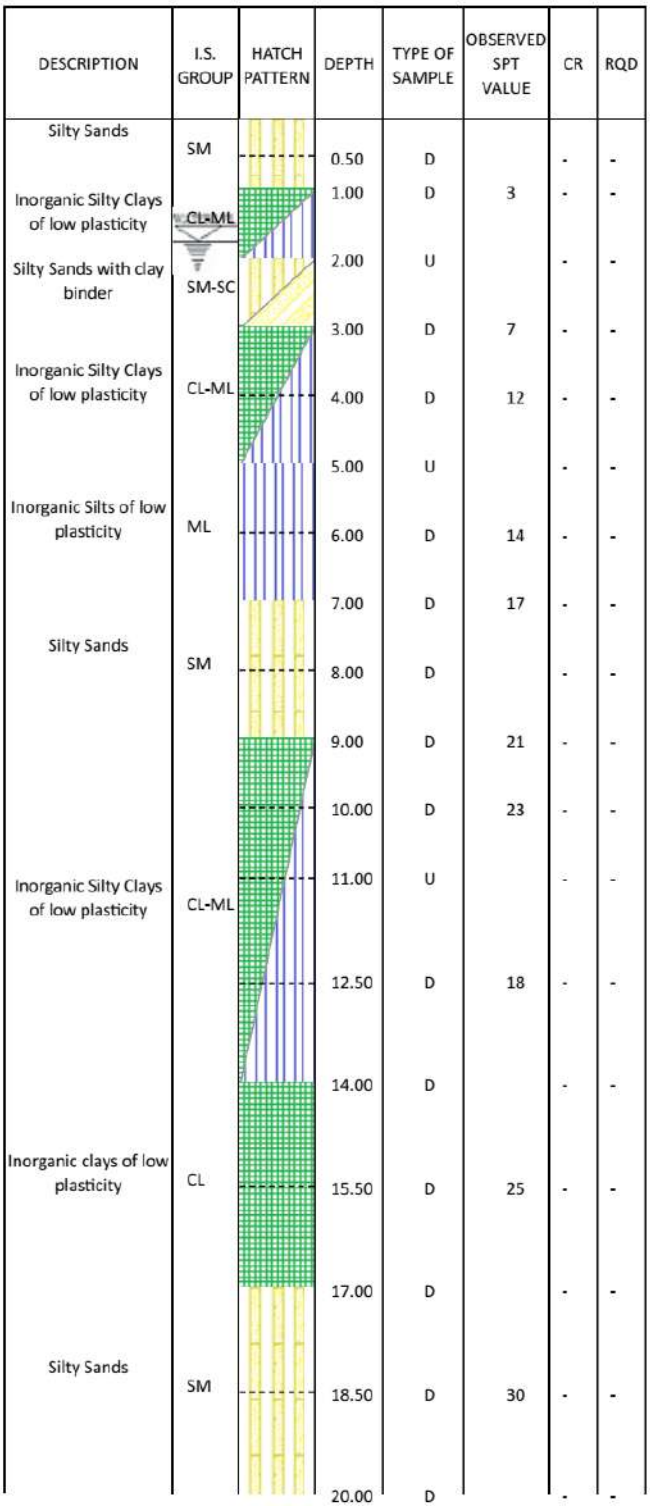


BH-P74-22854.687

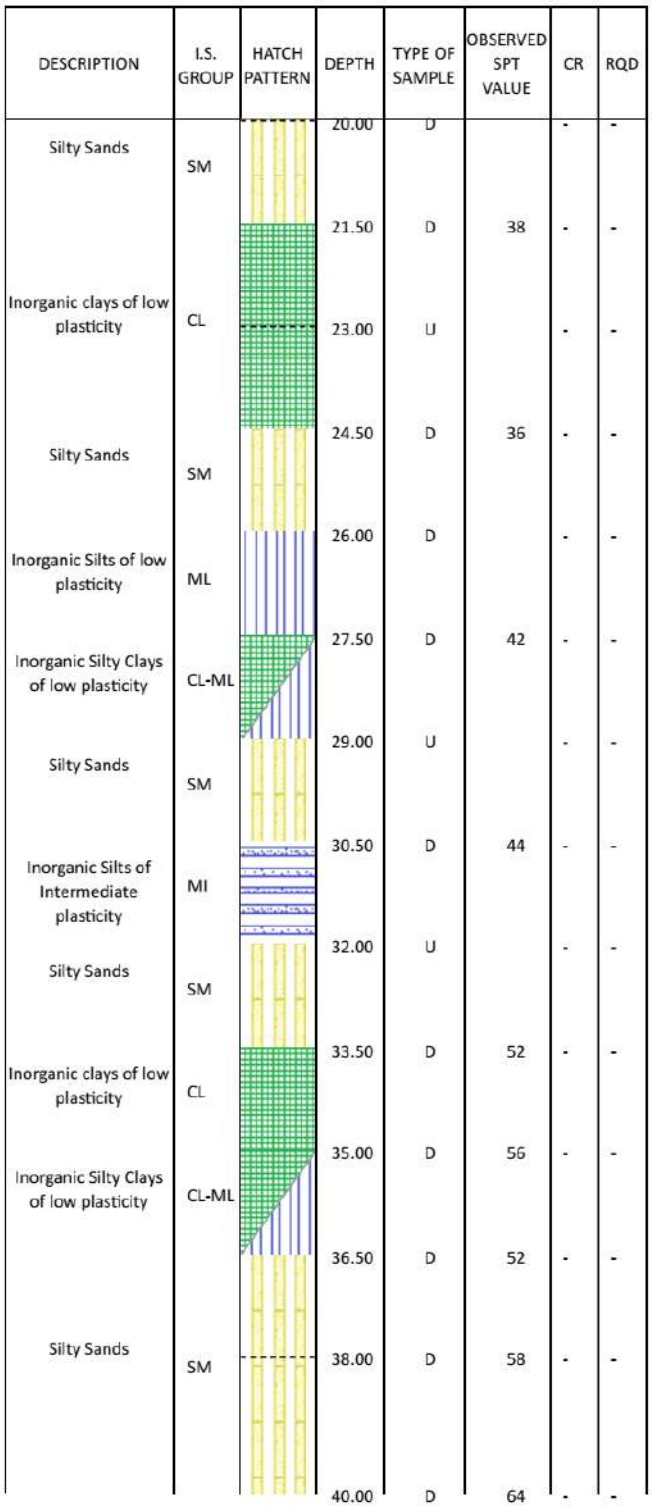


APPENDIX-C
PLOT 19: LITHOLOGICAL PLOTS

BH-P75-22880.887

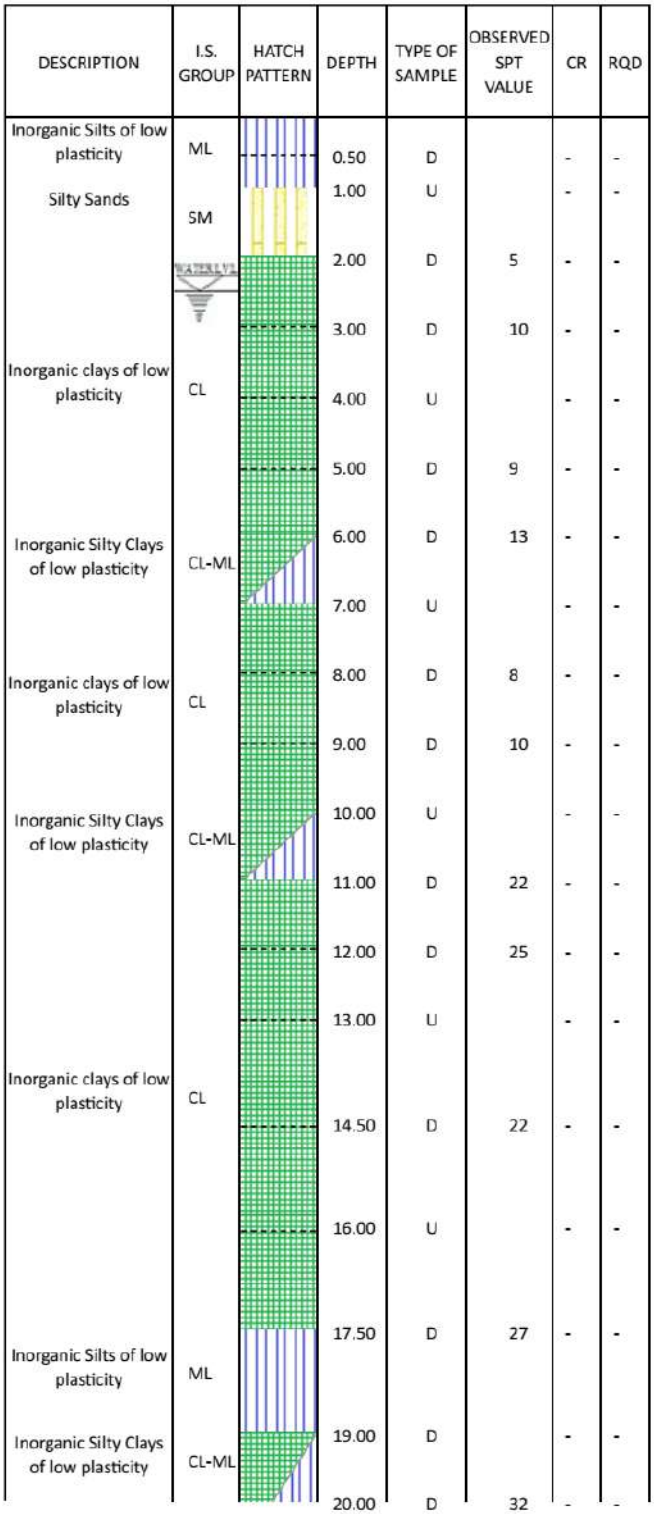


BH-P75-22880.887

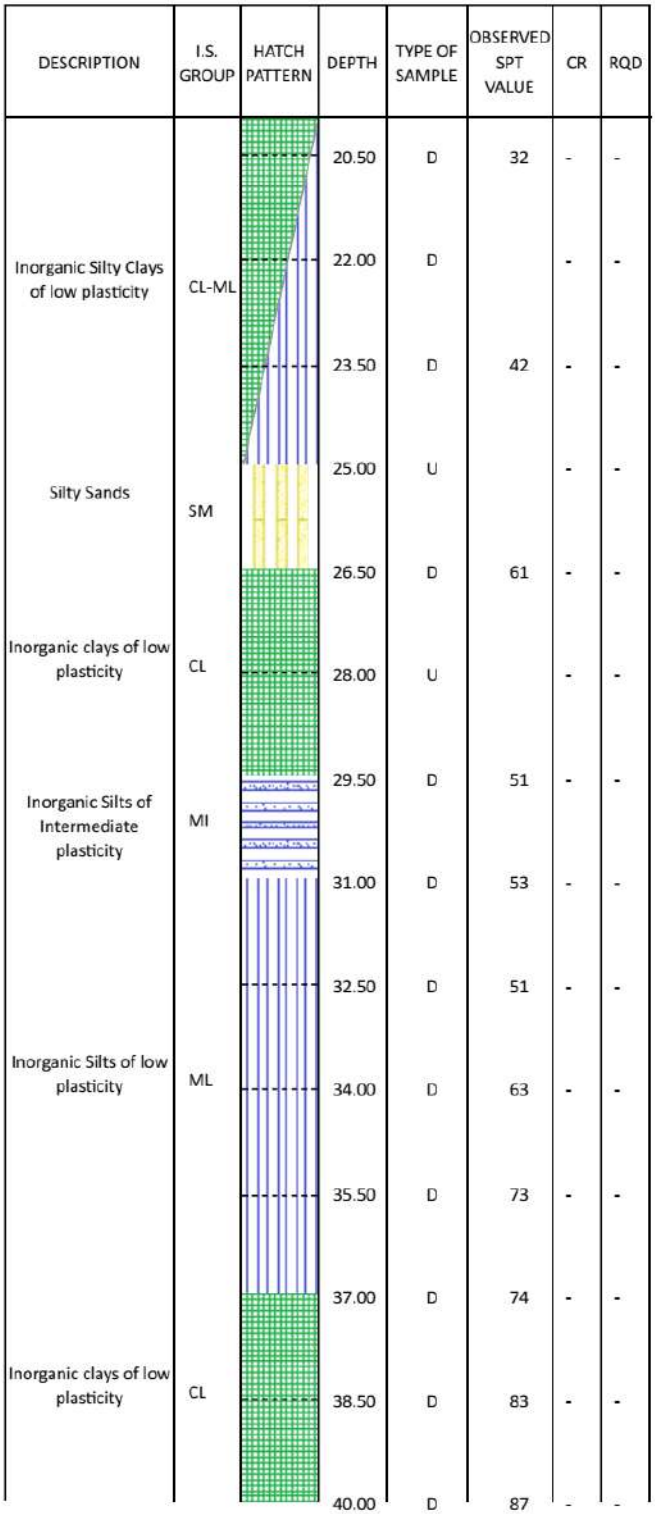


APPENDIX-C
PLOT 20: LITHOLOGICAL PLOTS

BH-P76-22907.0870

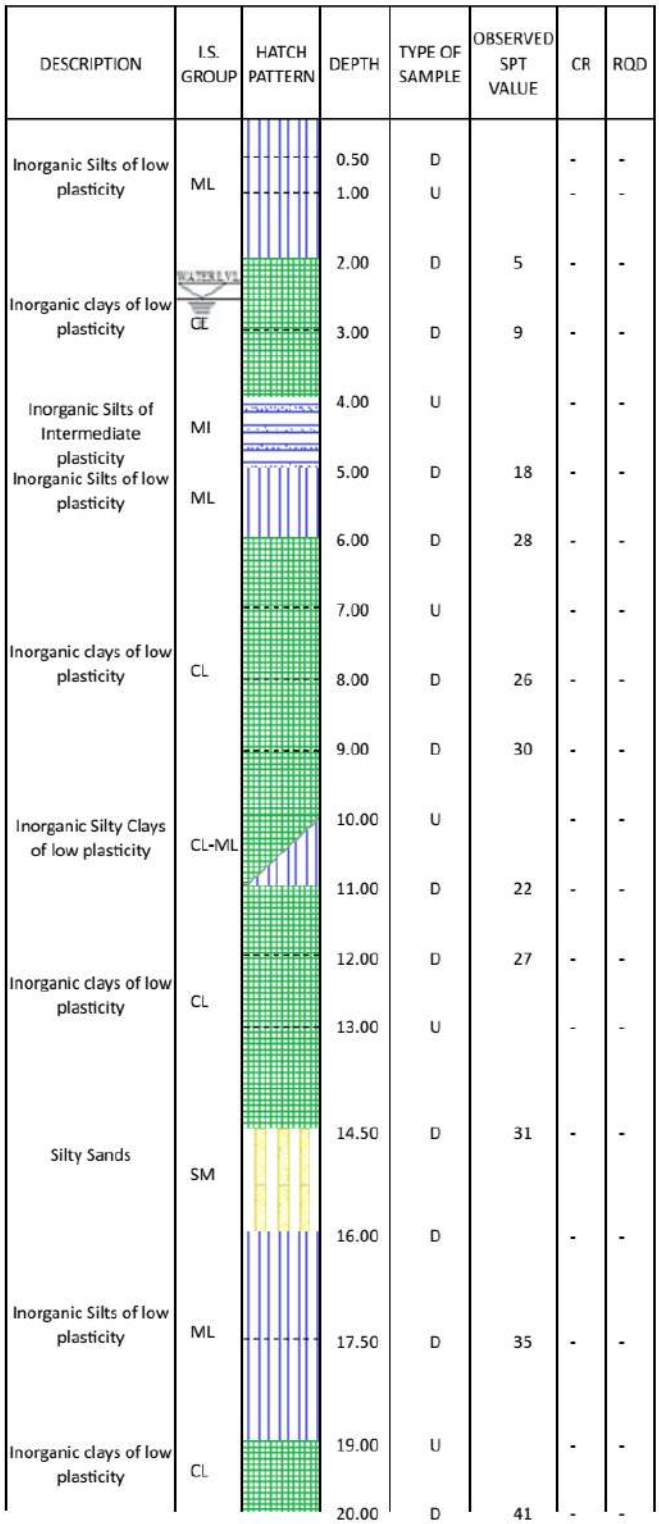


BH-P76-22907.0870

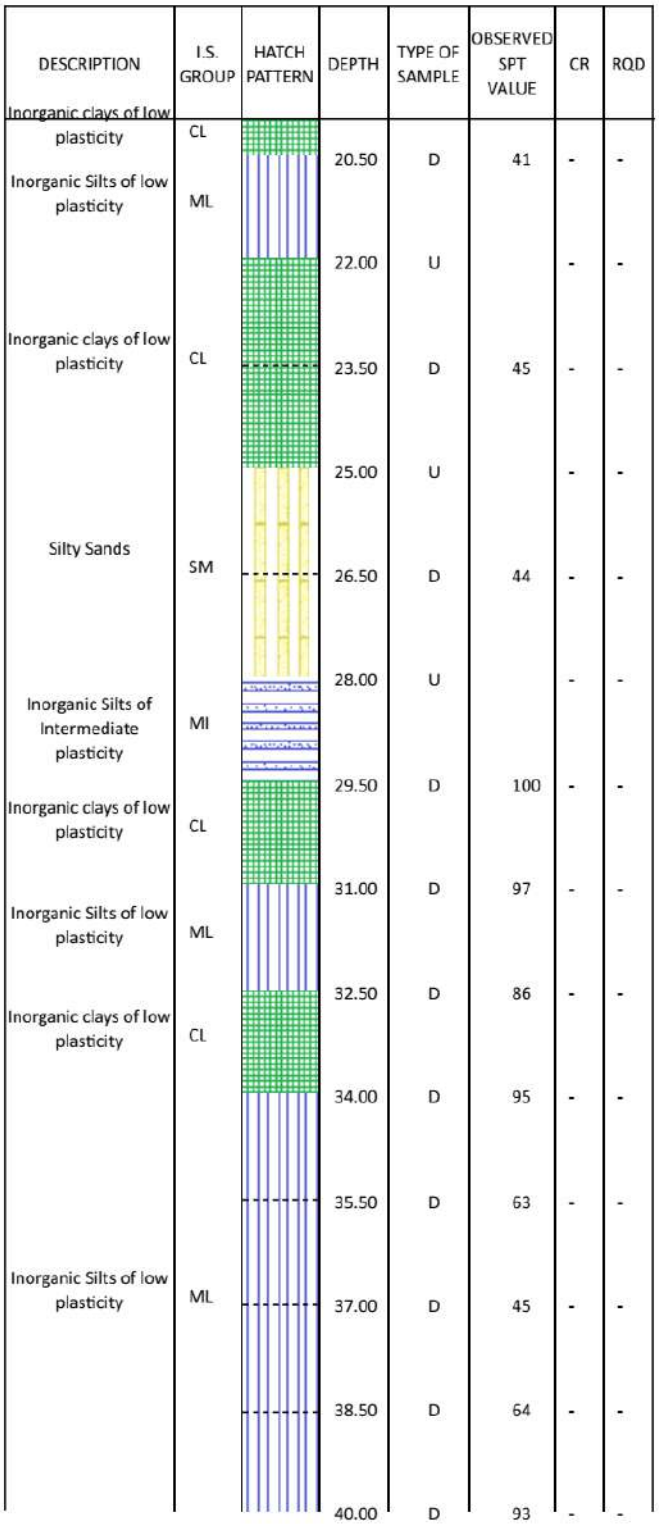


APPENDIX-C
PLOT 21: LITHOLOGICAL PLOTS

BH-P77-22933.2870



BH-P77-22933.2870



APPENDIX-C
PLOT 22: LITHOLOGICAL PLOTS

BH-P78-22954.4870

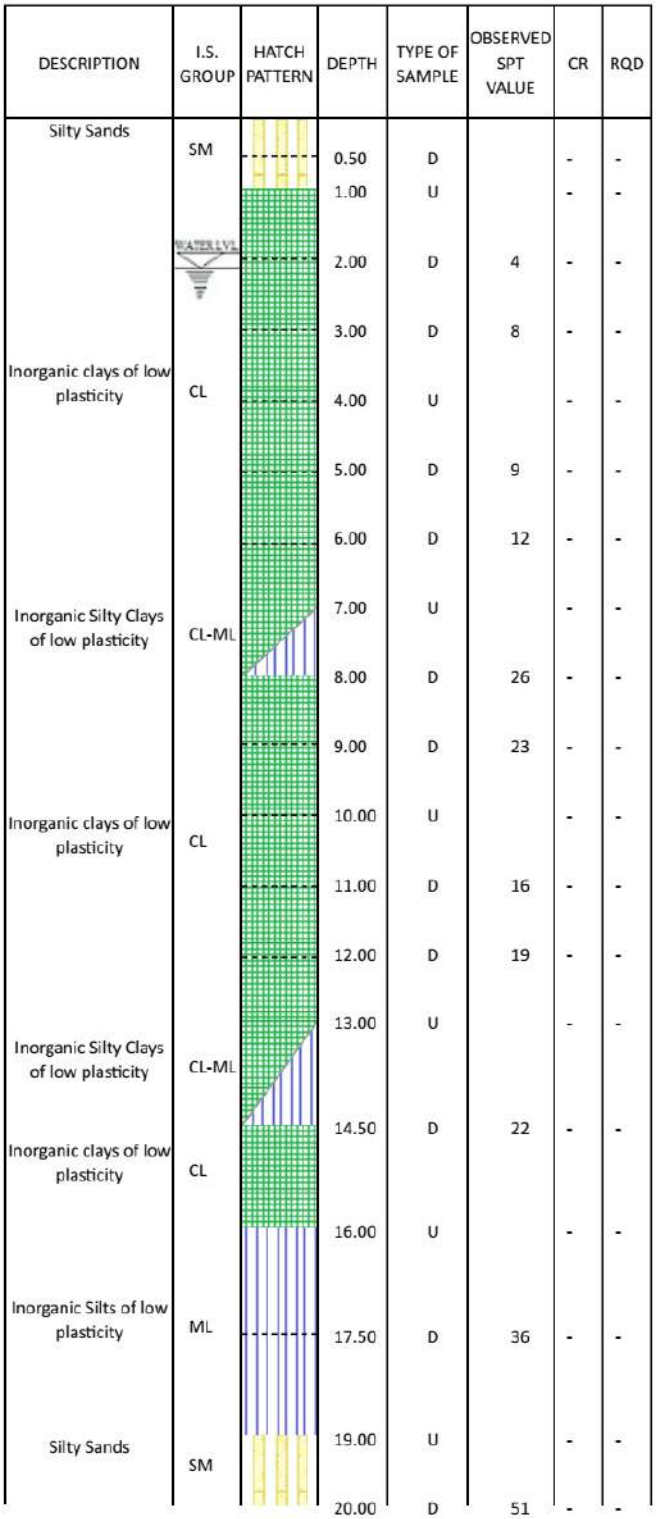
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			0.50	D		-	-
			1.00	D	8	-	-
Inorganic Silts of low plasticity	ML		2.00	U		-	-
			3.00	D	10	-	-
			4.00	D	9	-	-
			5.00	U		-	-
Silty Sands with clay binder	SM-SC		6.00	D	14	-	-
			7.00	D	12	-	-
Inorganic clays of low plasticity	CL		8.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML		9.00	D	31	-	-
Inorganic clays of low plasticity	CL		10.00	D	16	-	-
Inorganic Silty Clays of low plasticity	CL-ML		11.00	U		-	-
Inorganic clays of low plasticity	CL		12.50	D	18	-	-
			14.00	U		-	-
			15.50	D	28	-	-
Inorganic Silty Clays of low plasticity	CL-ML		17.00	U		-	-
			18.50	D	27	-	-
			20.00	U		-	-

BH-P78-22954.4870

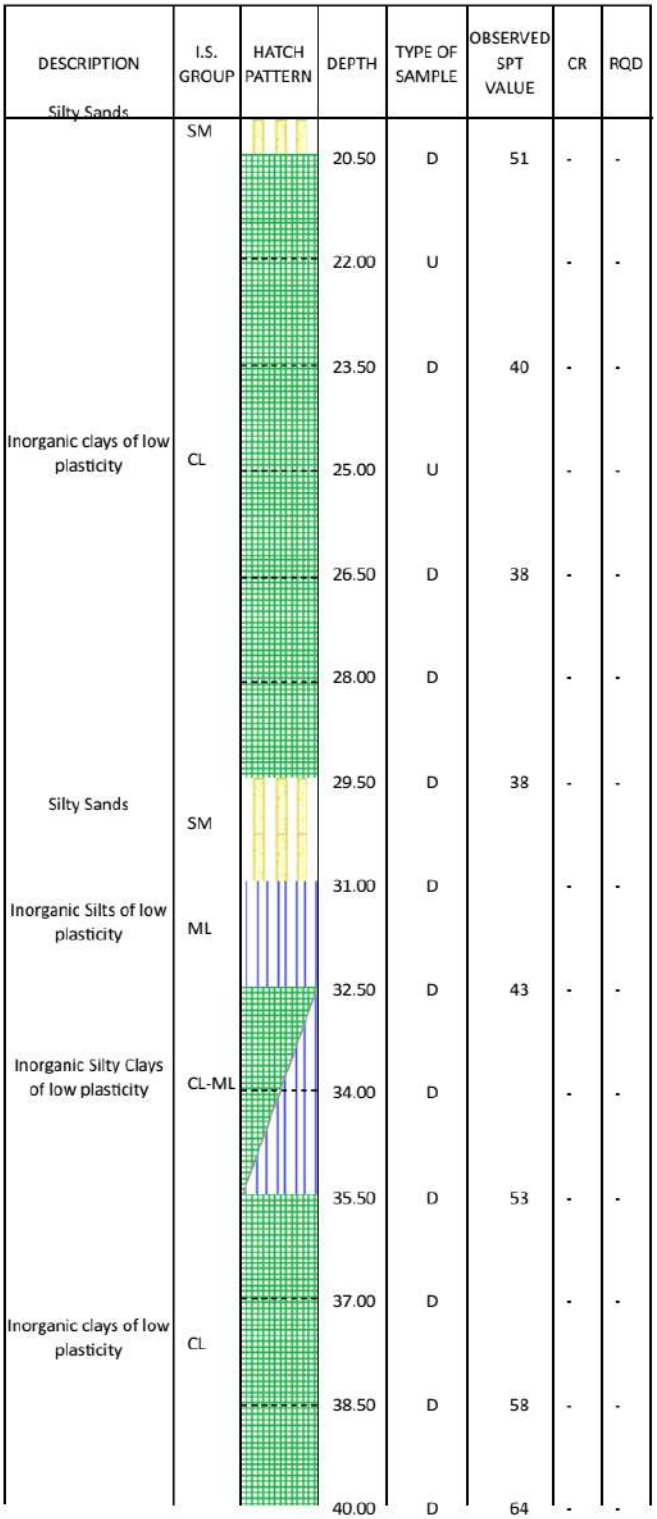
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			20.00	U		-	-
Inorganic clays of low plasticity	CL		21.50	D	33	-	-
			23.00	D		-	-
Inorganic Silts of low plasticity	ML		24.50	D	37	-	-
			26.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML		27.50	D	55	-	-
Silty Sands	SM		29.00	D	59	-	-
Inorganic Silty Clays of low plasticity	CL-ML		30.50	D	69	-	-
			32.00	D	75	-	-
Inorganic Silts of low plasticity	ML		33.50	D	68	-	-
			35.00	D	64	-	-
			36.50	D	72	-	-
Inorganic Silty Clays of low plasticity	CL-ML		38.00	D	78	-	-
			40.00	D	88	-	-

APPENDIX-C
PLOT 23: LITHOLOGICAL PLOTS

BH-P79-22985.6870



BH-P79-22985.6870



APPENDIX-C
PLOT 24: LITHOLOGICAL PLOTS

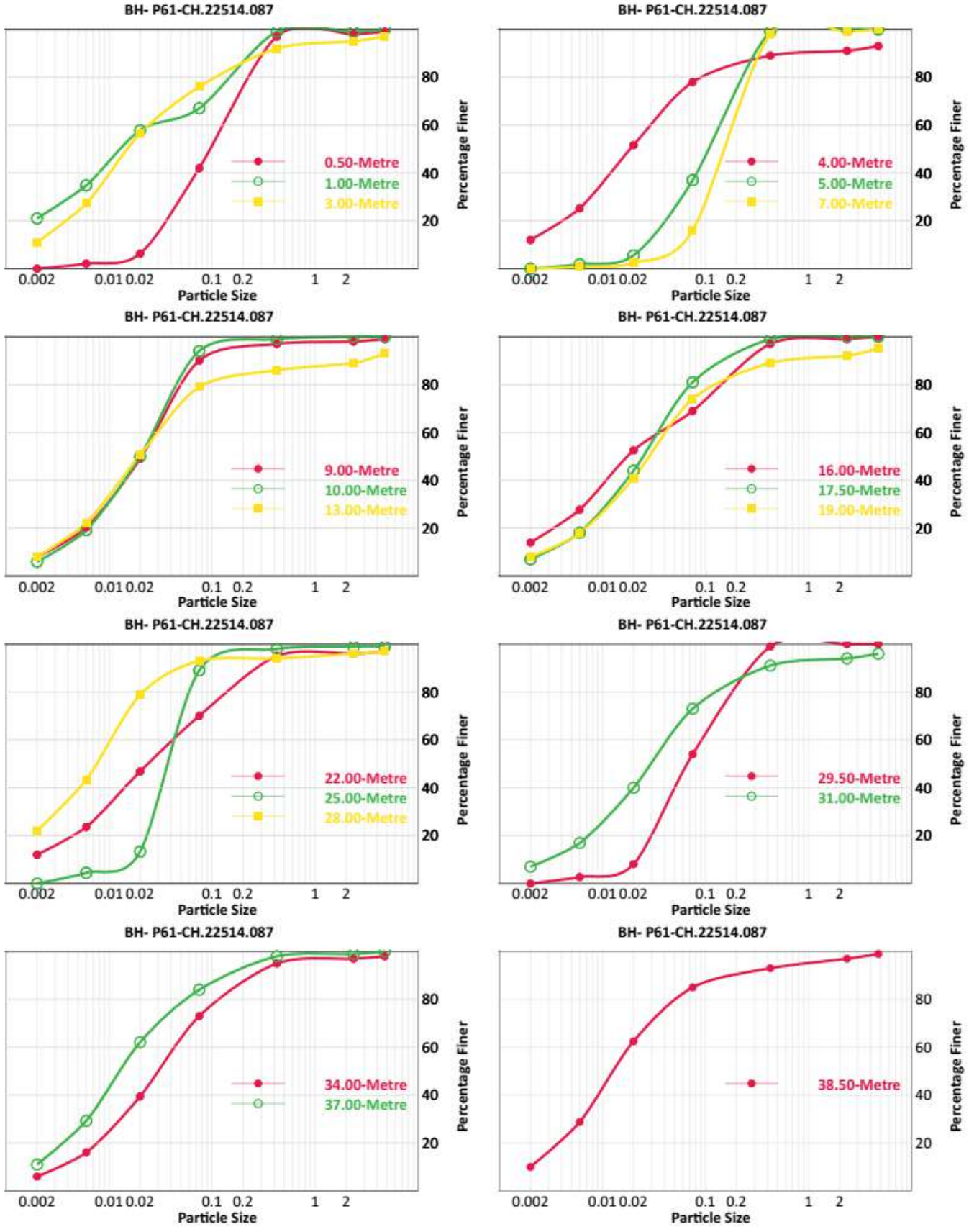
BH-P80-23011.887

DESCRIPTION	I.S. GROUP	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Inorganic Silty Clays of low plasticity	CL-ML	0.50	D		-	-
		1.00	U		-	-
Inorganic clays of low plasticity	CL	2.00	D	5	-	-
Silty Sands	SM	3.00	D	8	-	-
		4.00	U		-	-
Inorganic clays of low plasticity	CL	5.00	D	14	-	-
Inorganic Silts of low plasticity	ML	6.00	D	13	-	-
Silty Sands	SM	7.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML	8.00	D	24	-	-
		9.00	D	35	-	-
Inorganic clays of low plasticity	CL	10.00	U		-	-
Inorganic Silts of low plasticity	ML	11.00	D	37	-	-
		12.00	D	23	-	-
Inorganic clays of low plasticity	CL	13.00	U		-	-
		14.50	D	30	-	-
Clayey Sands	SC	16.00	U		-	-
		17.50	D	46	-	-
Silty Sands	SM	19.00	U		-	-
		20.00	D	49	-	-

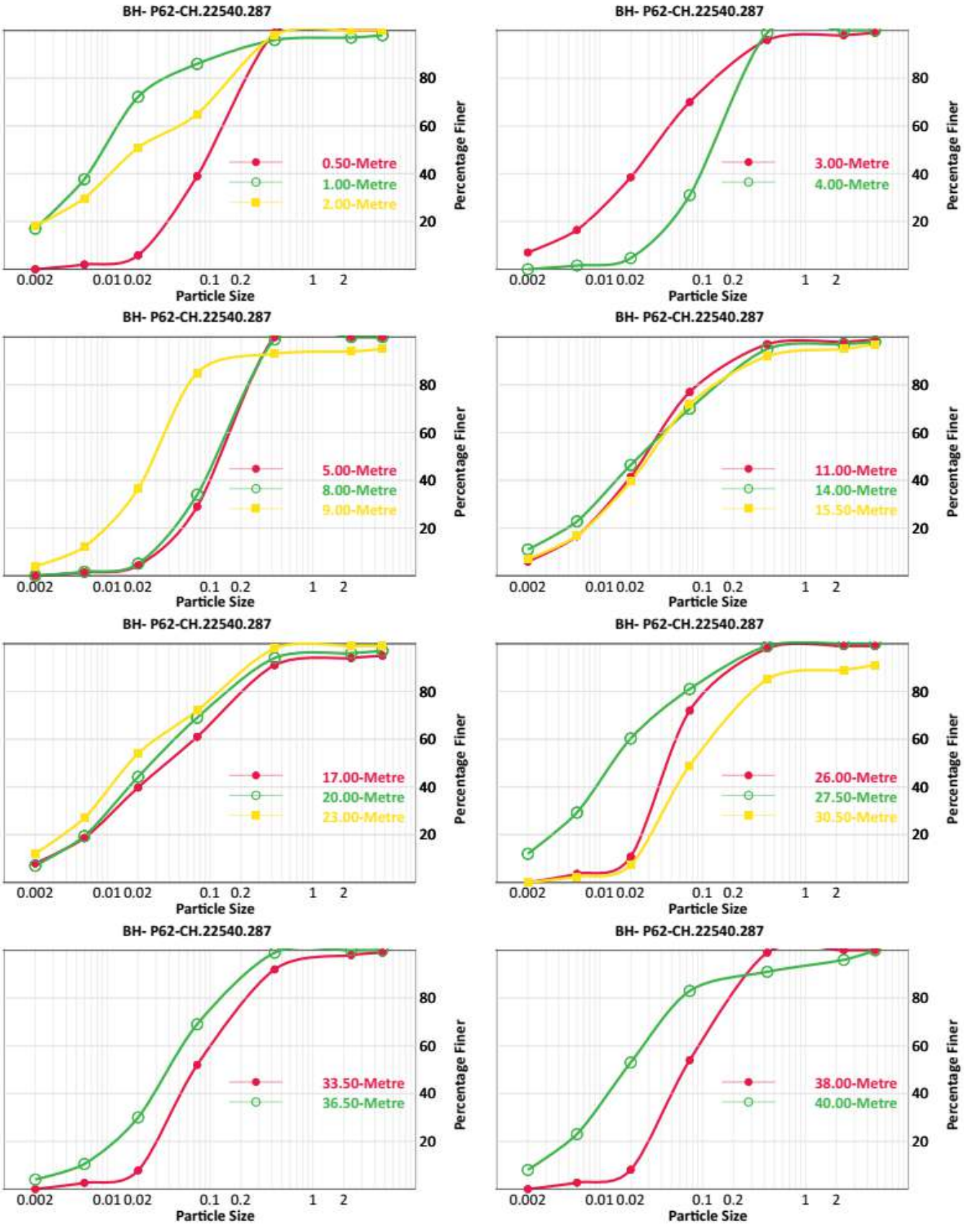
BH-P80-23011.887

DESCRIPTION	I.S. GROUP	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Silty Sands	SM	20.50	D	49	-	-
Silty Sands with clay binder	SM-SC	22.00	U		-	-
Inorganic clays of low plasticity	CL	23.50	D	65	-	-
		25.00	D	77	-	-
Inorganic Silty Clays of low plasticity	CL-ML	26.50	D	85	-	-
		28.00	D	101	-	-
Inorganic Silts of low plasticity	ML	29.50	D	51	-	-
		31.00	D	63	-	-
Inorganic Silty Clays of low plasticity	CL-ML	32.50	D	72	-	-
Inorganic clays of low plasticity	CL	34.00	D	77	-	-
Inorganic Silts of low plasticity	ML	35.50	D	80	-	-
		37.00	D	88	-	-
Inorganic Silty Clays of low plasticity	CL-ML	38.50	D	85	-	-
		40.00	D	91	-	-

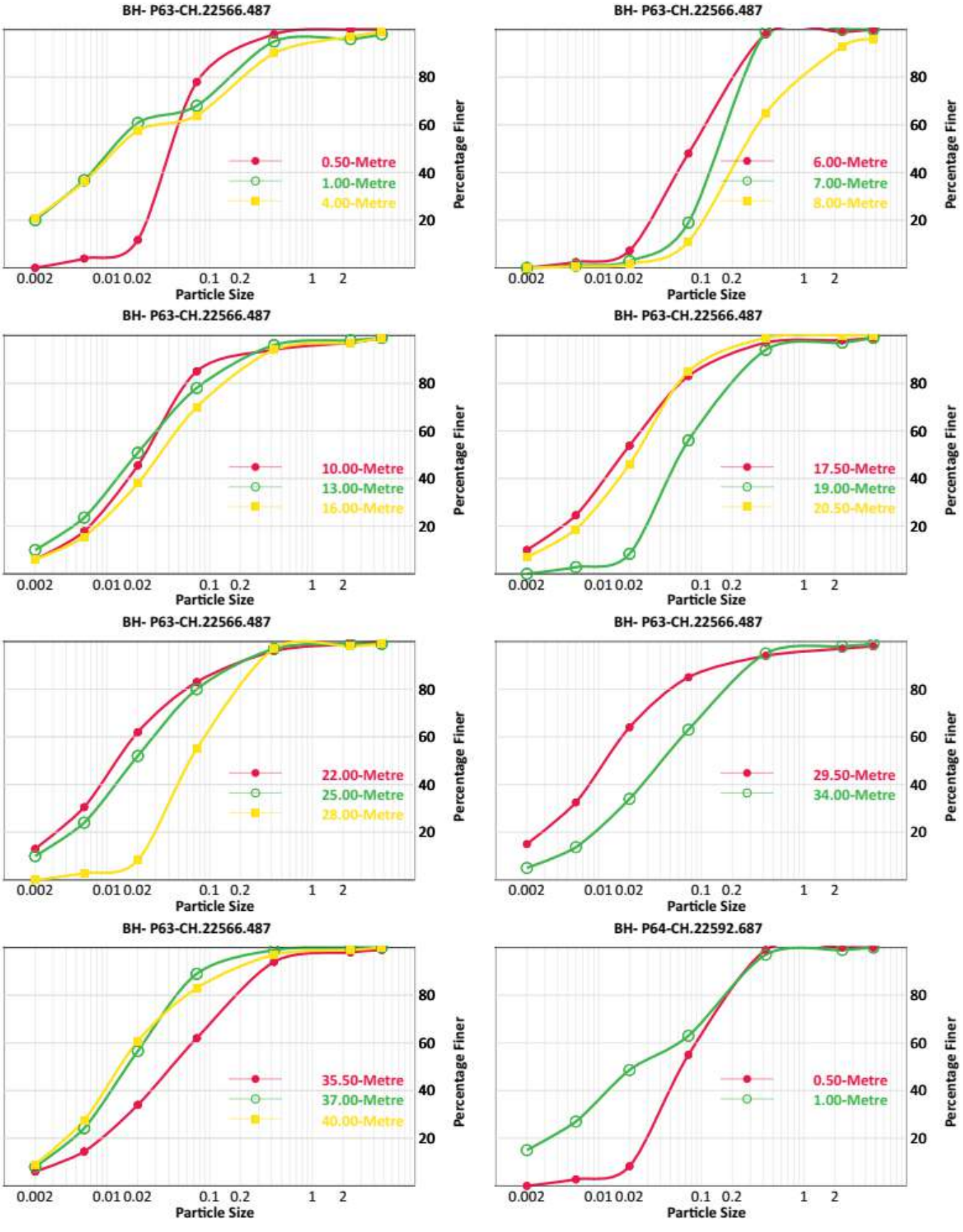
APPENDIX-D
PLOT 1: GRAIN SIZE DISTRIBUTION PLOTS



APPENDIX-D
PLOT 2: GRAIN SIZE DISTRIBUTION PLOTS

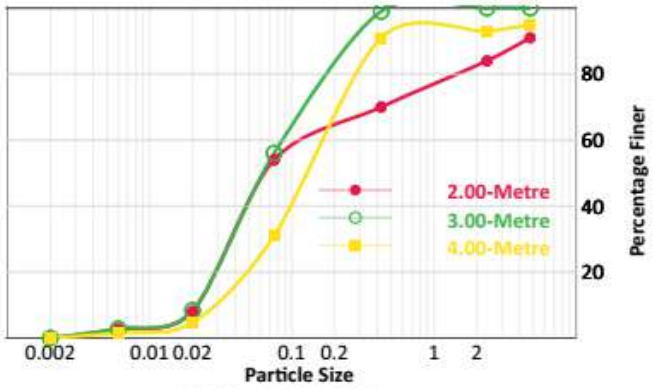


APPENDIX-D
PLOT 3: GRAIN SIZE DISTRIBUTION PLOTS

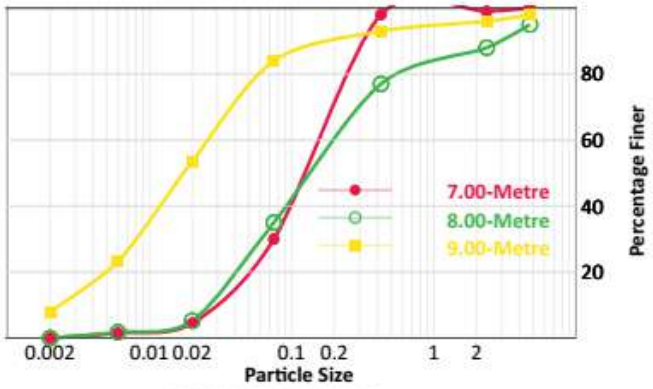


APPENDIX-D
PLOT 4: GRAIN SIZE DISTRIBUTION PLOTS

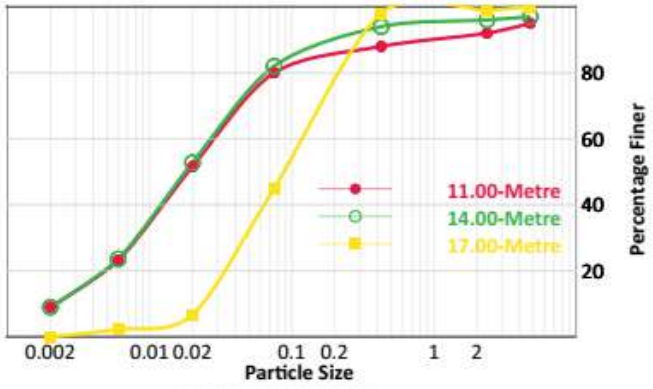
BH- P64-CH.22592.687



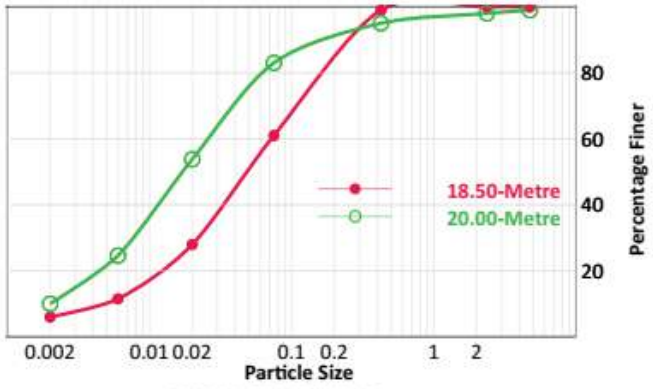
BH- P64-CH.22592.687



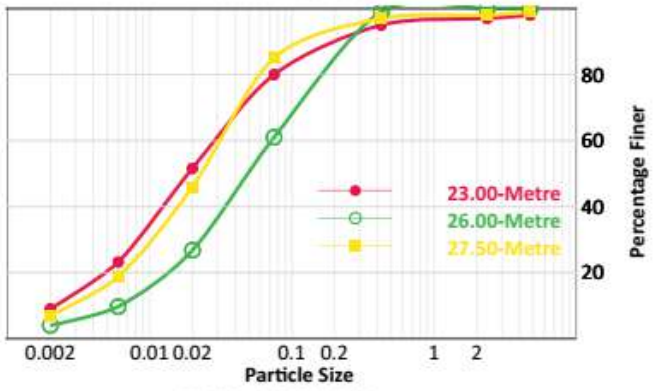
BH- P64-CH.22592.687



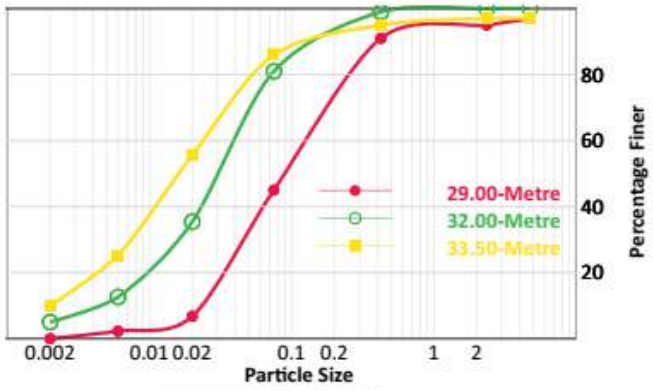
BH- P64-CH.22592.687



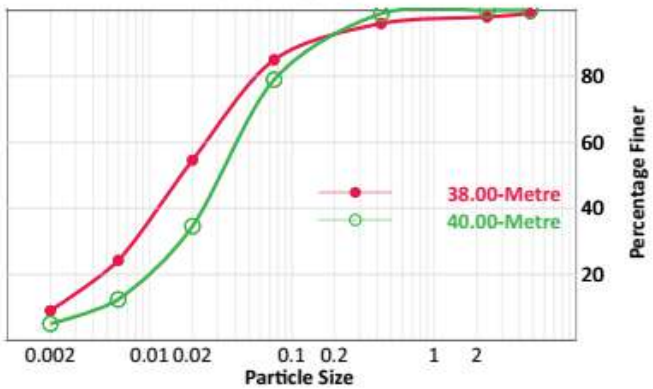
BH- P64-CH.22592.687



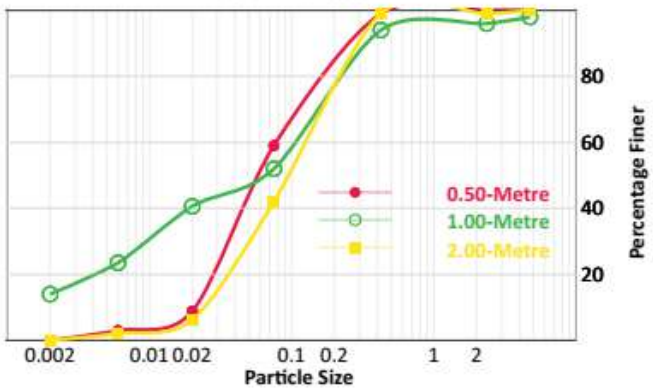
BH- P64-CH.22592.687



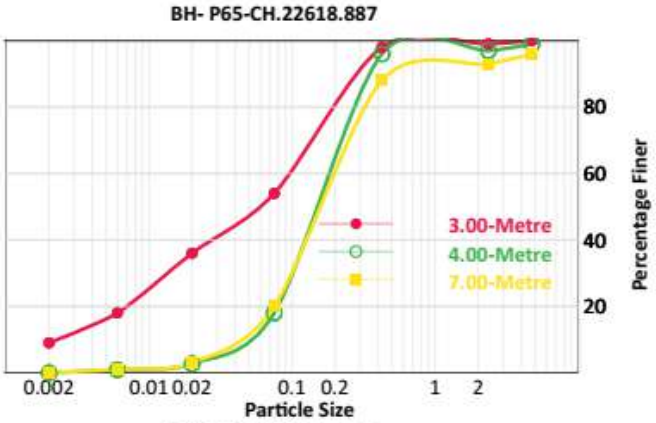
BH- P64-CH.22592.687

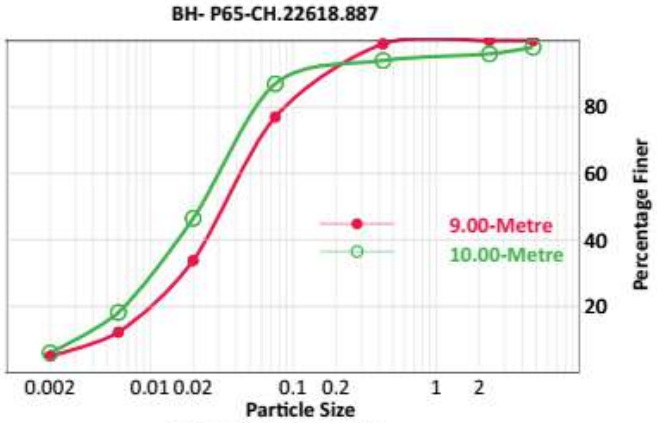


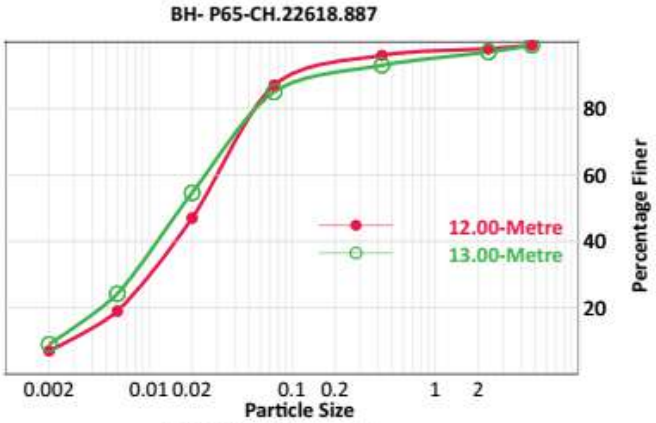
BH- P65-CH.22618.887

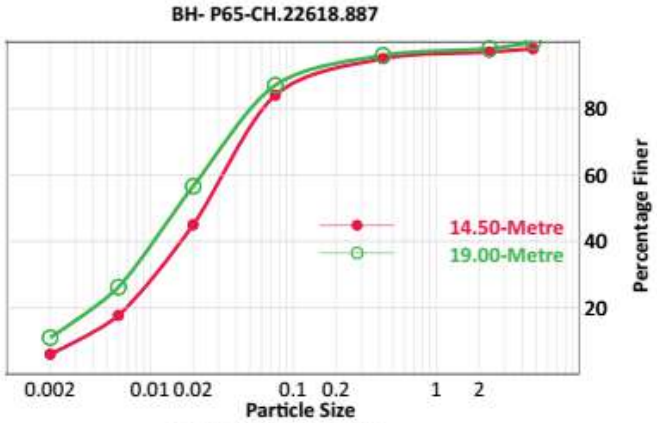


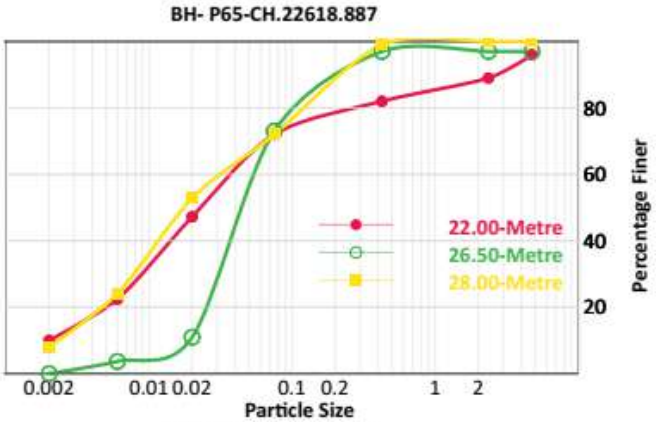
APPENDIX-D
PLOT 5: GRAIN SIZE DISTRIBUTION PLOTS

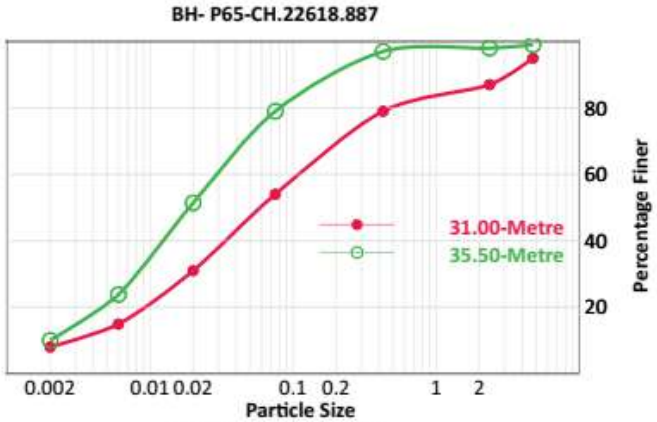


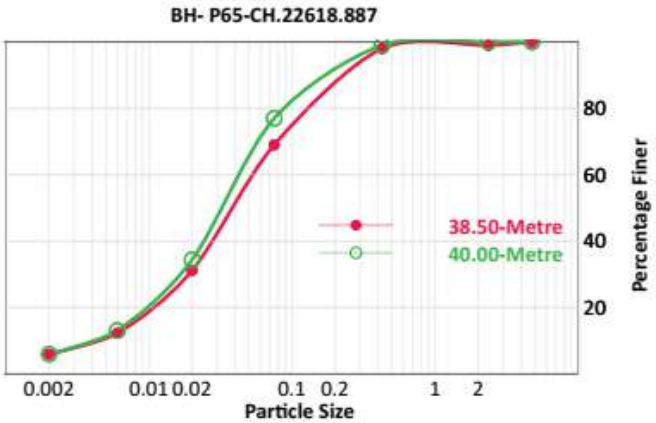


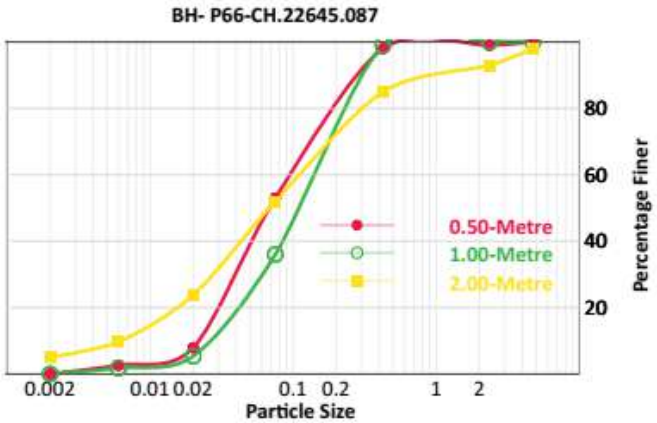




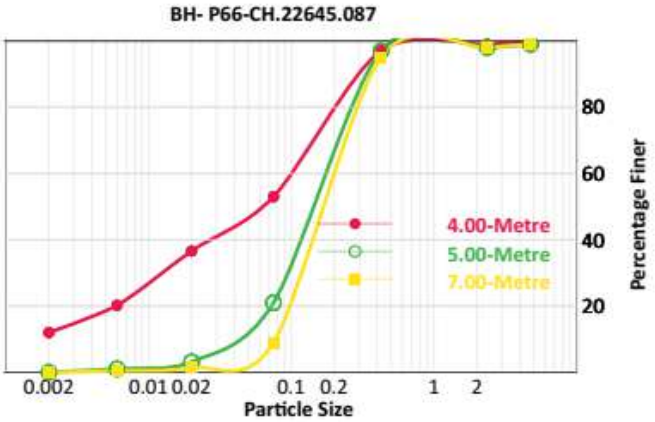


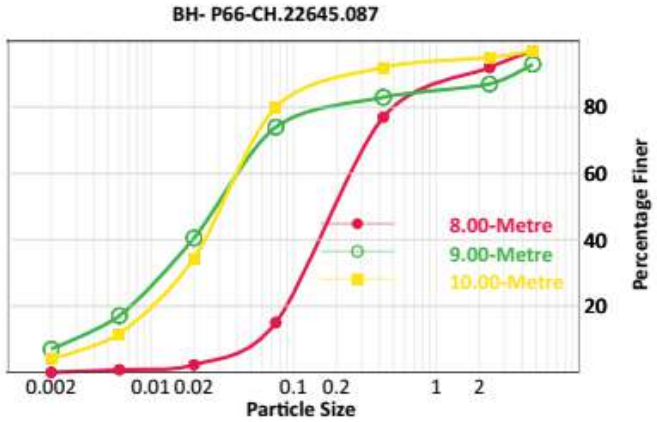


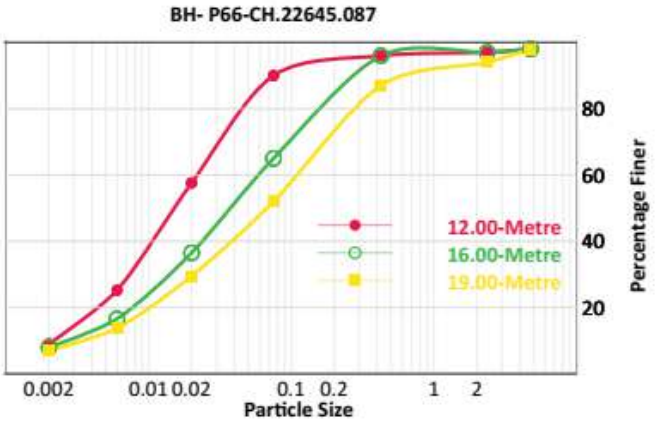


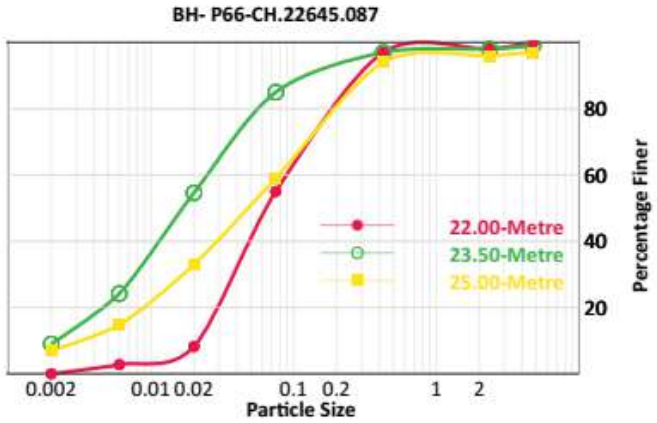


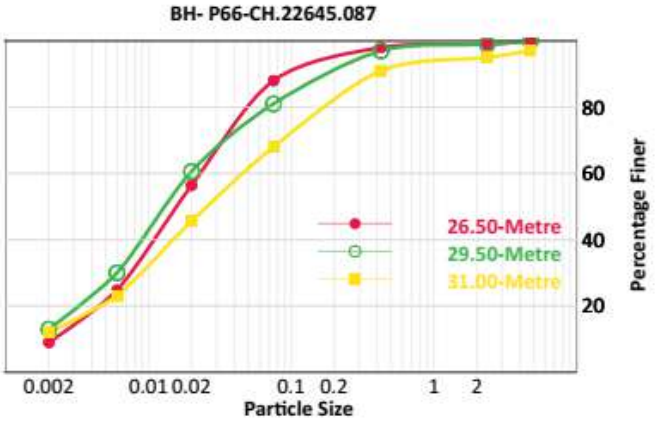
APPENDIX-D
PLOT 6: GRAIN SIZE DISTRIBUTION PLOTS

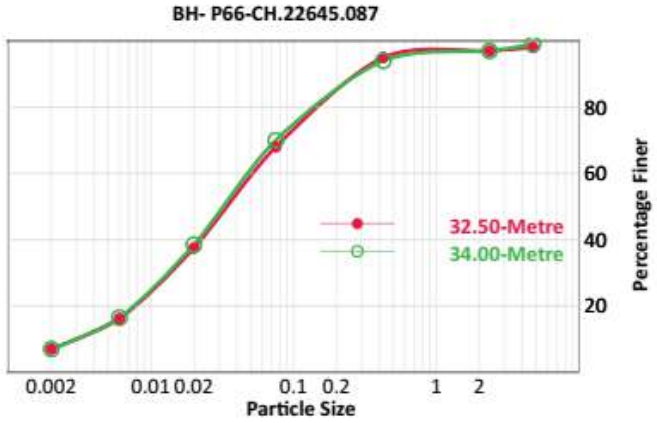


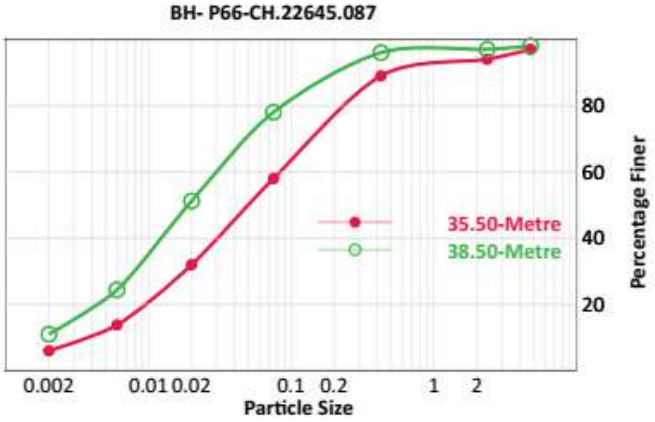


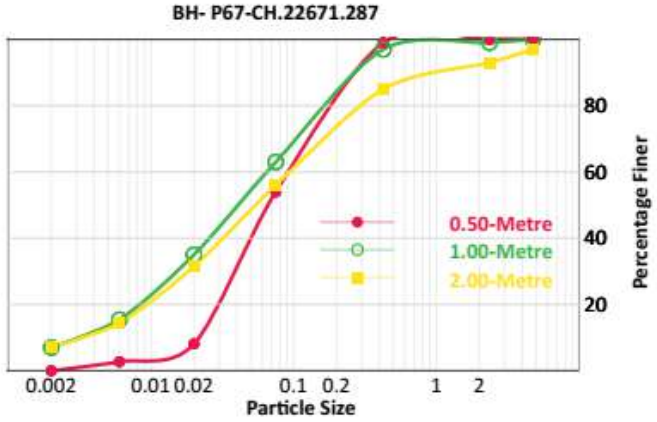






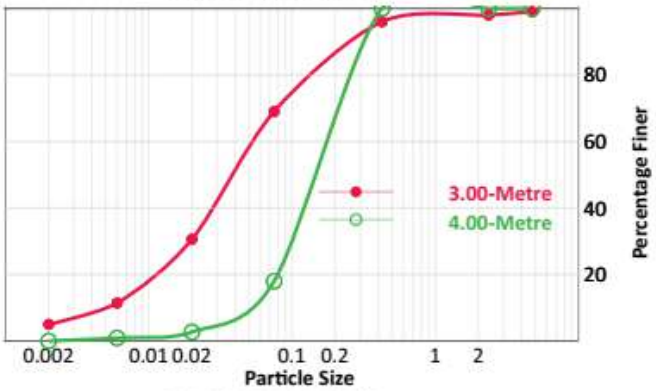




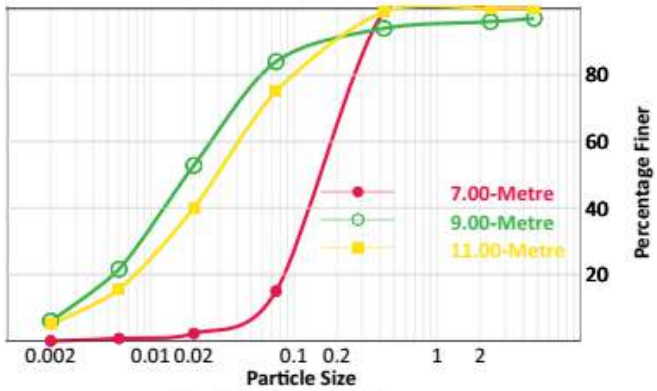


APPENDIX-D
PLOT 7: GRAIN SIZE DISTRIBUTION PLOTS

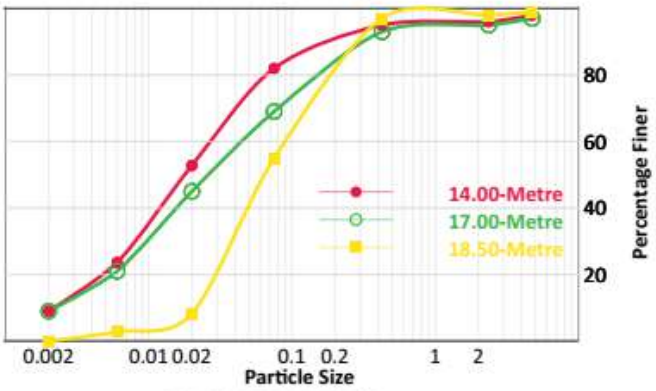
BH- P67-CH.22671.287



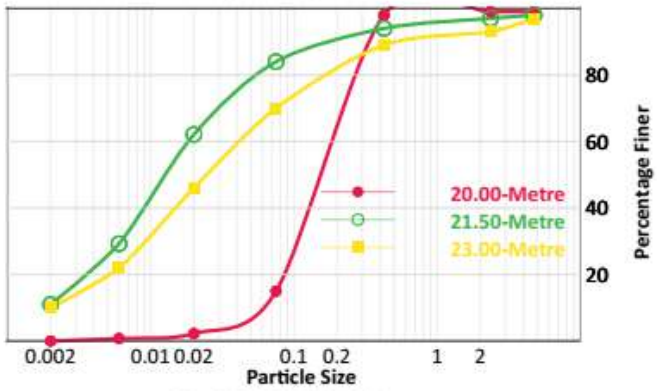
BH- P67-CH.22671.287



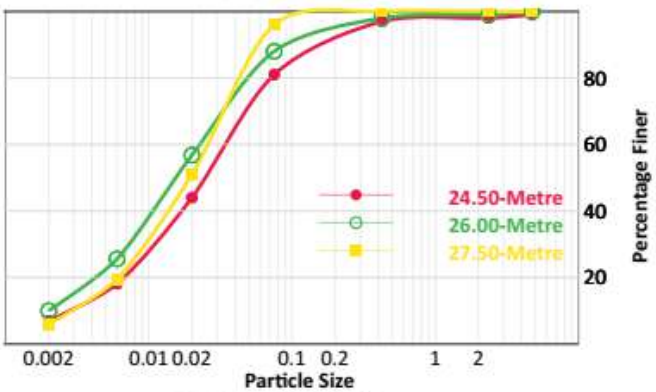
BH- P67-CH.22671.287



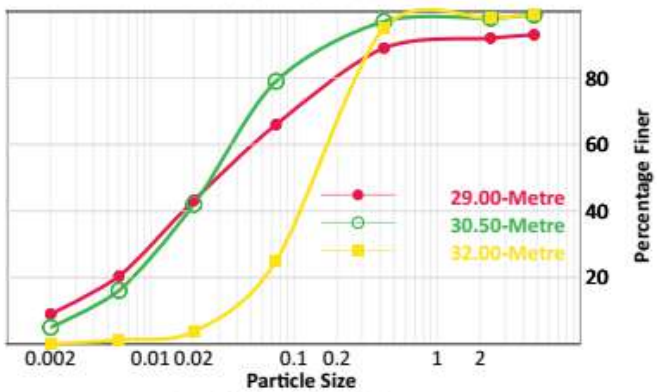
BH- P67-CH.22671.287



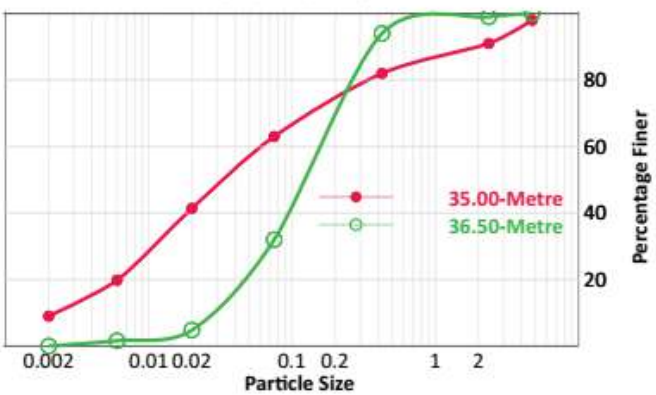
BH- P67-CH.22671.287



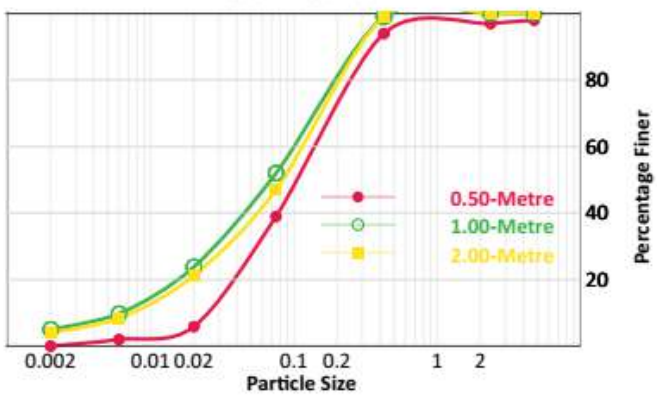
BH- P67-CH.22671.287



BH- P67-CH.22671.287

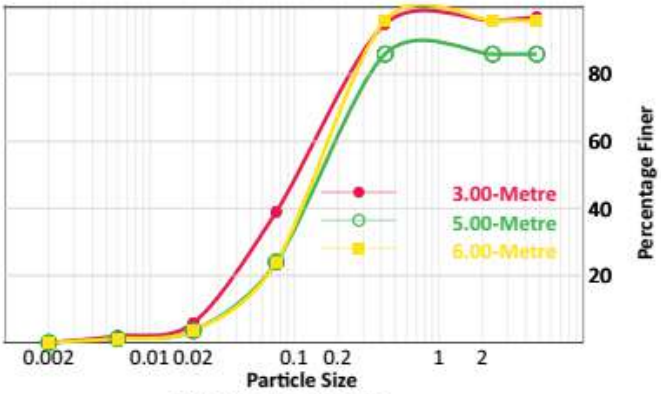


BH- P68-CH.22697.487



APPENDIX-D
PLOT 8: GRAIN SIZE DISTRIBUTION PLOTS

BH- P68-CH.22697.487



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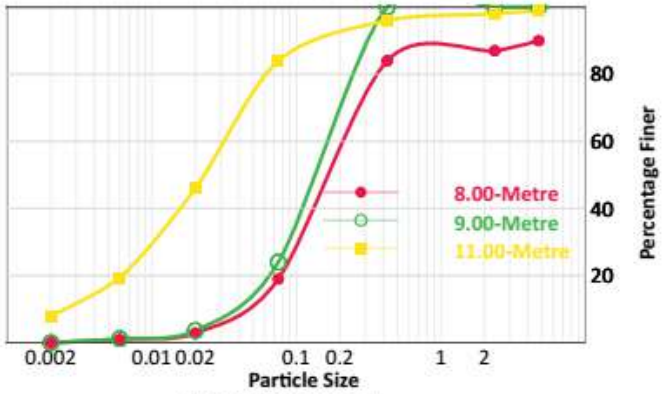
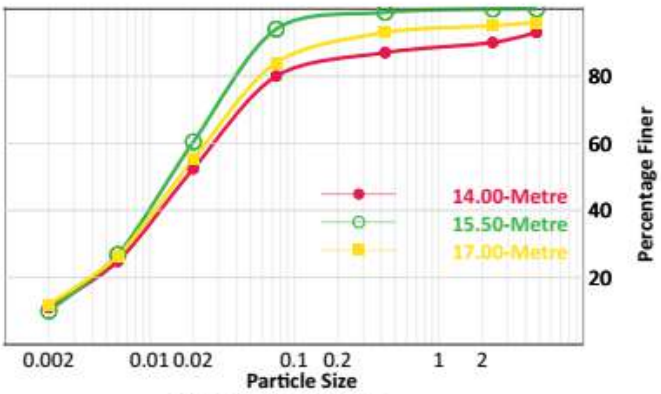
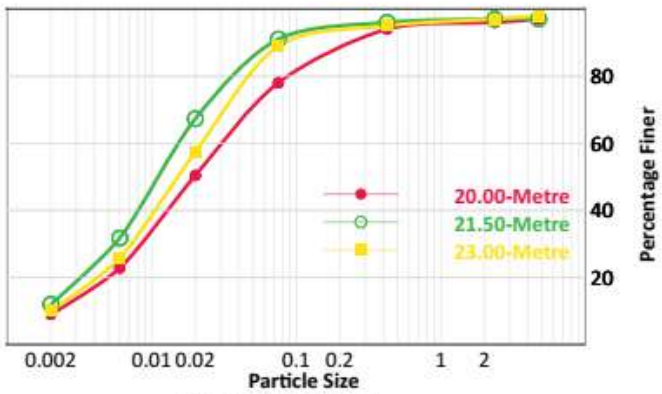


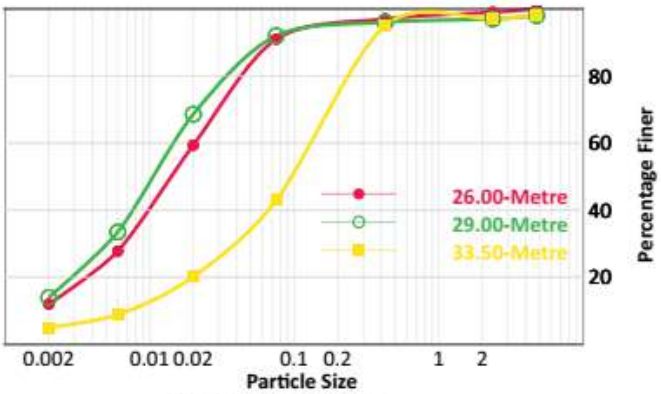
BH- P68-CH.22697.487



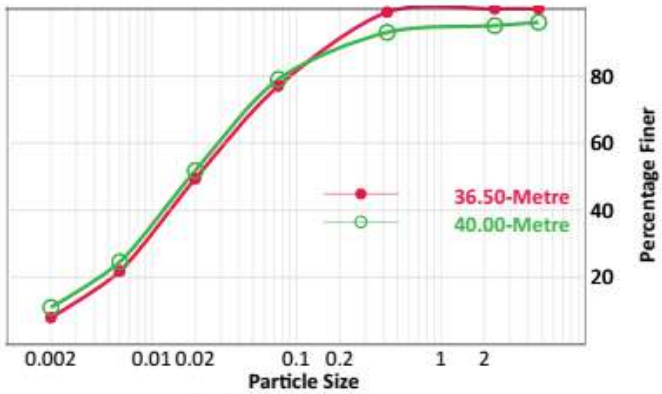
BH- P68-CH.22697.487



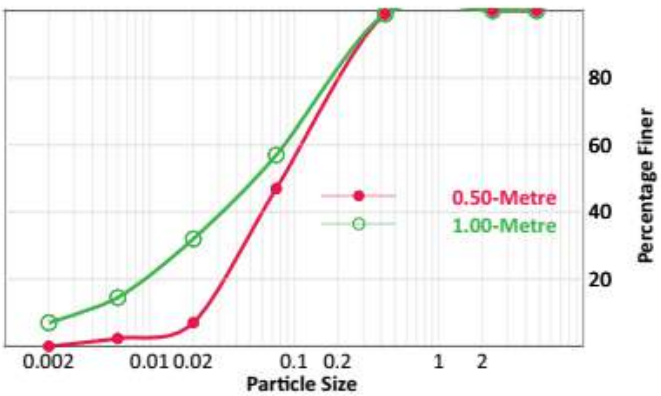
BH- P68-CH.22697.487



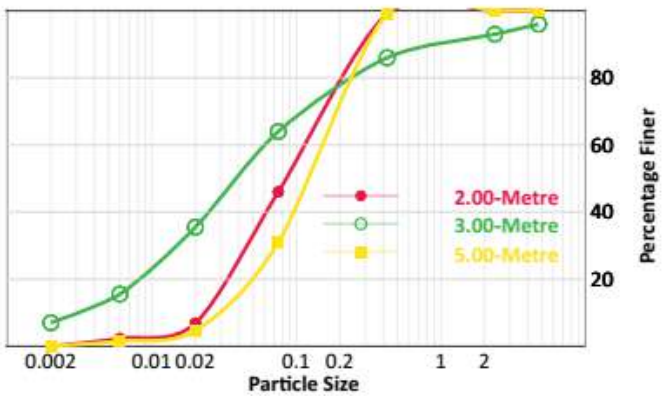
BH- P68-CH.22697.487



BH- P69-CH.22723.687

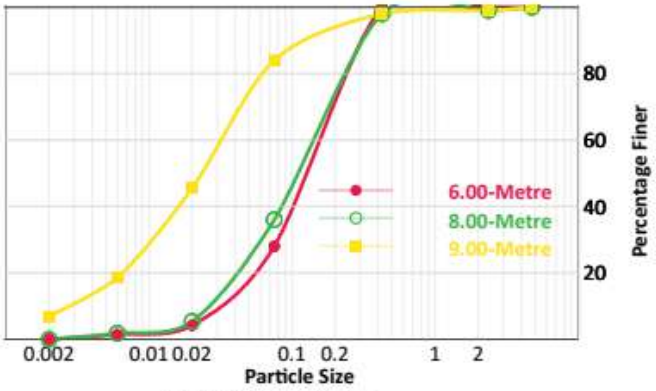


BH- P69-CH.22723.687

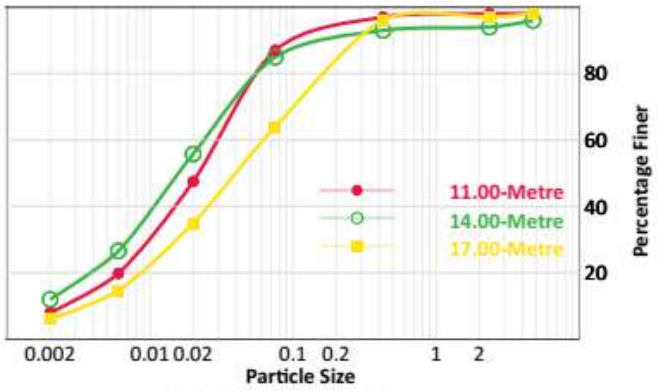


APPENDIX-D
PLOT 9: GRAIN SIZE DISTRIBUTION PLOTS

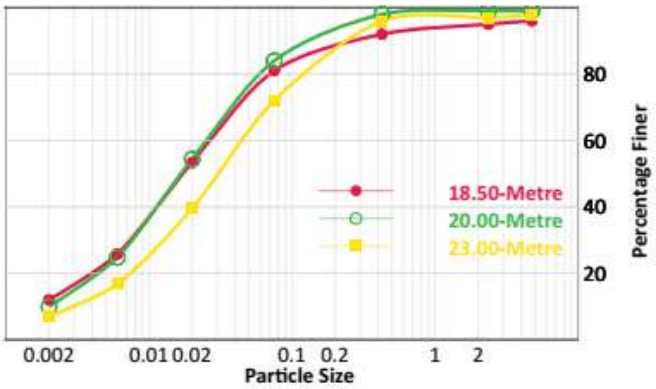
BH- P69-CH.22723.687



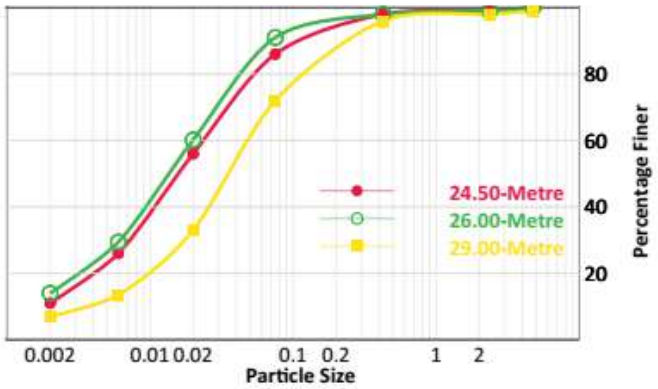
BH- P69-CH.22723.687



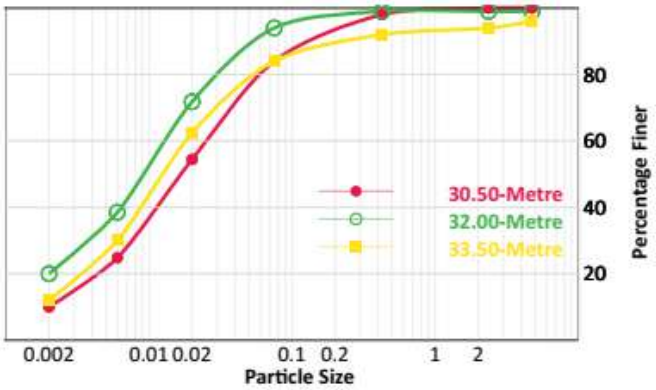
BH- P69-CH.22723.687



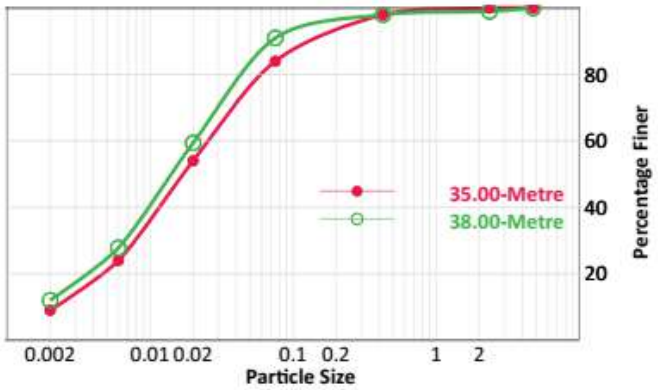
BH- P69-CH.22723.687



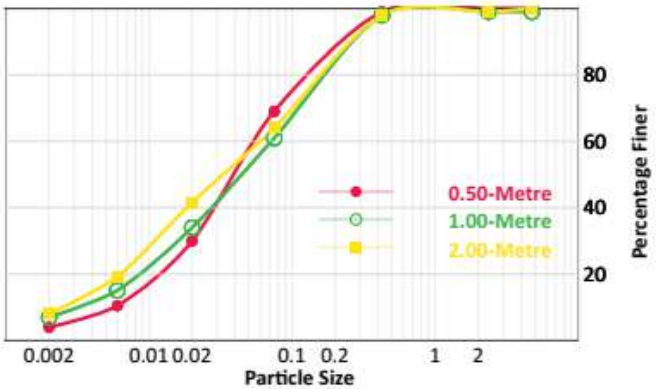
BH- P69-CH.22723.687



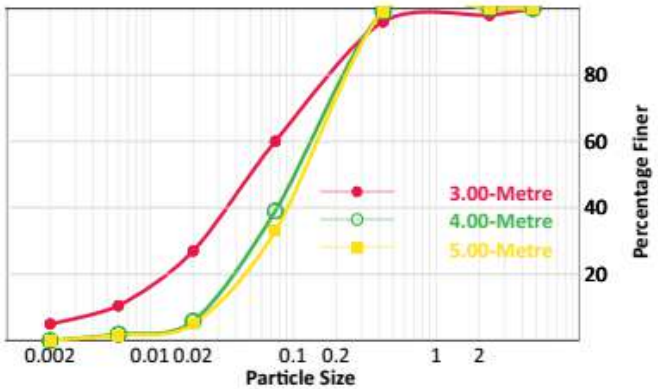
BH- P69-CH.22723.687



BH- P70-CH.22749.887

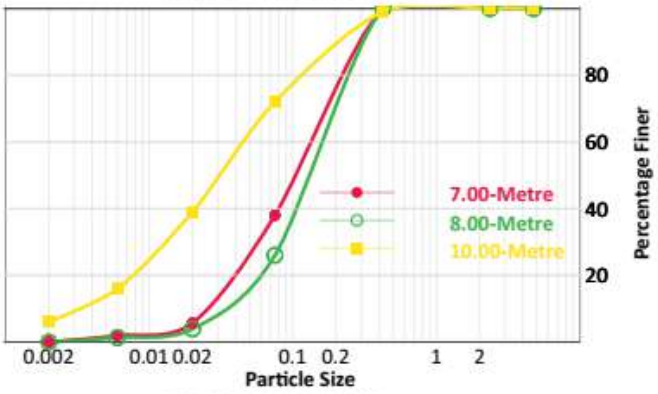


BH- P70-CH.22749.887

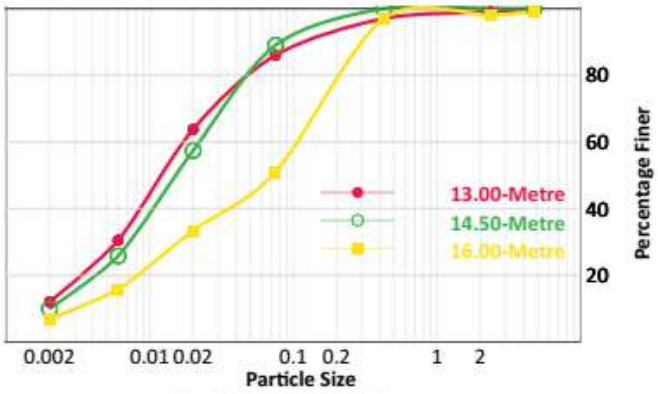


APPENDIX-D
PLOT 10: GRAIN SIZE DISTRIBUTION PLOTS

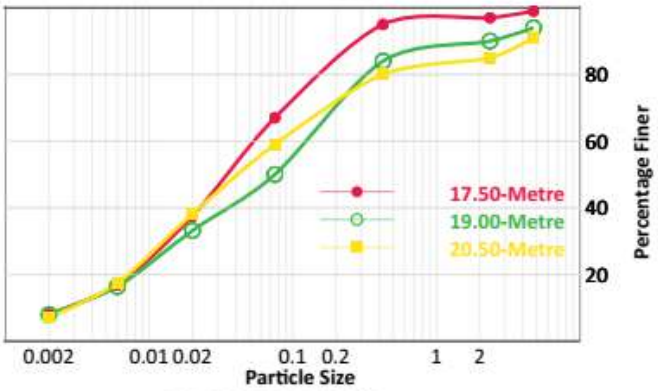
BH- P70-CH.22749.887



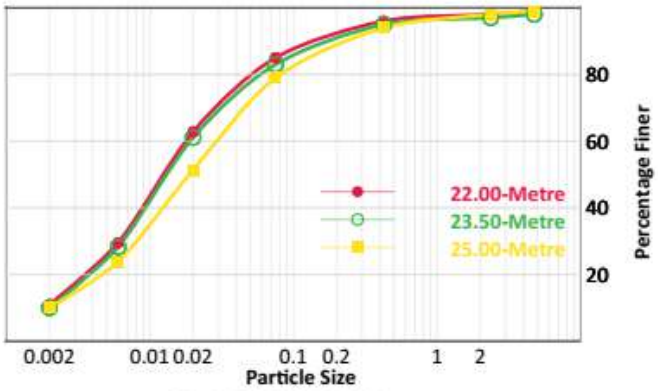
BH- P70-CH.22749.887



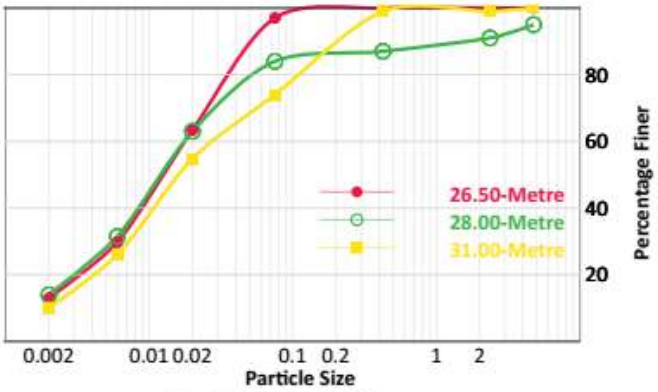
BH- P70-CH.22749.887



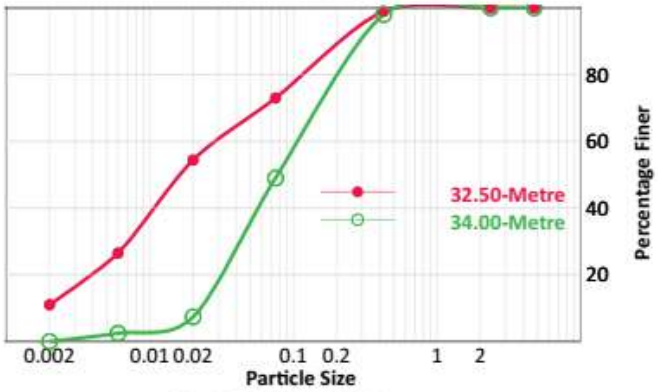
BH- P70-CH.22749.887



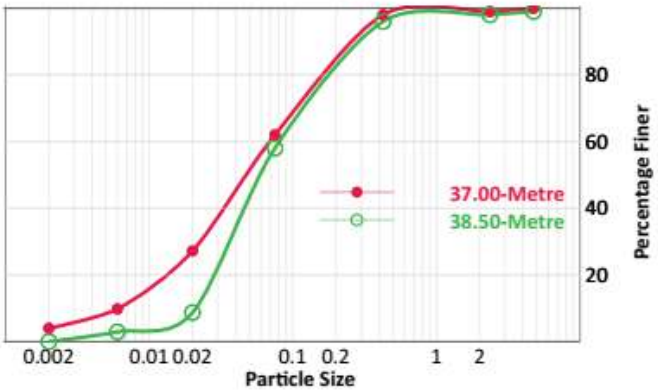
BH- P70-CH.22749.887



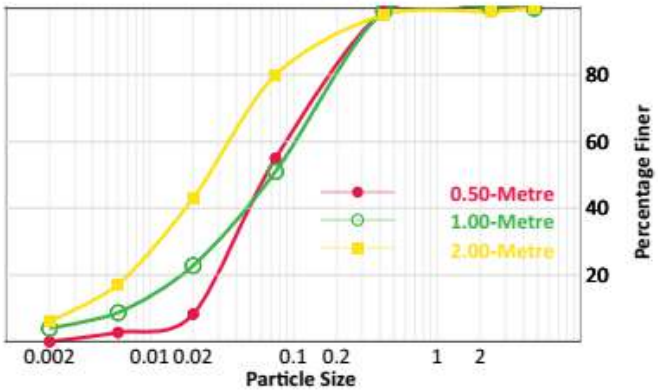
BH- P70-CH.22749.887



BH- P70-CH.22749.887

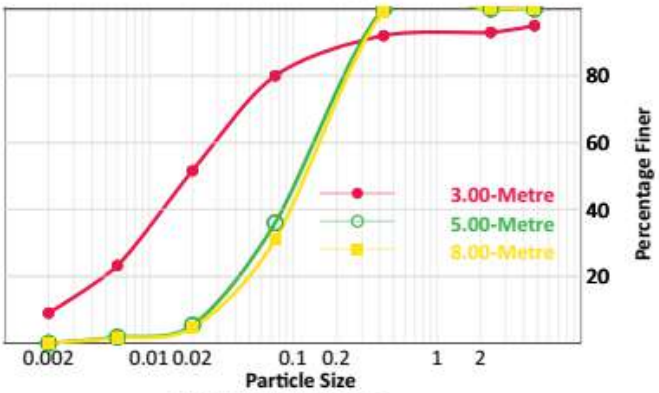


BH- P71-CH.22776.087

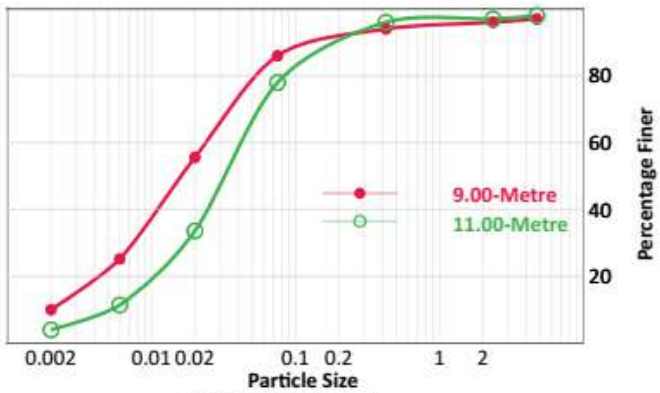


APPENDIX-D
PLOT 11: GRAIN SIZE DISTRIBUTION PLOTS

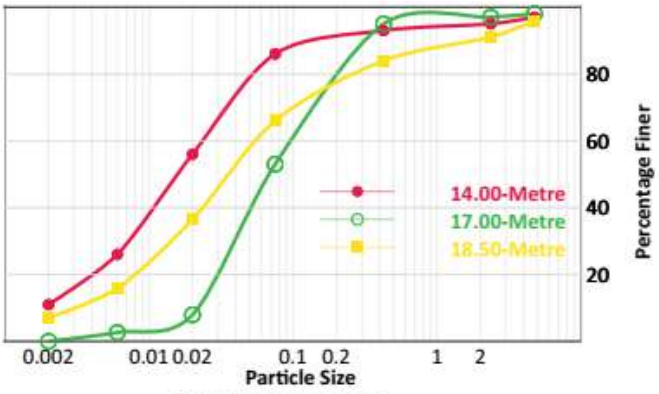
BH- P71-CH.22776.087



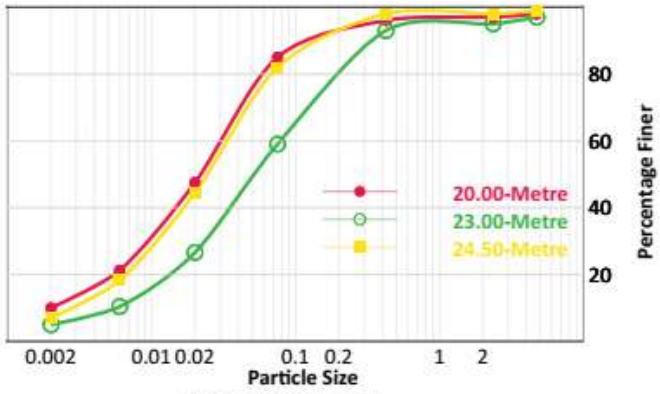
BH- P71-CH.22776.087



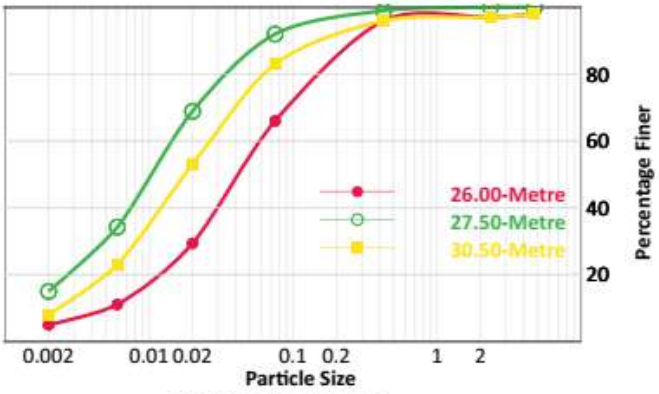
BH- P71-CH.22776.087



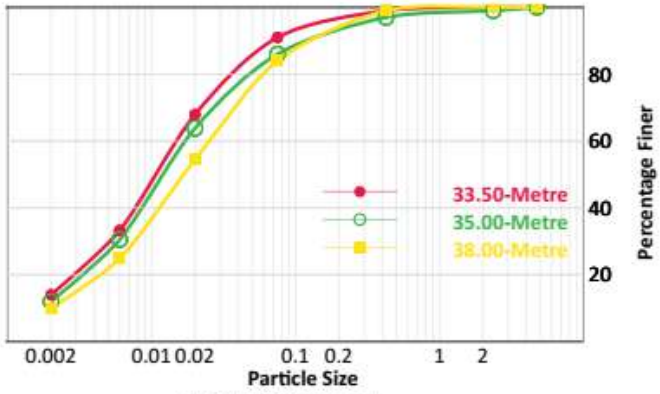
BH- P71-CH.22776.087



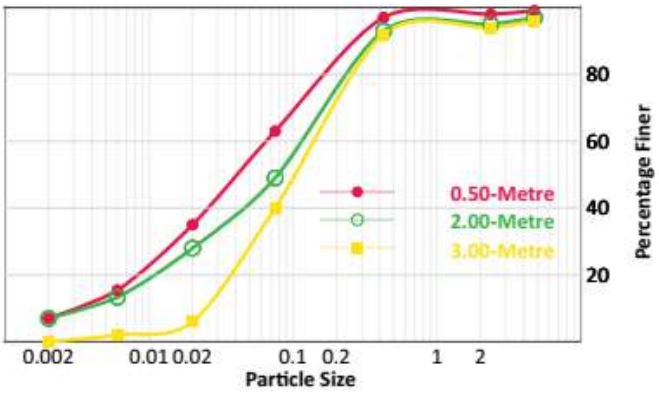
BH- P71-CH.22776.087



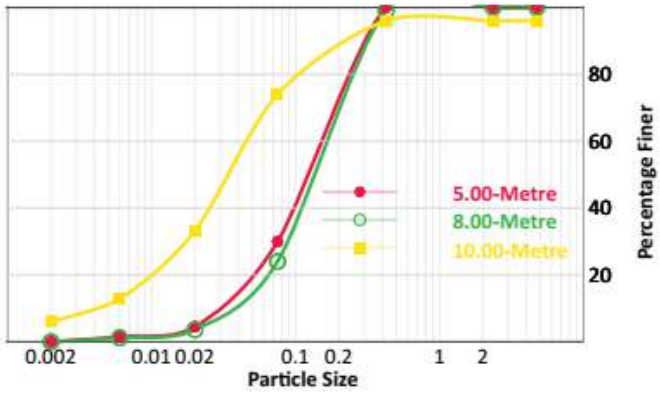
BH- P71-CH.22776.087



BH- P72-CH.22802.287

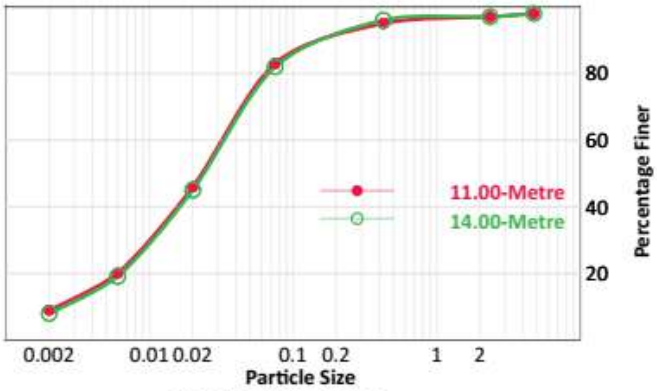


BH- P72-CH.22802.287

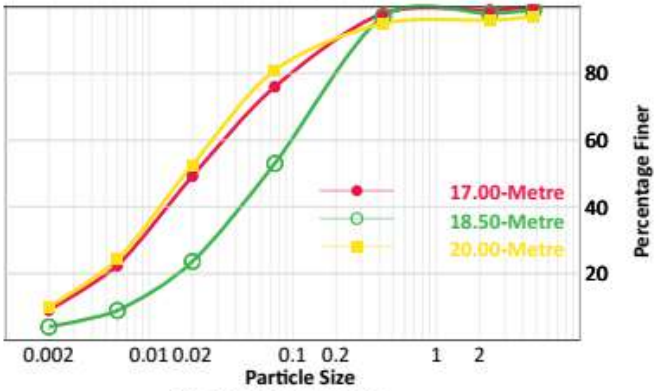


APPENDIX-D
PLOT 12: GRAIN SIZE DISTRIBUTION PLOTS

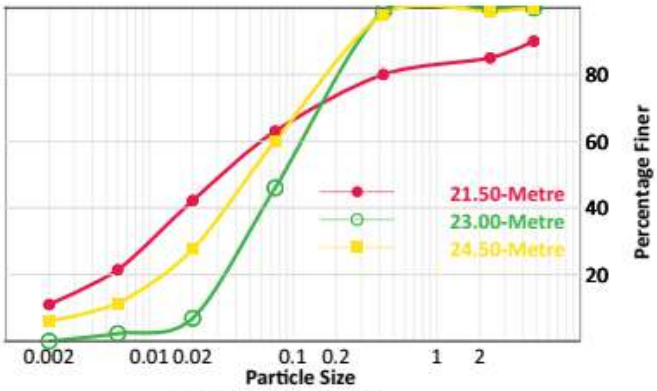
BH- P72-CH.22802.287



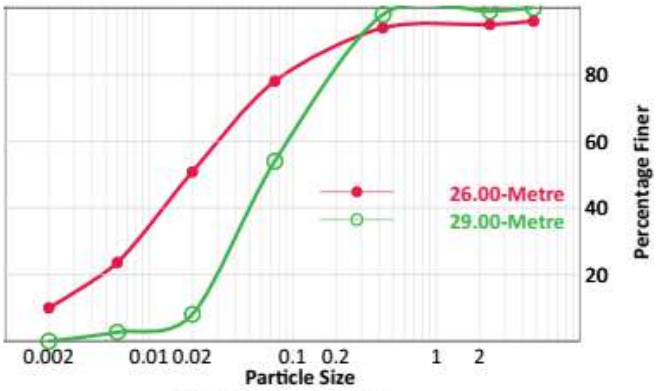
BH- P72-CH.22802.287



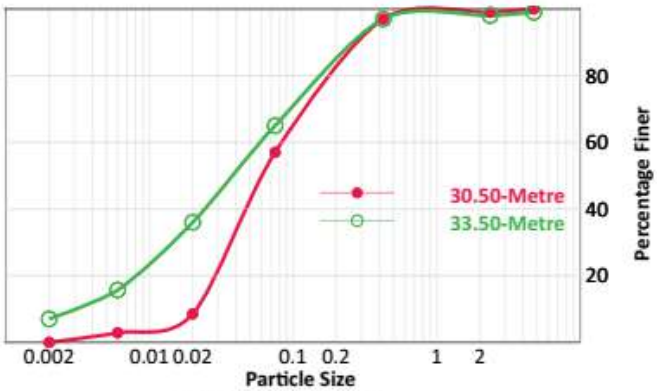
BH- P72-CH.22802.287



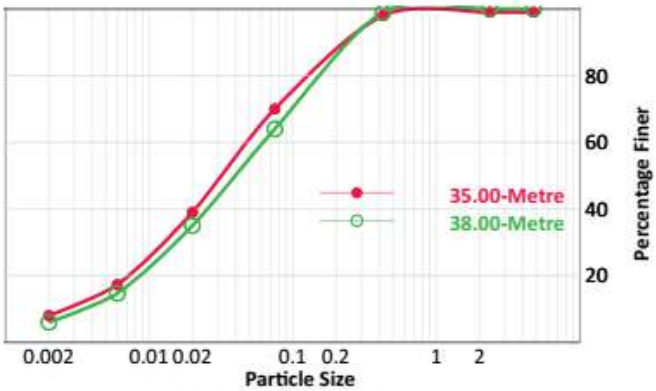
BH- P72-CH.22802.287



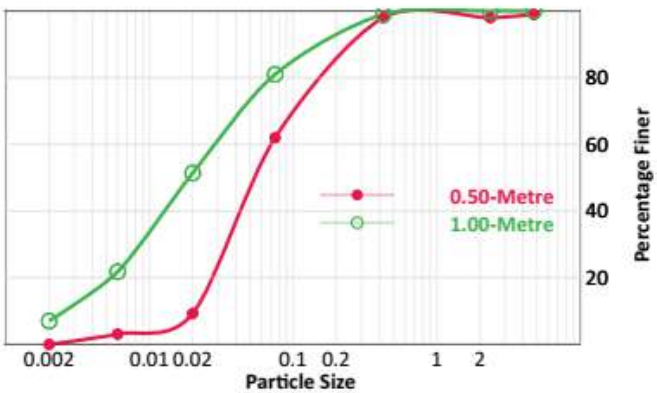
BH- P72-CH.22802.287



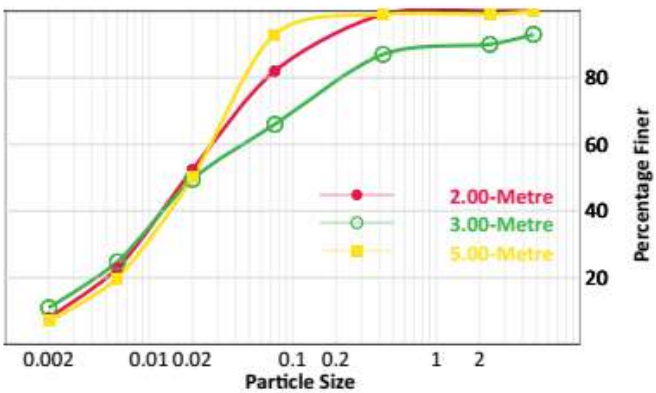
BH- P72-CH.22802.287



BH- P73-CH.22828.487

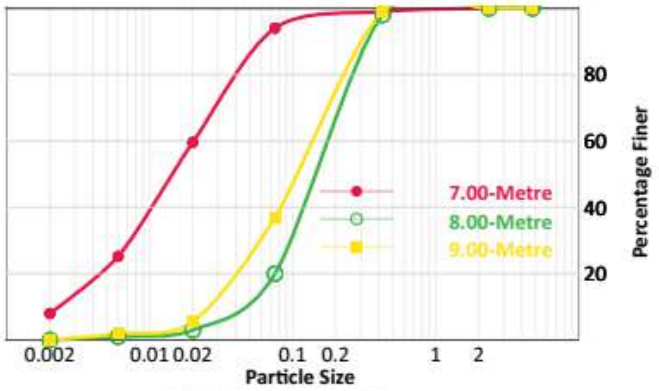


BH- P73-CH.22828.487

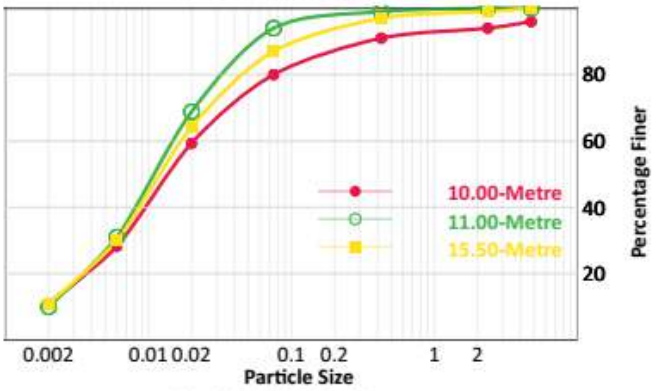


APPENDIX-D
PLOT 13: GRAIN SIZE DISTRIBUTION PLOTS

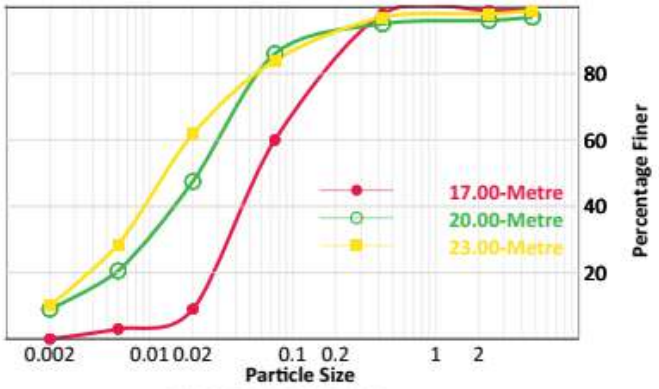
BH- P73-CH.22828.487



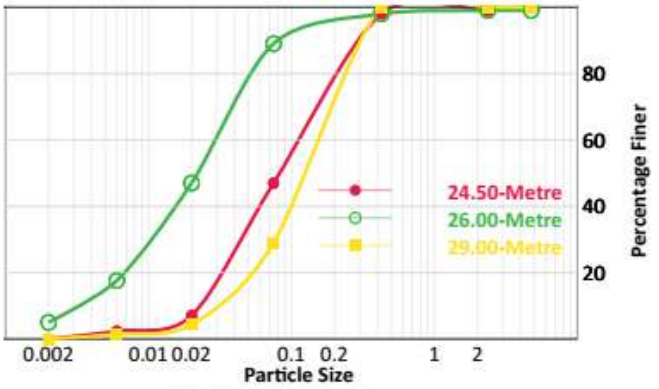
BH- P73-CH.22828.487



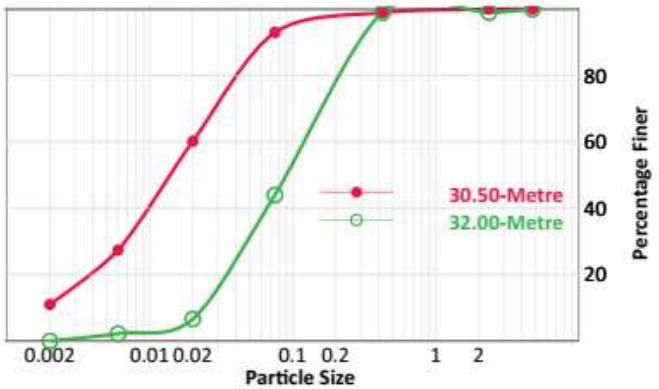
BH- P73-CH.22828.487



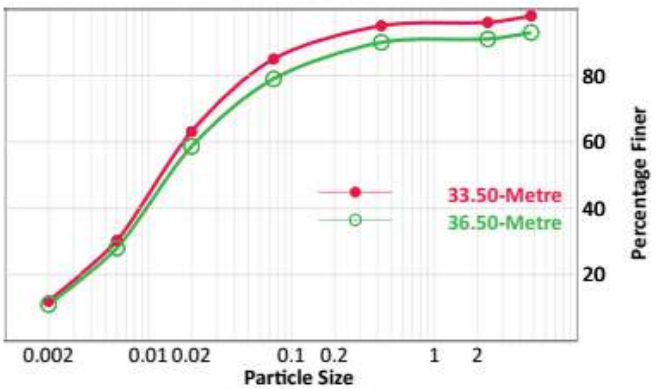
BH- P73-CH.22828.487



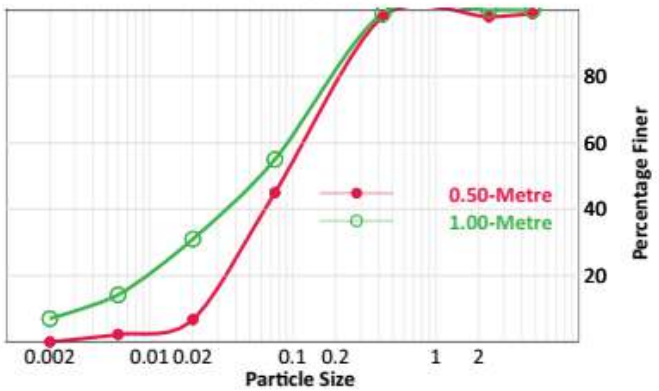
BH- P73-CH.22828.487



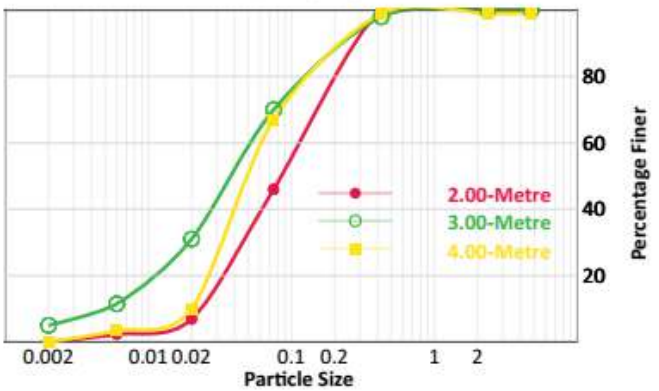
BH- P73-CH.22828.487



BH- P74-CH.22854.687

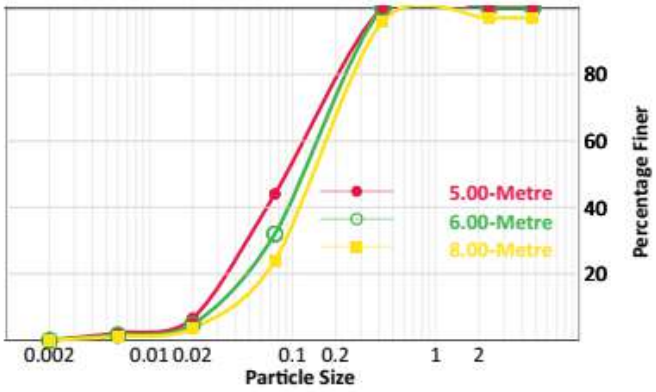


BH- P74-CH.22854.687

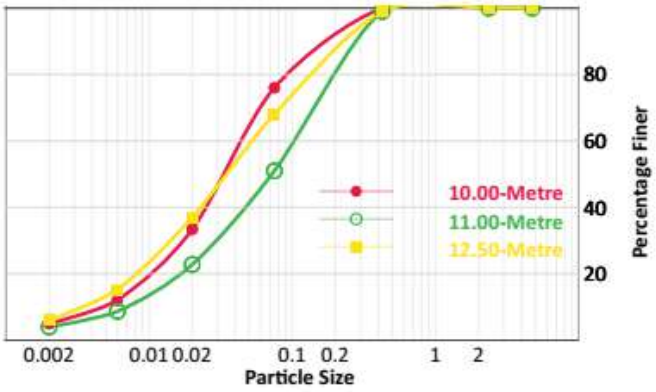


APPENDIX-D
PLOT 14: GRAIN SIZE DISTRIBUTION PLOTS

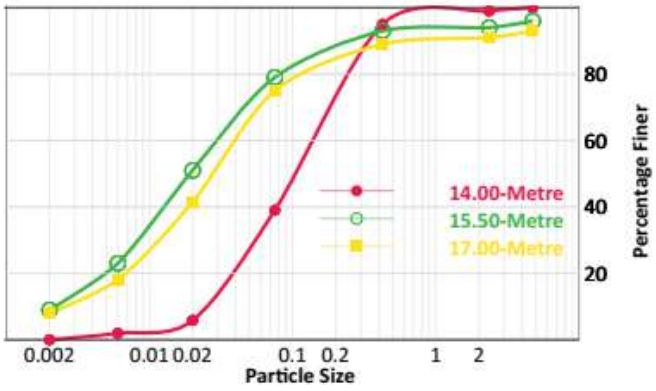
BH- P74-CH.22854.687



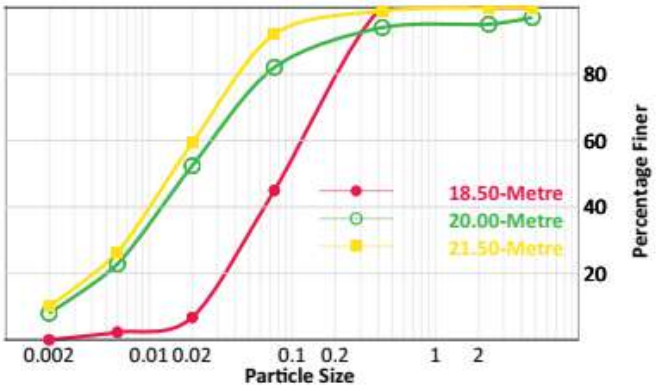
BH- P74-CH.22854.687



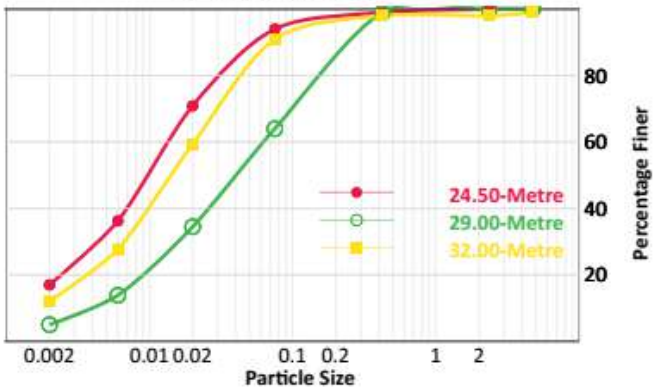
BH- P74-CH.22854.687



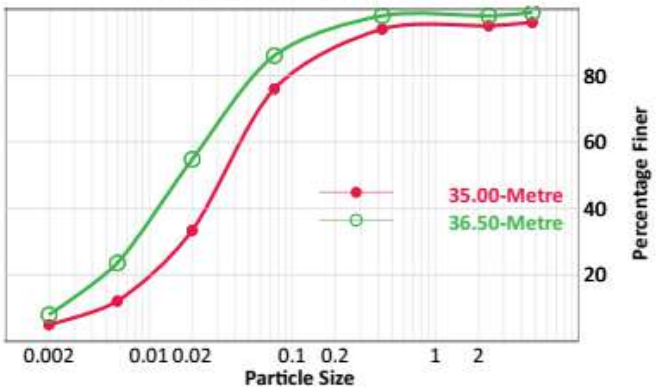
BH- P74-CH.22854.687



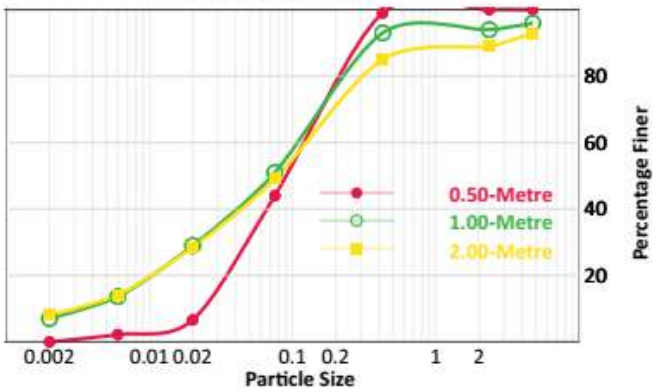
BH- P74-CH.22854.687



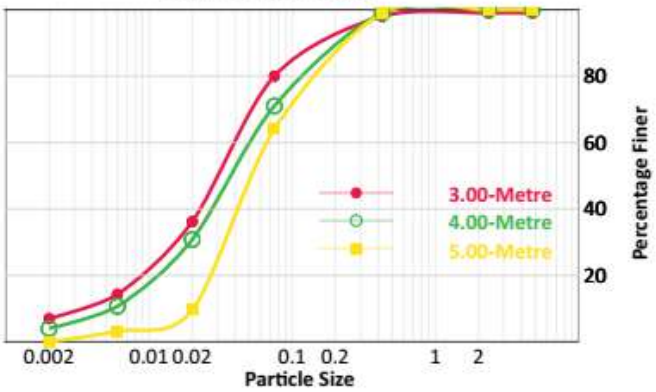
BH- P74-CH.22854.687



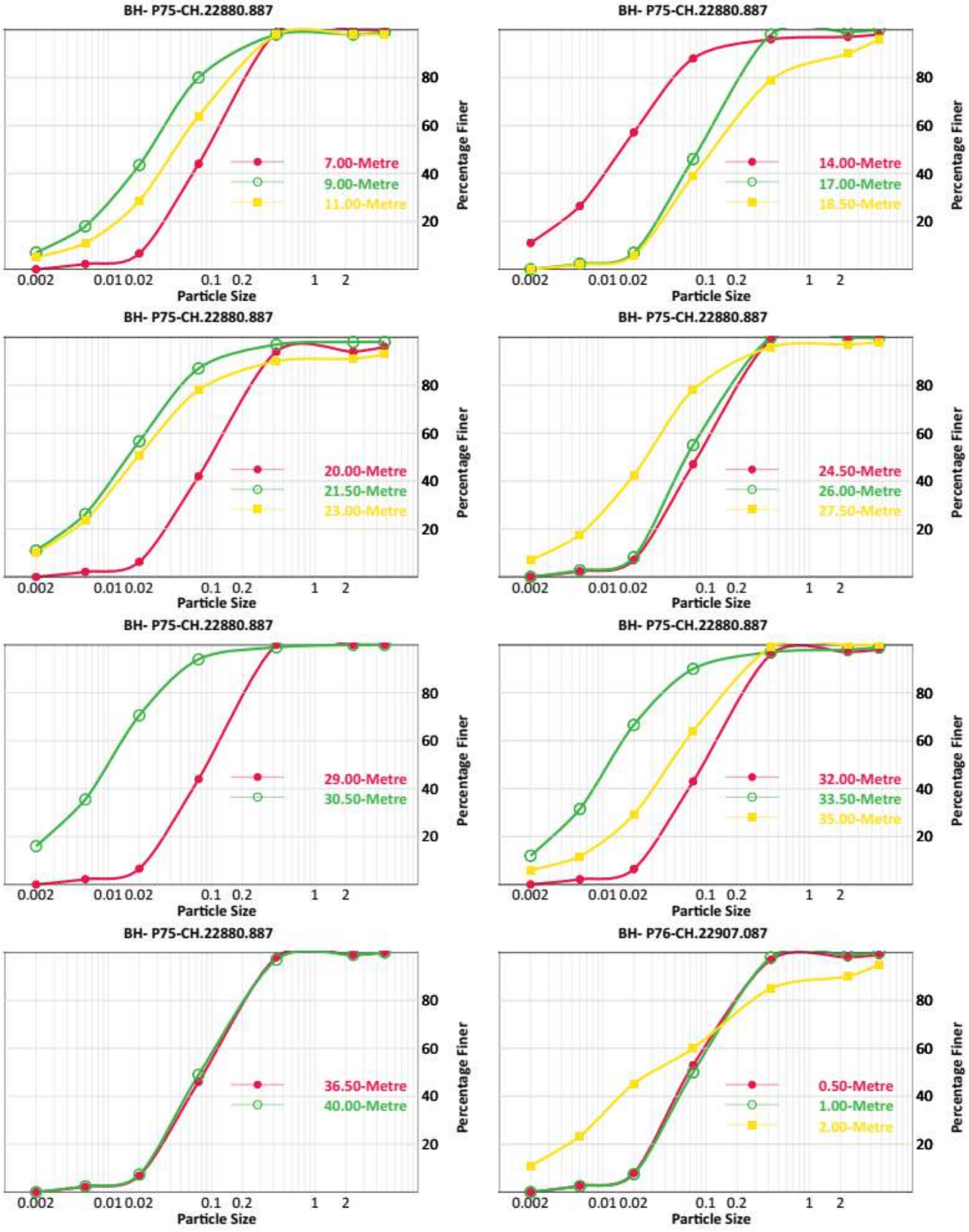
BH- P75-CH.22880.887



BH- P75-CH.22880.887

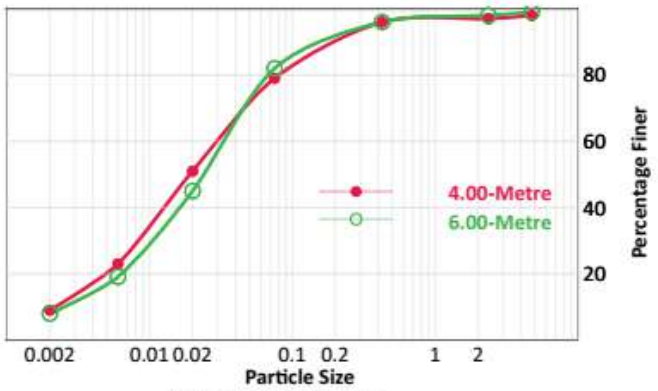


APPENDIX-D
PLOT 15: GRAIN SIZE DISTRIBUTION PLOTS

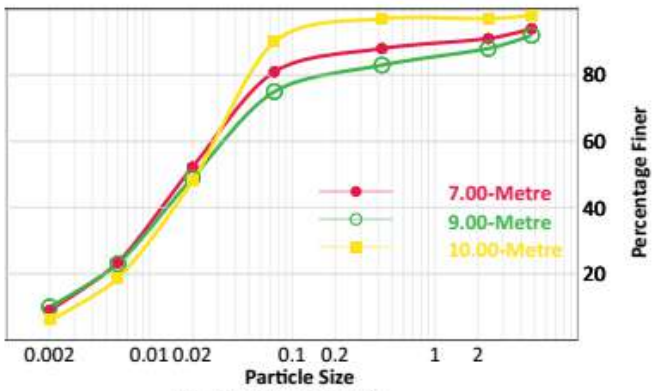


APPENDIX-D
PLOT 16: GRAIN SIZE DISTRIBUTION PLOTS

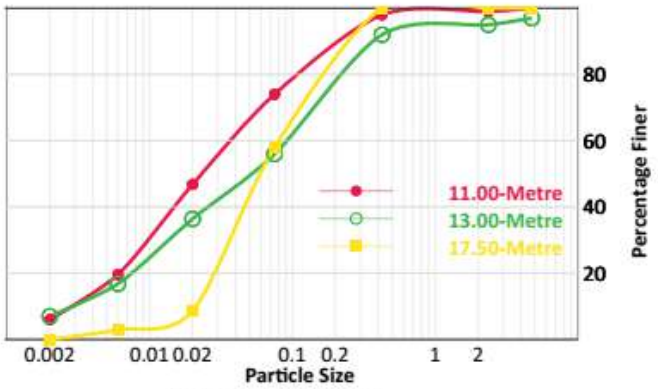
BH- P76-CH.22907.087



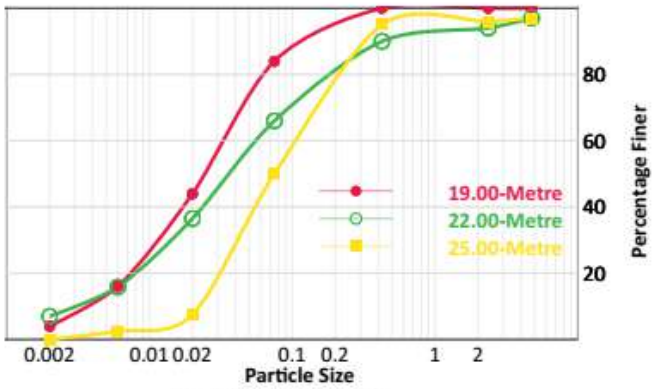
BH- P76-CH.22907.087



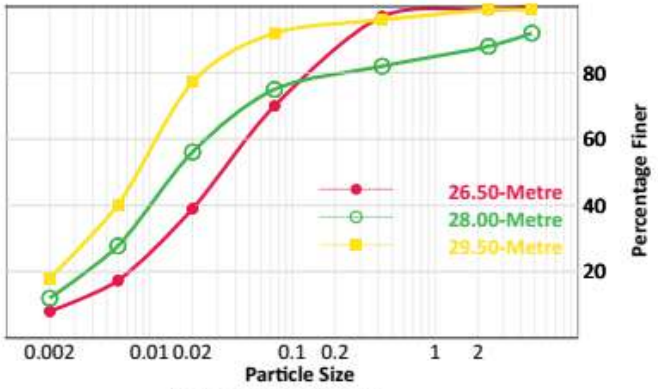
BH- P76-CH.22907.087



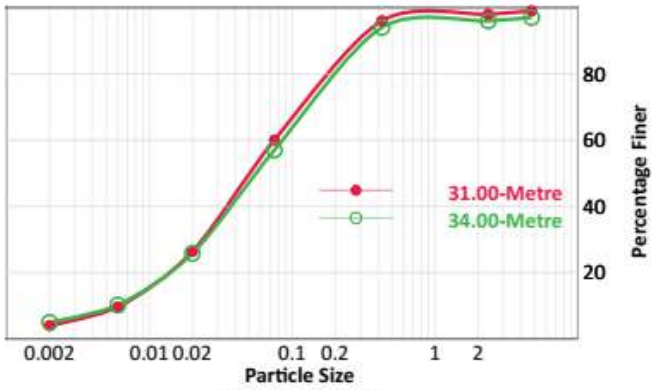
BH- P76-CH.22907.087



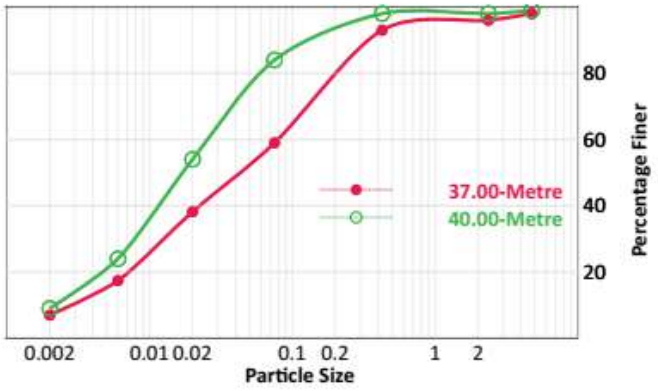
BH- P76-CH.22907.087



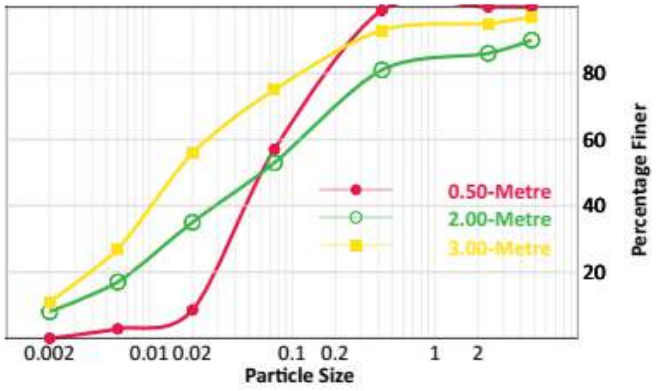
BH- P76-CH.22907.087



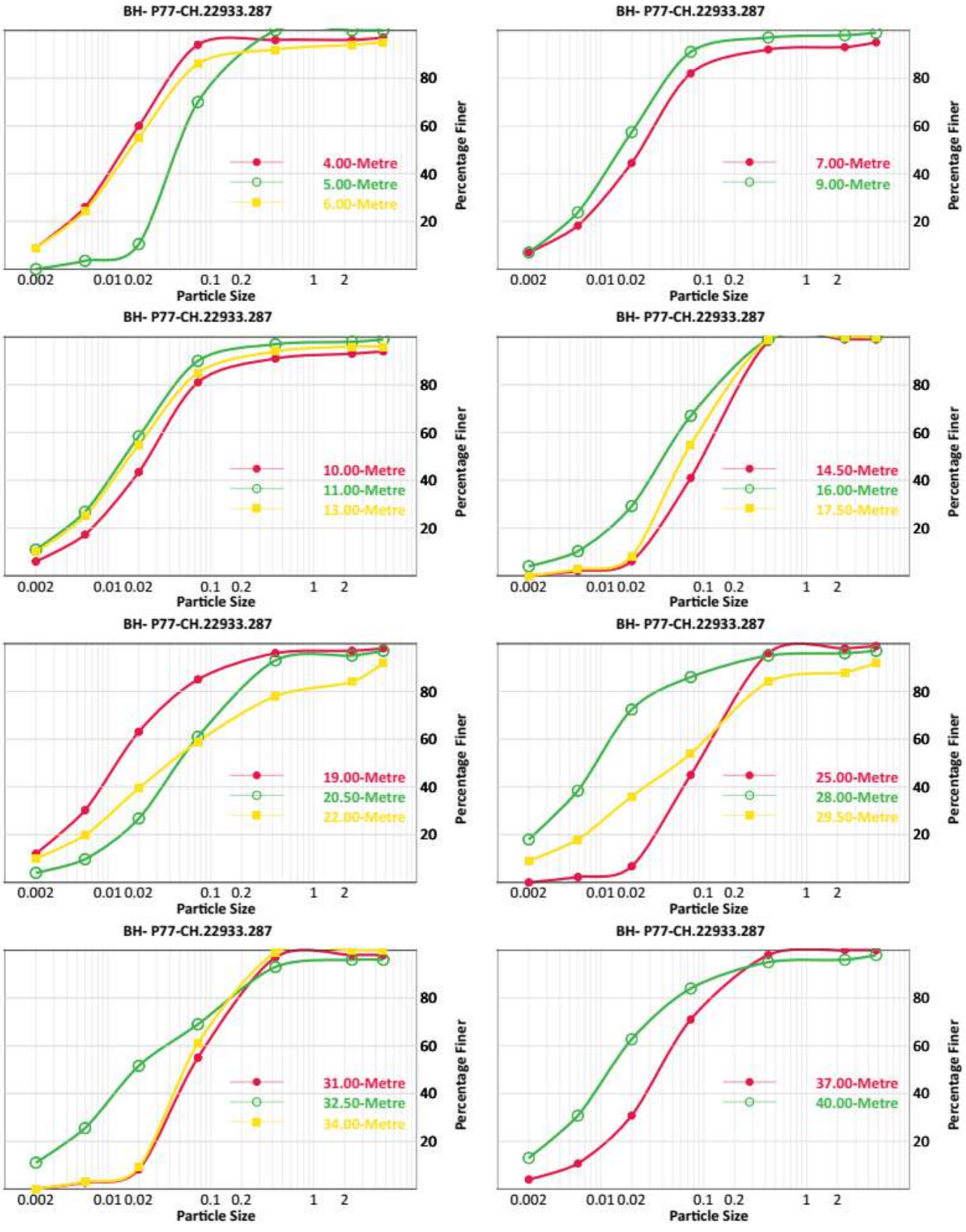
BH- P76-CH.22907.087



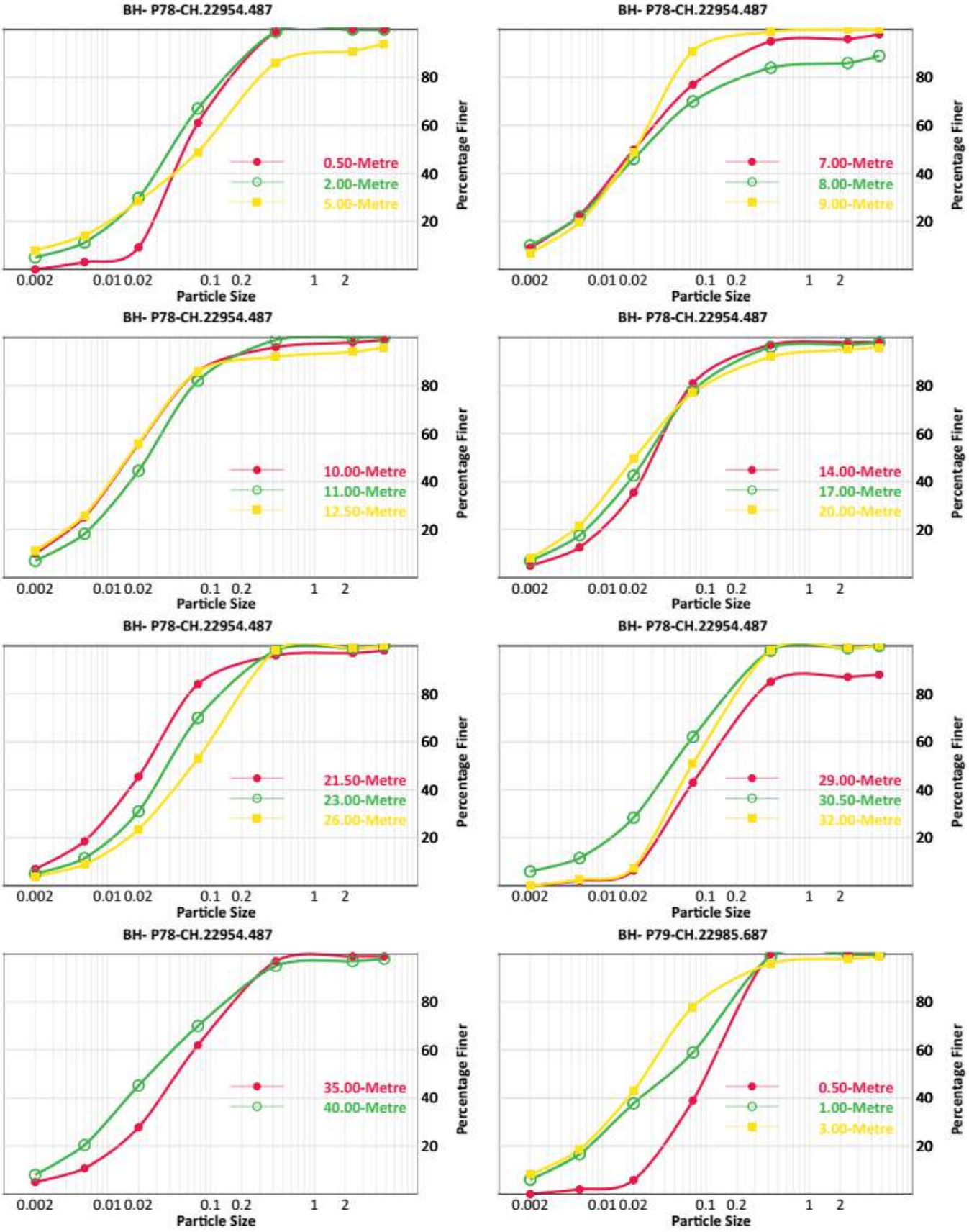
BH- P77-CH.22933.287



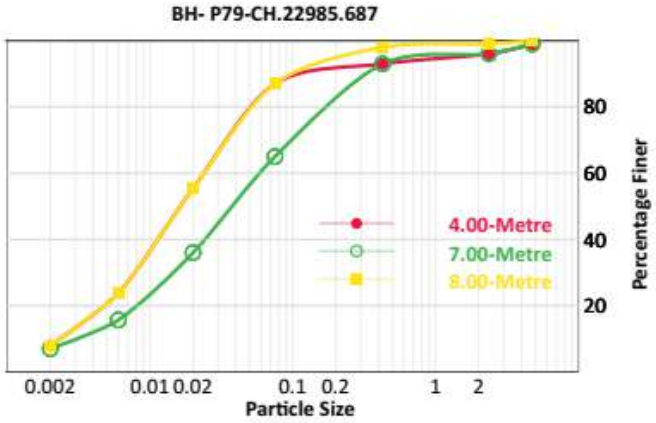
APPENDIX-D
PLOT 17: GRAIN SIZE DISTRIBUTION PLOTS

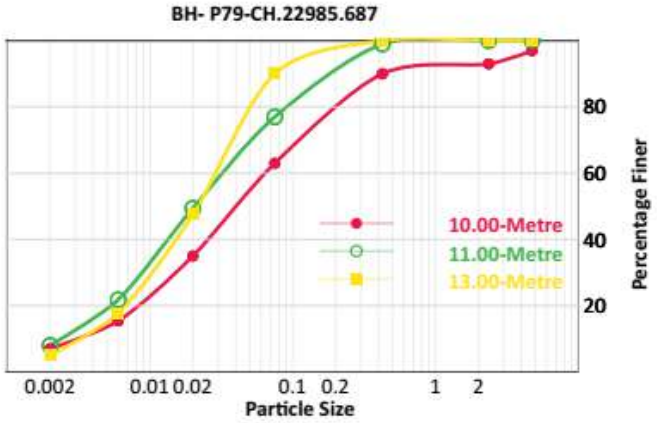


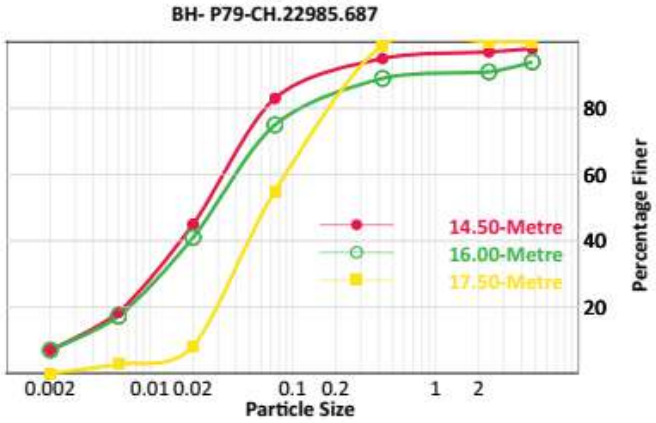
APPENDIX-D
PLOT 18: GRAIN SIZE DISTRIBUTION PLOTS

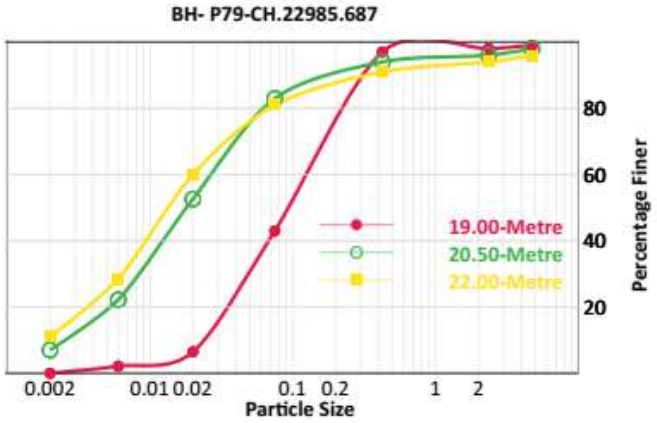


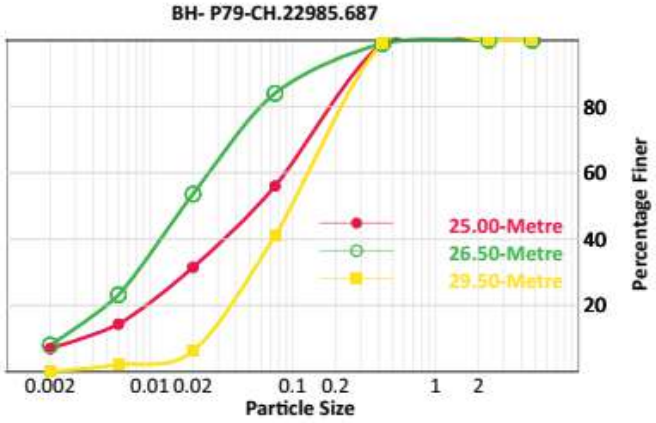
APPENDIX-D
PLOT 19: GRAIN SIZE DISTRIBUTION PLOTS

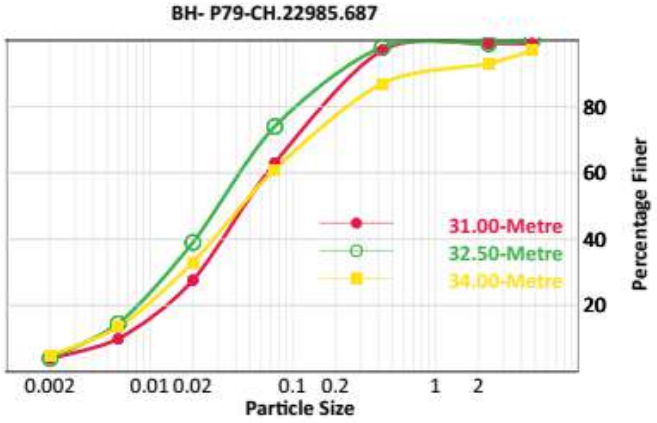


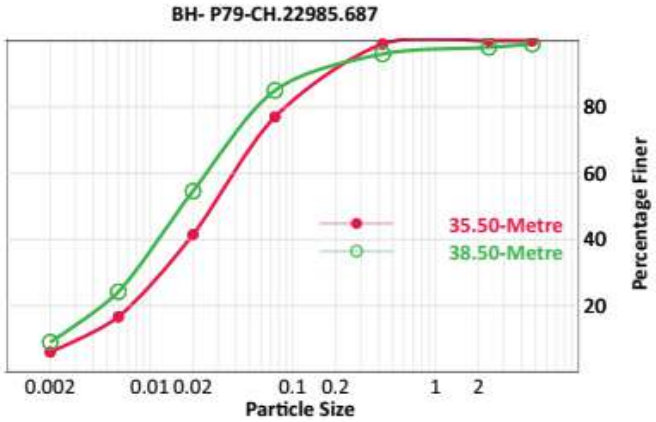


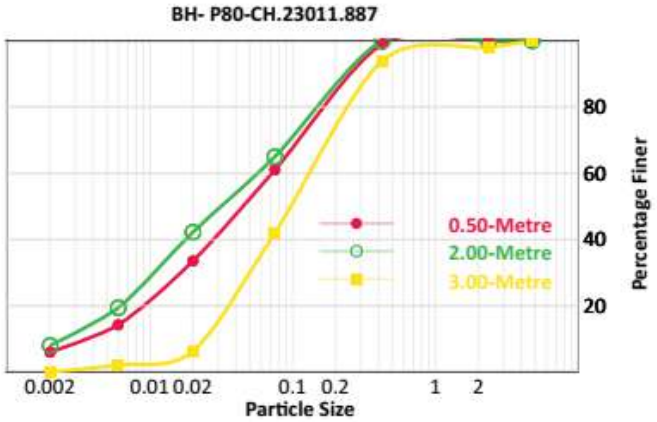




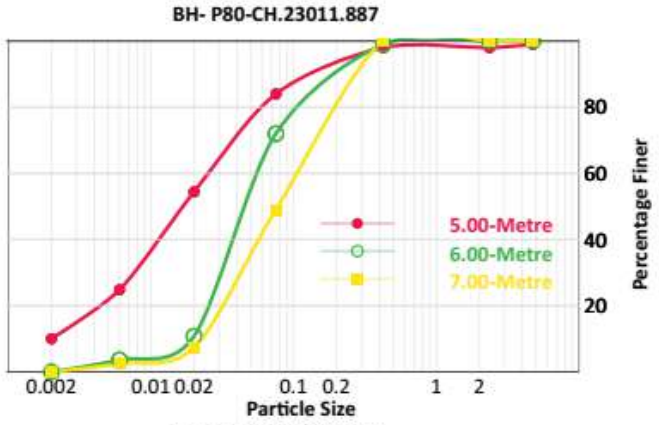


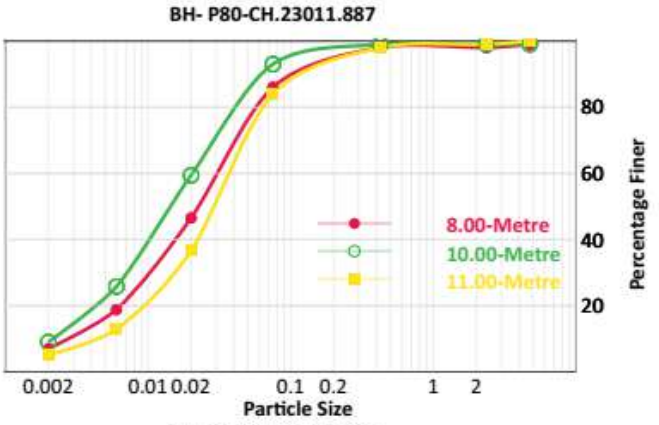


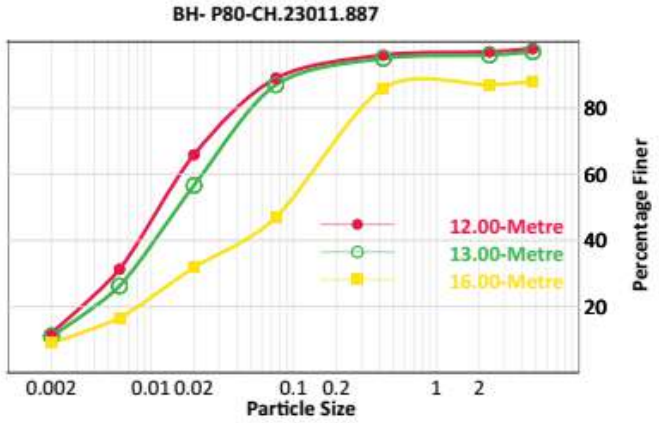


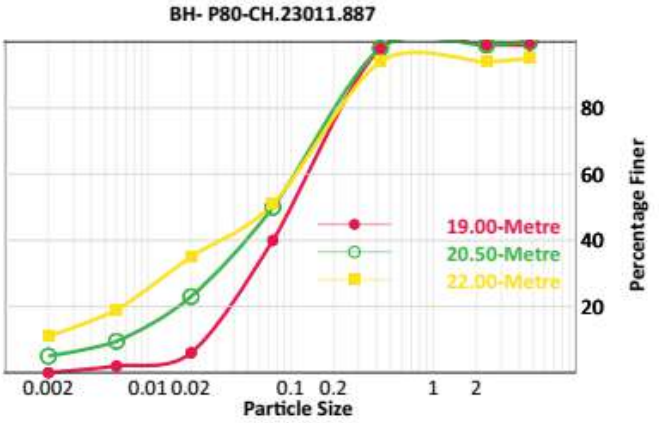


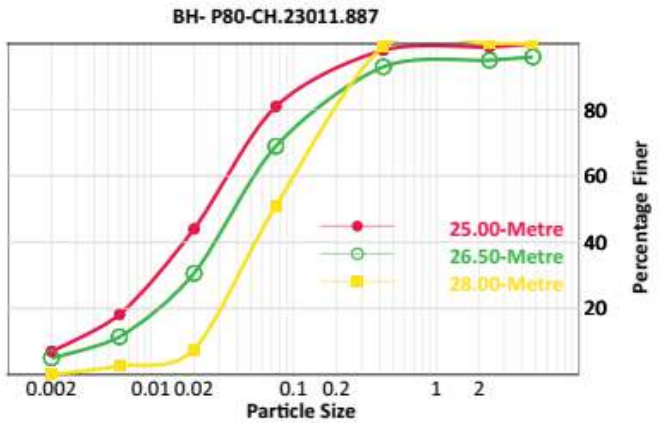
APPENDIX-D
PLOT 20: GRAIN SIZE DISTRIBUTION PLOTS

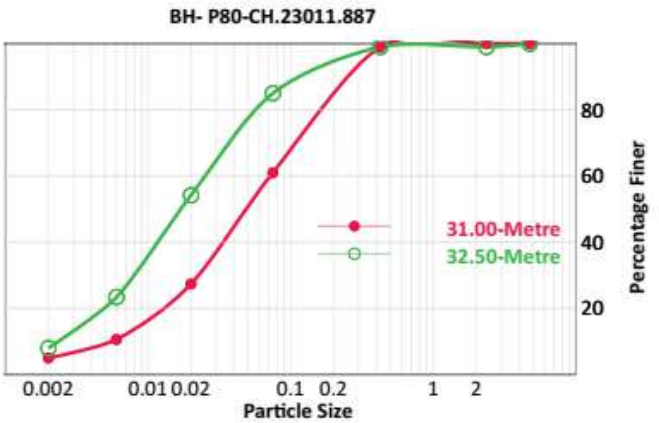


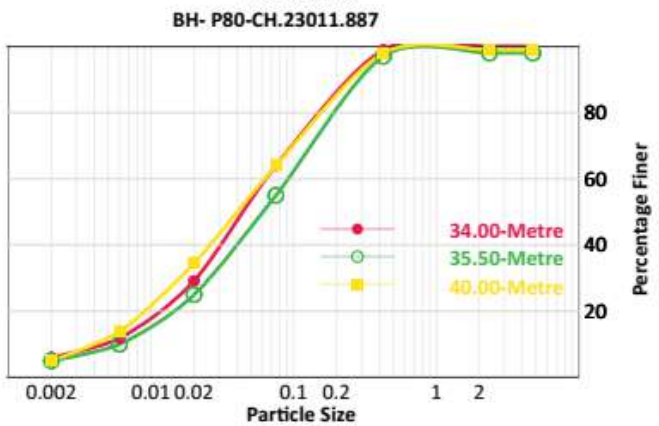




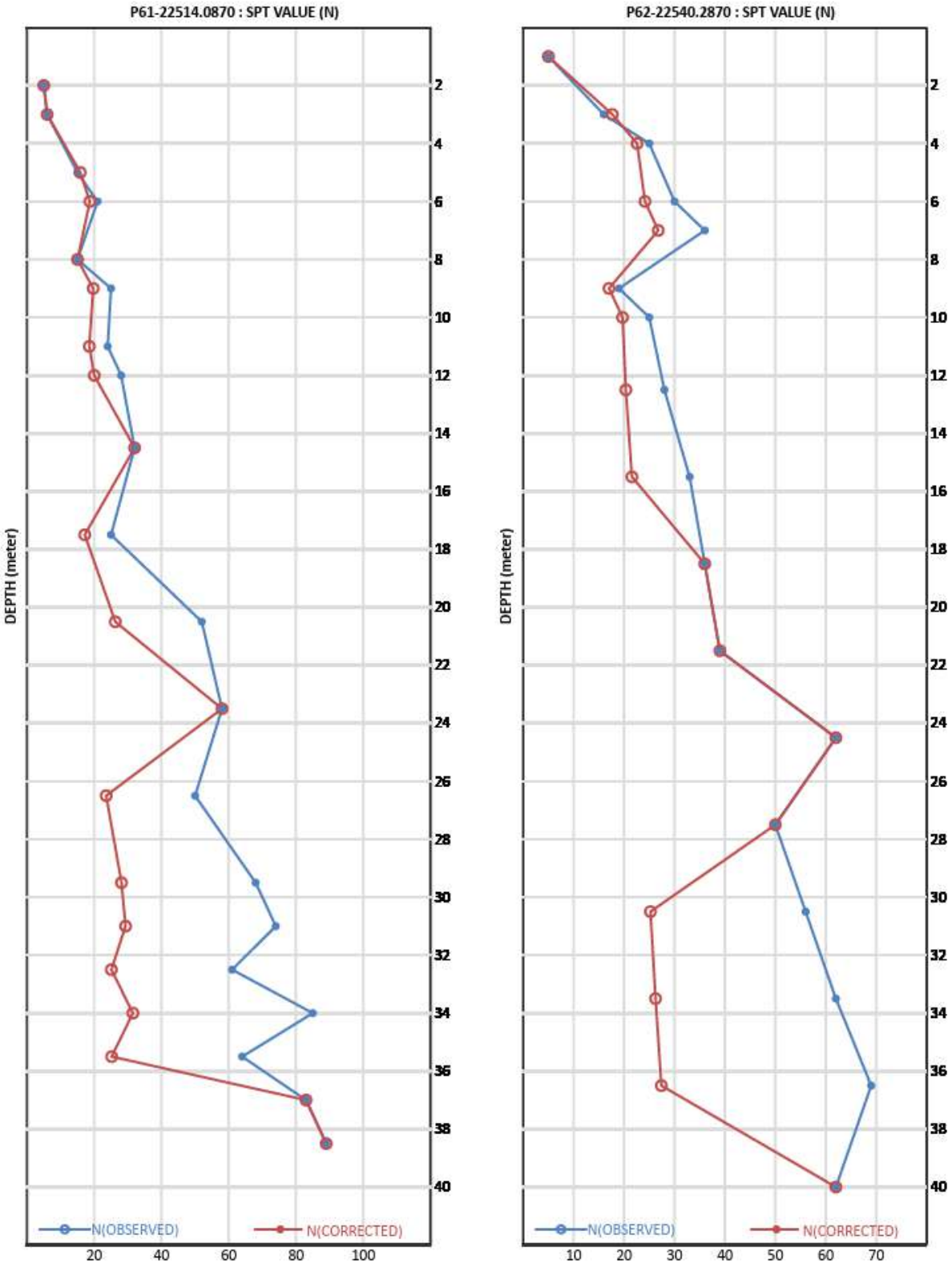




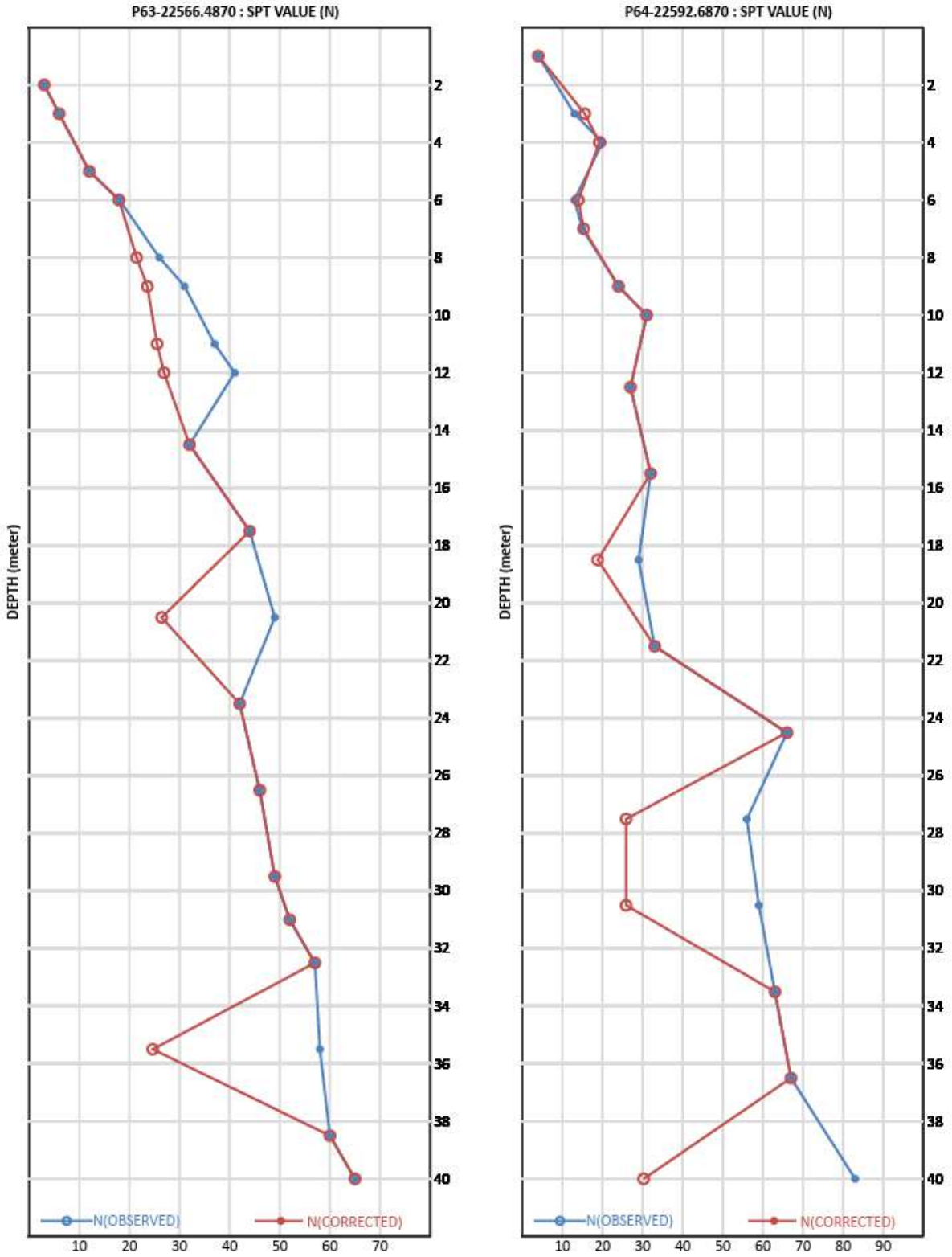




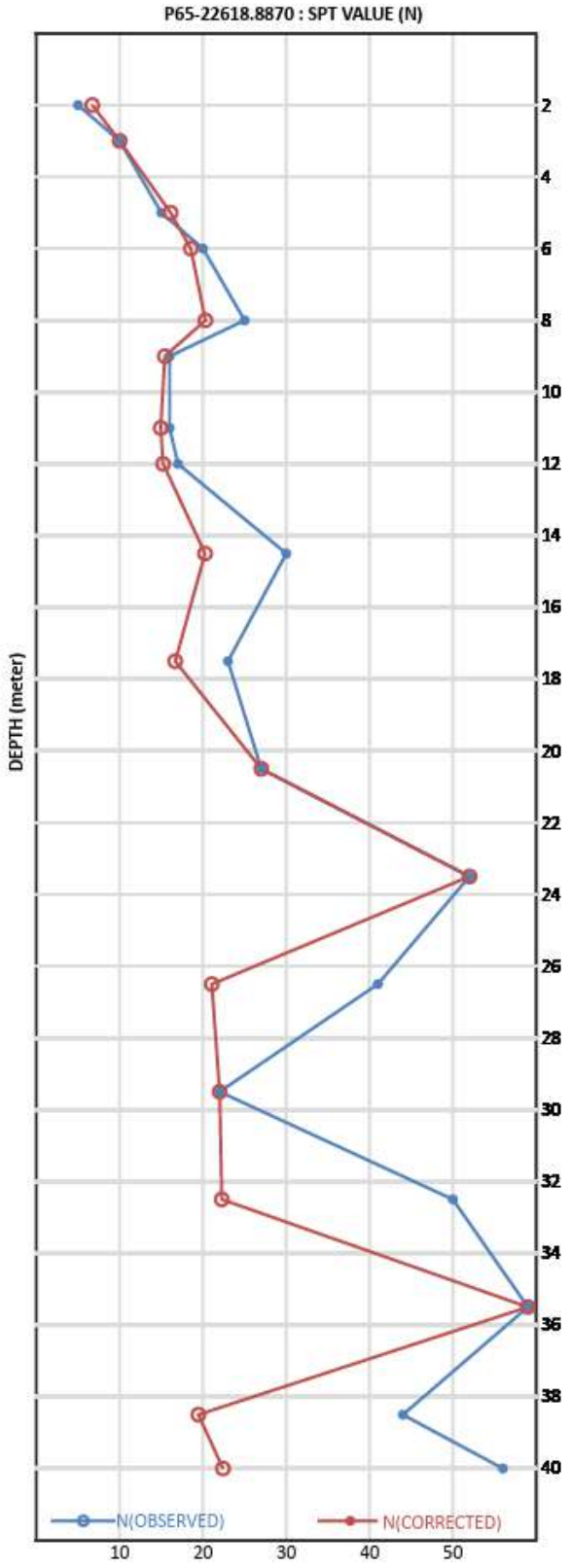
APPENDIX-E
PLOT 1: RECORDED SPT Vs CORRECTED SPT

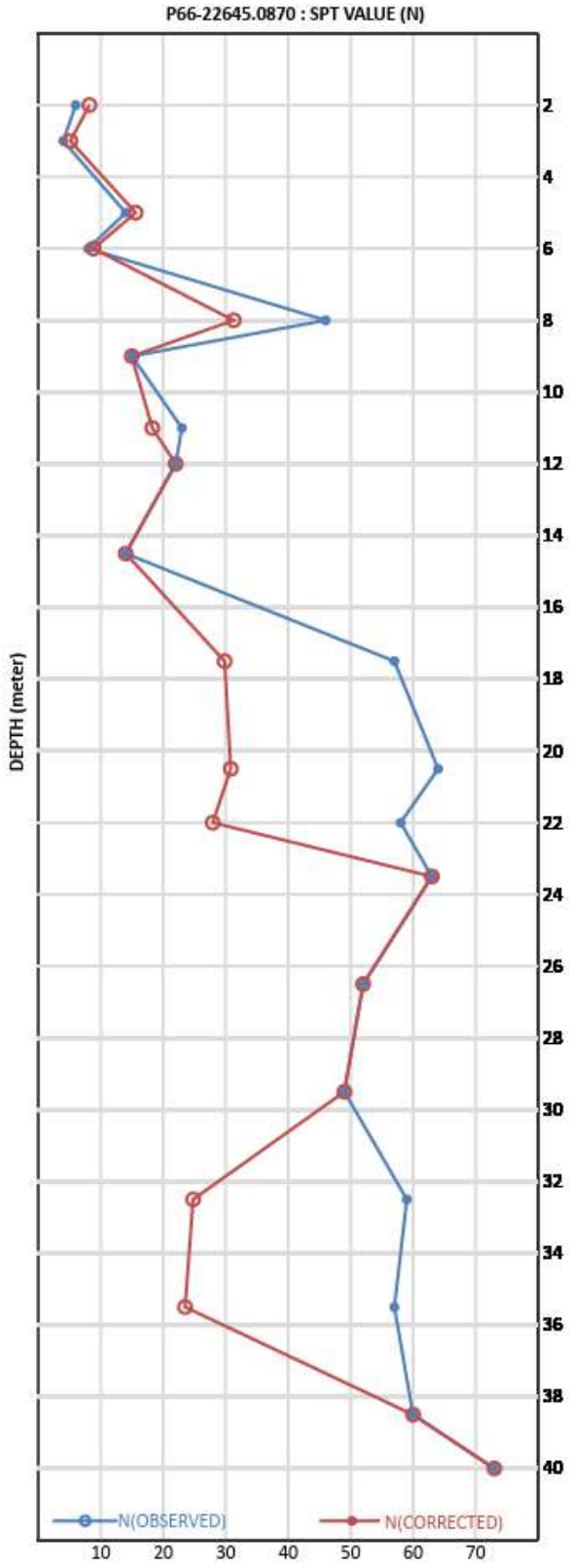


APPENDIX-E
PLOT 2: RECORDED SPT Vs CORRECTED SPT

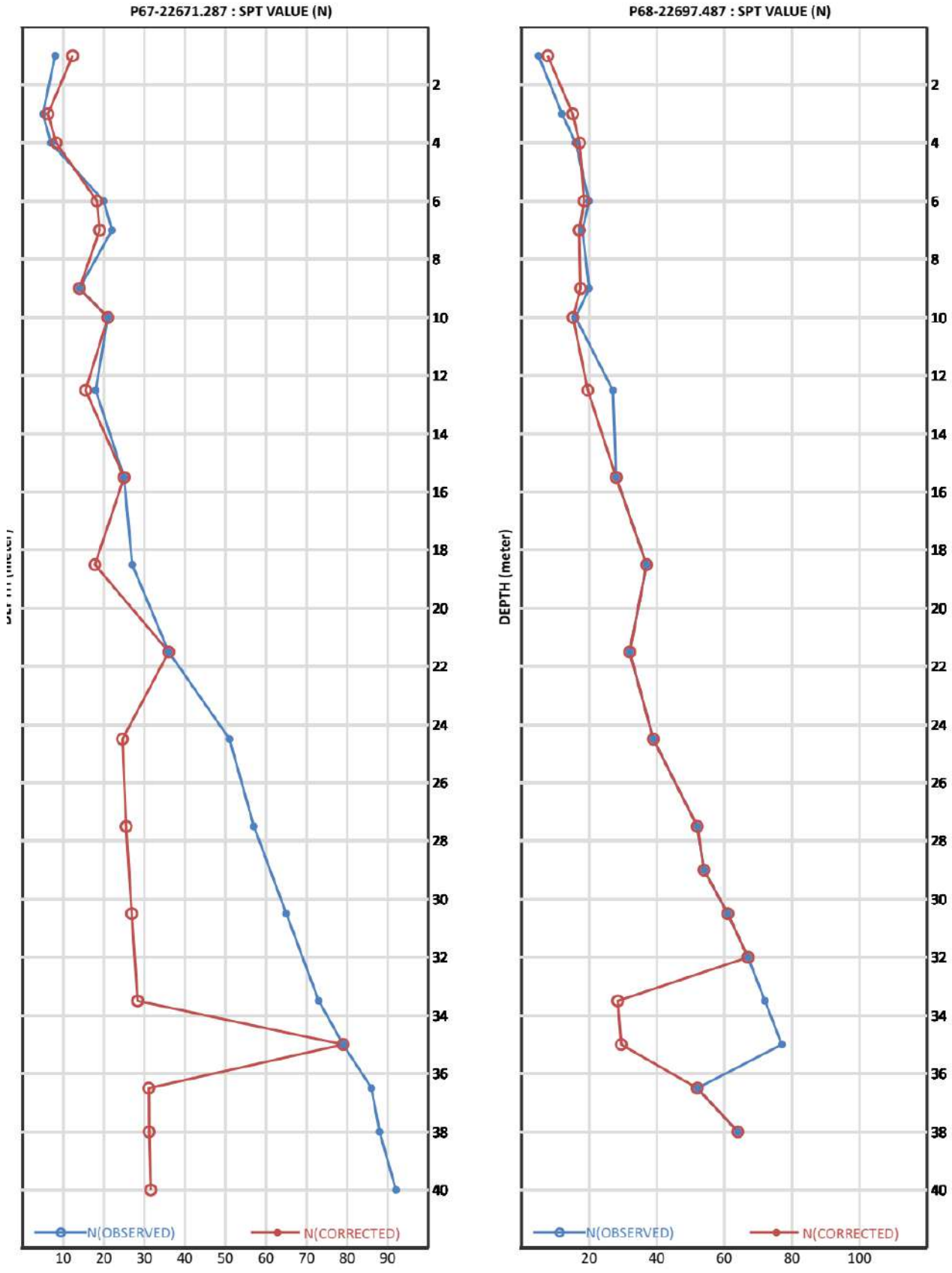


APPENDIX-E
PLOT 3: RECORDED SPT Vs CORRECTED SPT

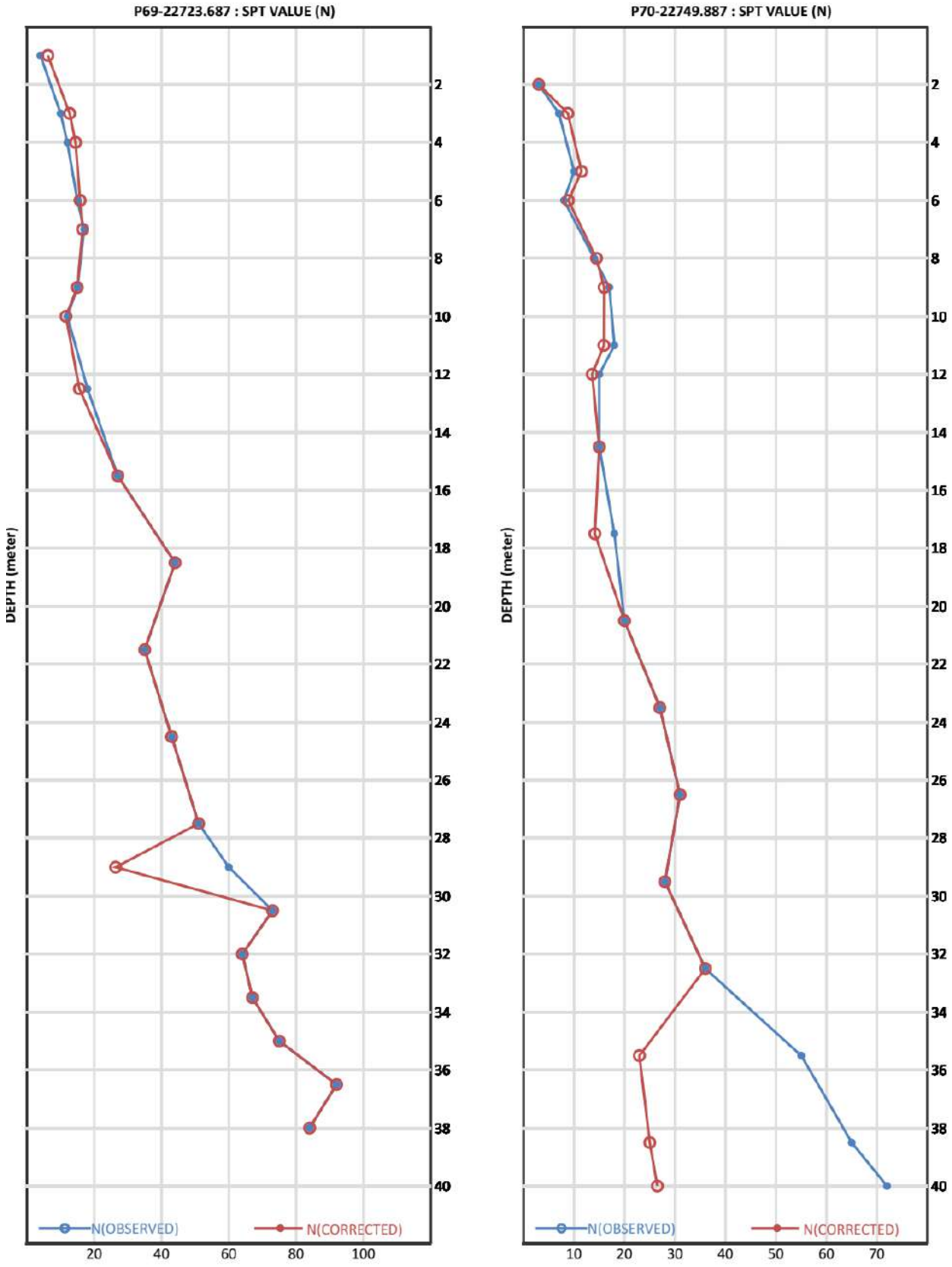




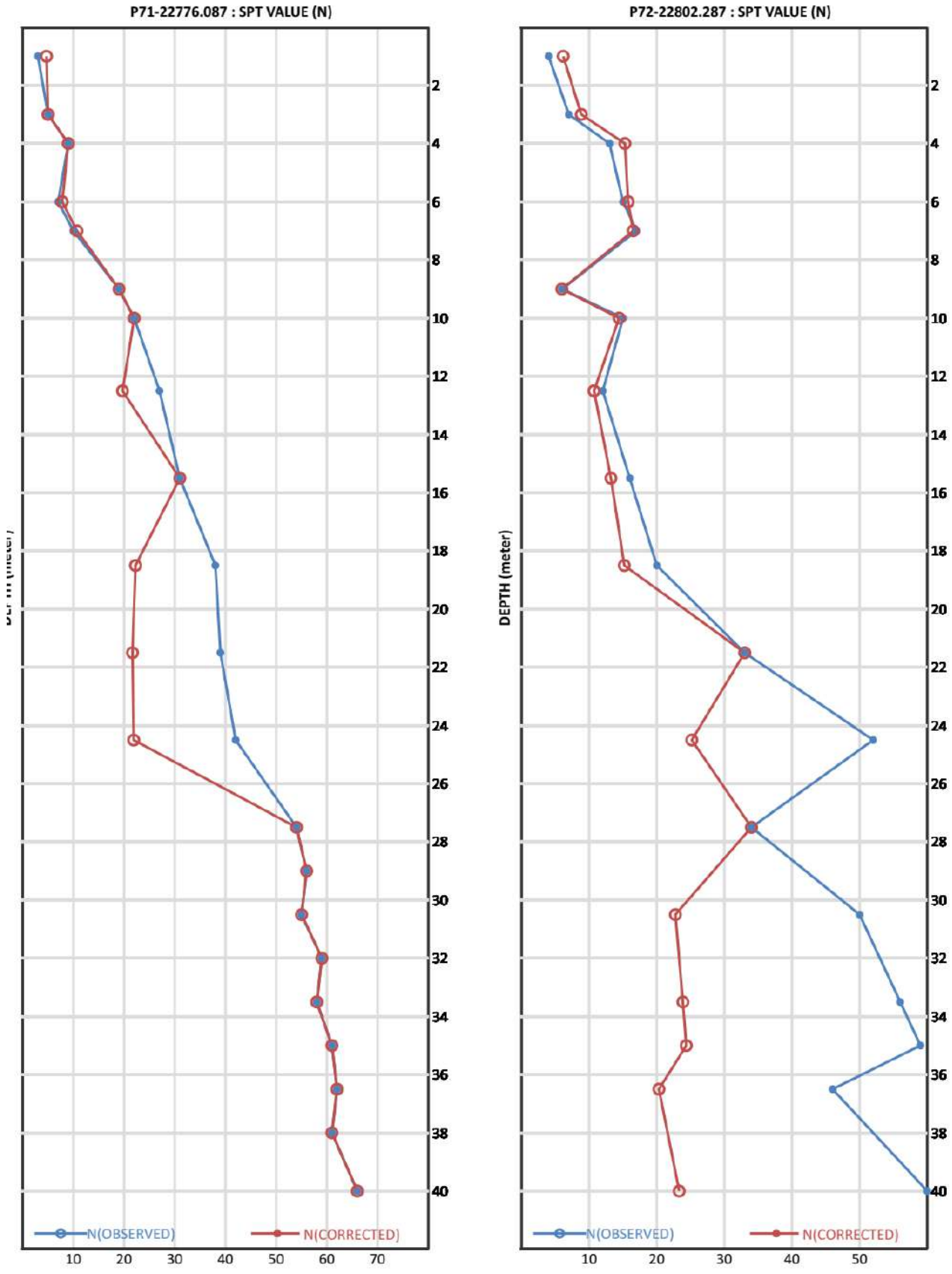
APPENDIX-E
PLOT 4: RECORDED SPT Vs CORRECTED SPT



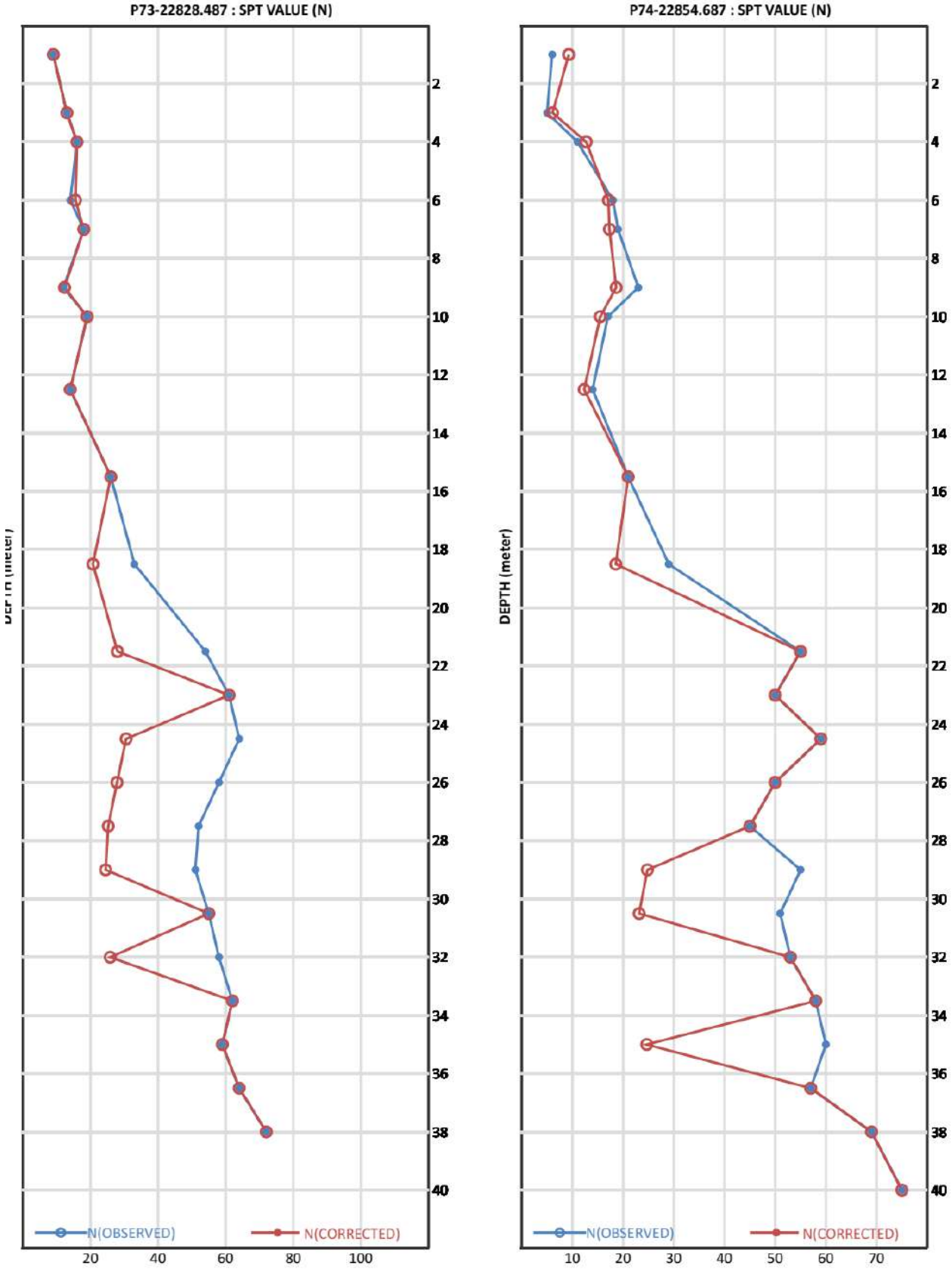
APPENDIX-E
PLOT 5: RECORDED SPT Vs CORRECTED SPT



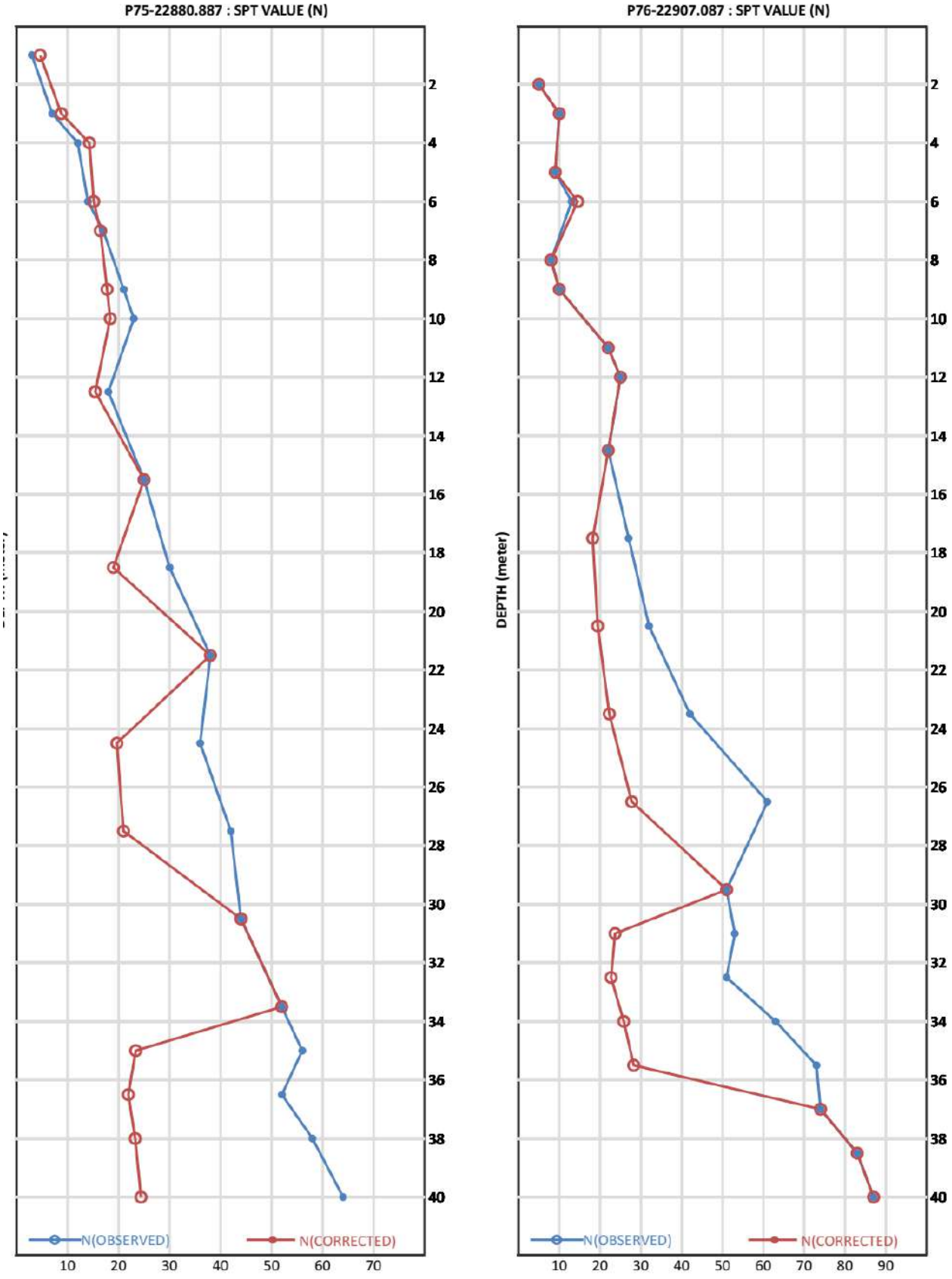
APPENDIX-E
PLOT 6: RECORDED SPT Vs CORRECTED SPT



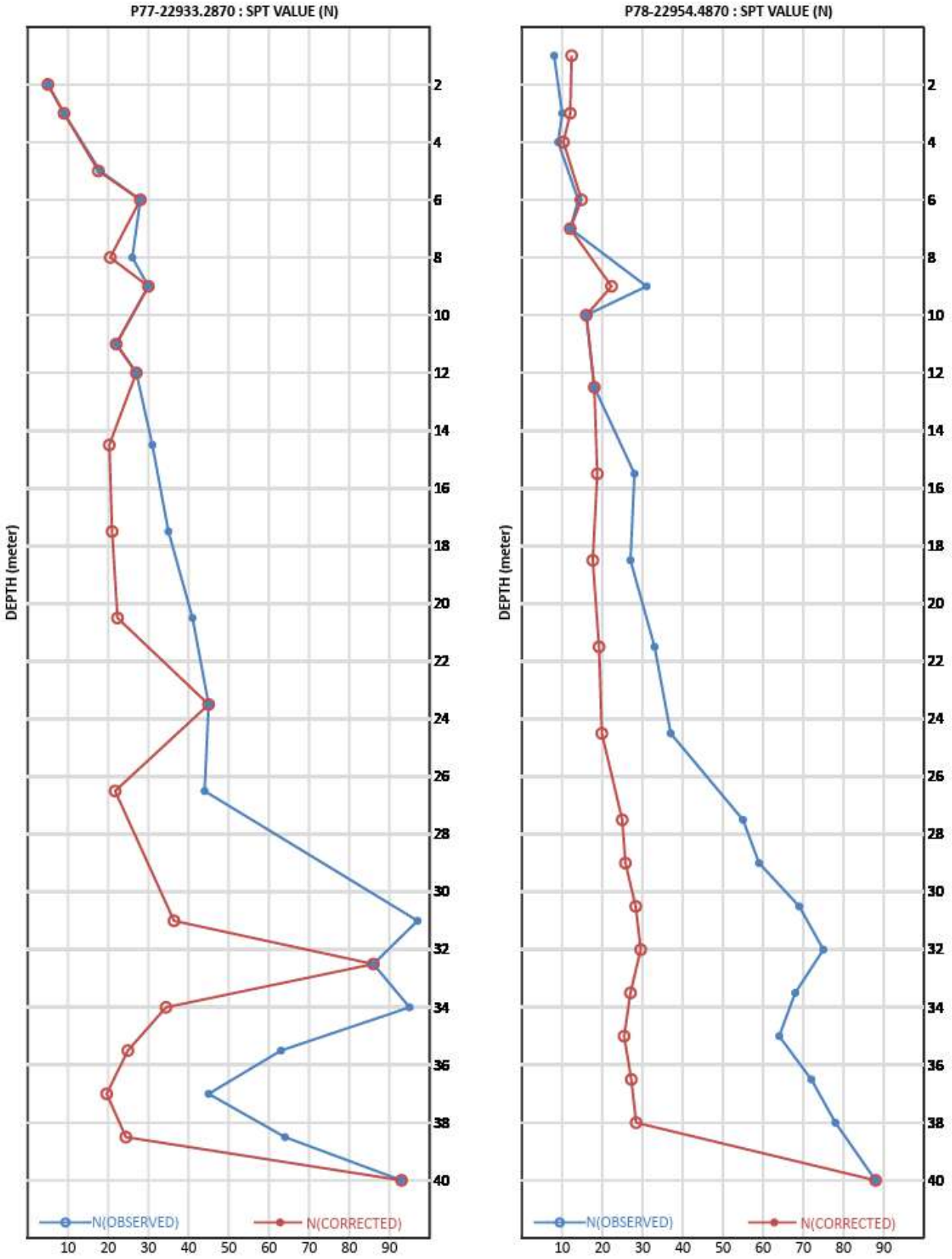
APPENDIX-E
PLOT 7: RECORDED SPT Vs CORRECTED SPT



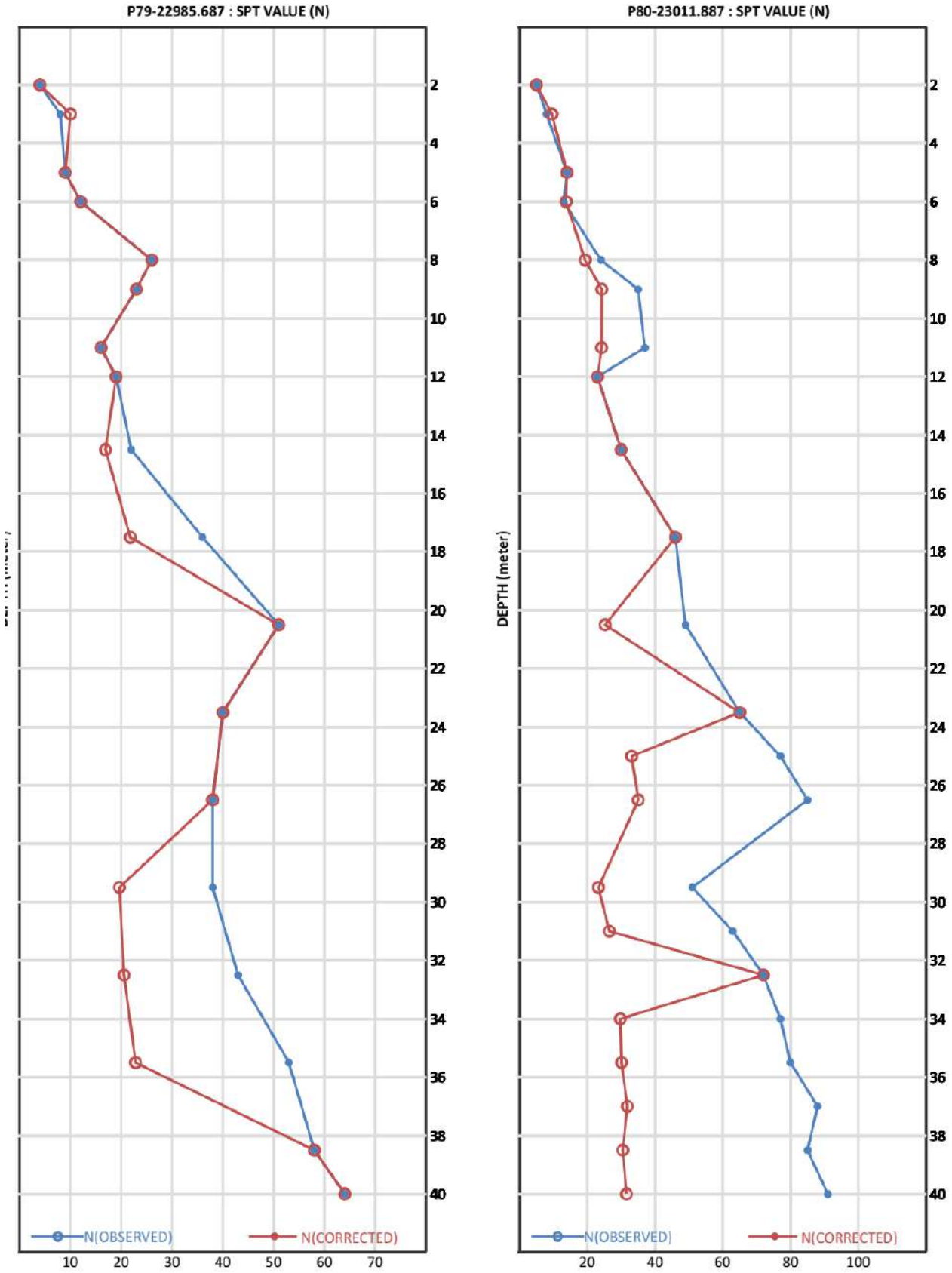
APPENDIX-E
PLOT 8: RECORDED SPT Vs CORRECTED SPT



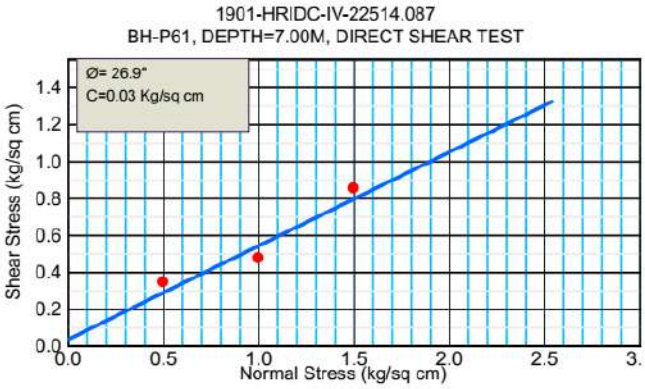
APPENDIX-E
PLOT 9: RECORDED SPT Vs CORRECTED SPT

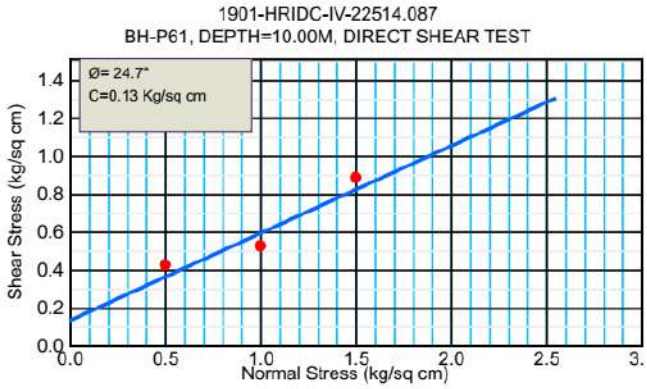


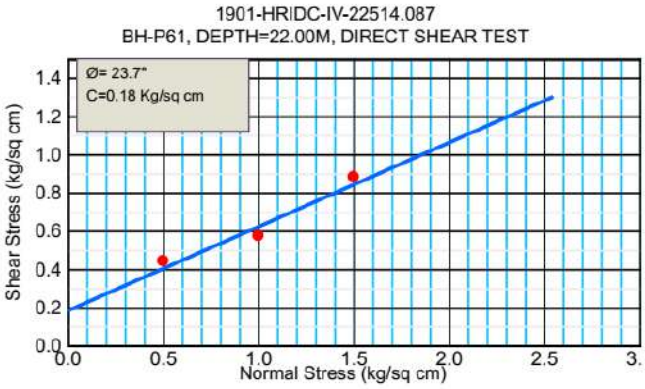
APPENDIX-E
PLOT 10: RECORDED SPT Vs CORRECTED SPT

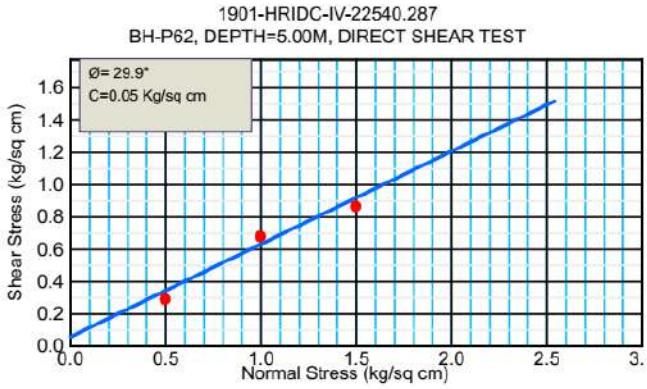


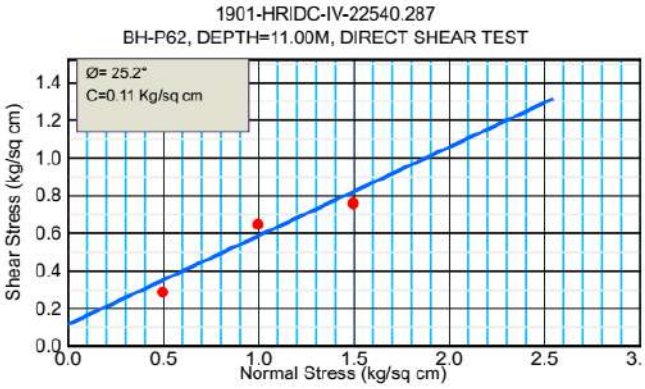
APPENDIX-F
GRAPH 1: DST GRAPH

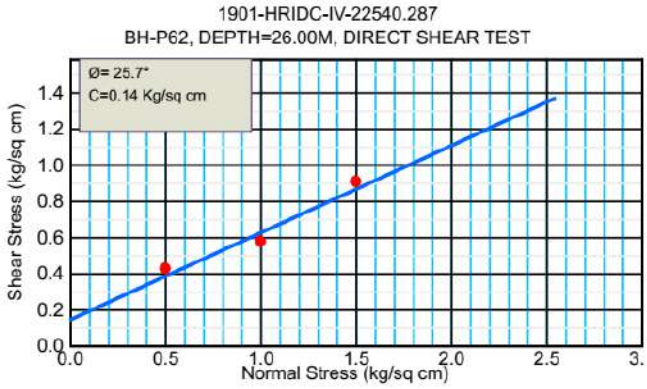


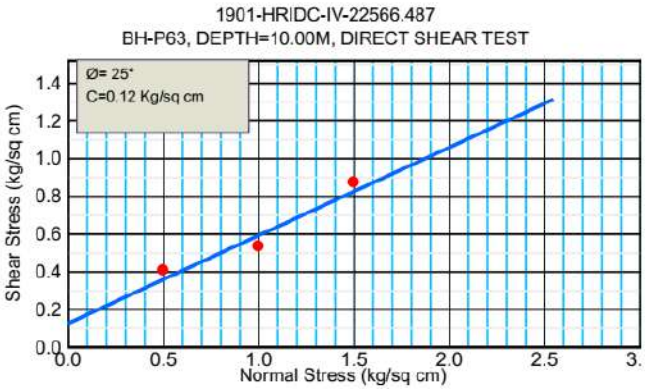


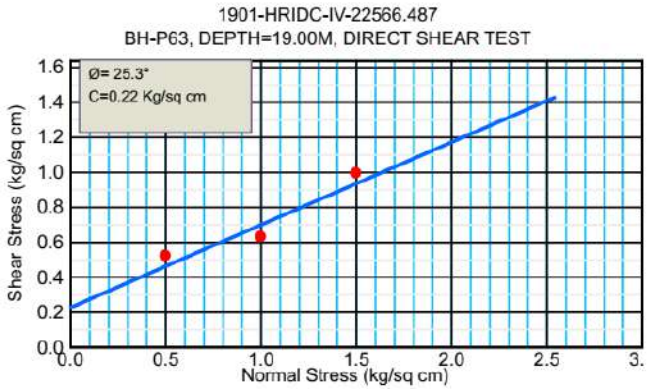




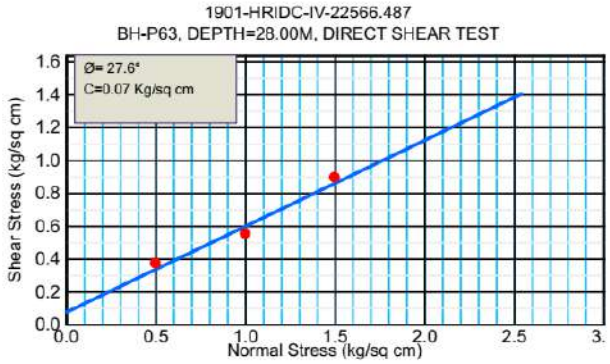


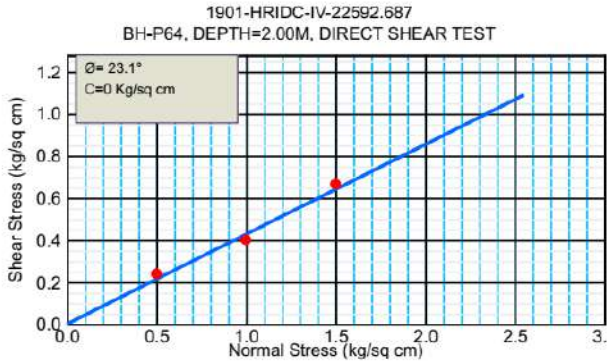


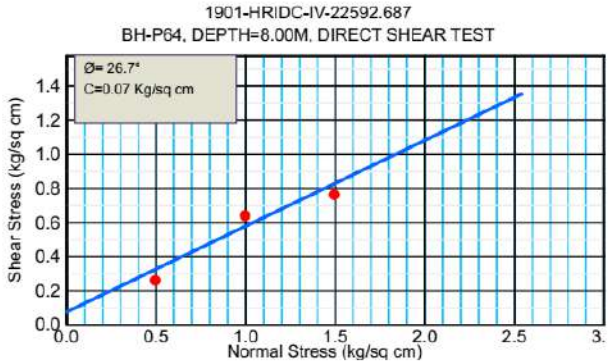


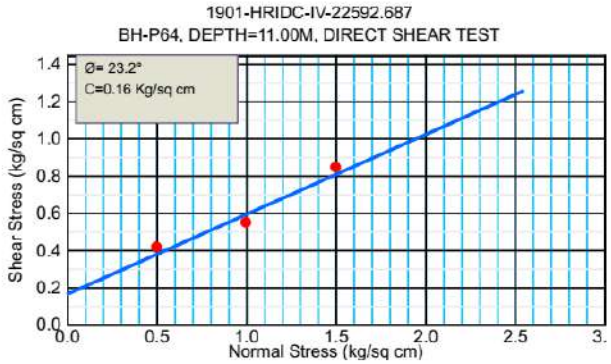


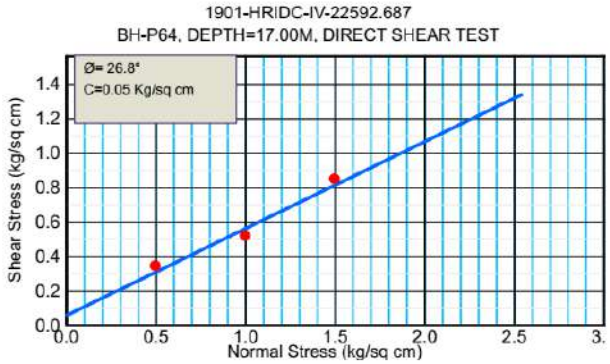
APPENDIX-F
GRAPH 2: DST GRAPH

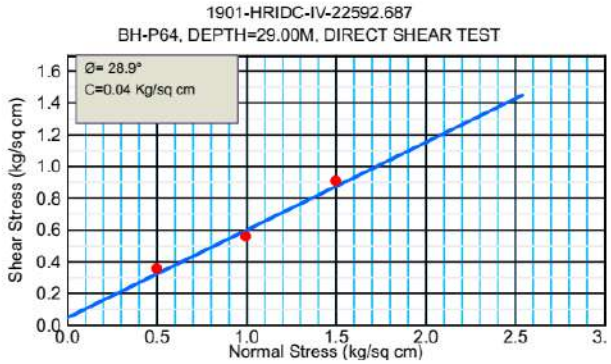


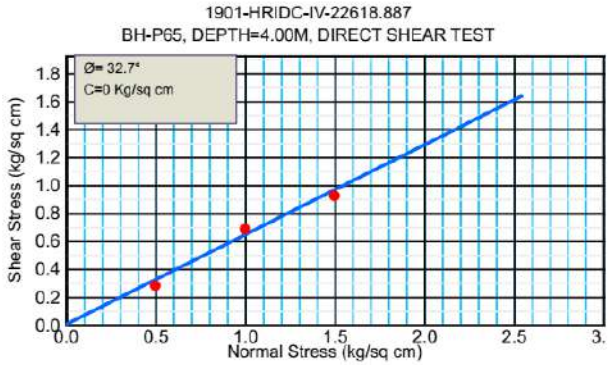


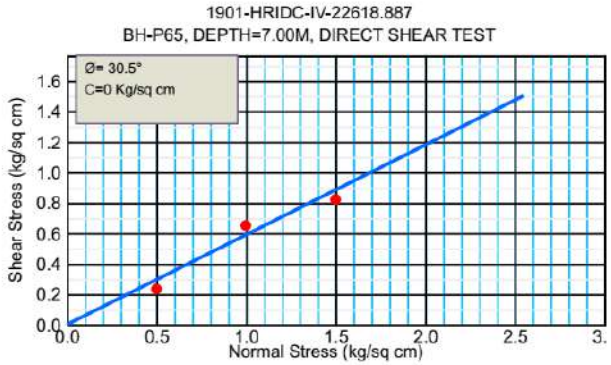






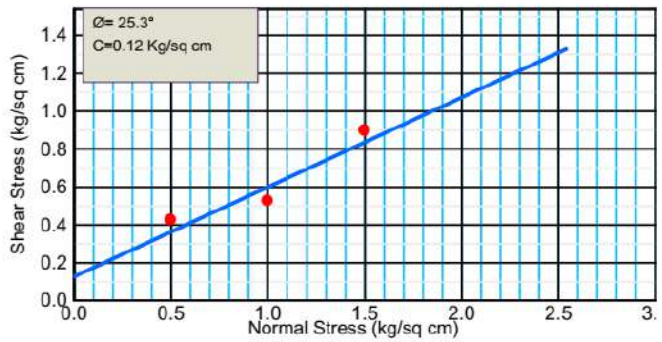




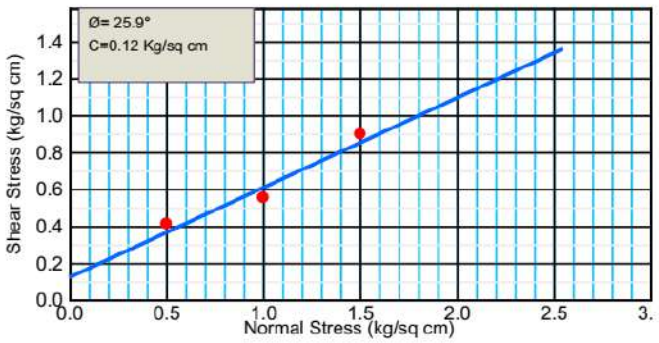


APPENDIX-F
GRAPH 3: DST GRAPH

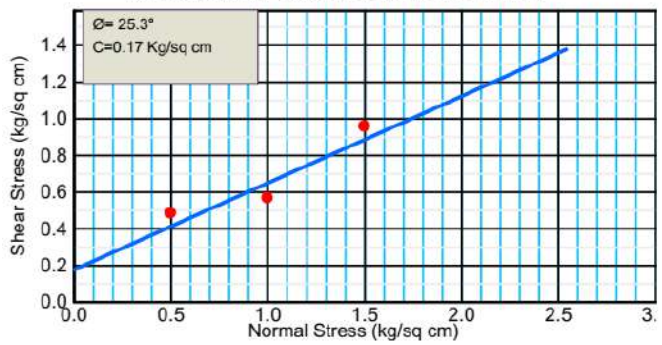
1901-HRIDC-IV-22618.887
BH-P65, DEPTH=10.00M, DIRECT SHEAR TEST



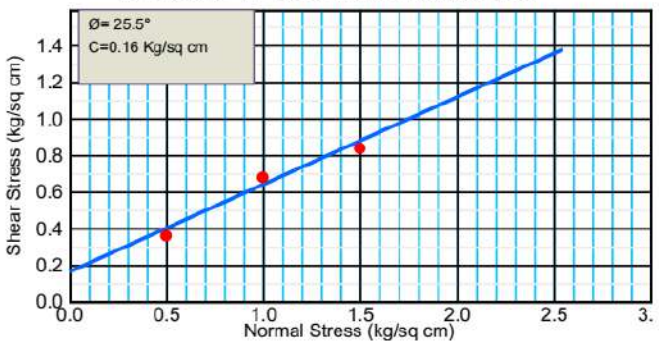
1901-HRIDC-IV-22618.887
BH-P65, DEPTH=13.00M, DIRECT SHEAR TEST



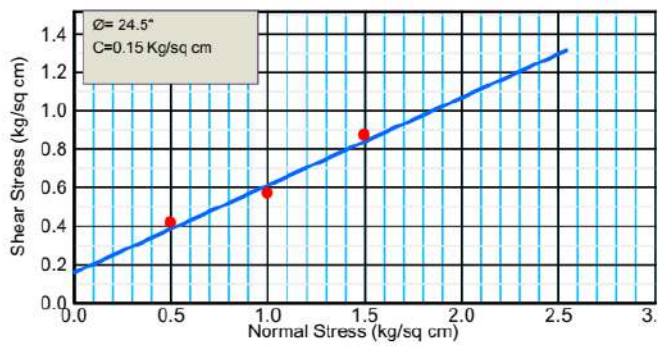
1901-HRIDC-IV-22645.087
BH-P66, DEPTH=10.00M, DIRECT SHEAR TEST



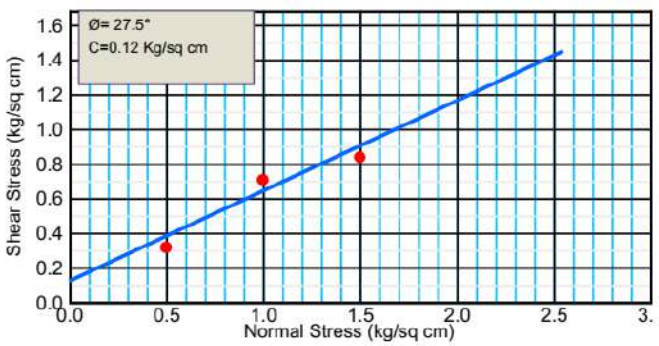
1901-HRIDC-IV-22645.087
BH-P66, DEPTH=16.00M, DIRECT SHEAR TEST



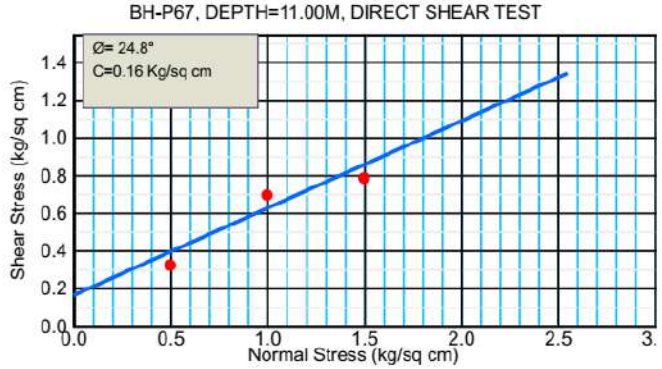
1901-HRIDC-IV-22645.087
BH-P66, DEPTH=19.00M, DIRECT SHEAR TEST



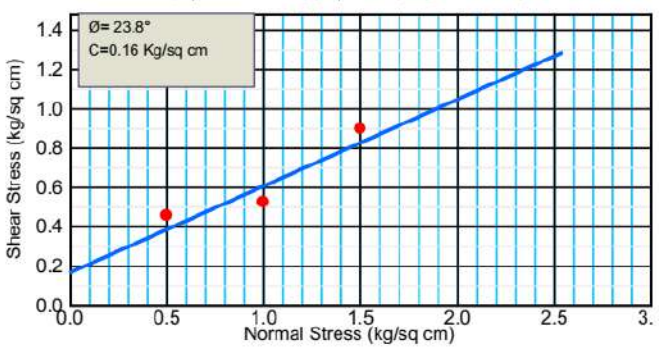
1901-HRIDC-IV-22671.287
BH-P67, DEPTH=2.00M, DIRECT SHEAR TEST



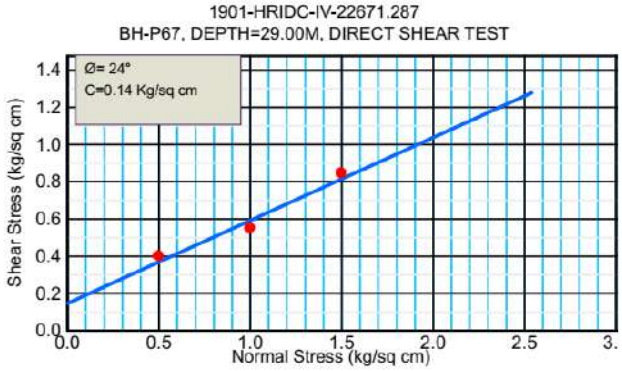
1901-HRIDC-IV-22671.287
BH-P67, DEPTH=11.00M, DIRECT SHEAR TEST

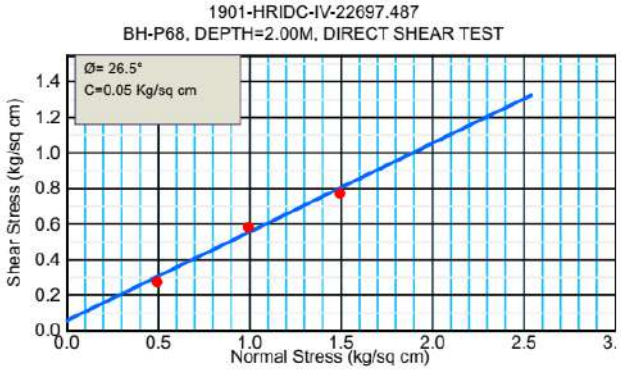


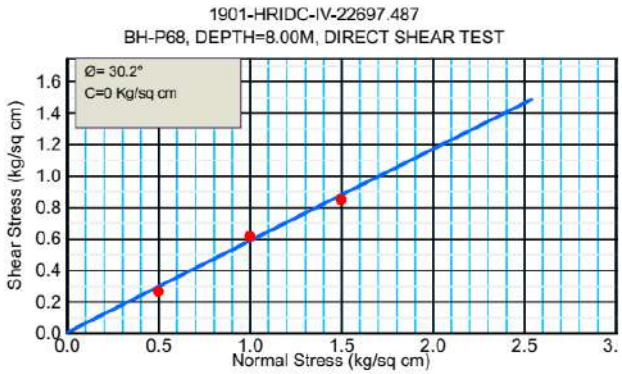
1901-HRIDC-IV-22671.287
BH-P67, DEPTH=17.00M, DIRECT SHEAR TEST

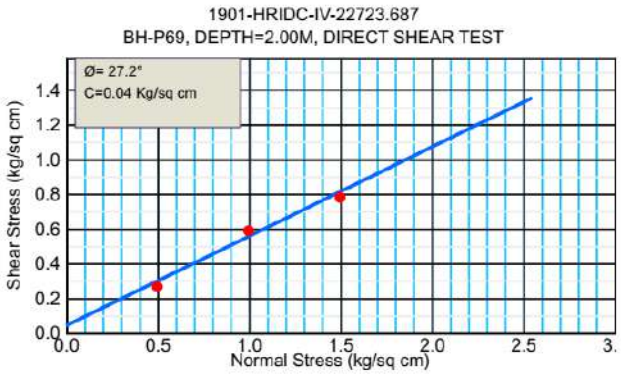


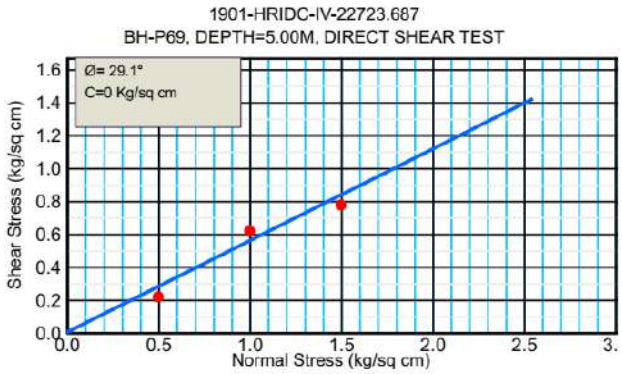
APPENDIX-F
GRAPH 4: DST GRAPH

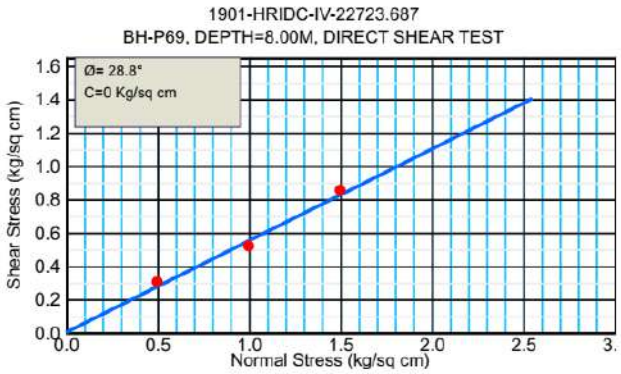


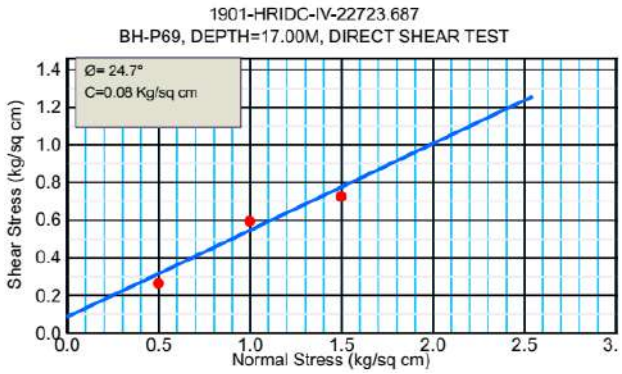


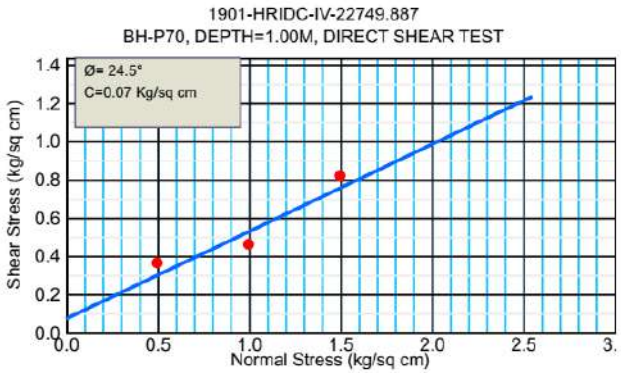






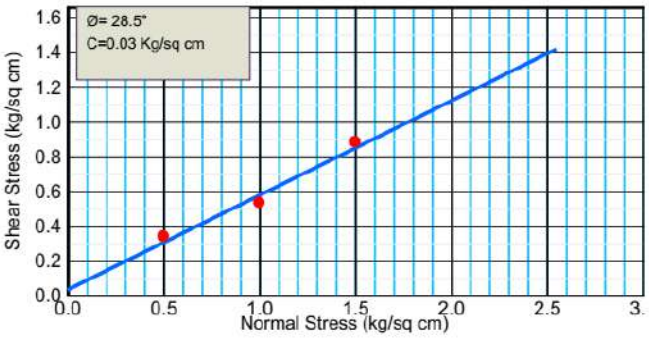




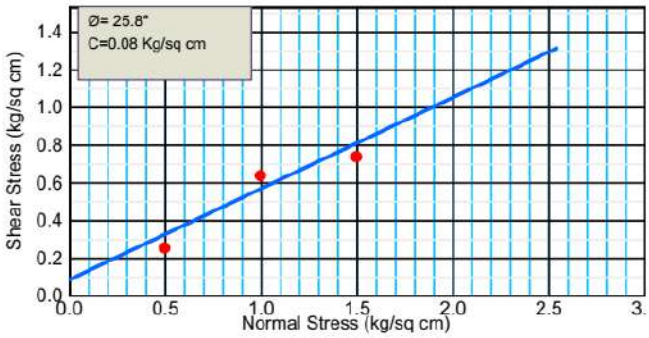


APPENDIX-F
GRAPH 5: DST GRAPH

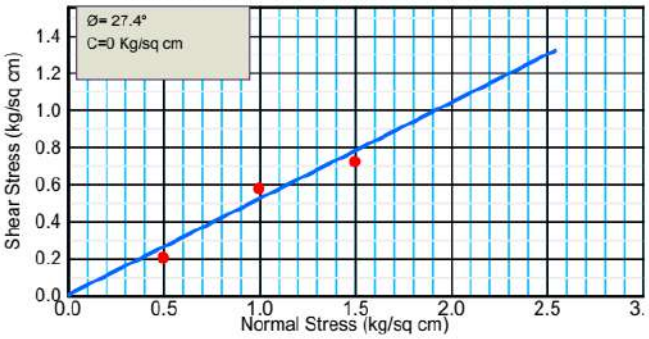
1901-HRIDC-IV-22749.887
BH-P70, DEPTH=4.00M, DIRECT SHEAR TEST



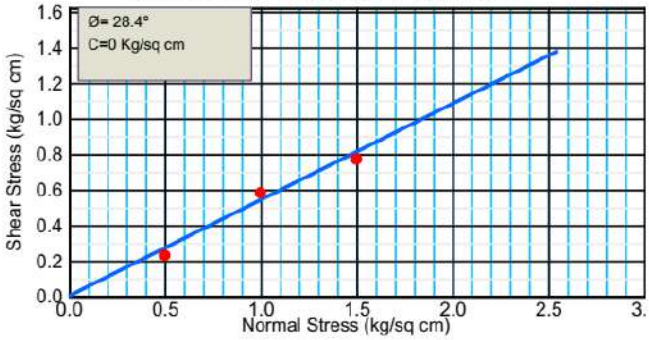
1901-HRIDC-IV-22749.887
BH-P70, DEPTH=10.00M, DIRECT SHEAR TEST



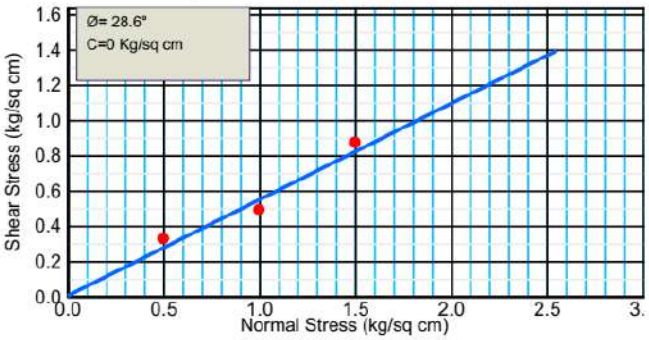
1901-HRIDC-IV-22749.887
BH-P70, DEPTH=34.00M, DIRECT SHEAR TEST



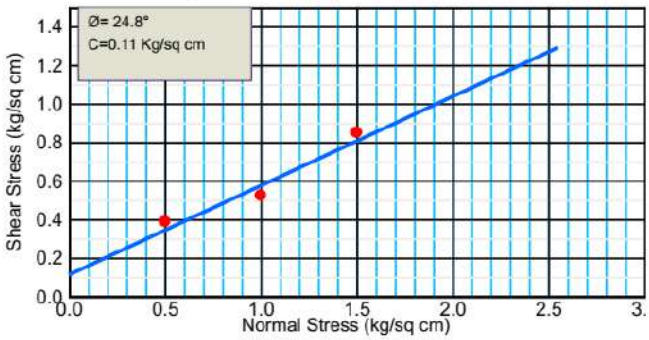
1901-HRIDC-IV-22776.087
BH-P71, DEPTH=5.00M, DIRECT SHEAR TEST



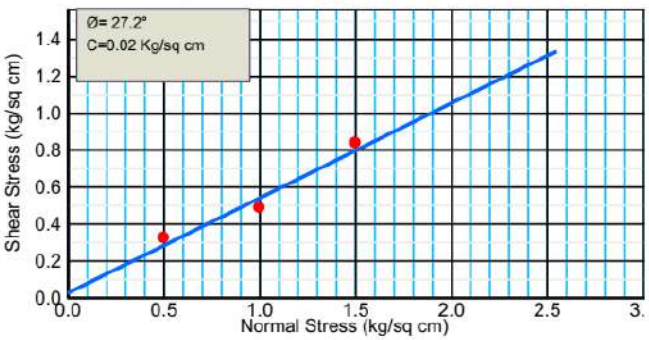
1901-HRIDC-IV-22776.087
BH-P71, DEPTH=8.00M, DIRECT SHEAR TEST



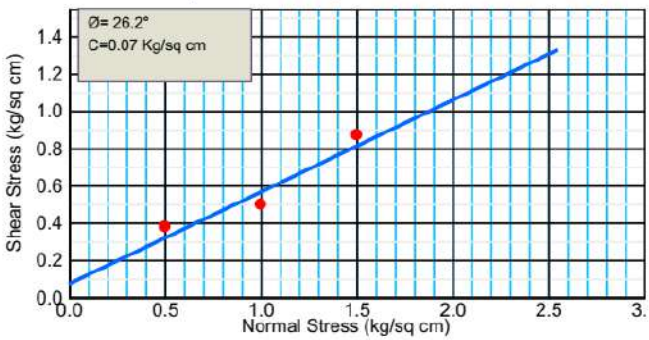
1901-HRIDC-IV-22776.087
BH-P71, DEPTH=11.00M, DIRECT SHEAR TEST



1901-HRIDC-IV-22776.087
BH-P71, DEPTH=17.00M, DIRECT SHEAR TEST

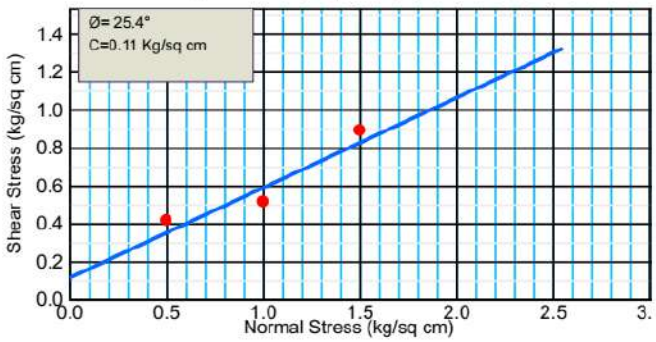


1901-HRIDC-IV-22776.087
BH-P71, DEPTH=26.00M, DIRECT SHEAR TEST

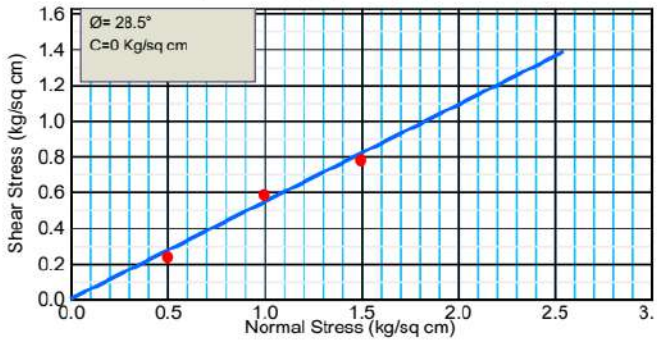


APPENDIX-F
GRAPH 6: DST GRAPH

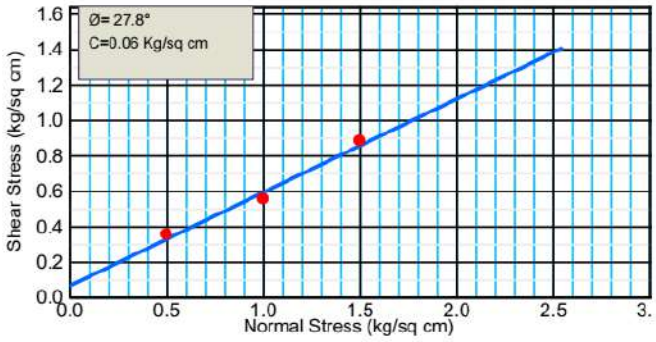
1901-HRIDC-IV-22802.287
BH-P72, DEPTH=2.00M, DIRECT SHEAR TEST



1901-HRIDC-IV-22802.287
BH-P72, DEPTH=5.00M, DIRECT SHEAR TEST



1901-HRIDC-IV-22802.287
BH-P72, DEPTH=29.00M, DIRECT SHEAR TEST



1901-HRIDC-IV-22802.287
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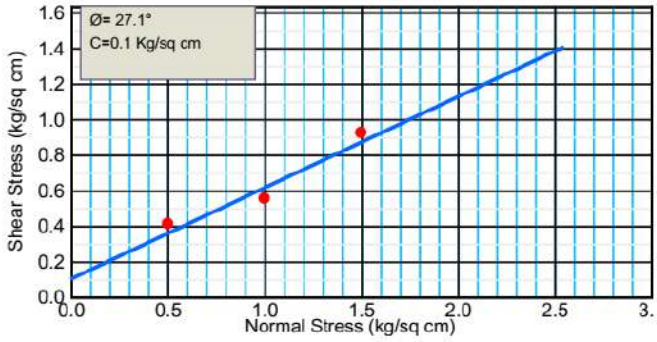
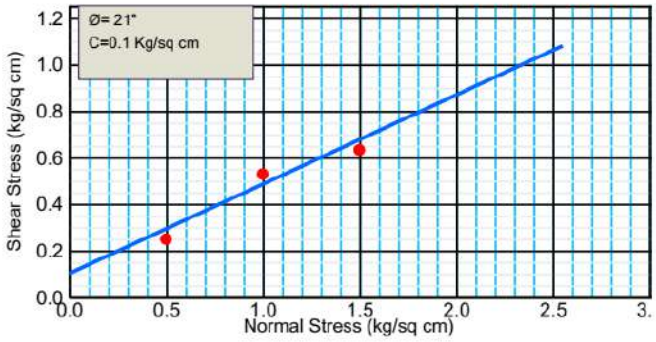
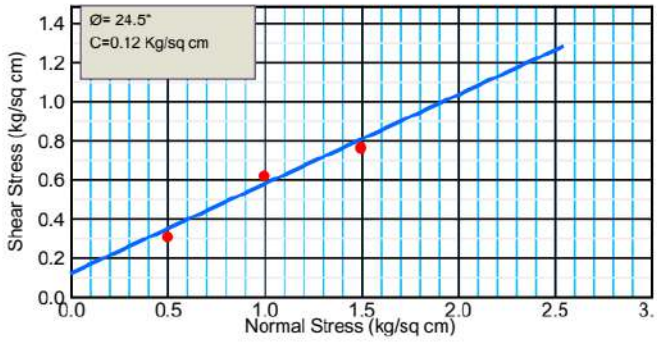


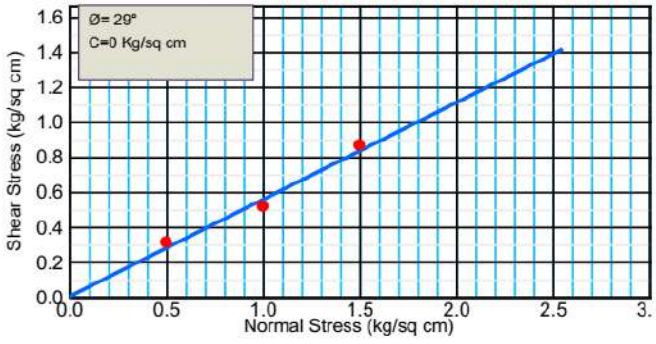
1901-HRIDC-IV-22828.487
BH-P73, DEPTH=2.00M, DIRECT SHEAR TEST



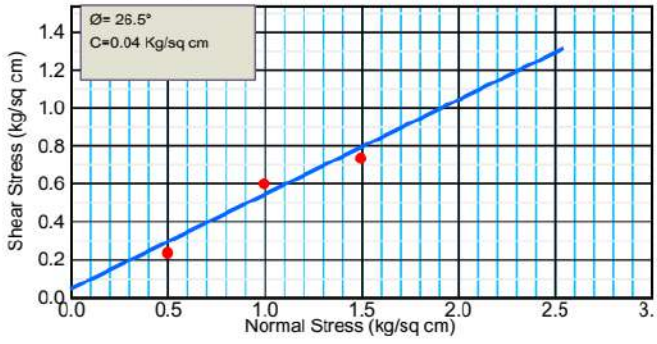
1901-HRIDC-IV-22828.487
BH-P73, DEPTH=5.00M, DIRECT SHEAR TEST



1901-HRIDC-IV-22828.487
BH-P73, DEPTH=8.00M, DIRECT SHEAR TEST

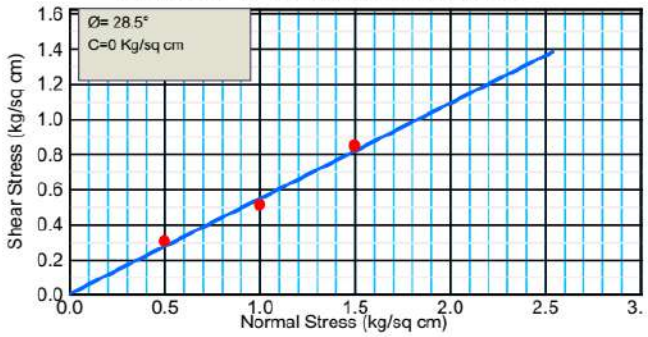


1901-HRIDC-IV-22828.487
BH-P73, DEPTH=17.00M, DIRECT SHEAR TEST

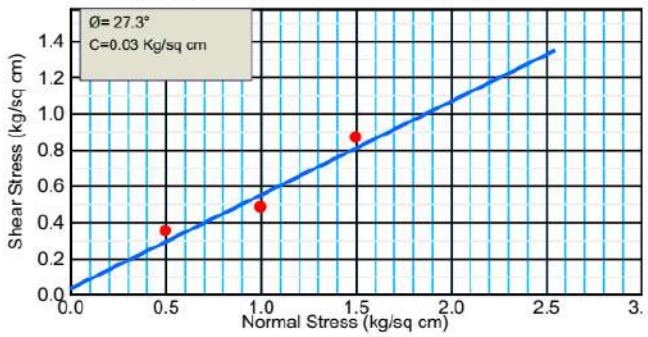


APPENDIX-F
GRAPH 7: DST GRAPH

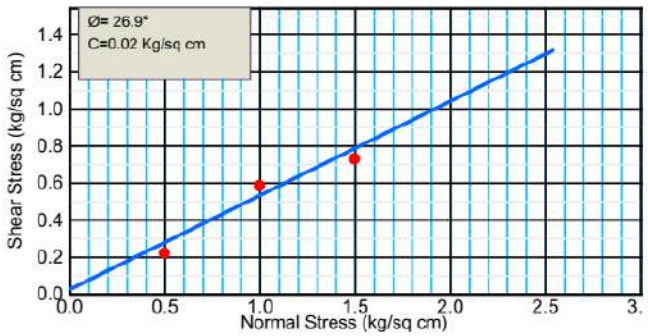
1901-HRIDC-IV-22828.487
BH-P73, DEPTH=29.00M, DIRECT SHEAR TEST



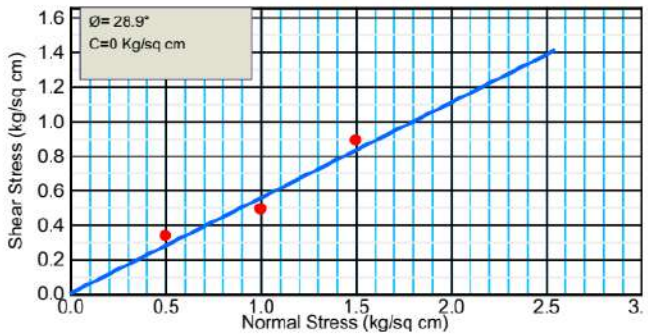
1901-HRIDC-IV-22854.687
BH-P74, DEPTH=2.00M, DIRECT SHEAR TEST



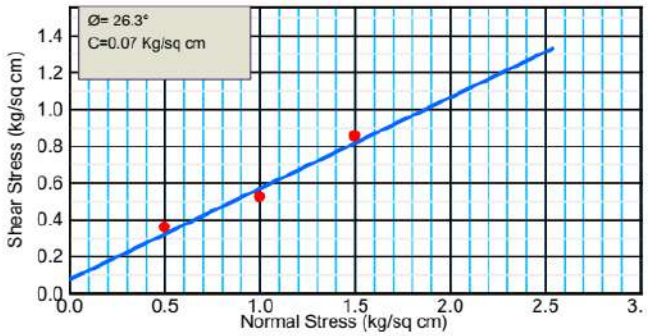
1901-HRIDC-IV-22854.687
BH-P74, DEPTH=5.00M, DIRECT SHEAR TEST



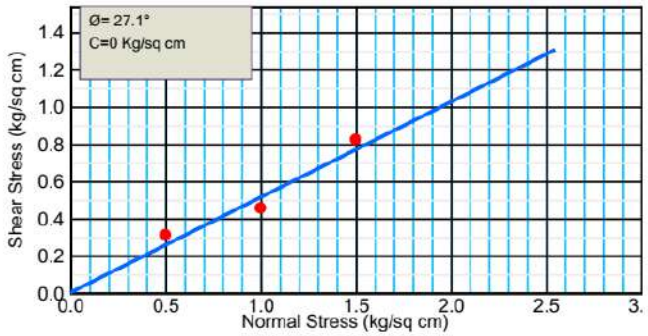
1901-HRIDC-IV-22854.687
BH-P74, DEPTH=8.00M, DIRECT SHEAR TEST



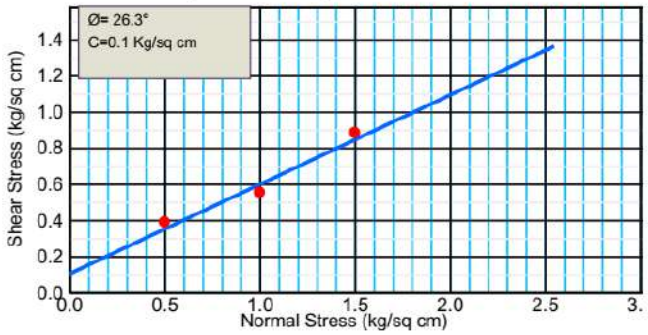
1901-HRIDC-IV-22854.687
BH-P74, DEPTH=11.00M, DIRECT SHEAR TEST



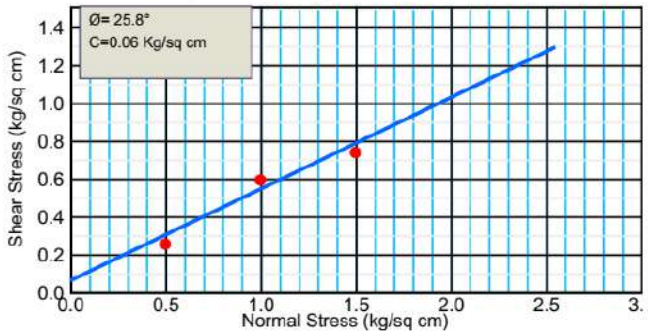
1901-HRIDC-IV-22854.687
BH-P74, DEPTH=14.00M, DIRECT SHEAR TEST



1901-HRIDC-IV-22880.887
BH-P75, DEPTH=2.00M, DIRECT SHEAR TEST

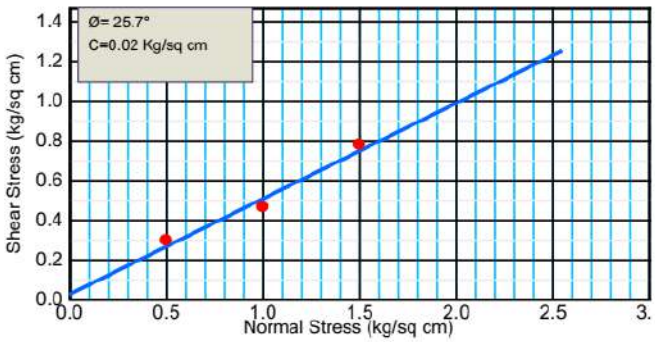


1901-HRIDC-IV-22880.887
BH-P75, DEPTH=5.00M, DIRECT SHEAR TEST

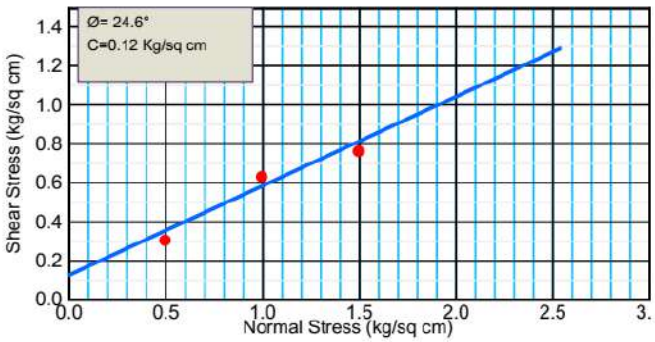


APPENDIX-F
GRAPH 8: DST GRAPH

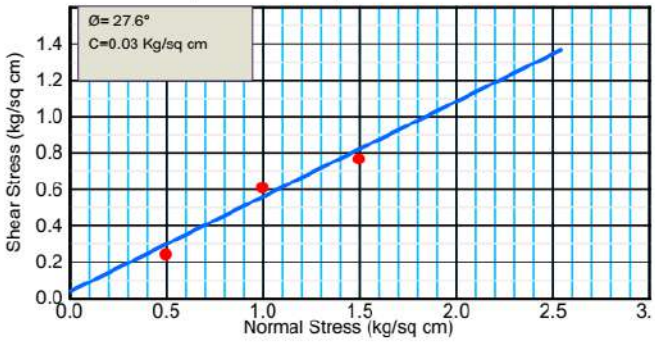
1901-HRIDC-IV-22880.887
BH-P75, DEPTH=8.00M, DIRECT SHEAR TEST



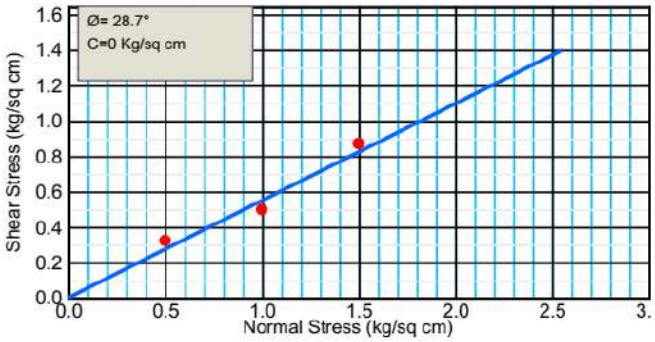
1901-HRIDC-IV-22880.887
BH-P75, DEPTH=11.00M, DIRECT SHEAR TEST



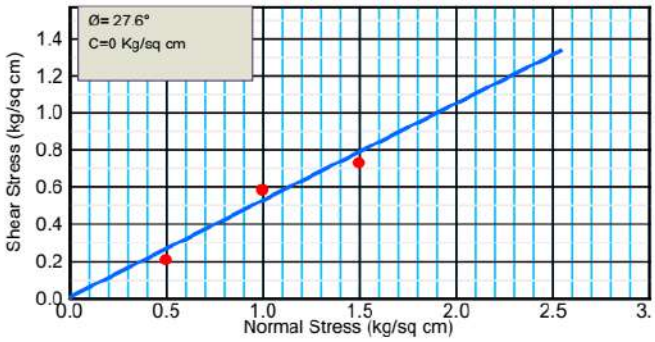
1901-HRIDC-IV-22880.887
BH-P75, DEPTH=17.00M, DIRECT SHEAR TEST



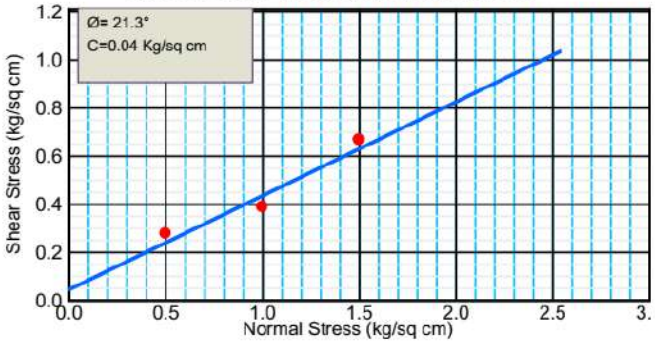
1901-HRIDC-IV-22880.887
BH-P75, DEPTH=29.00M, DIRECT SHEAR TEST



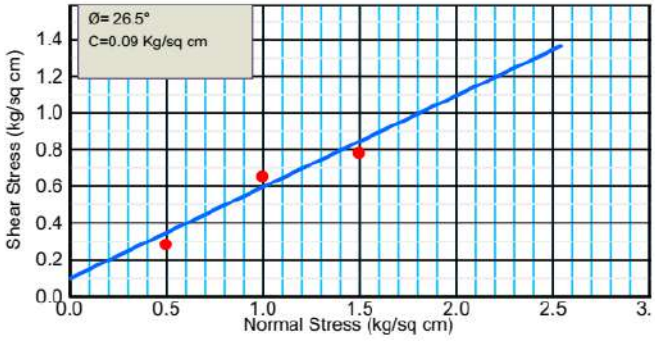
1901-HRIDC-IV-22880.887
BH-P75, DEPTH=32.00M, DIRECT SHEAR TEST



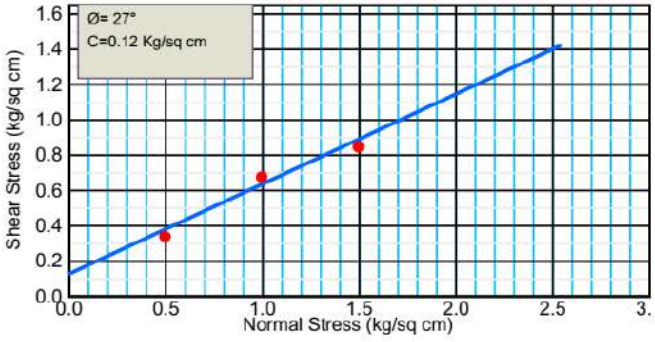
1901-HRIDC-IV-22907.087
BH-P76, DEPTH=1.00M, DIRECT SHEAR TEST



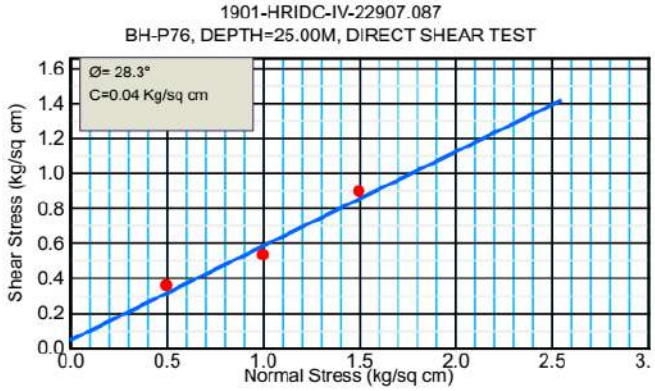
1901-HRIDC-IV-22907.087
BH-P76, DEPTH=10.00M, DIRECT SHEAR TEST

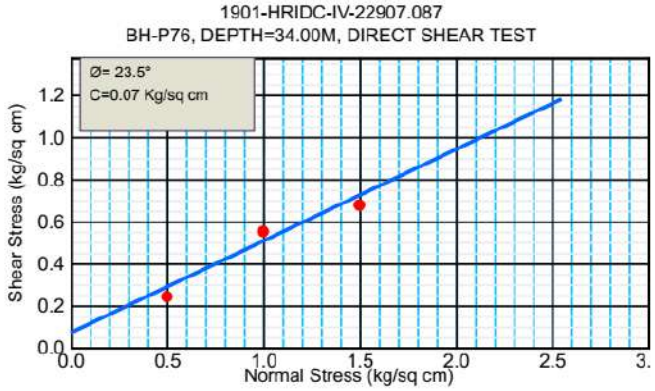


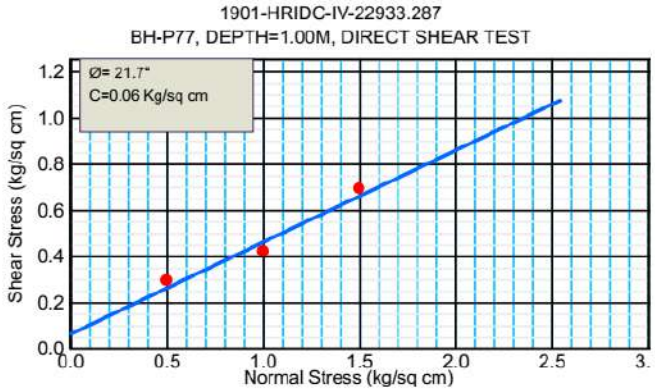
1901-HRIDC-IV-22907.087
BH-P76, DEPTH=13.00M, DIRECT SHEAR TEST

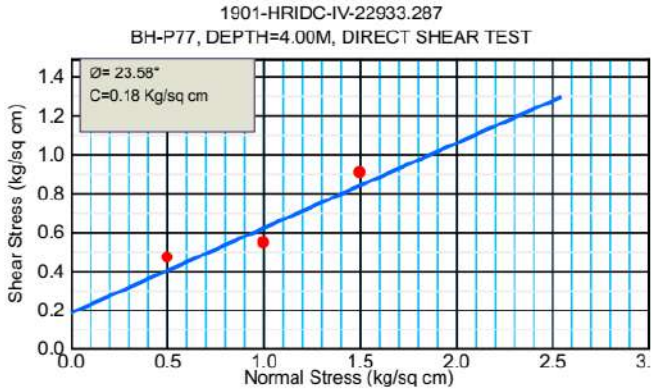


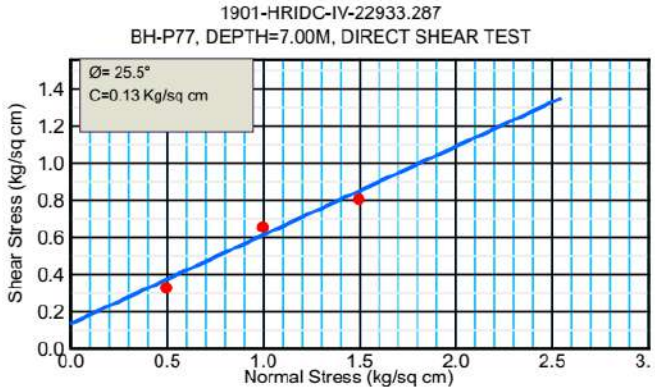
APPENDIX-F
GRAPH 9: DST GRAPH

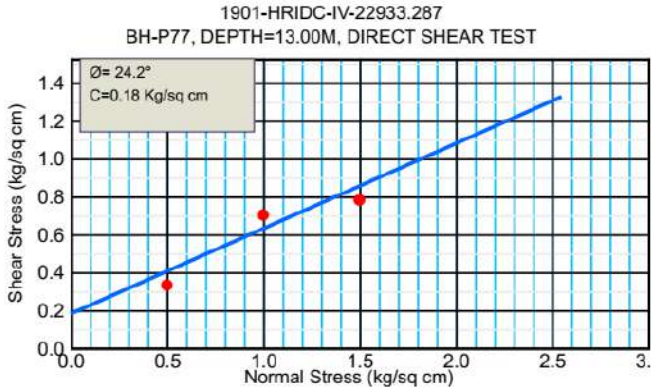


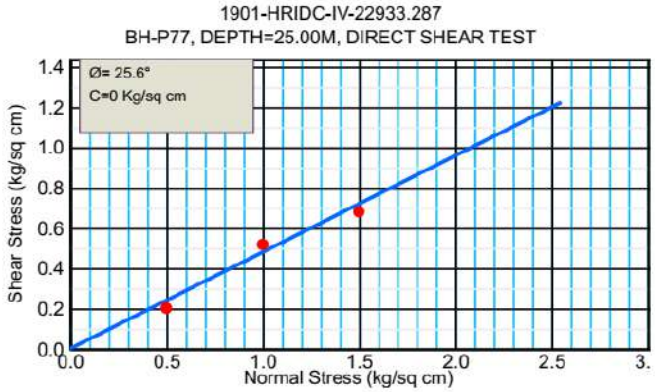


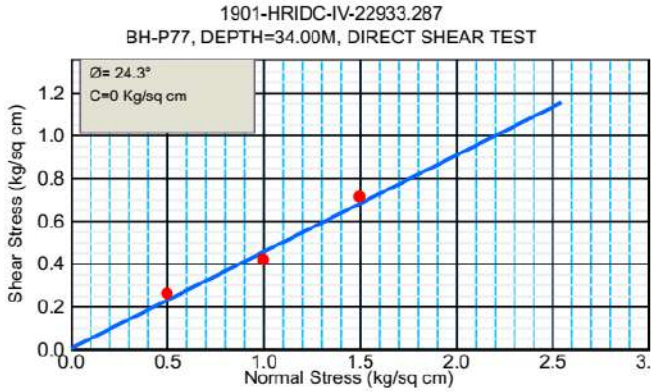




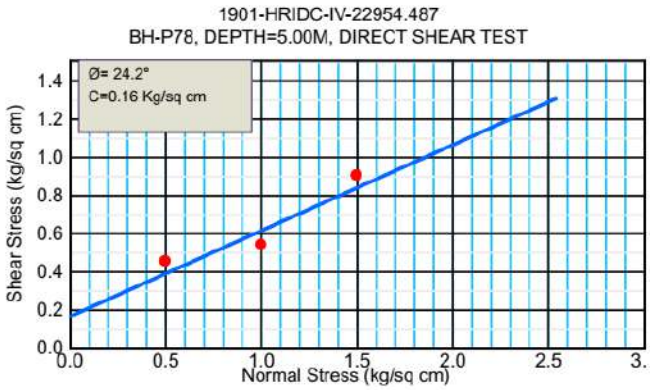


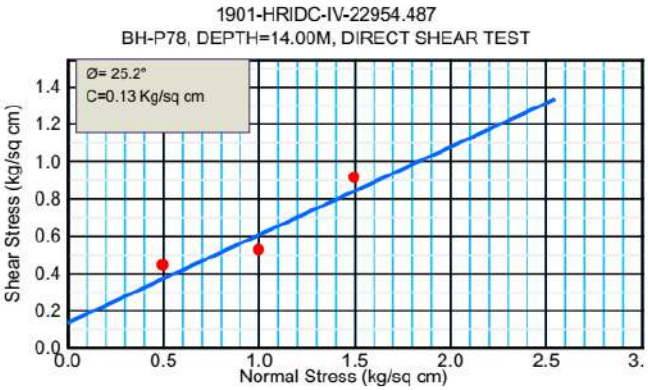


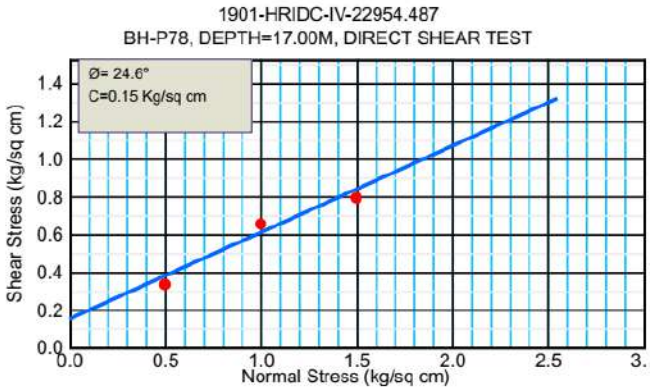


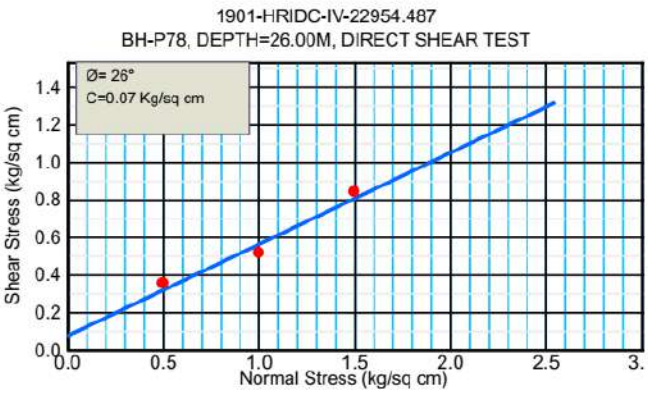


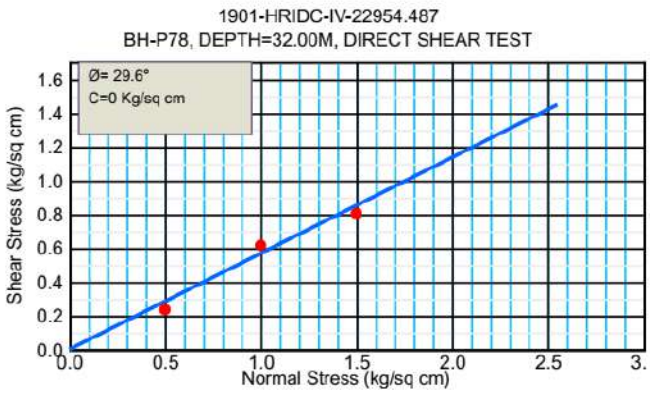
APPENDIX-F
GRAPH 10: DST GRAPH

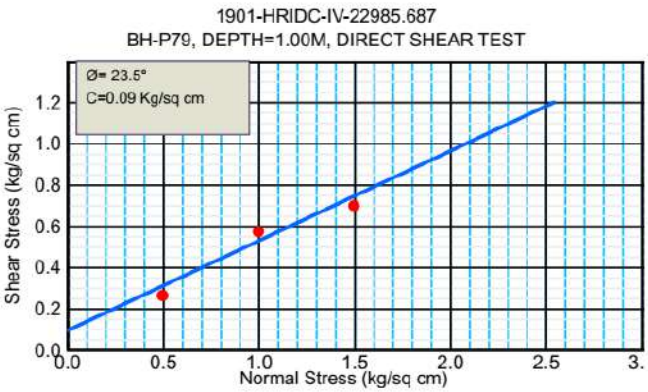


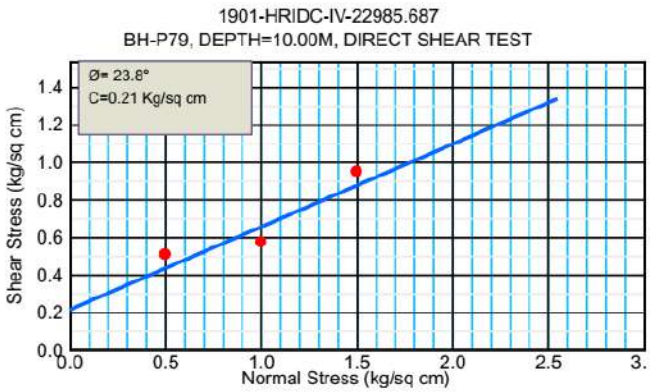




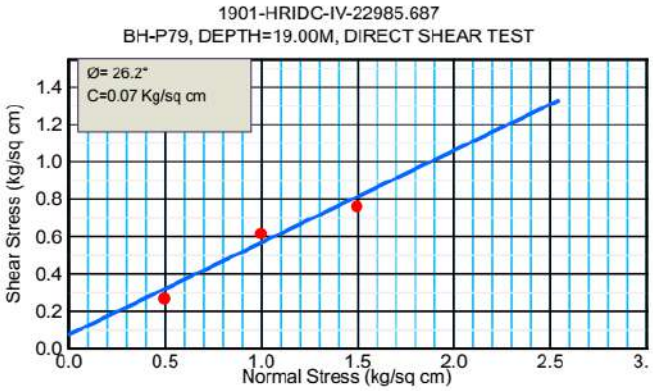


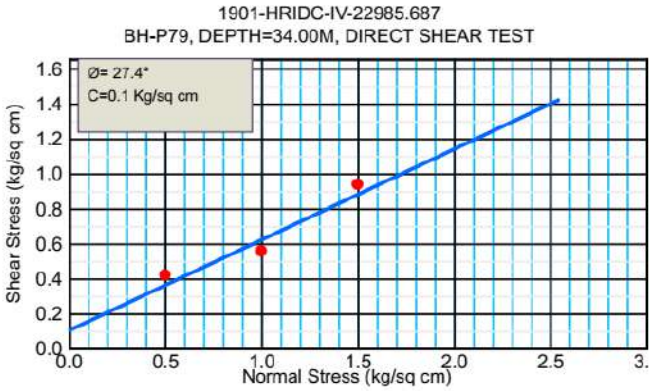


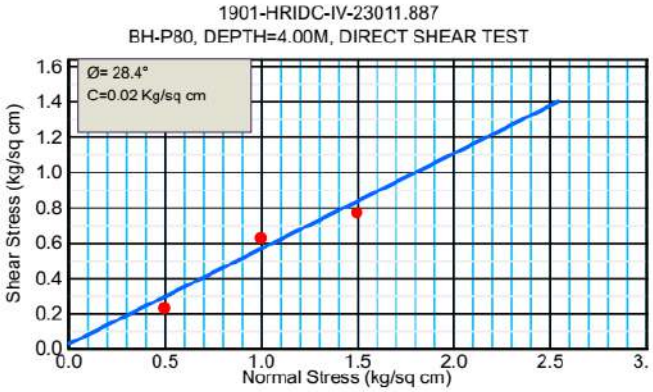


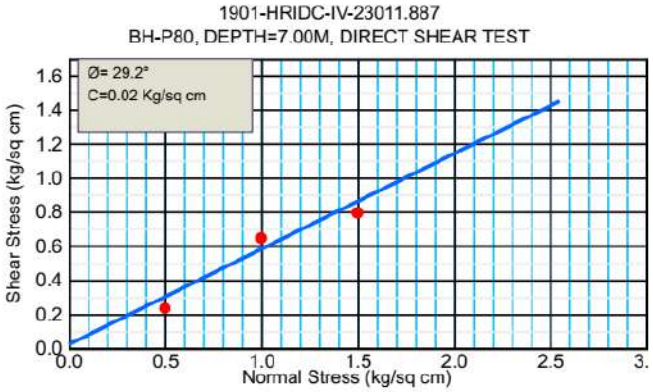


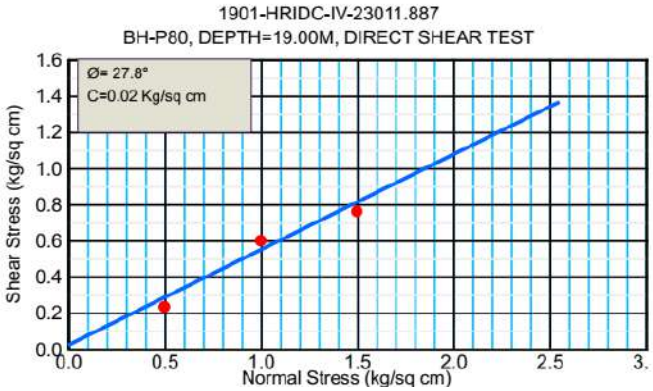
APPENDIX-F
GRAPH 11: DST GRAPH





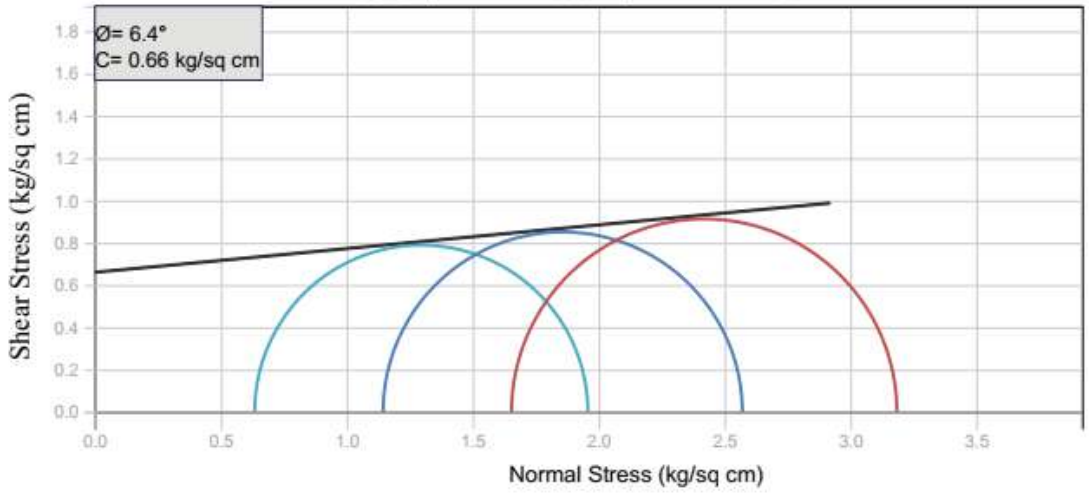




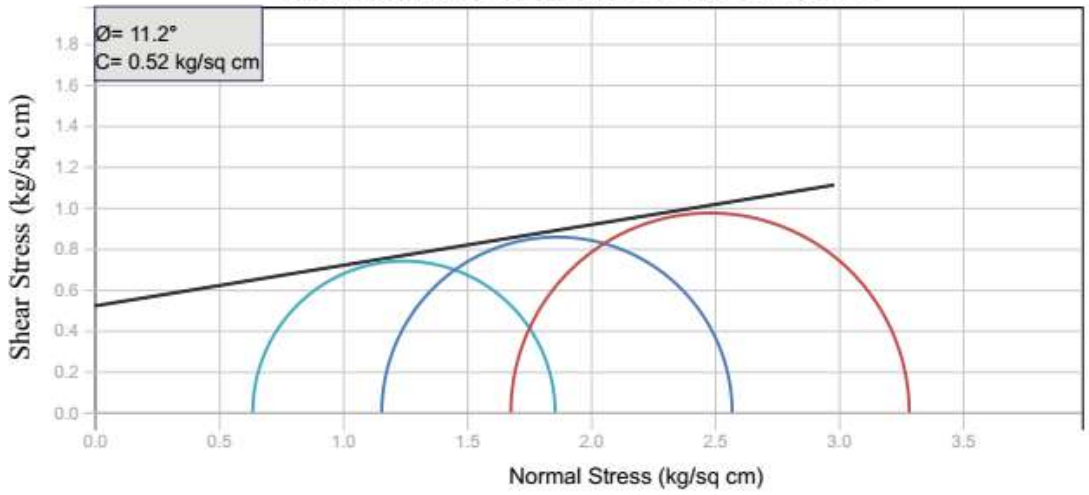


APPENDIX-G
GRAPH 1: UU GRAPH

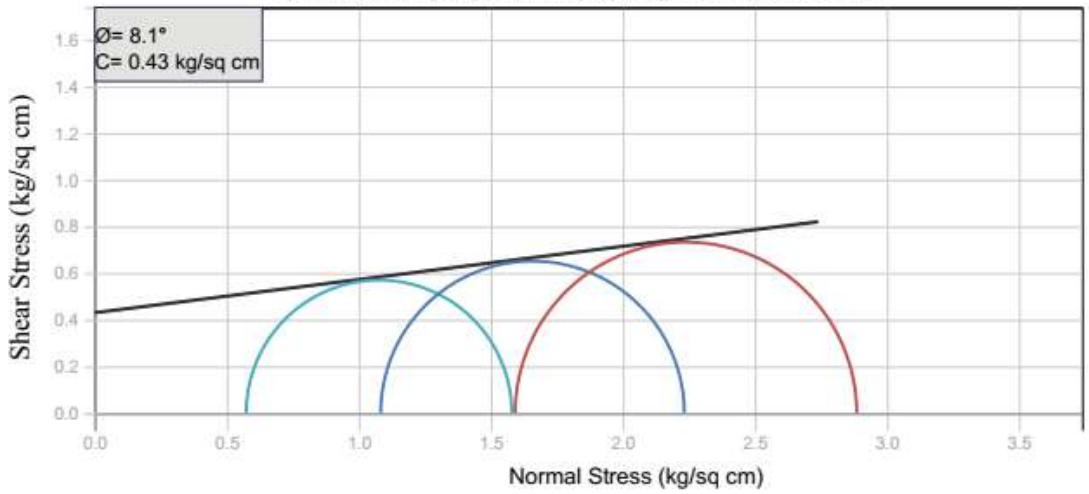
1901-HRIDC-IV-22514.0870
BH-NO.P61, DEPTH-1.00M, TRIAXIAL GRAPH



1901-HRIDC-IV-22514.0870
BH-NO.P61, DEPTH-16.00M, TRIAXIAL GRAPH

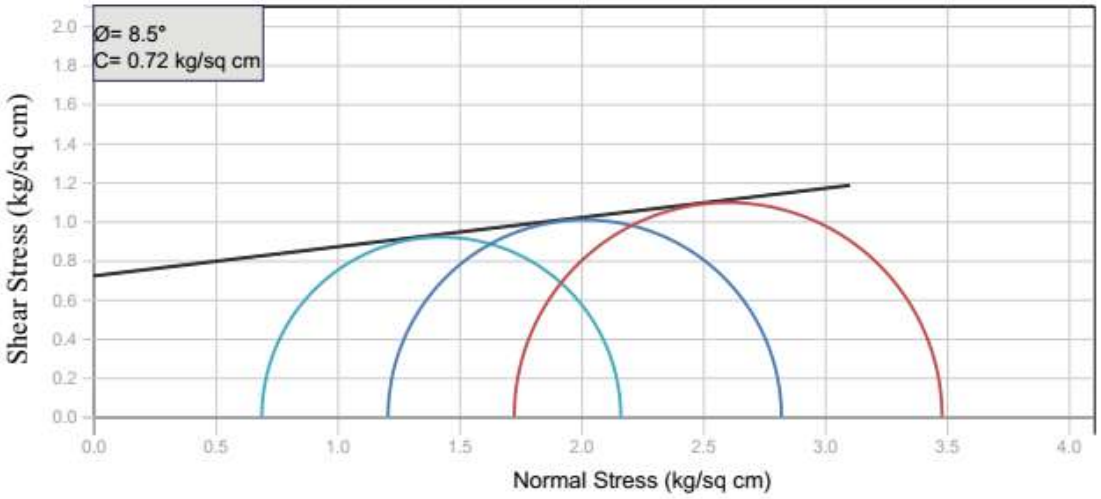


1901-HRIDC-IV-22514.0870
BH-NO.P61, DEPTH-19.00M, TRIAXIAL GRAPH

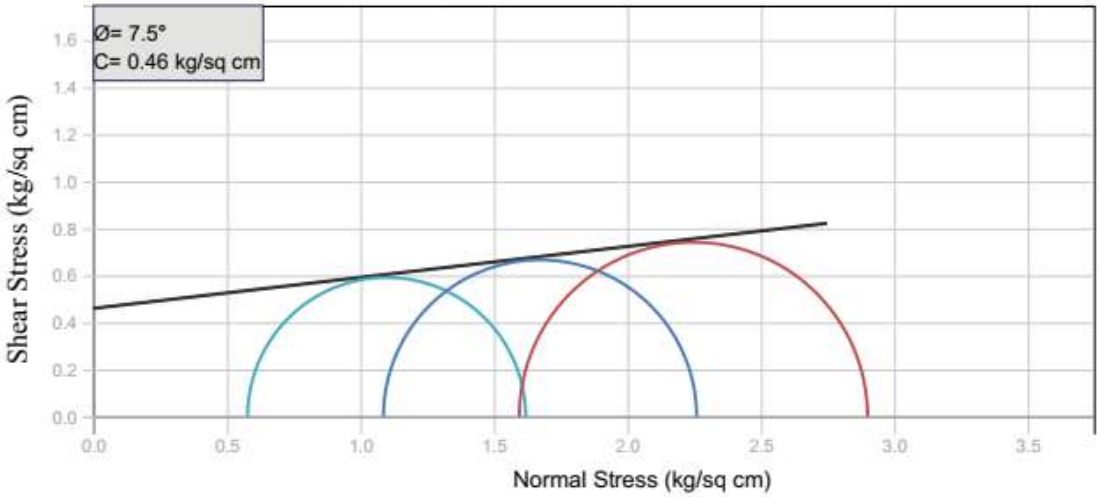


APPENDIX-G
GRAPH 2: UU GRAPH

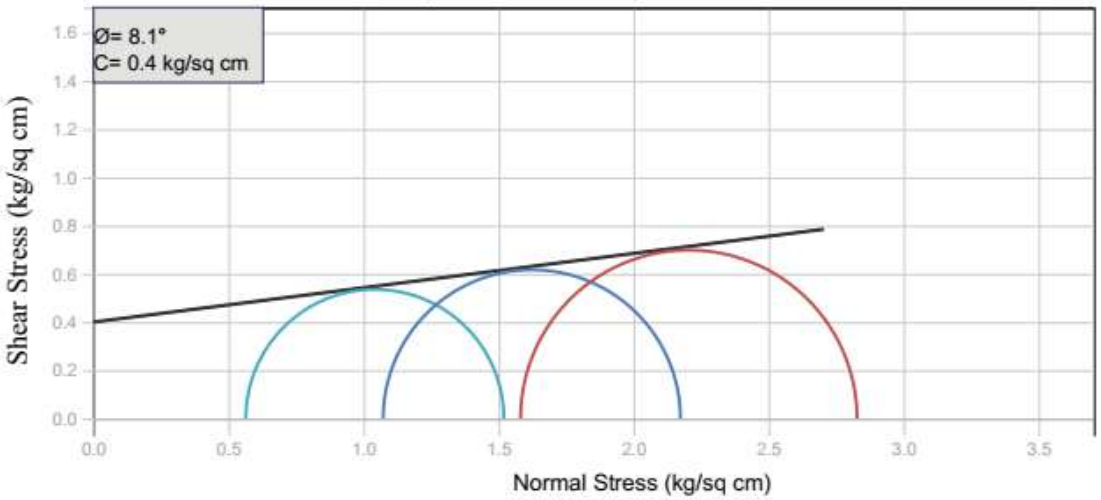
1901-HRIDC-IV-22514.0870
BH-NO.P61, DEPTH-28.00M, TRIAXIAL GRAPH



1901-HRIDC-IV-22540.2870
BH-NO.P62, DEPTH-2.00M, TRIAXIAL GRAPH

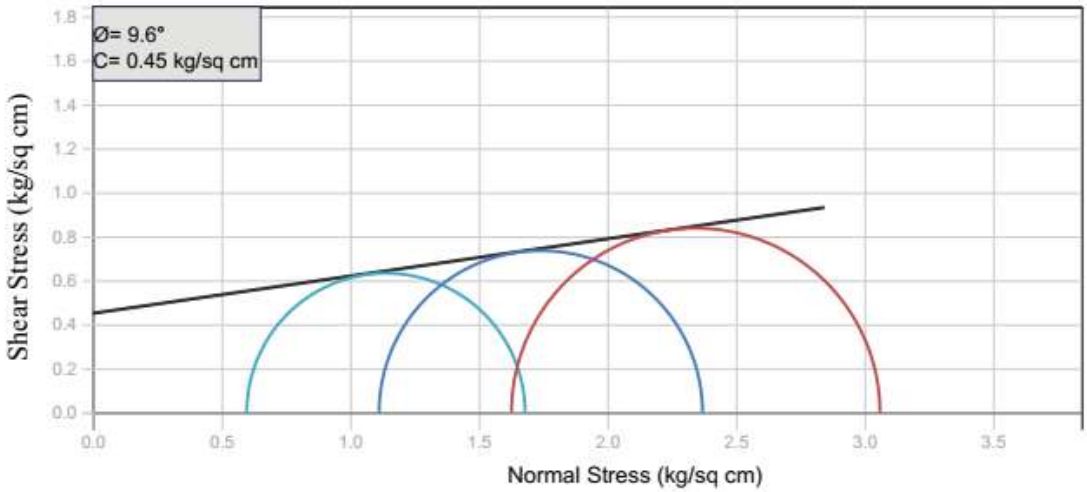


1901-HRIDC-IV-22540.2870
BH-NO.P62, DEPTH-14.00M, TRIAXIAL GRAPH

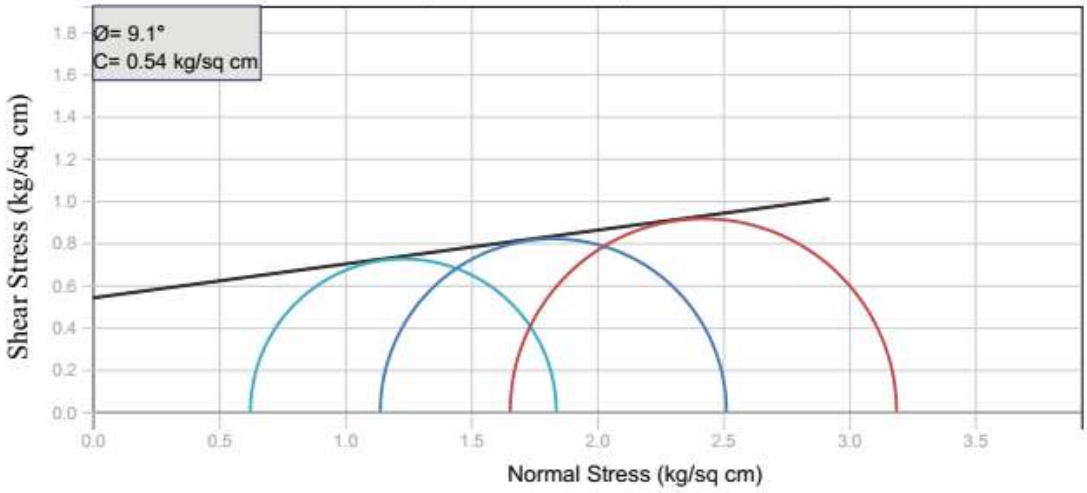


APPENDIX-G
GRAPH 3: UU GRAPH

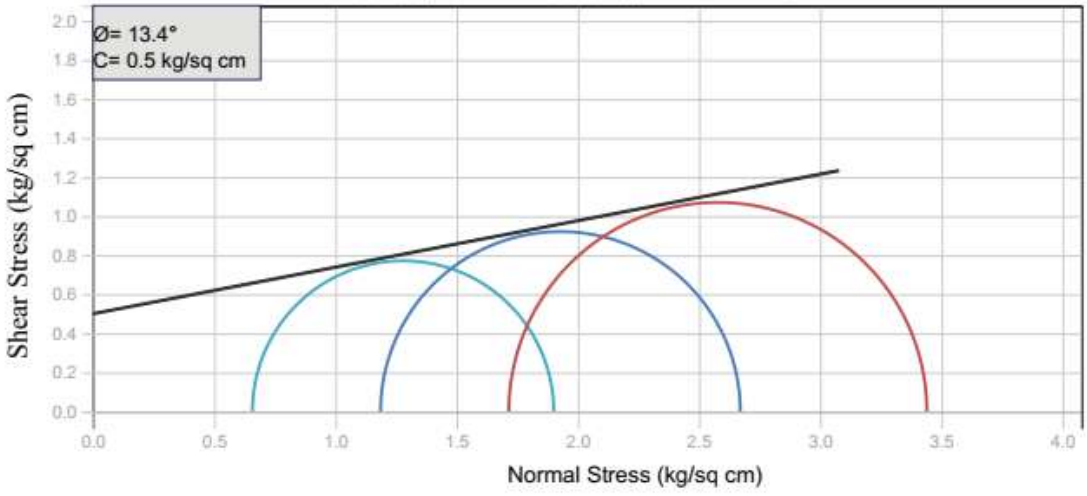
1901-HRIDC-IV-22540.2870
BH-NO.P62, DEPTH-23.00M, TRIAXIAL GRAPH



1901-HRIDC-IV-22566.4870
BH-NO.P63, DEPTH-4.00M, TRIAXIAL GRAPH

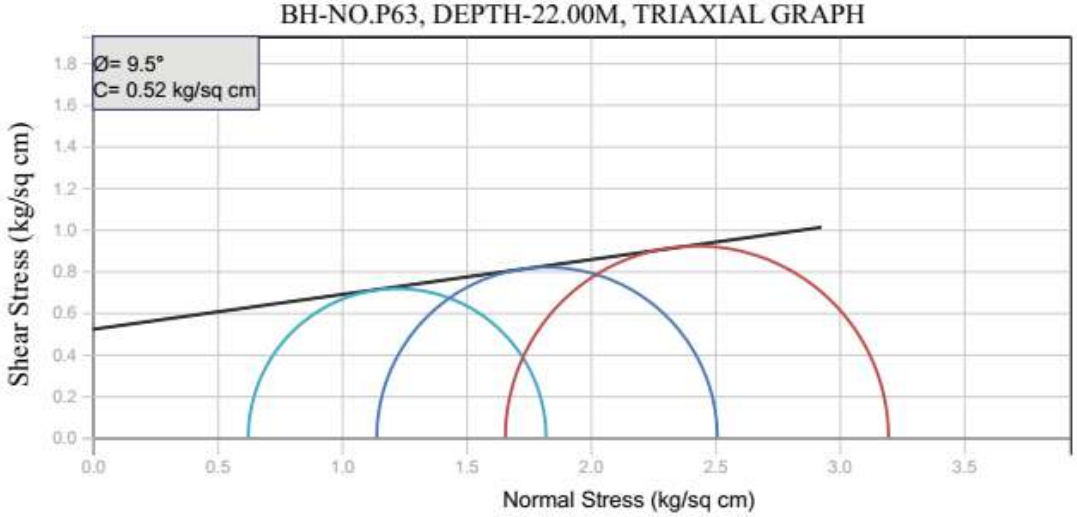


1901-HRIDC-IV-22566.4870
BH-NO.P63, DEPTH-16.00M, TRIAXIAL GRAPH

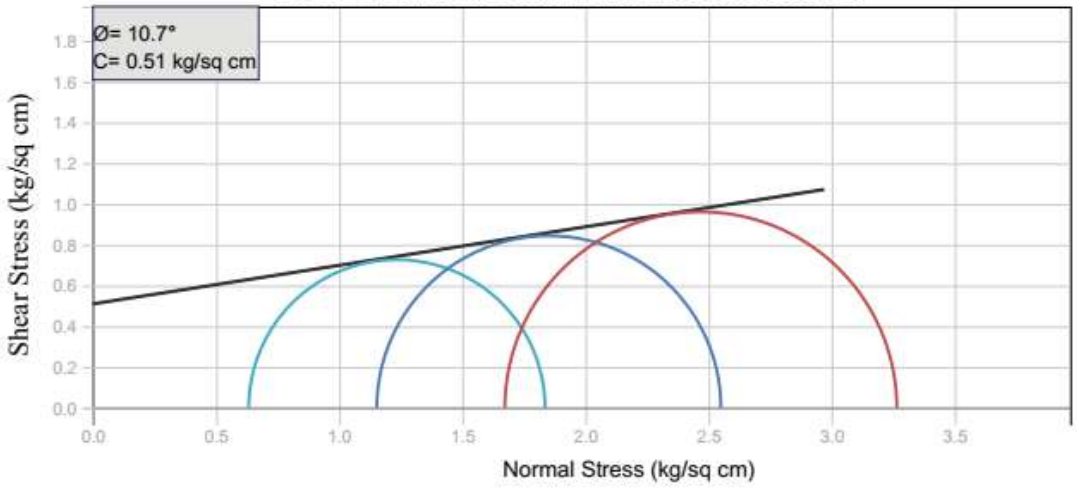


APPENDIX-G
GRAPH 4: UU GRAPH

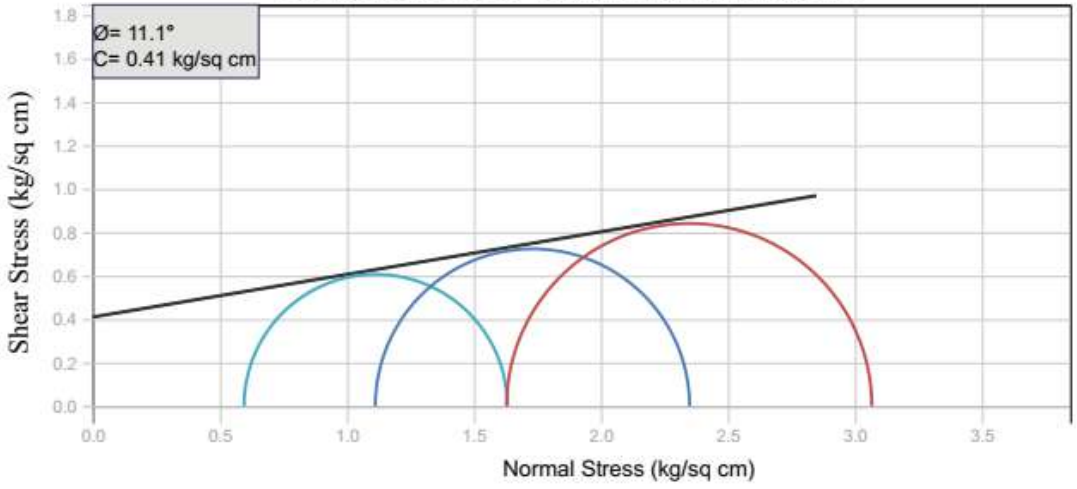
1901-HRIDC-IV-22566.4870
BH-NO.P63, DEPTH-22.00M, TRIAXIAL GRAPH



1901-HRIDC-IV-22566.4870
BH-NO.P63, DEPTH-25.00M, TRIAXIAL GRAPH

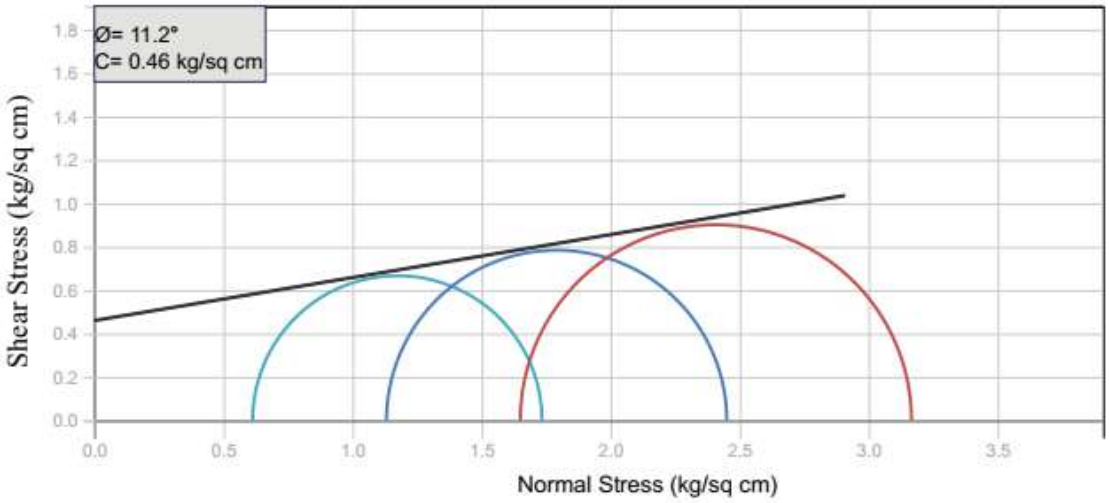


1901-HRIDC-IV-22592.6870
BH-NO.P64, DEPTH-14.00M, TRIAXIAL GRAPH

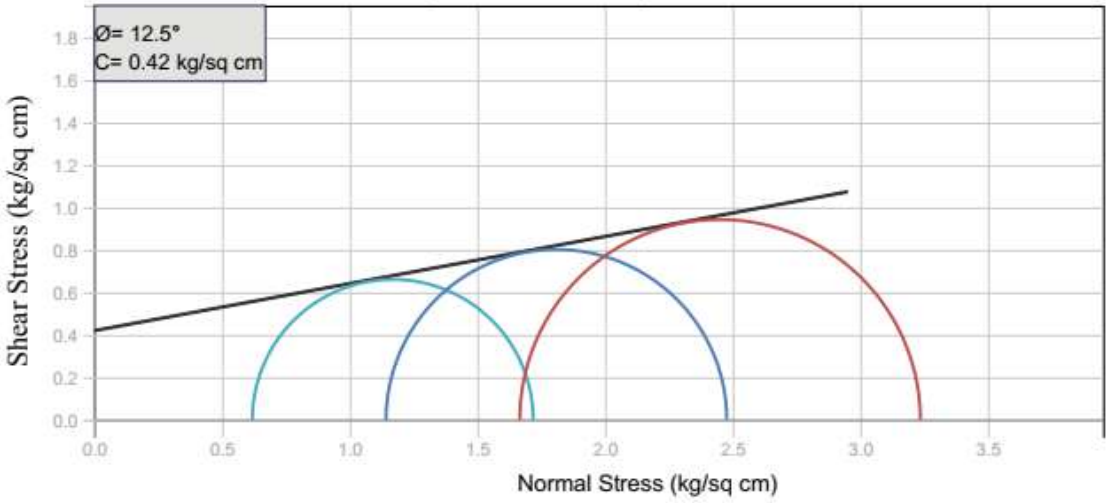


APPENDIX-G
GRAPH 5: UU GRAPH

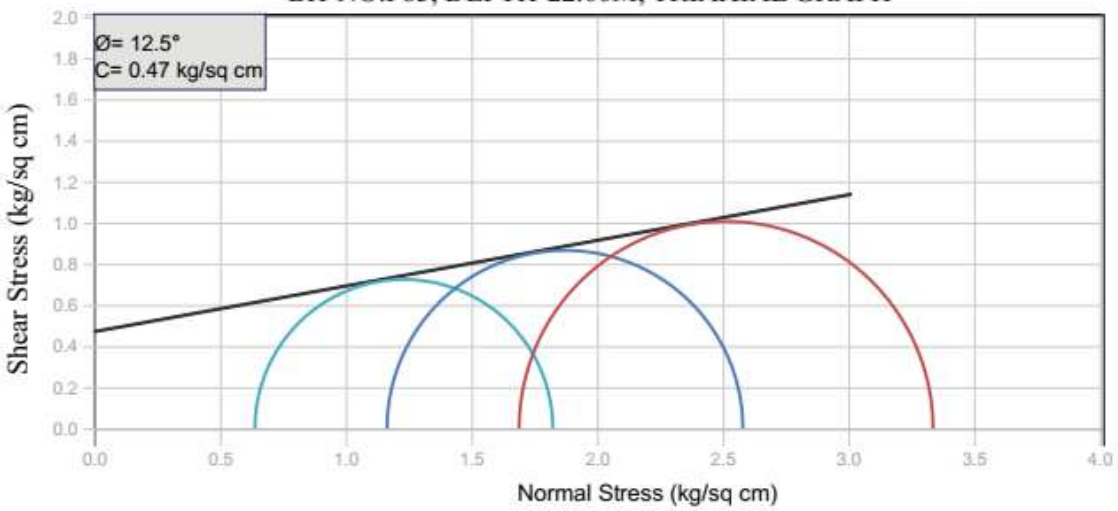
1901-HRIDC-IV-22592.6870
BH-NO.P64, DEPTH-20.00M, TRIAXIAL GRAPH



1901-HRIDC-IV-22592.6870
BH-NO.P64, DEPTH-23.00M, TRIAXIAL GRAPH

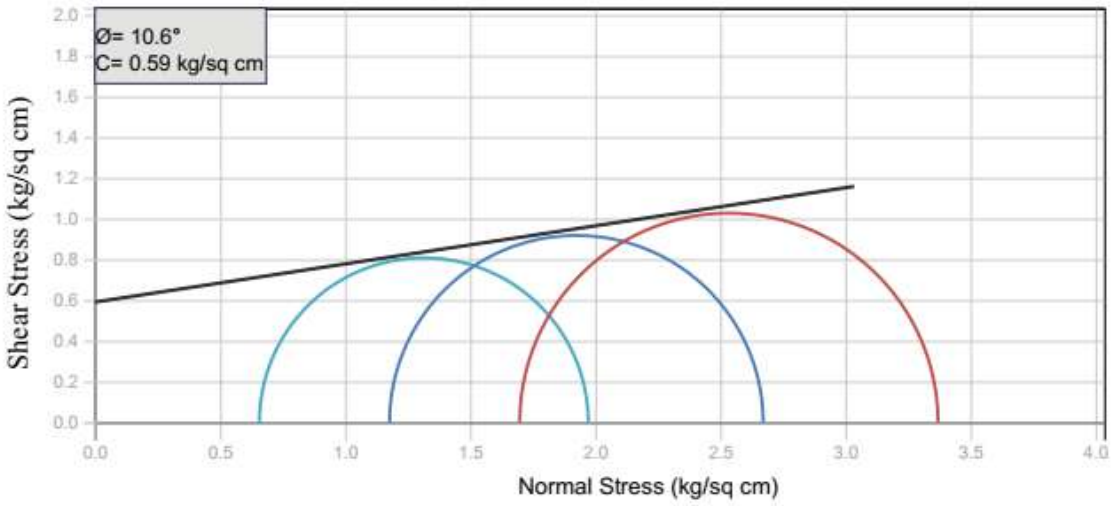


1901-HRIDC-IV-22618.8870
BH-NO.P65, DEPTH-22.00M, TRIAXIAL GRAPH

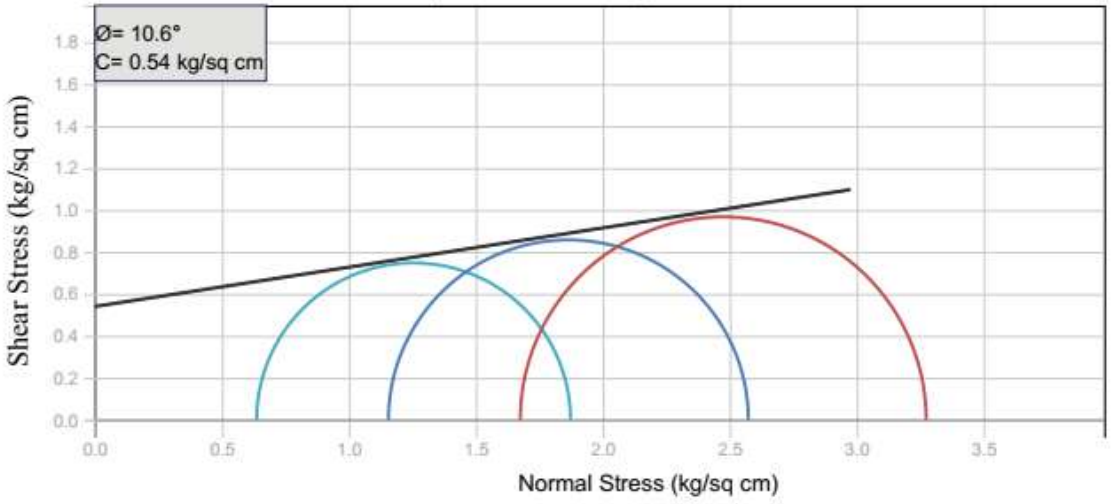


APPENDIX-G
GRAPH 6: UU GRAPH

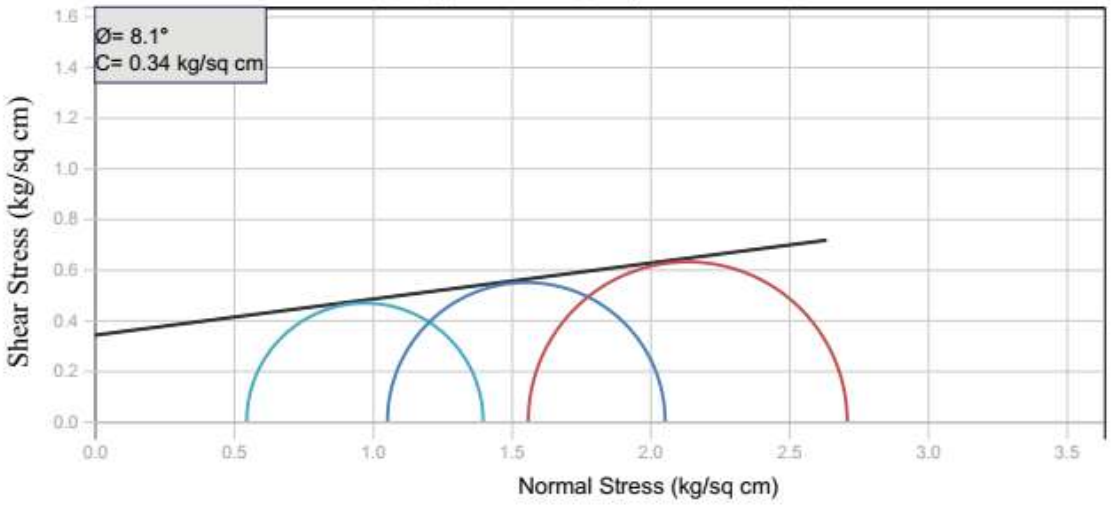
1901-HRIDC-IV-22618.8870
BH-NO.P65, DEPTH-28.00M, TRIAXIAL GRAPH



1901-HRIDC-IV-22618.8870
BH-NO.P65, DEPTH-31.00M, TRIAXIAL GRAPH

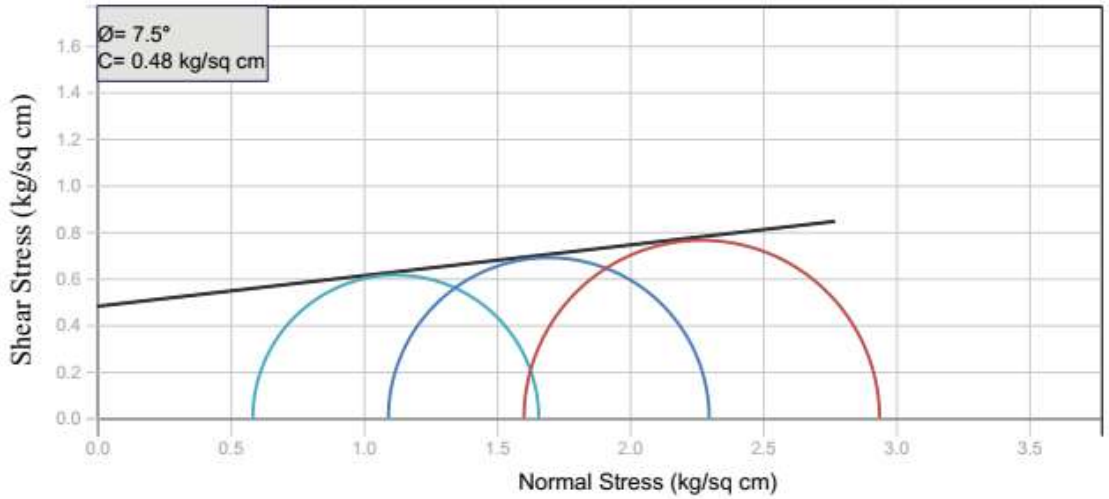


1901-HRIDC-IV-22645.0870
BH-NO.P66, DEPTH-4.00M, TRIAXIAL GRAPH

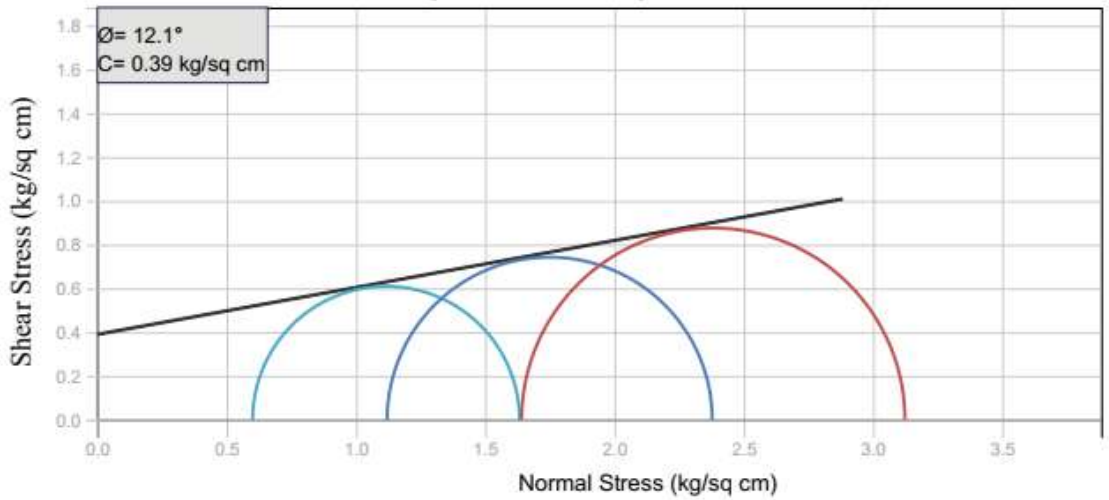


APPENDIX-G
GRAPH 7: UU GRAPH

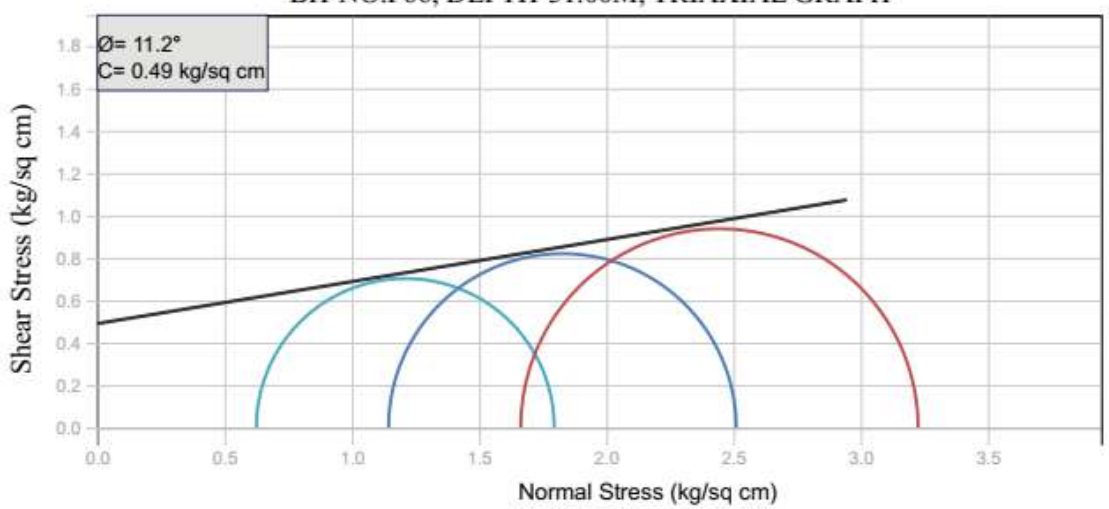
1901-HRIDC-IV-22645.0870
BH-NO.P66, DEPTH-13.00M, TRIAXIAL GRAPH



1901-HRIDC-IV-22645.0870
BH-NO.P66, DEPTH-25.00M, TRIAXIAL GRAPH

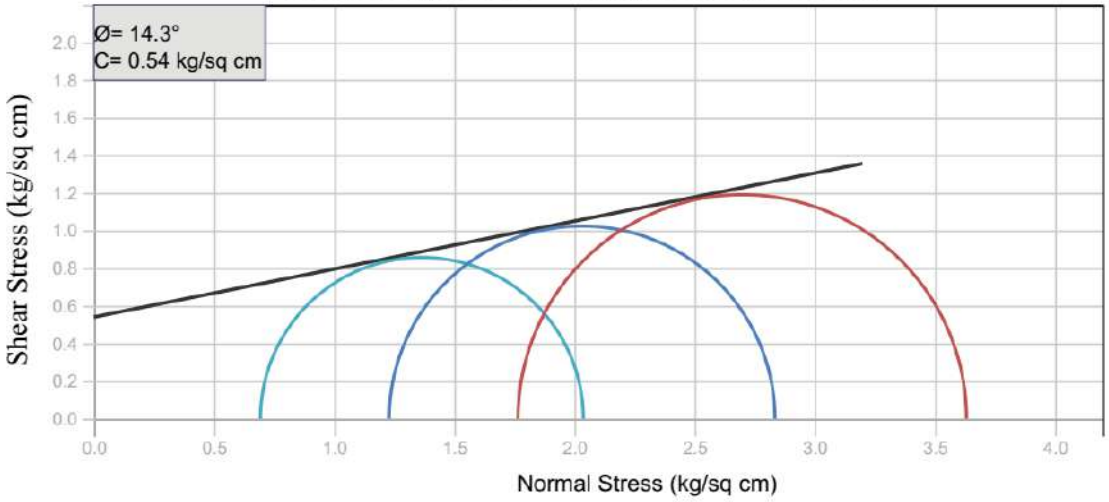


1901-HRIDC-IV-22645.0870
BH-NO.P66, DEPTH-31.00M, TRIAXIAL GRAPH

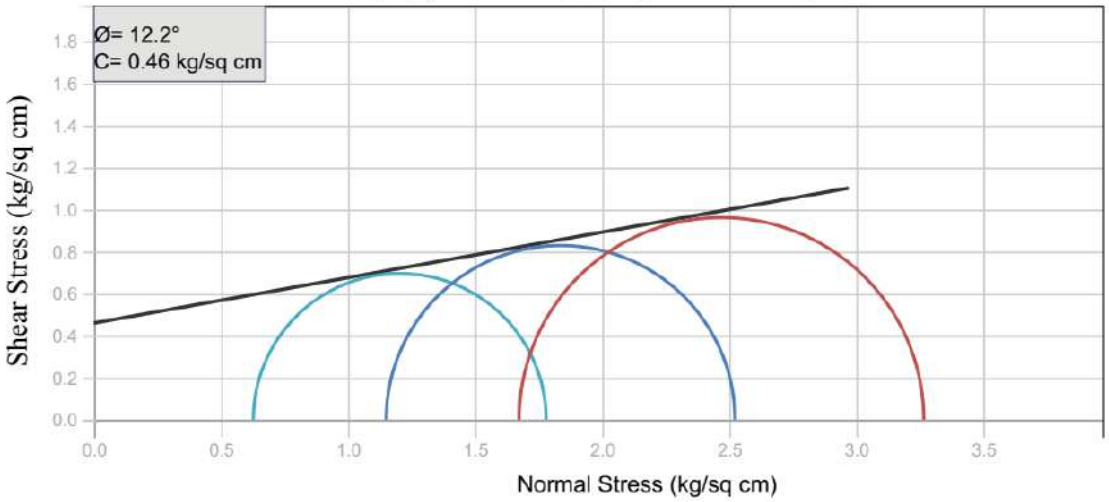


APPENDIX-G
GRAPH 8: UU GRAPH

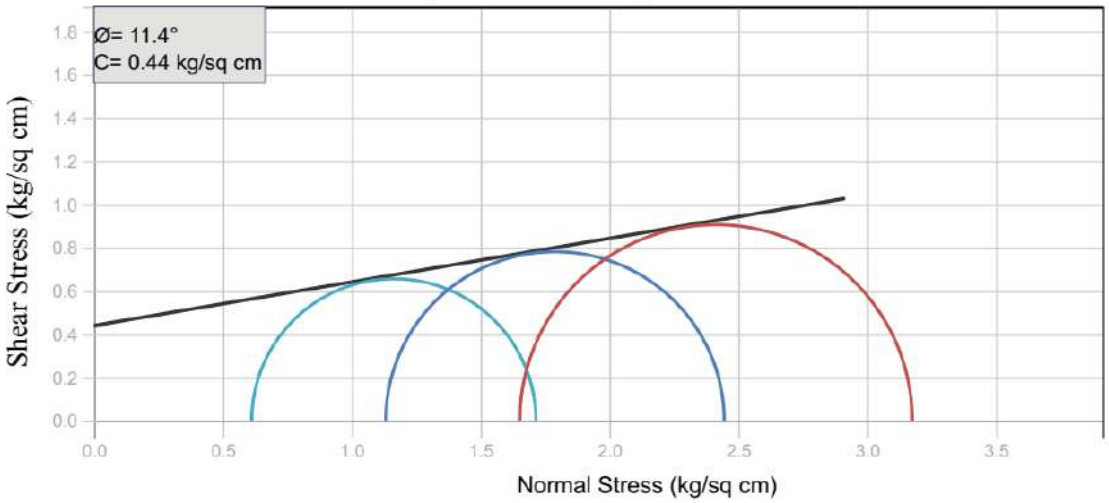
1901-HRIDC-IV-22671.287
BH-NO.P67, DEPTH-14.00M, TRIAXIAL GRAPH



1901-HRIDC-IV-22671.287
BH-NO.P67, DEPTH-23.00M, TRIAXIAL GRAPH

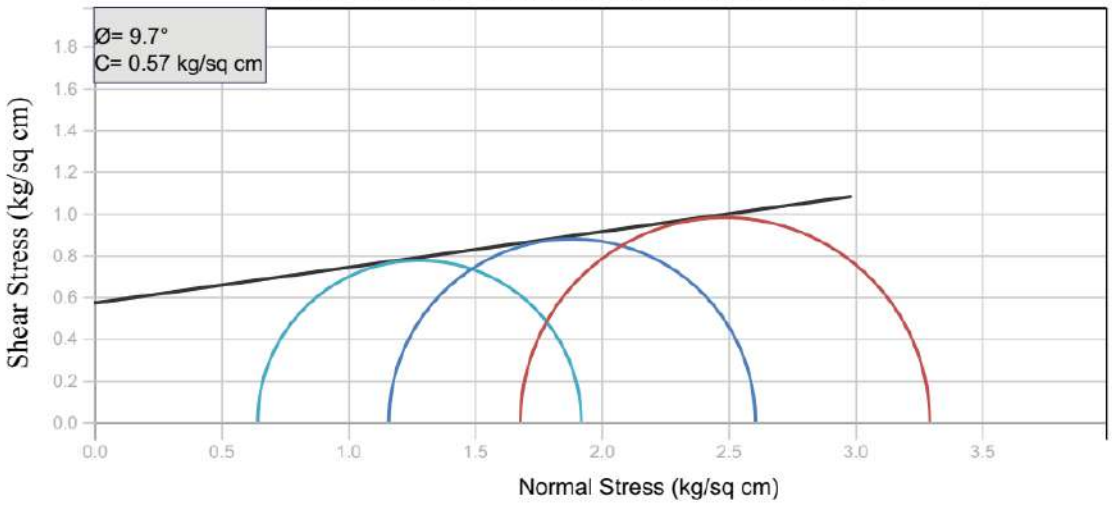


1901-HRIDC-IV-22697.487
BH-NO.P68, DEPTH-11.00M, TRIAXIAL GRAPH

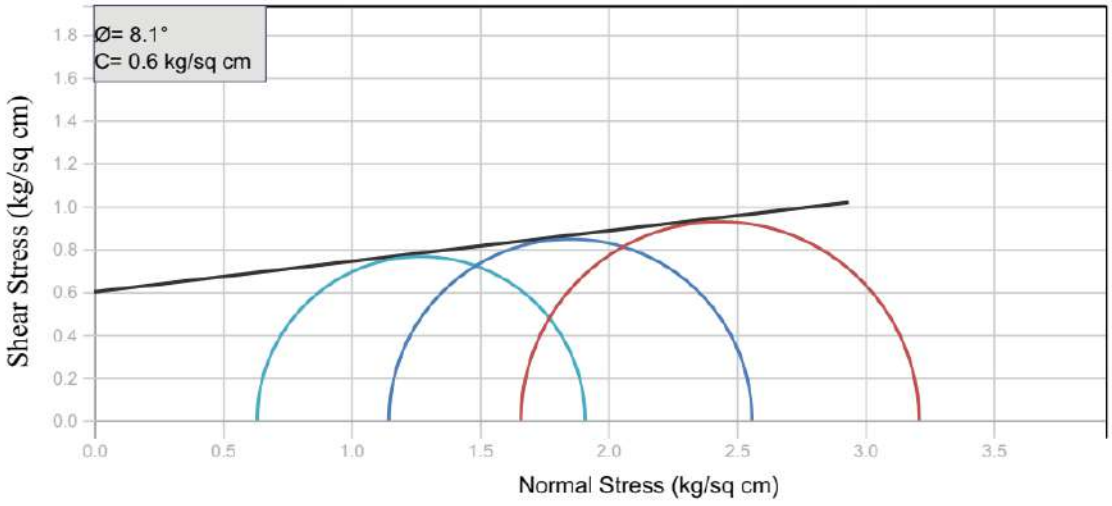


APPENDIX-G
GRAPH 9: UU GRAPH

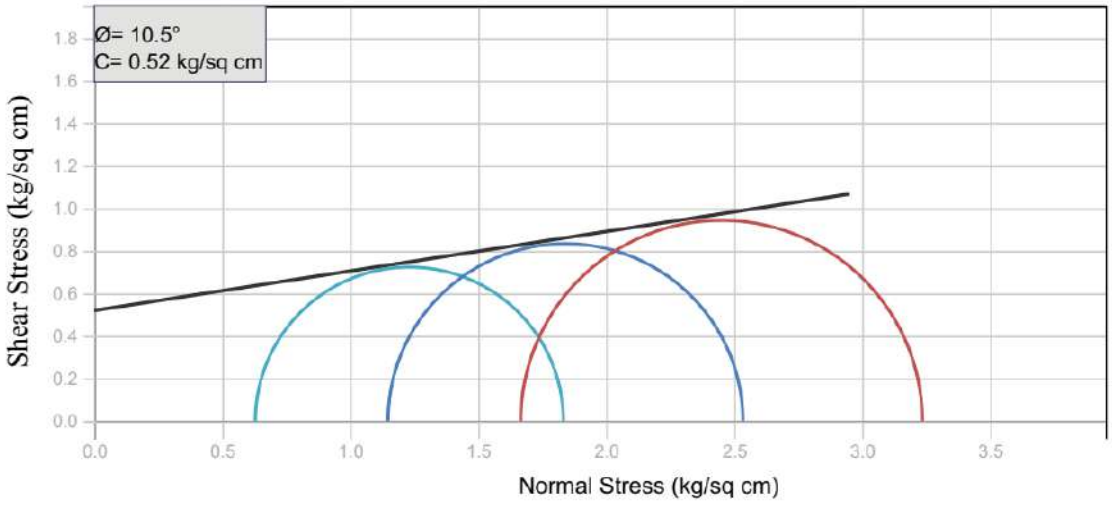
1901-HRIDC-IV-22697.487
BH-NO.P68, DEPTH-14.00M, TRIAXIAL GRAPH



1901-HRIDC-IV-22697.487
BH-NO.P68, DEPTH-17.00M, TRIAXIAL GRAPH

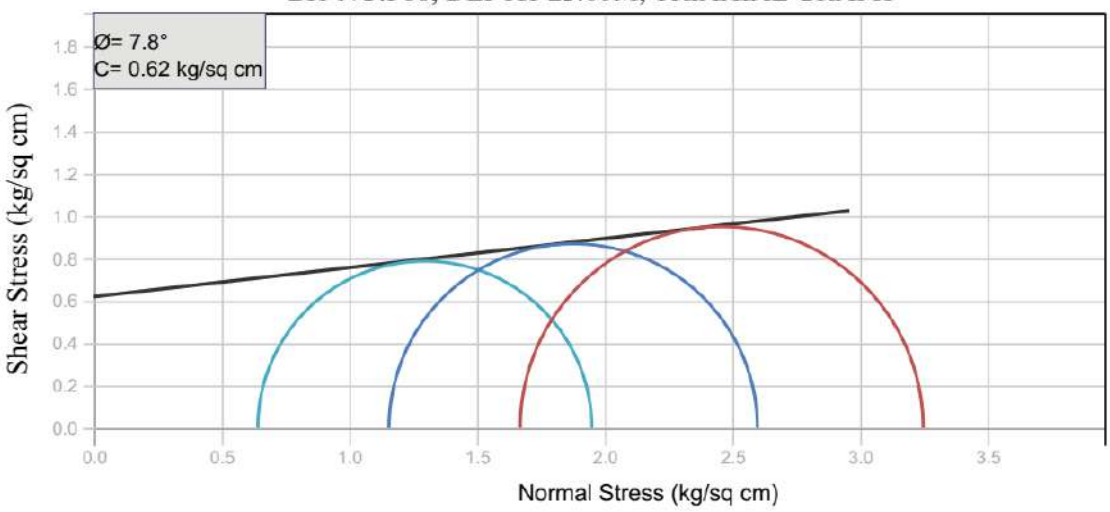


1901-HRIDC-IV-22697.487
BH-NO.P68, DEPTH-20.00M, TRIAXIAL GRAPH

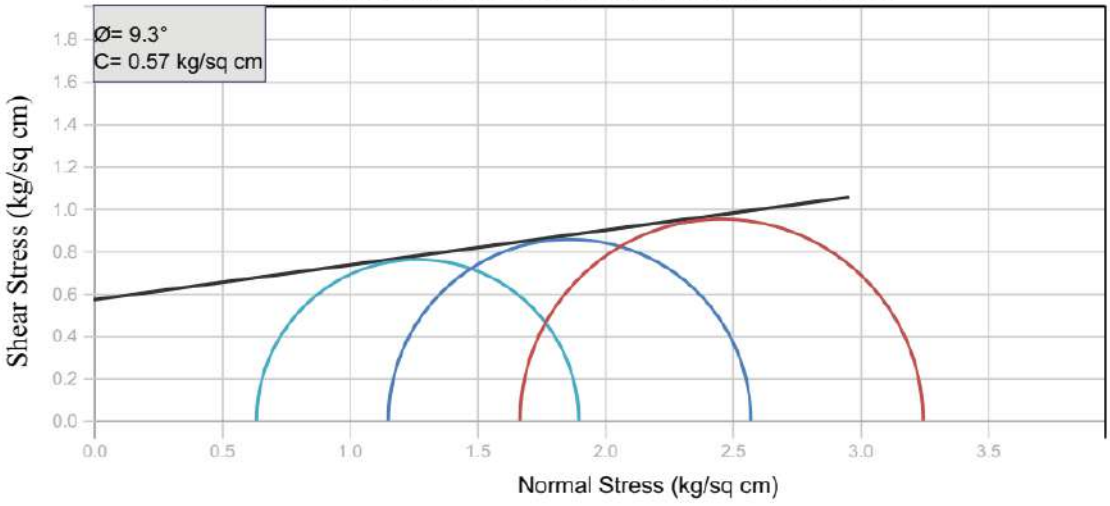


APPENDIX-G
GRAPH 10: UU GRAPH

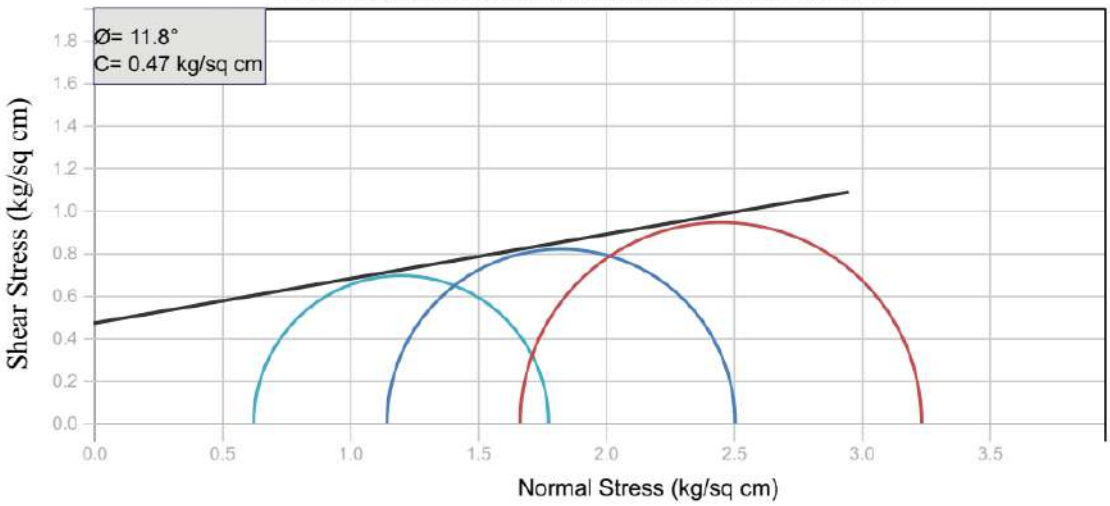
1901-HRIDC-IV-22697.487
BH-NO.P68, DEPTH-23.00M, TRIAXIAL GRAPH



1901-HRIDC-IV-22697.487
BH-NO.P68, DEPTH-26.00M, TRIAXIAL GRAPH

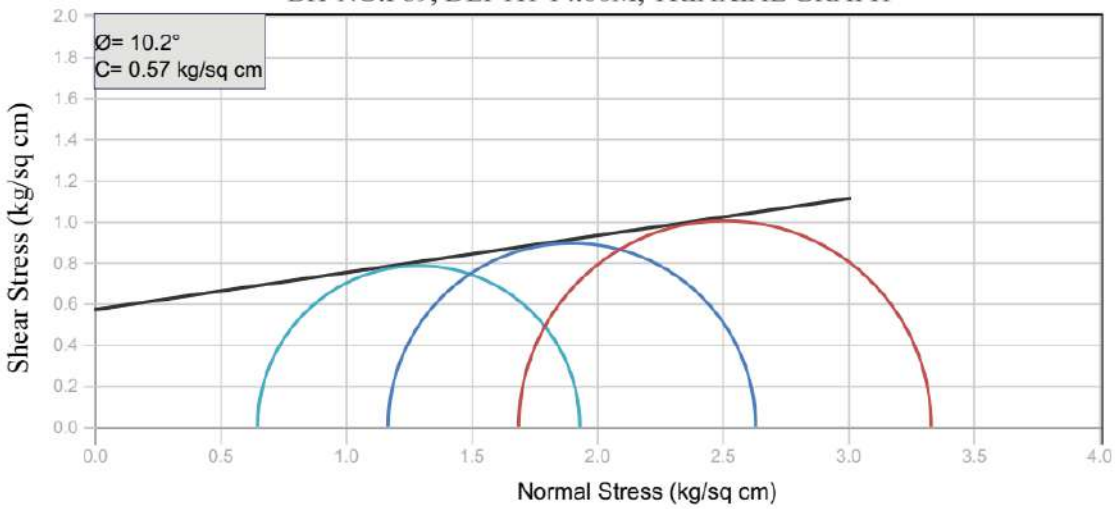


1901-HRIDC-IV-22723.687
BH-NO.P69, DEPTH-11.00M, TRIAXIAL GRAPH

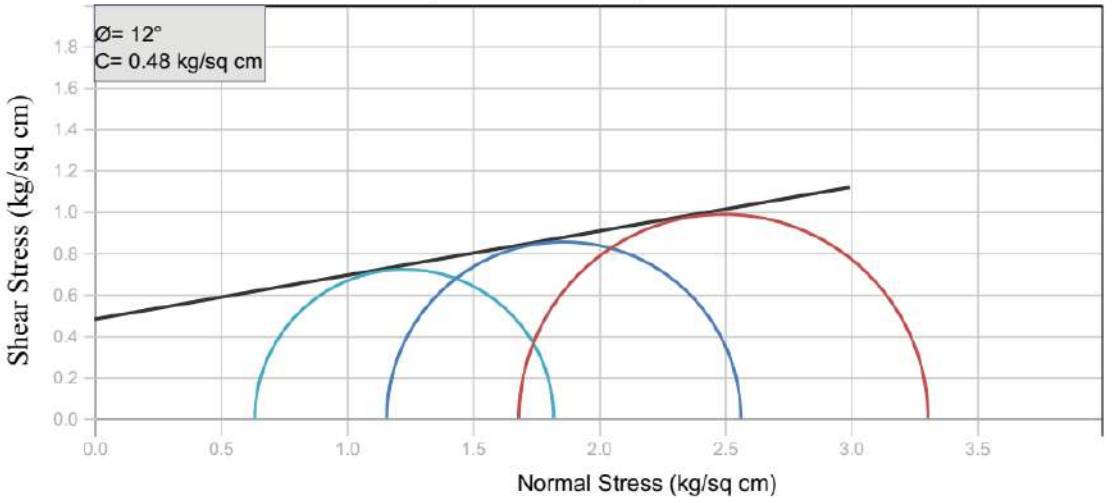


APPENDIX-G
GRAPH 11: UU GRAPH

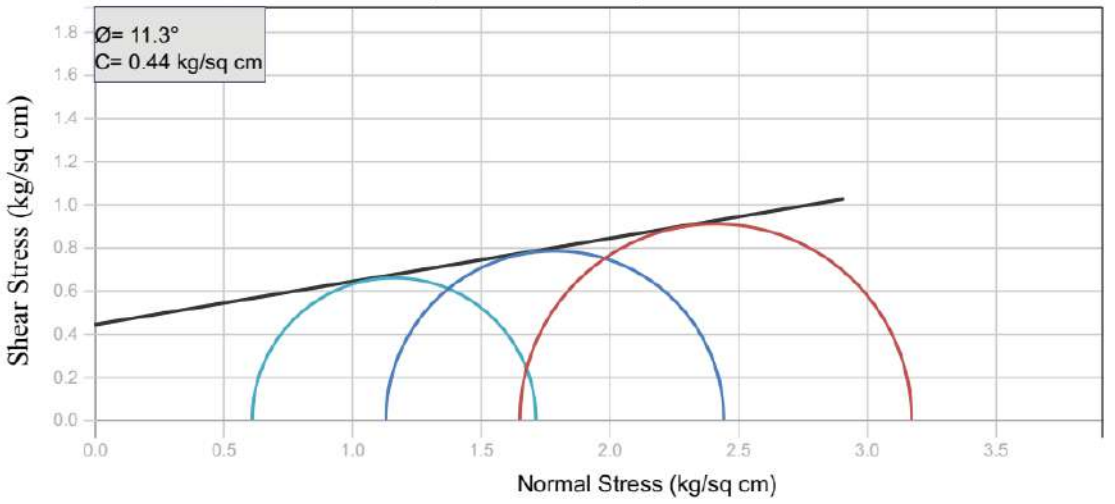
1901-HRIDC-IV-22723.687
BH-NO.P69, DEPTH-14.00M, TRIAXIAL GRAPH



1901-HRIDC-IV-22723.687
BH-NO.P69, DEPTH-20.00M, TRIAXIAL GRAPH

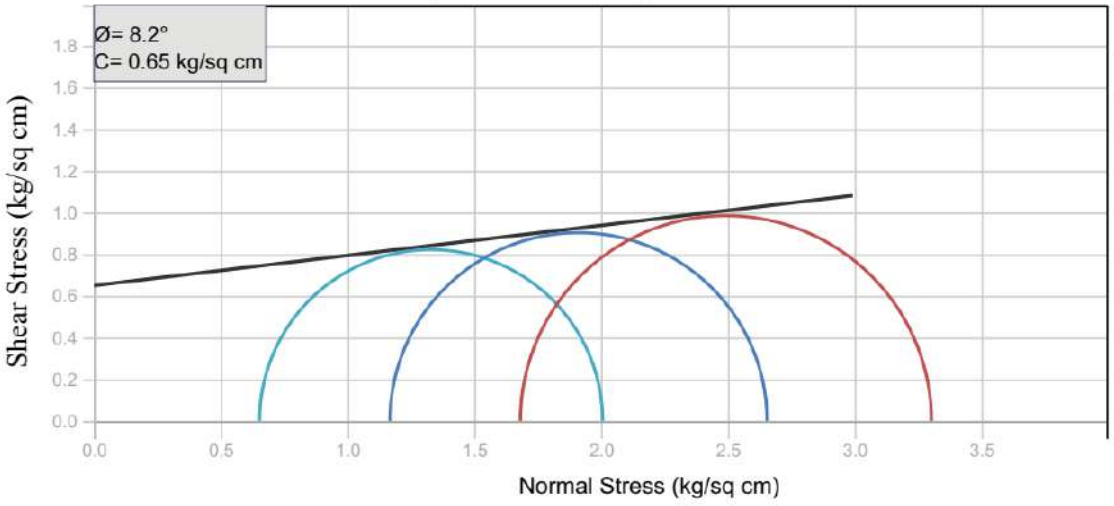


1901-HRIDC-IV-22723.687
BH-NO.P69, DEPTH-23.00M, TRIAXIAL GRAPH

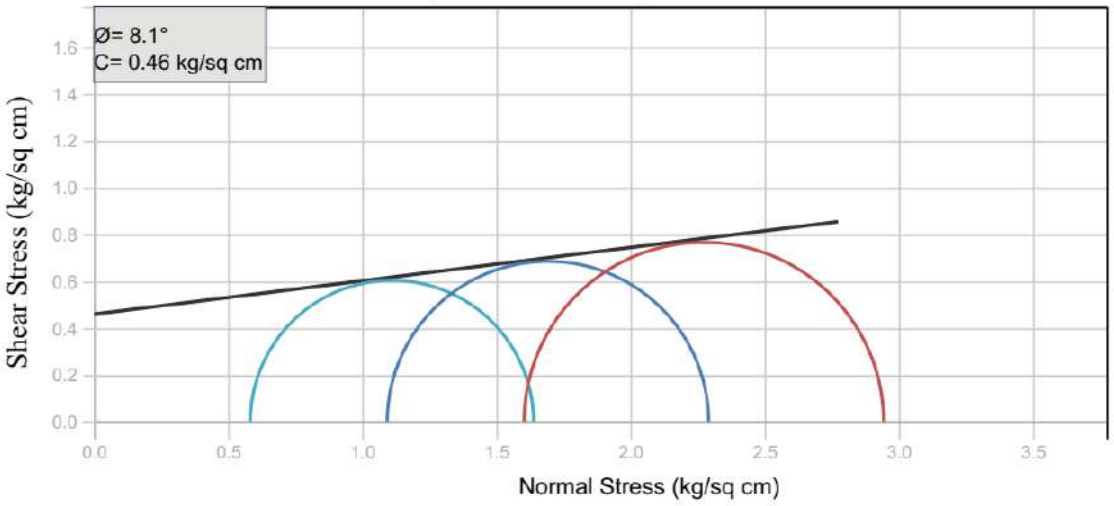


APPENDIX-G
GRAPH 12: UU GRAPH

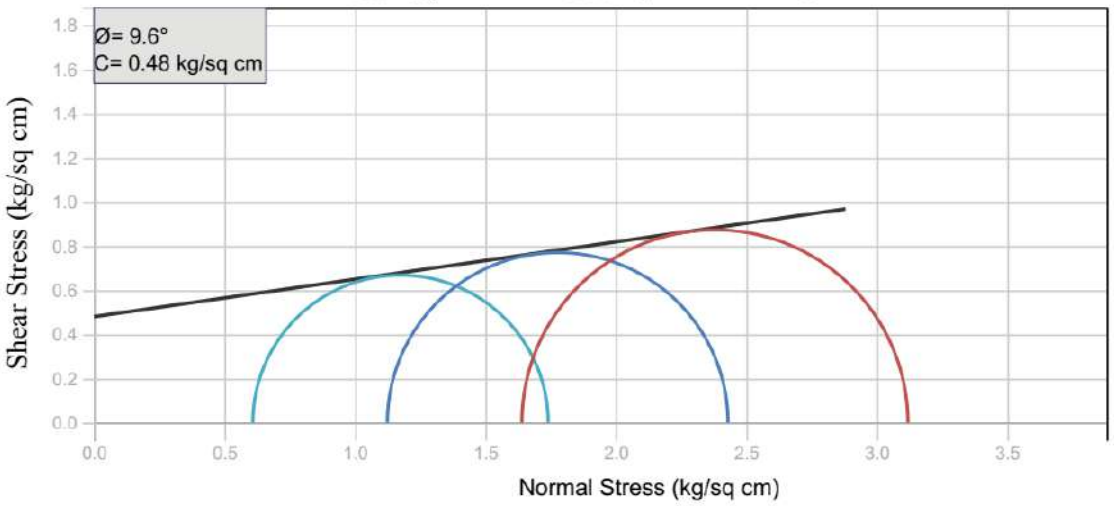
1901-HRIDC-IV-22723.687
BH-NO.P69, DEPTH-26.00M, TRIAXIAL GRAPH



1901-HRIDC-IV-22749.887
BH-NO.P70, DEPTH-13.00M, TRIAXIAL GRAPH

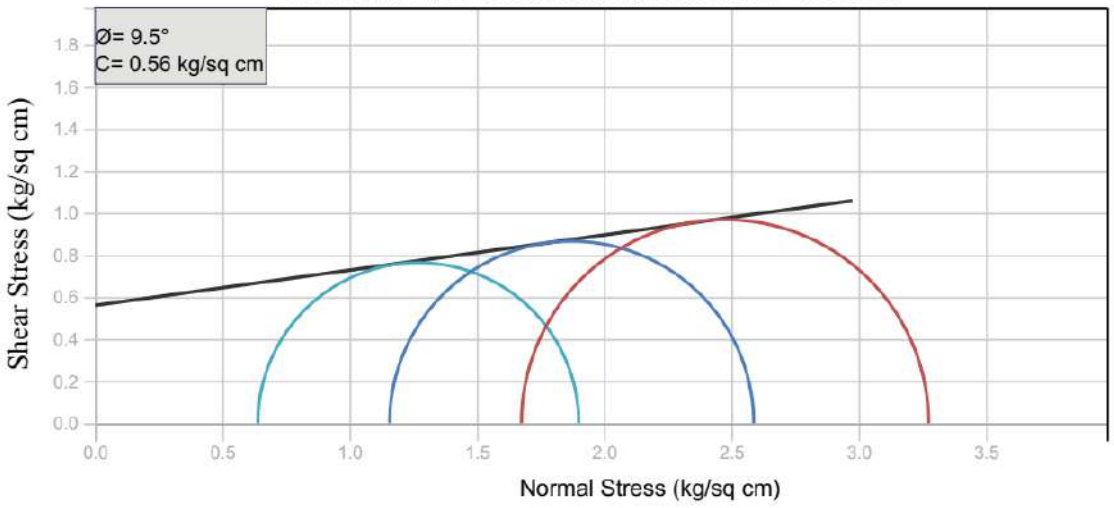


1901-HRIDC-IV-22749.887
BH-NO.P70, DEPTH-16.00M, TRIAXIAL GRAPH

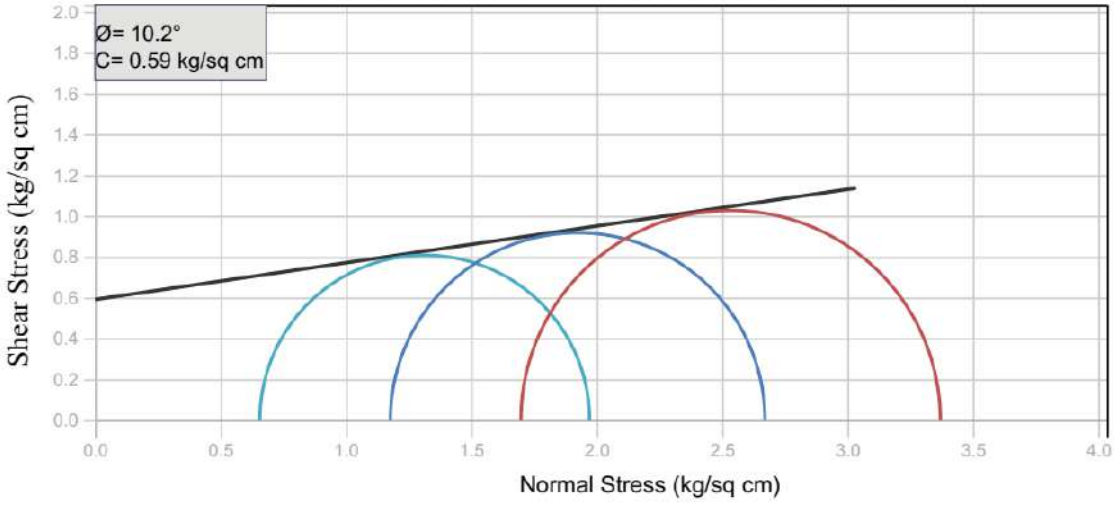


APPENDIX-G
GRAPH 13: UU GRAPH

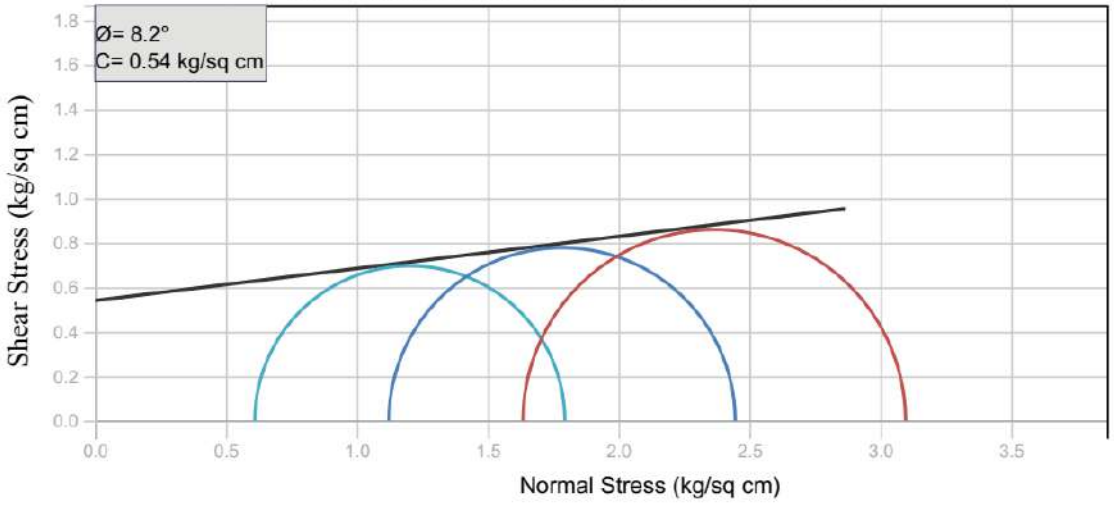
1901-HRIDC-IV-22749.887
BH-NO.P70, DEPTH-22.00M, TRIAXIAL GRAPH



1901-HRIDC-IV-22749.887
BH-NO.P70, DEPTH-25.00M, TRIAXIAL GRAPH

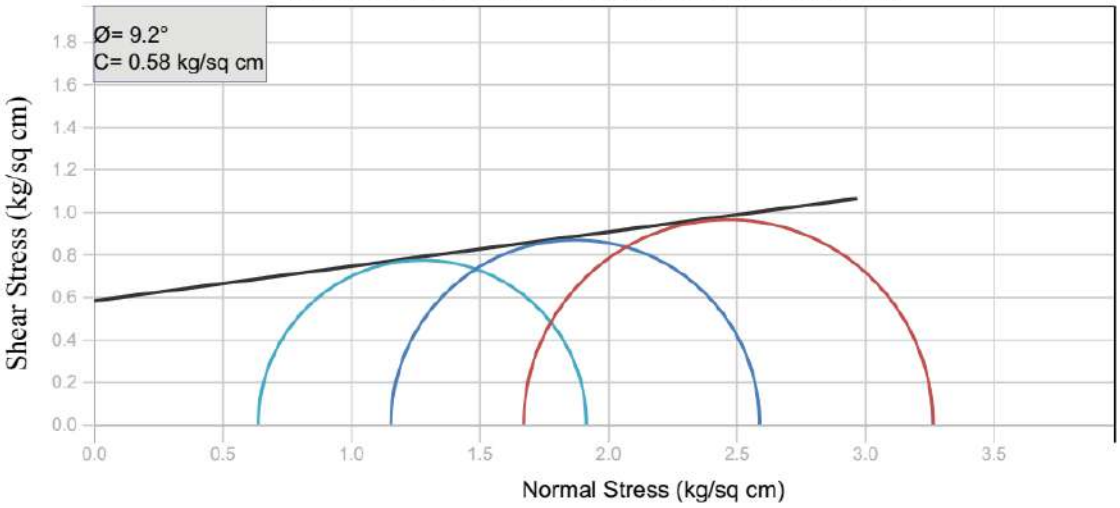


1901-HRIDC-IV-22749.887
BH-NO.P70, DEPTH-28.00M, TRIAXIAL GRAPH

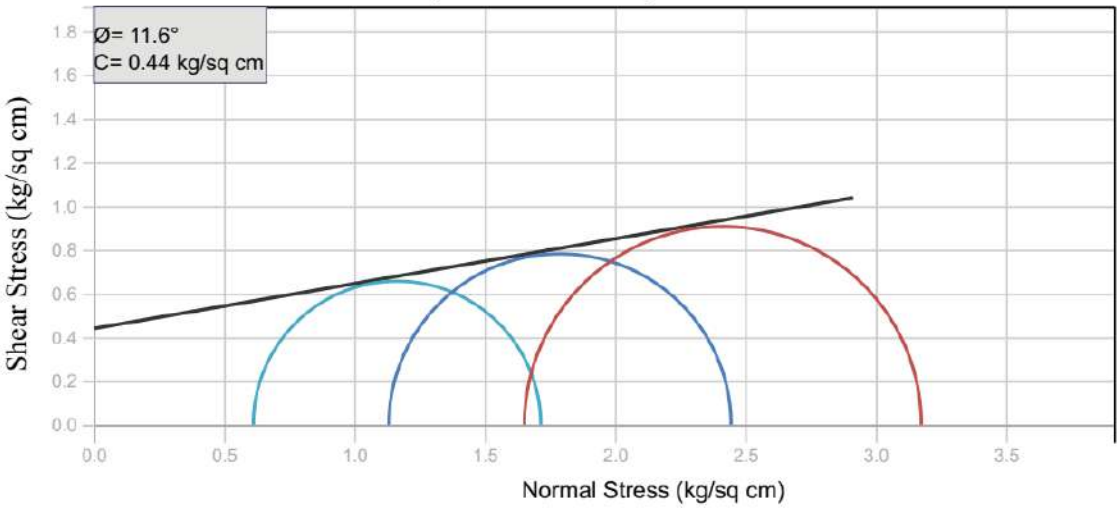


APPENDIX-G
GRAPH 14: UU GRAPH

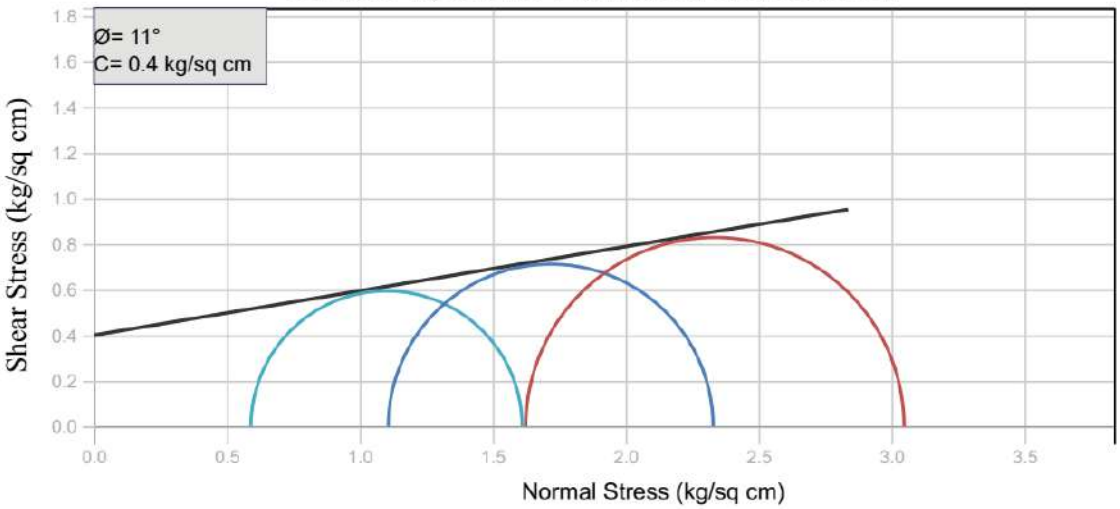
1901-HRIDC-IV-22776.087
BH-NO.P71, DEPTH-14.00M, TRIAXIAL GRAPH



1901-HRIDC-IV-22802.287
BH-NO.P72, DEPTH-11.00M, TRIAXIAL GRAPH

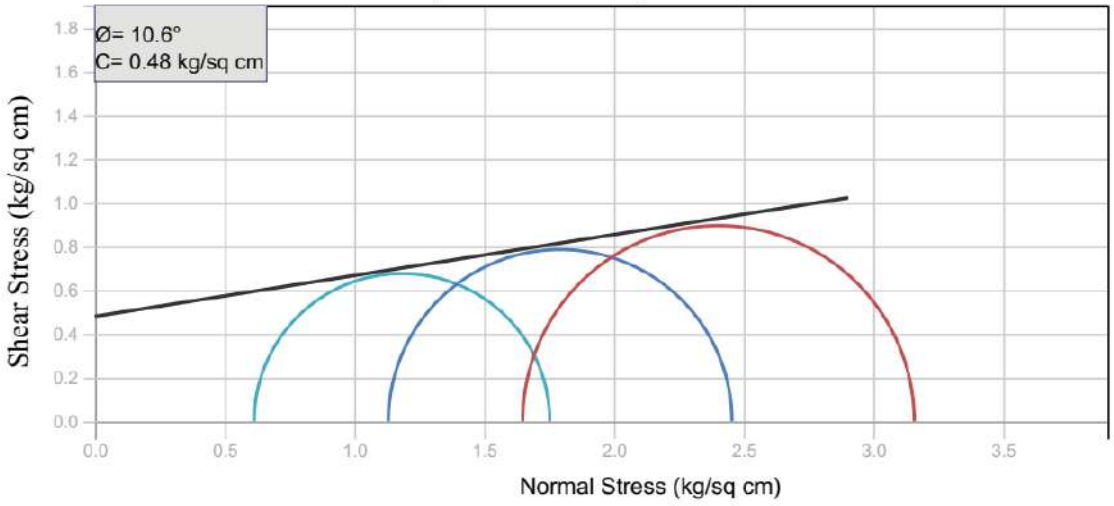


1901-HRIDC-IV-22802.287
BH-NO.P72, DEPTH-14.00M, TRIAXIAL GRAPH

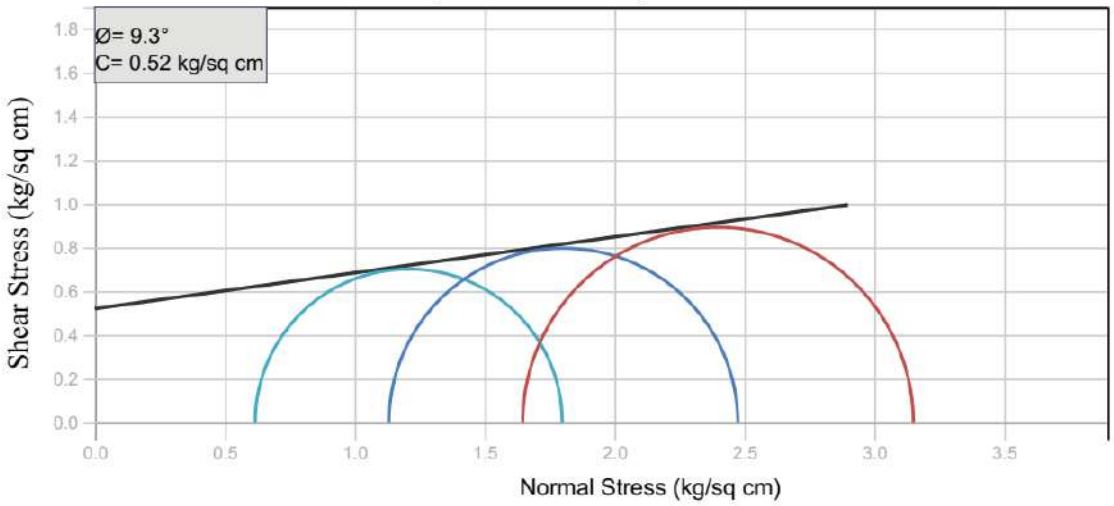


APPENDIX-G
GRAPH 15: UU GRAPH

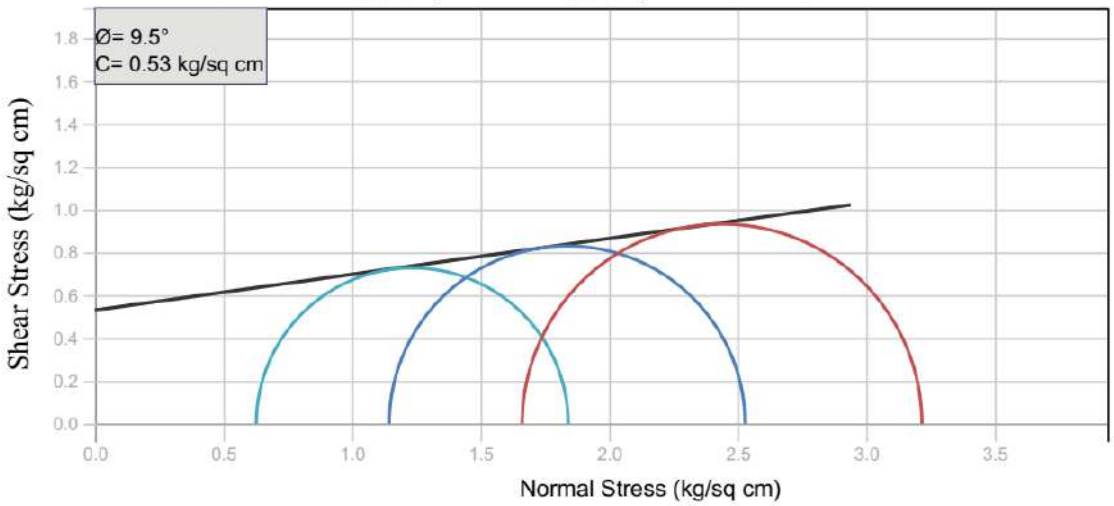
1901-HRIDC-IV-22802.287
BH-NO.P72, DEPTH-17.00M, TRIAXIAL GRAPH



1901-HRIDC-IV-22802.287
BH-NO.P72, DEPTH-20.00M, TRIAXIAL GRAPH

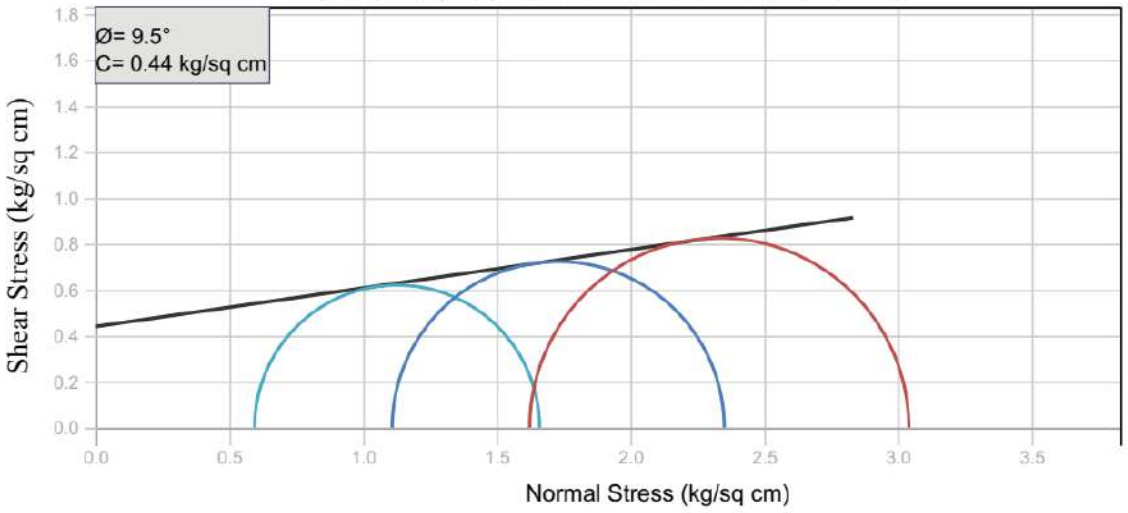


1901-HRIDC-IV-22802.287
BH-NO.P72, DEPTH-26.00M, TRIAXIAL GRAPH

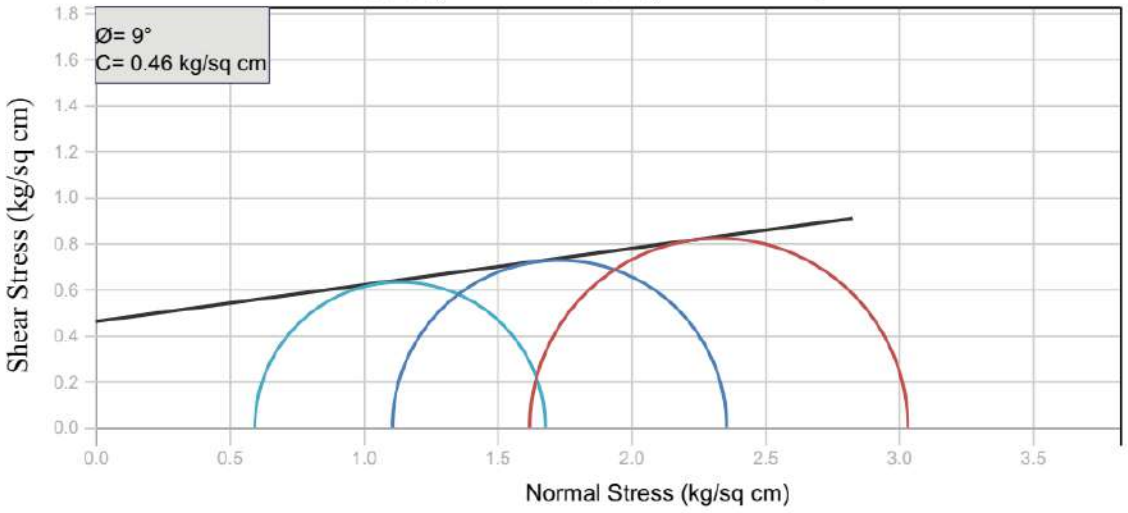


APPENDIX-G
GRAPH 16: UU GRAPH

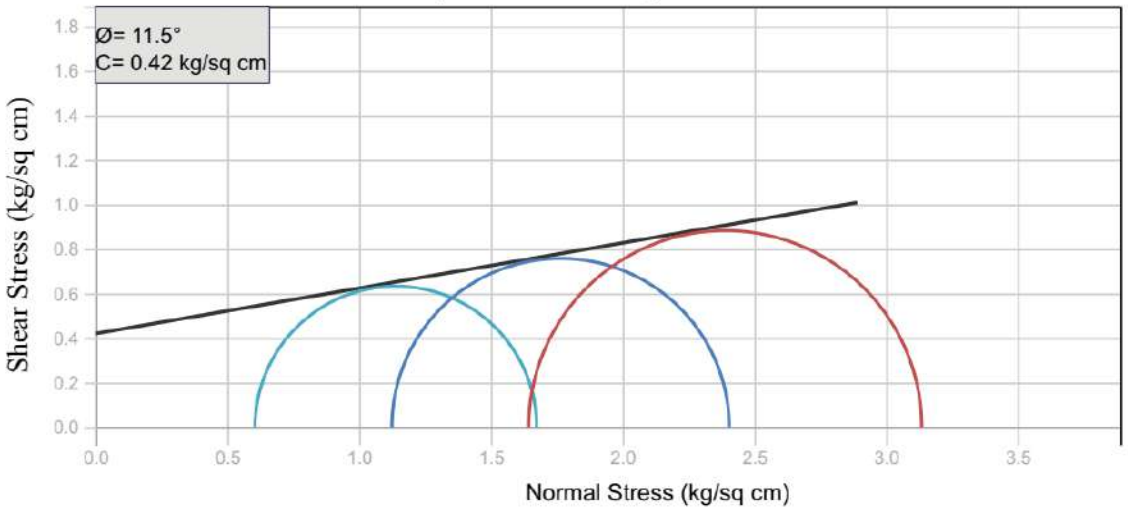
1901-HRIDC-IV-22828.487
BH-NO.P73, DEPTH-11.00M, TRIAXIAL GRAPH



1901-HRIDC-IV-22828.487
BH-NO.P73, DEPTH-14.00M, TRIAXIAL GRAPH

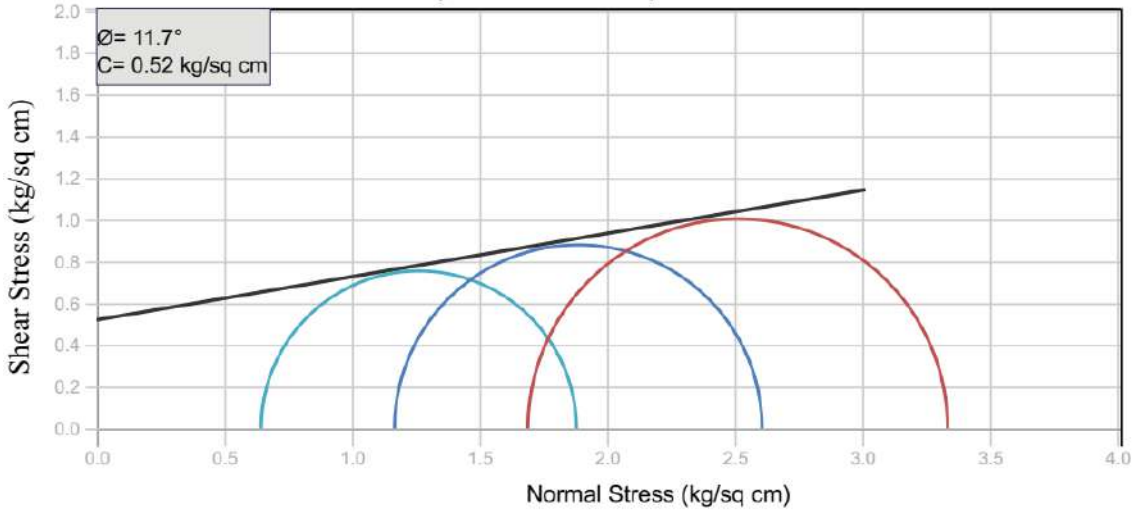


1901-HRIDC-IV-22828.487
BH-NO.P73, DEPTH-20.00M, TRIAXIAL GRAPH

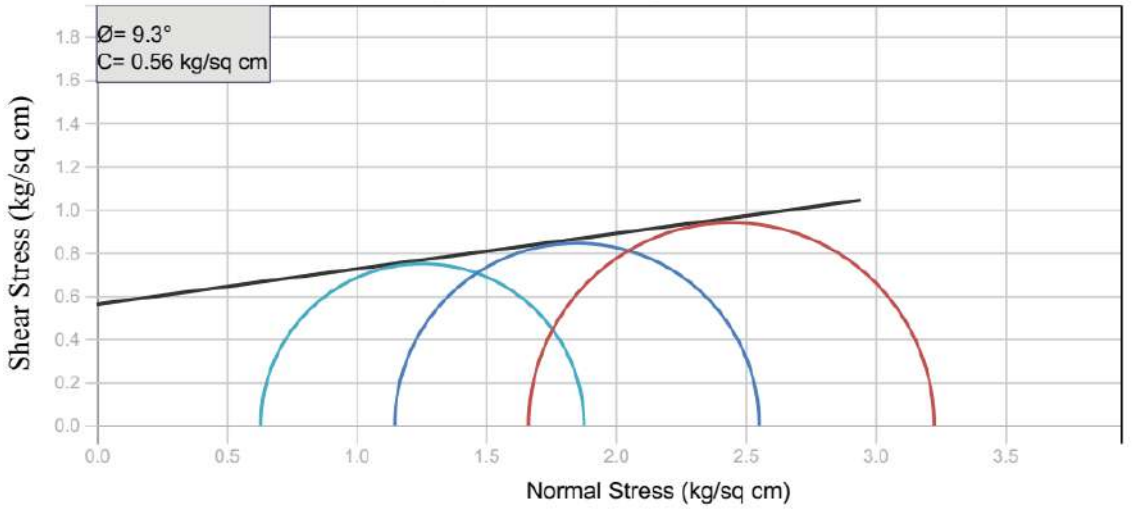


APPENDIX-G
GRAPH 17: UU GRAPH

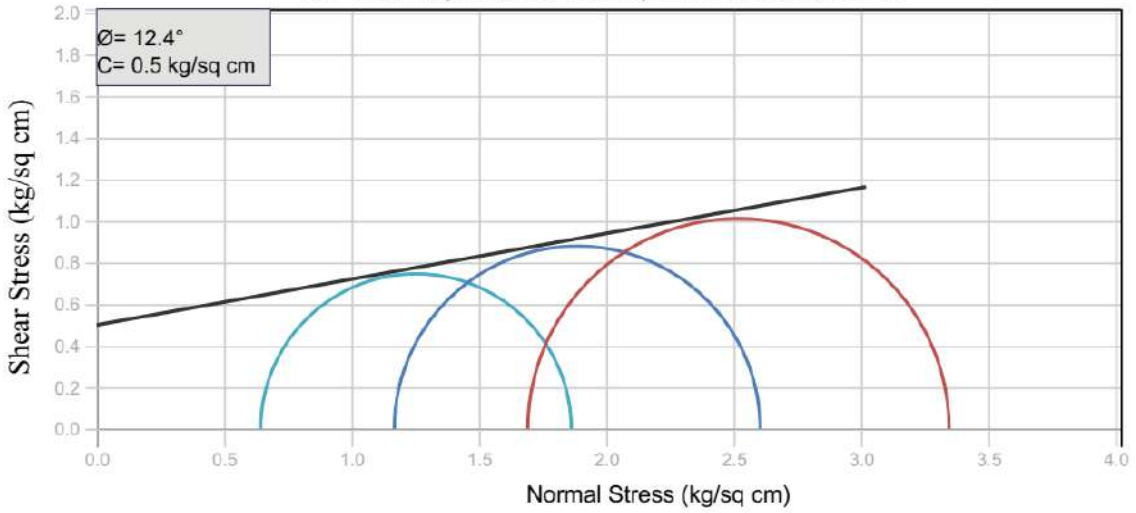
1901-HRIDC-IV-22854.687
BH-NO.P74, DEPTH-17.00M, TRIAXIAL GRAPH



1901-HRIDC-IV-22880.887
BH-NO.P75, DEPTH-23.00M, TRIAXIAL GRAPH



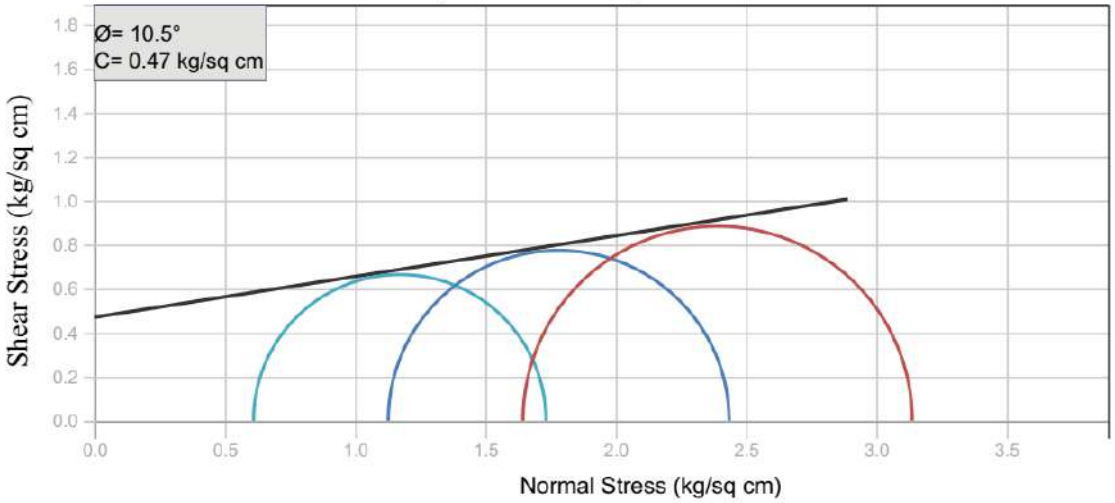
1901-HRIDC-IV-22907.087
BH-NO.P76, DEPTH-4.00M, TRIAXIAL GRAPH



APPENDIX-G

GRAPH 18: APPENDIX-G

1901-HRIDC-IV-22907.087
BH-NO.P76, DEPTH-7.00M, TRIAXIAL GRAPH



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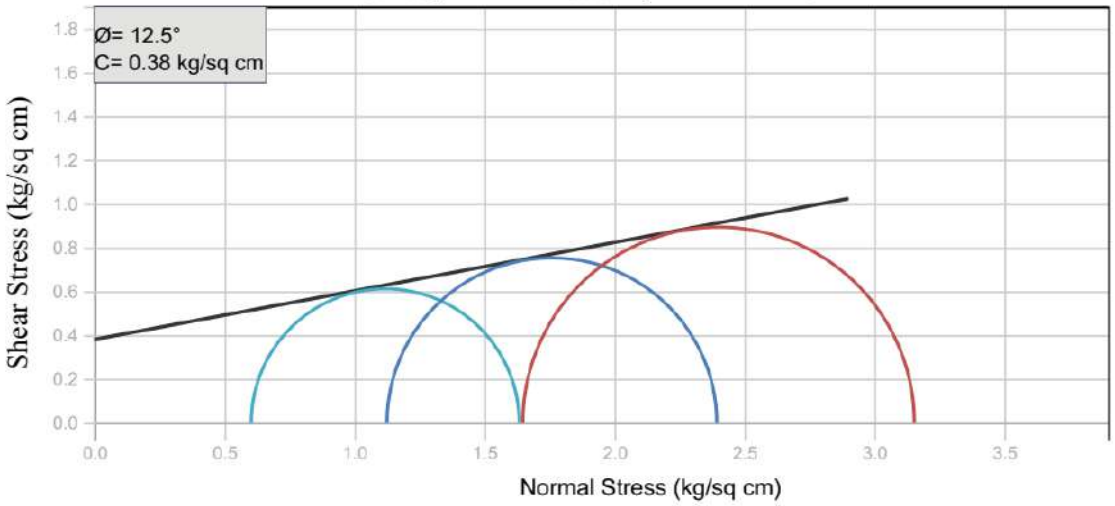
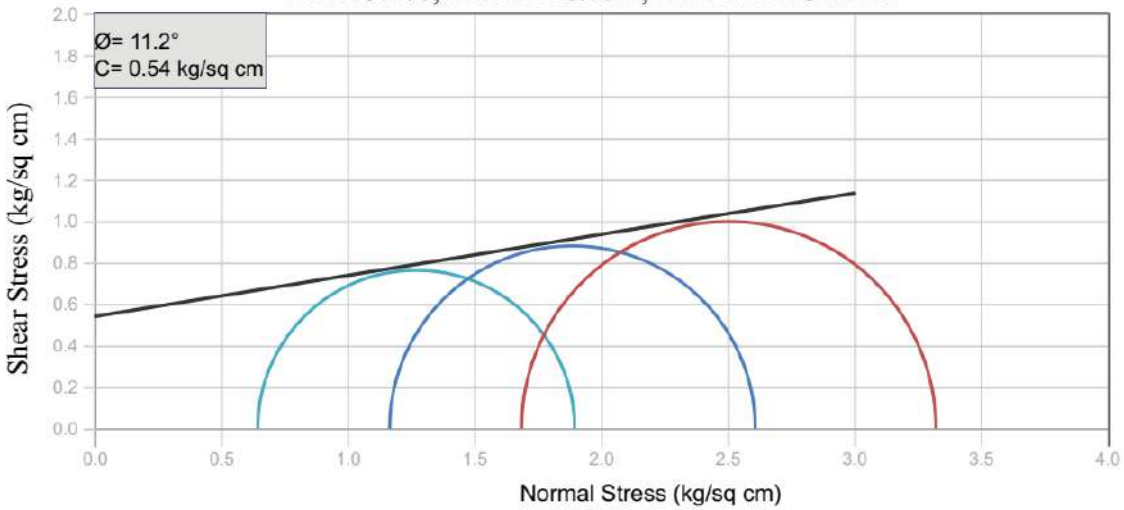


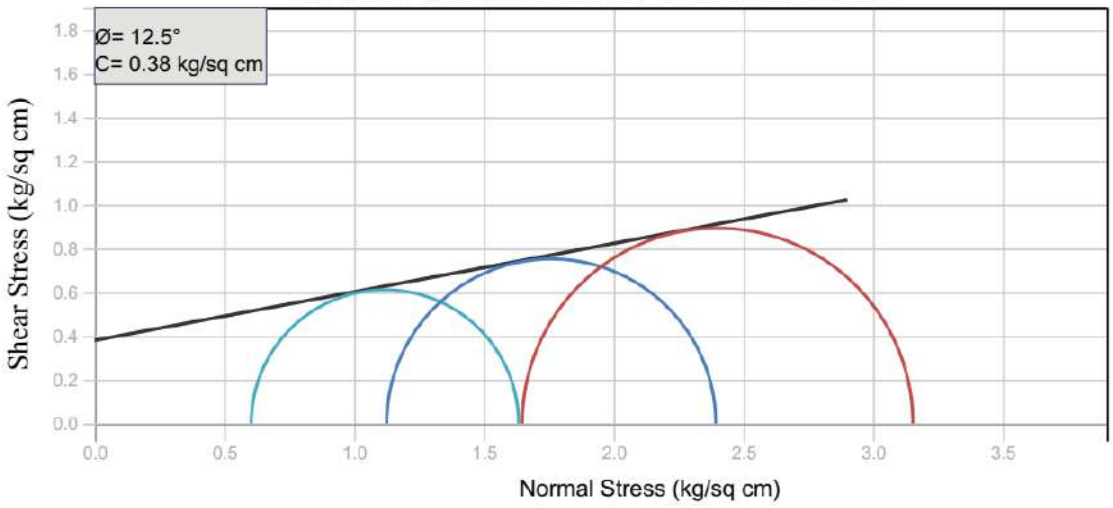
1901-HRIDC-IV-22907.087
BH-NO.P76, DEPTH-28.00M, TRIAXIAL GRAPH



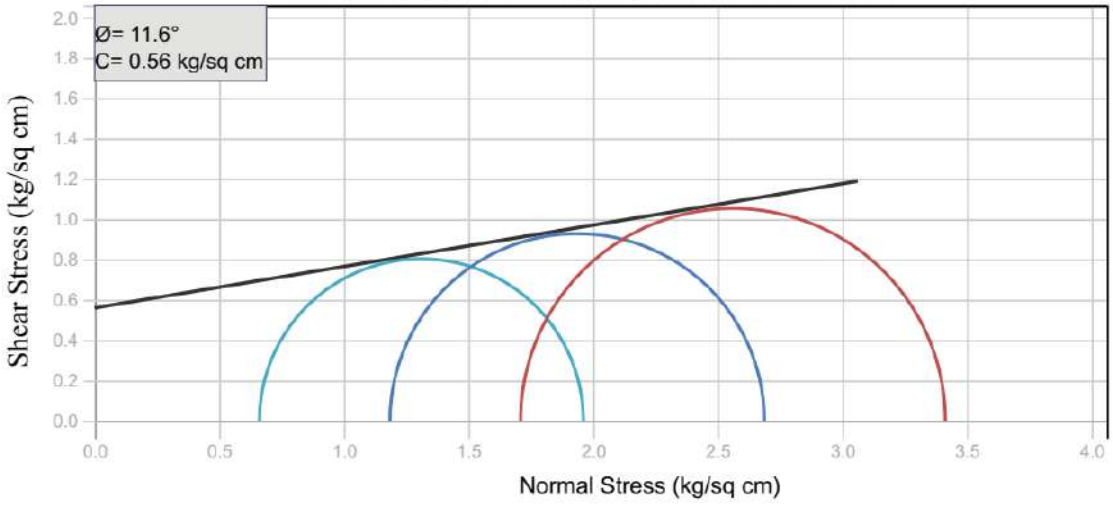
APPENDIX-G

GRAPH 19: APPENDIX-G

1901-HRIDC-IV-22933.287
BH-NO.P77, DEPTH-10.00M, TRIAXIAL GRAPH



1901-HRIDC-IV-22933.287
BH-NO.P77, DEPTH-19.00M, TRIAXIAL GRAPH



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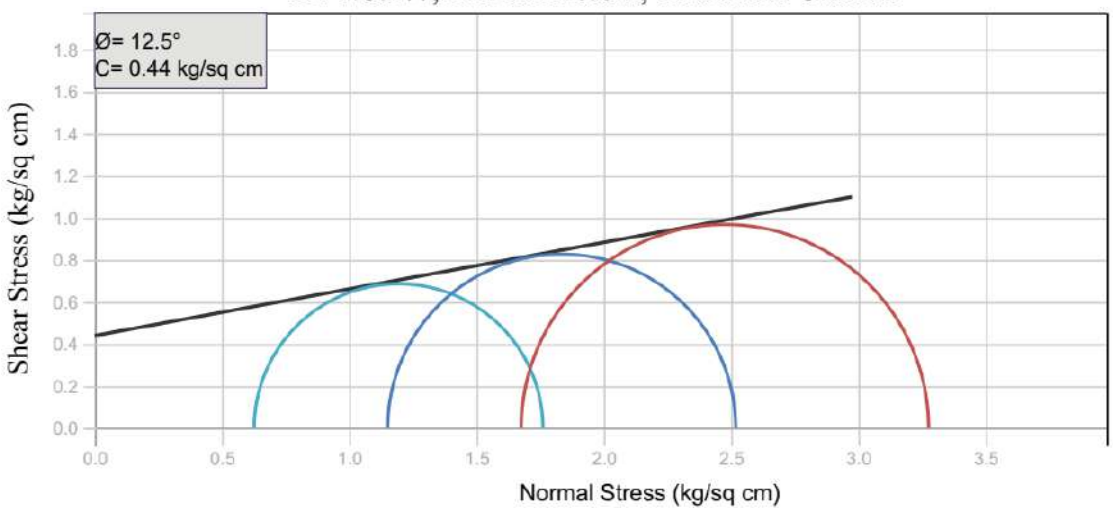
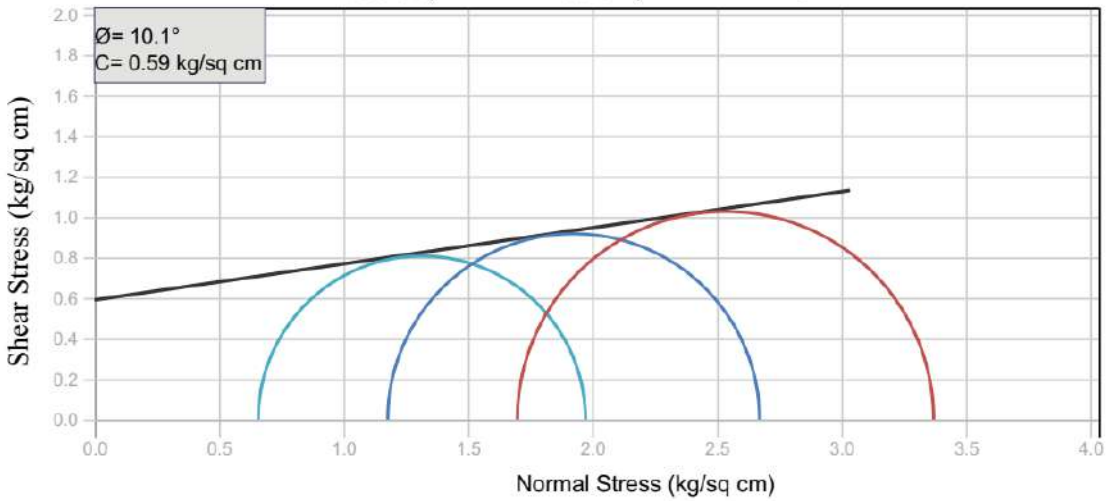
BH-NO.P77, DEPTH-22.00M, TRIAXIAL GRAPH

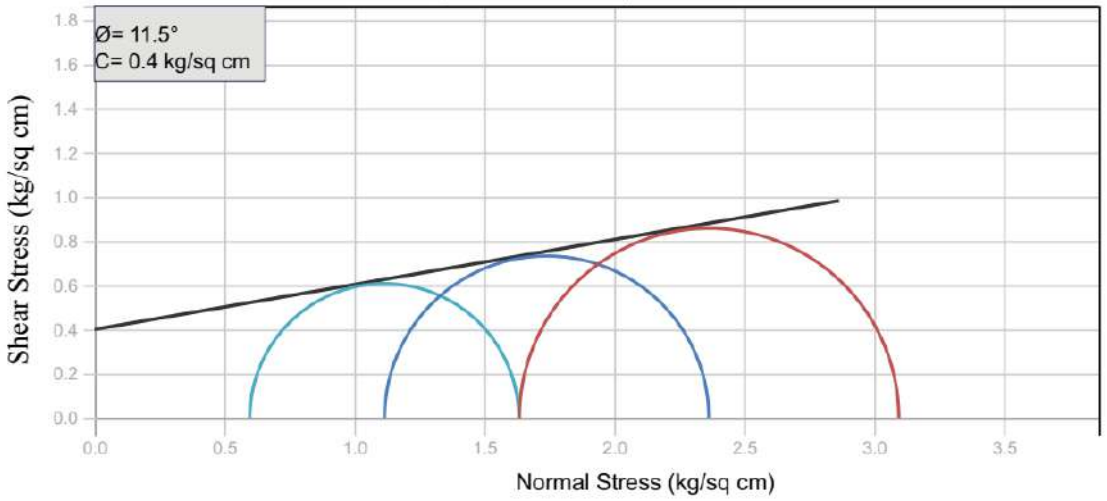


APPENDIX-G
GRAPH 20: UU GRAPH

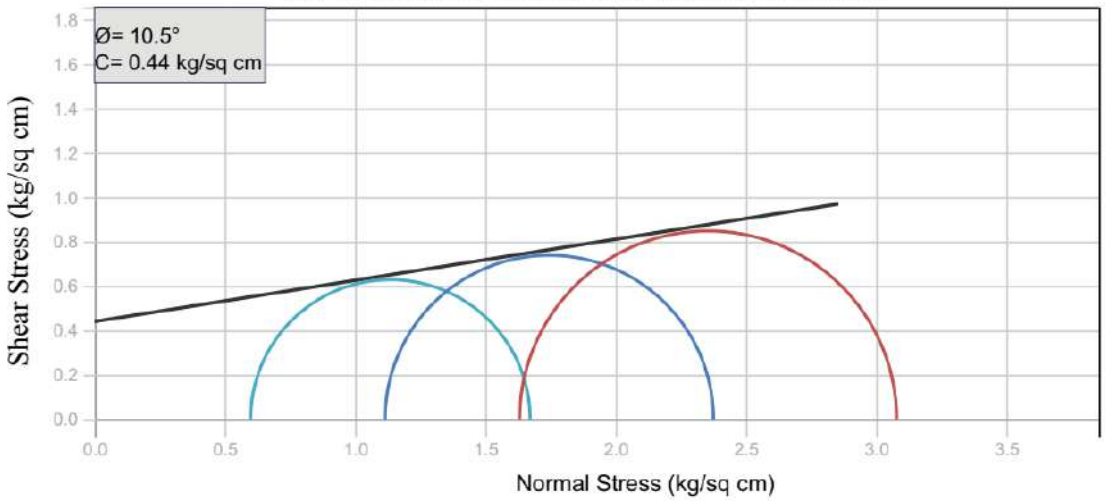
1901-HRIDC-IV-22933.287
BH-NO.P77, DEPTH-28.00M, TRIAXIAL GRAPH



1901-HRIDC-IV-22954.487
BH-NO.P78, DEPTH-8.00M, TRIAXIAL GRAPH

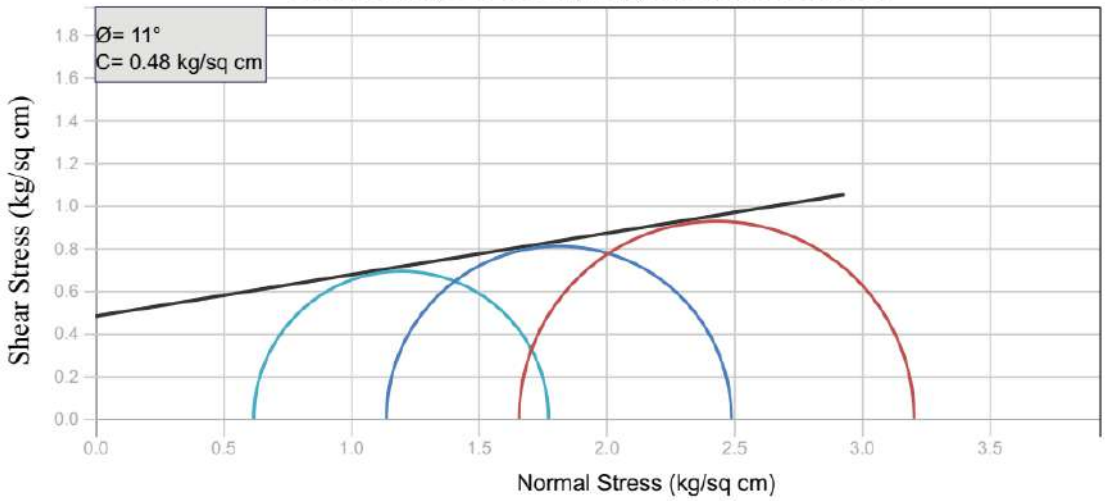


1901-HRIDC-IV-22954.487
BH-NO.P78, DEPTH-11.00M, TRIAXIAL GRAPH

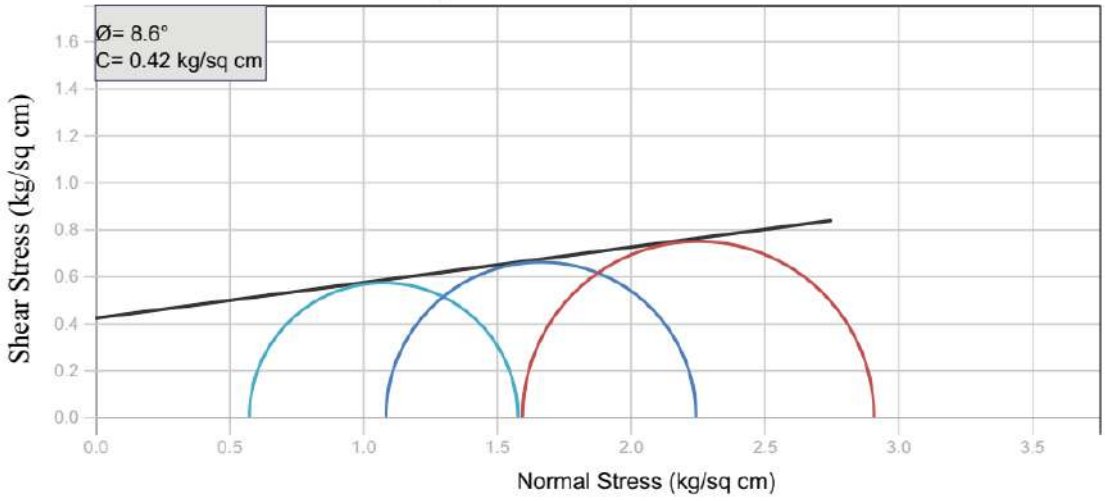


APPENDIX-G
GRAPH 21: UU GRAPH

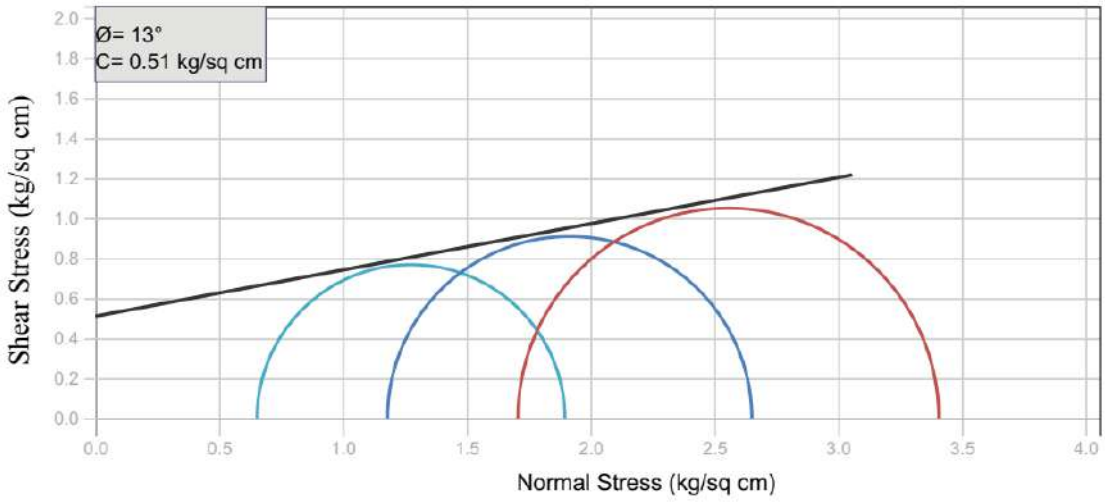
1901-HRIDC-IV-22954.487
BH-NO.P78, DEPTH-20.00M, TRIAXIAL GRAPH



1901-HRIDC-IV-22985.687
BH-NO.P79, DEPTH-4.00M, TRIAXIAL GRAPH

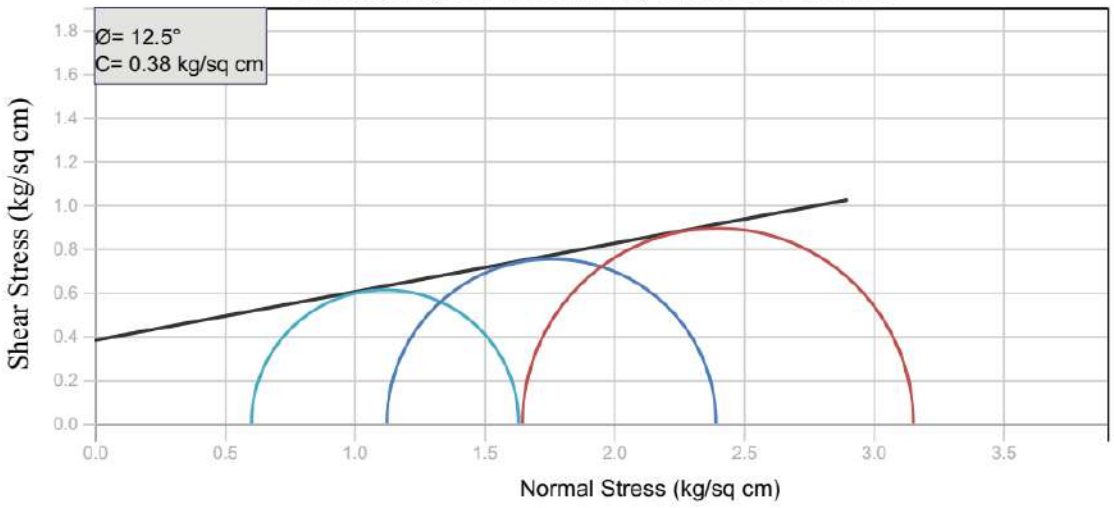


1901-HRIDC-IV-22985.687
BH-NO.P79, DEPTH-7.00M, TRIAXIAL GRAPH

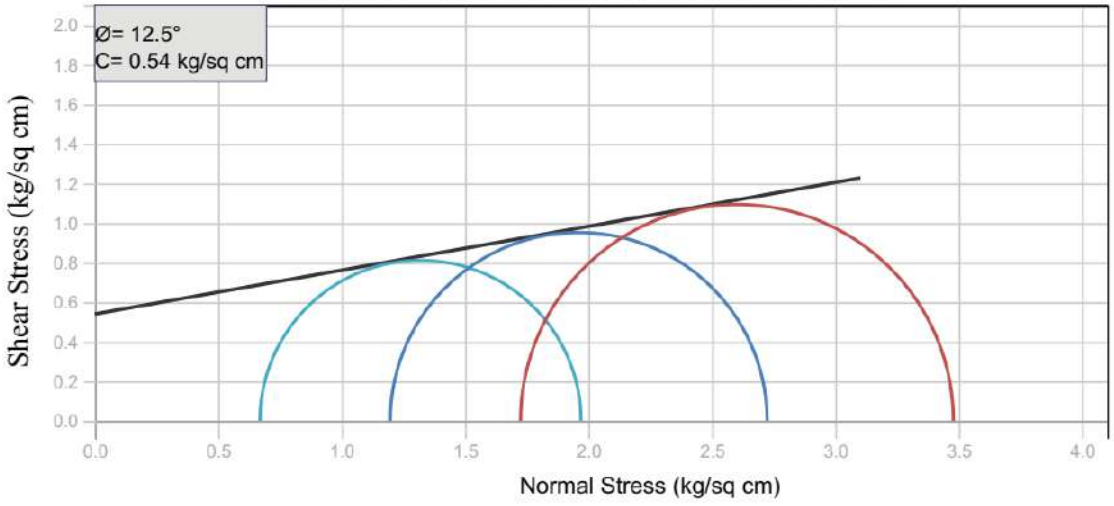


APPENDIX-G
GRAPH 22: UU GRAPH

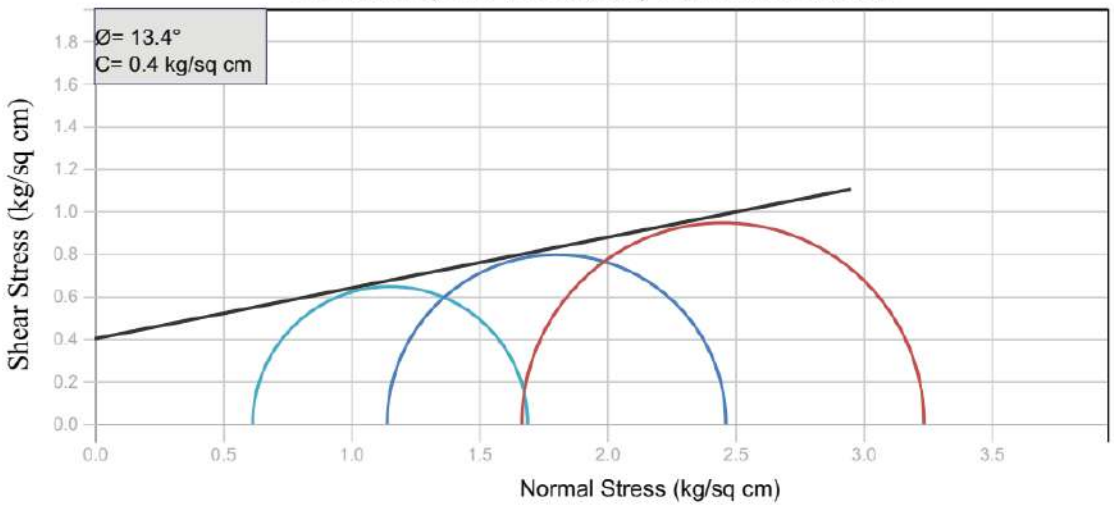
1901-HRIDC-IV-22985.687
BH-NO.P79, DEPTH-13.00M, TRIAXIAL GRAPH



1901-HRIDC-IV-22985.687
BH-NO.P79, DEPTH-22.00M, TRIAXIAL GRAPH

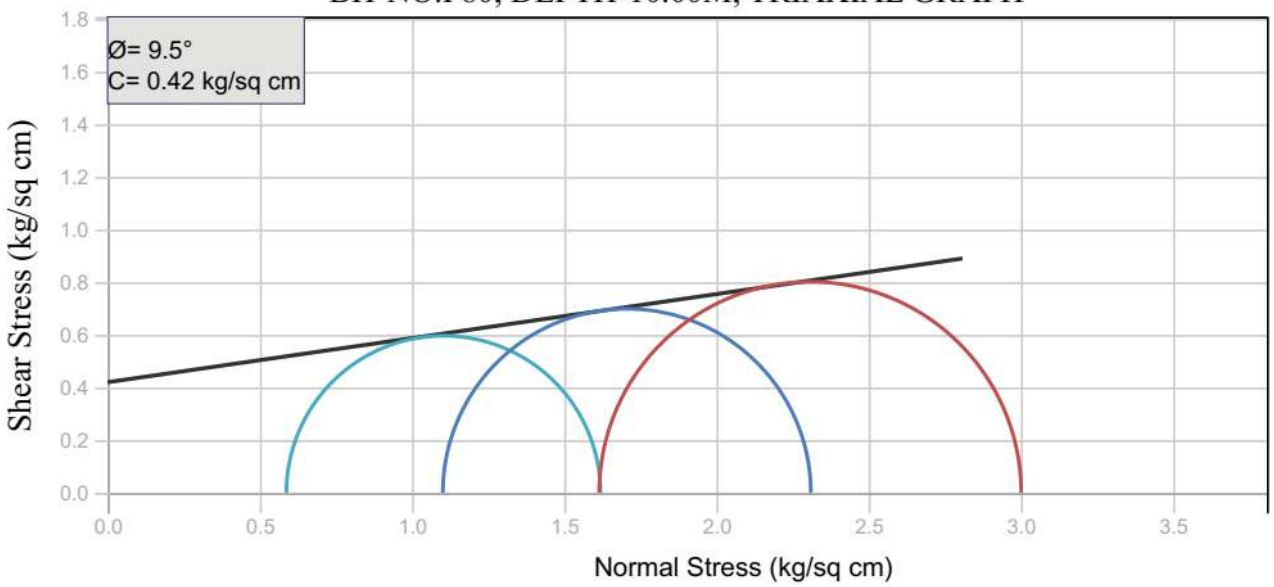


1901-HRIDC-IV-22985.687
BH-NO.P79, DEPTH-25.00M, TRIAXIAL GRAPH



APPENDIX-G
GRAPH 23: UU GRAPH

1901-HRIDC-IV-23011.887
BH-NO.P80, DEPTH-10.00M, TRIAXIAL GRAPH



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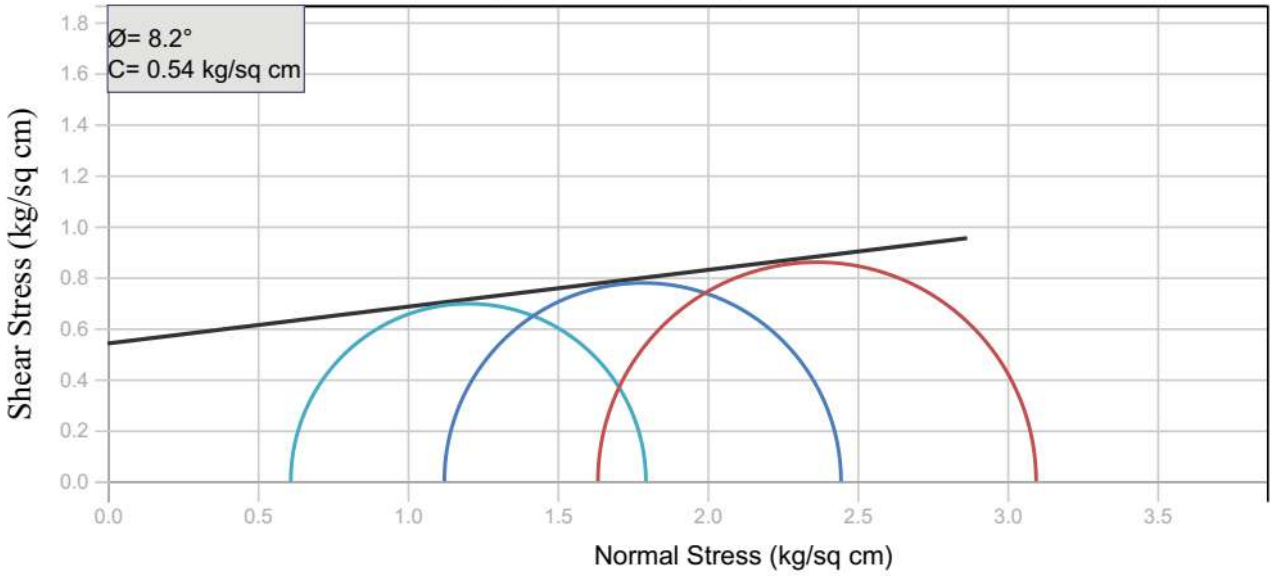
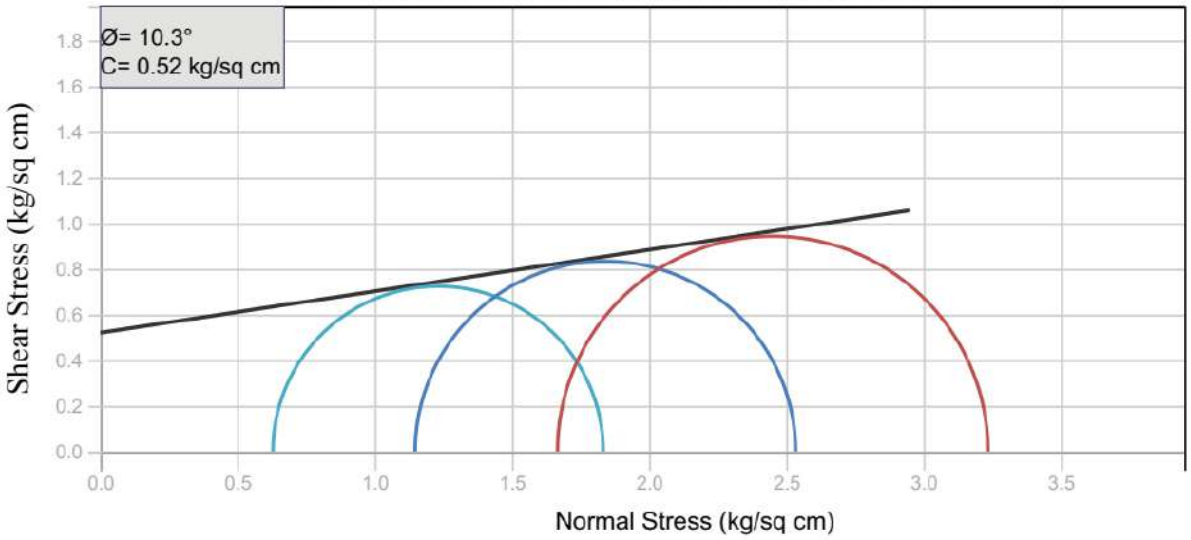
BH-NO.P80, DEPTH-13.00M, TRIAXIAL GRAPH

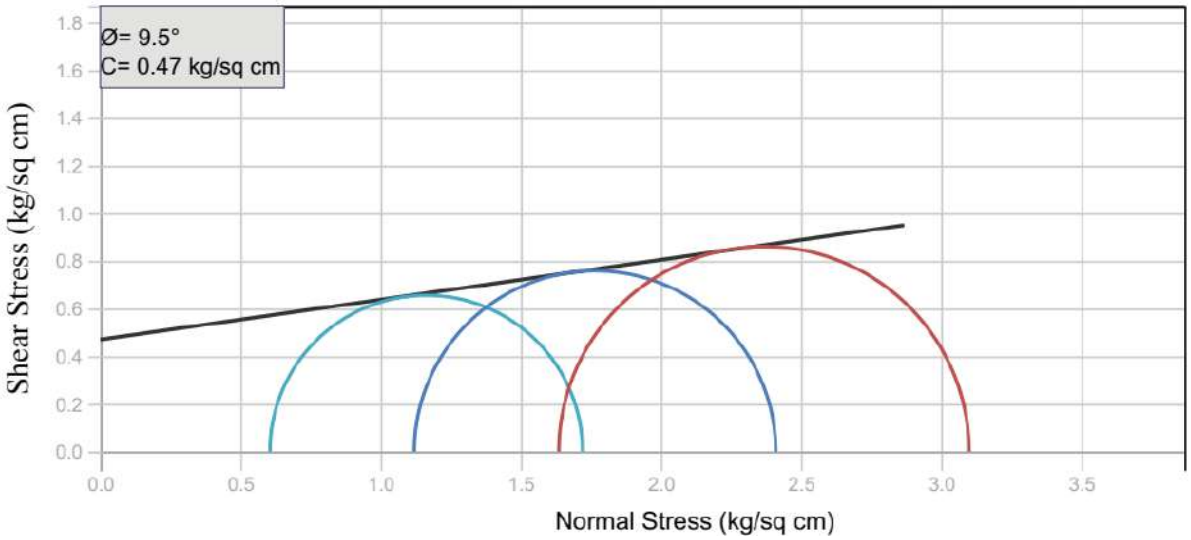


APPENDIX-G
GRAPH 24: UU GRAPH

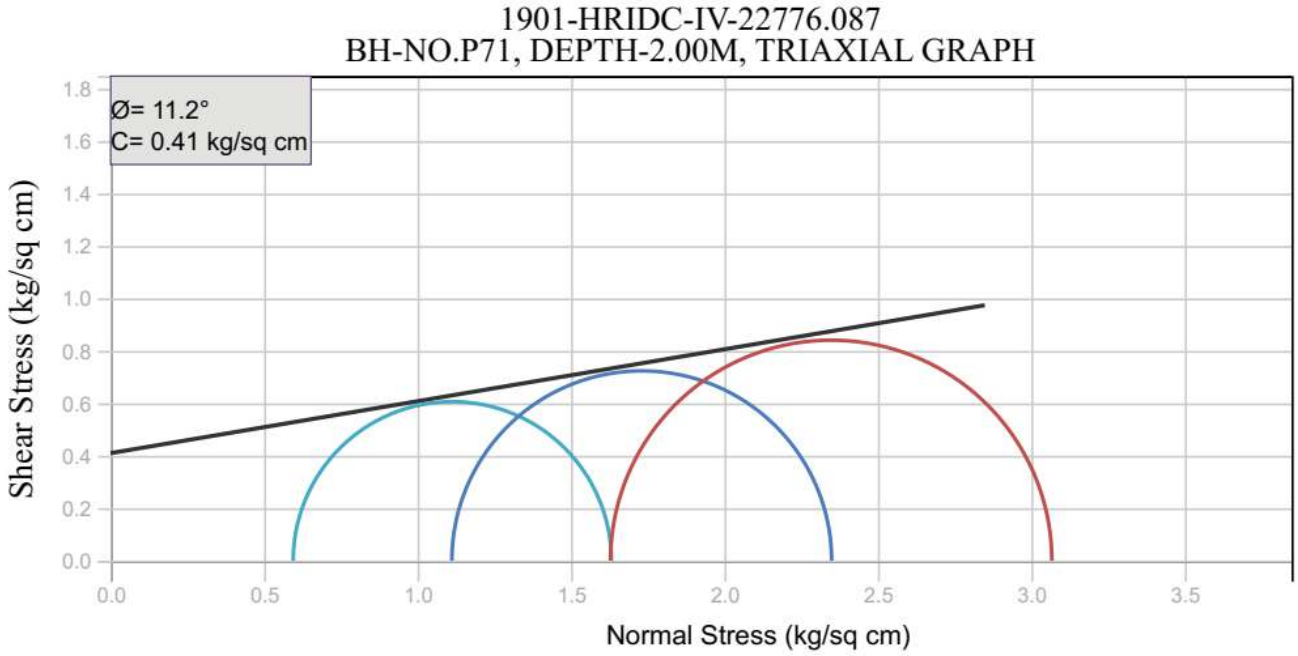
1901-HRIDC-IV-23011.887
BH-NO.P80, DEPTH-16.00M, TRIAXIAL GRAPH

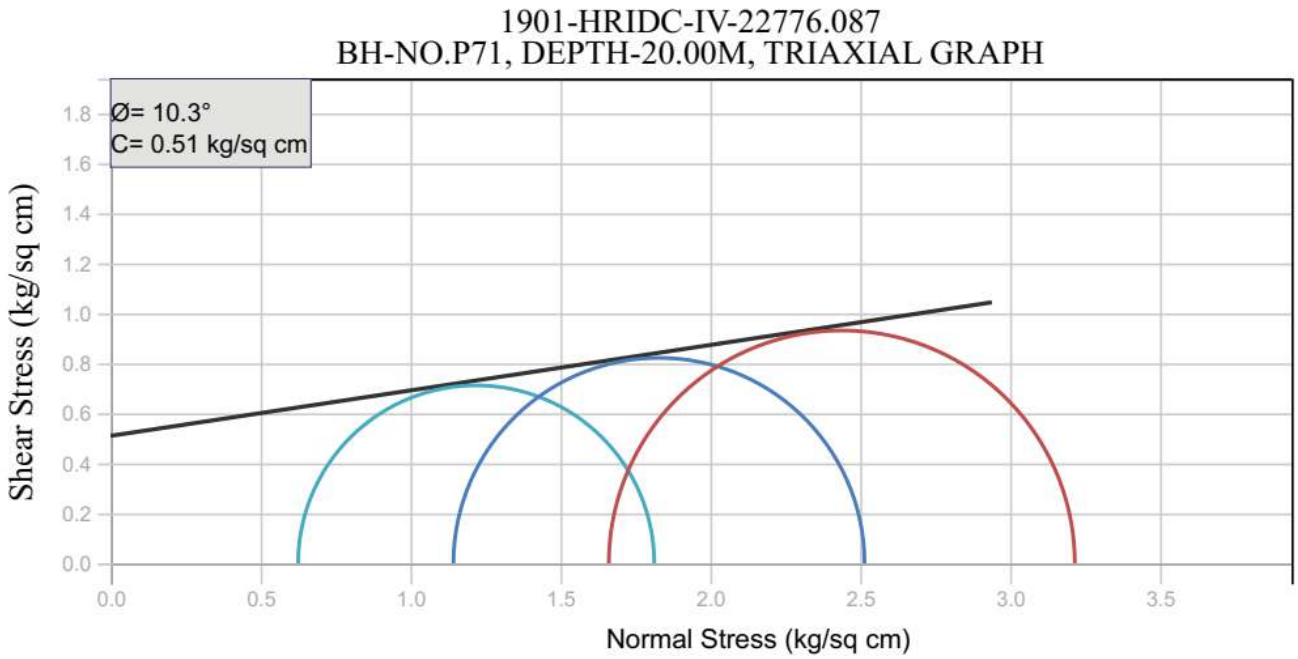


1901-HRIDC-IV-23011.887
BH-NO.P80, DEPTH-22.00M, TRIAXIAL GRAPH

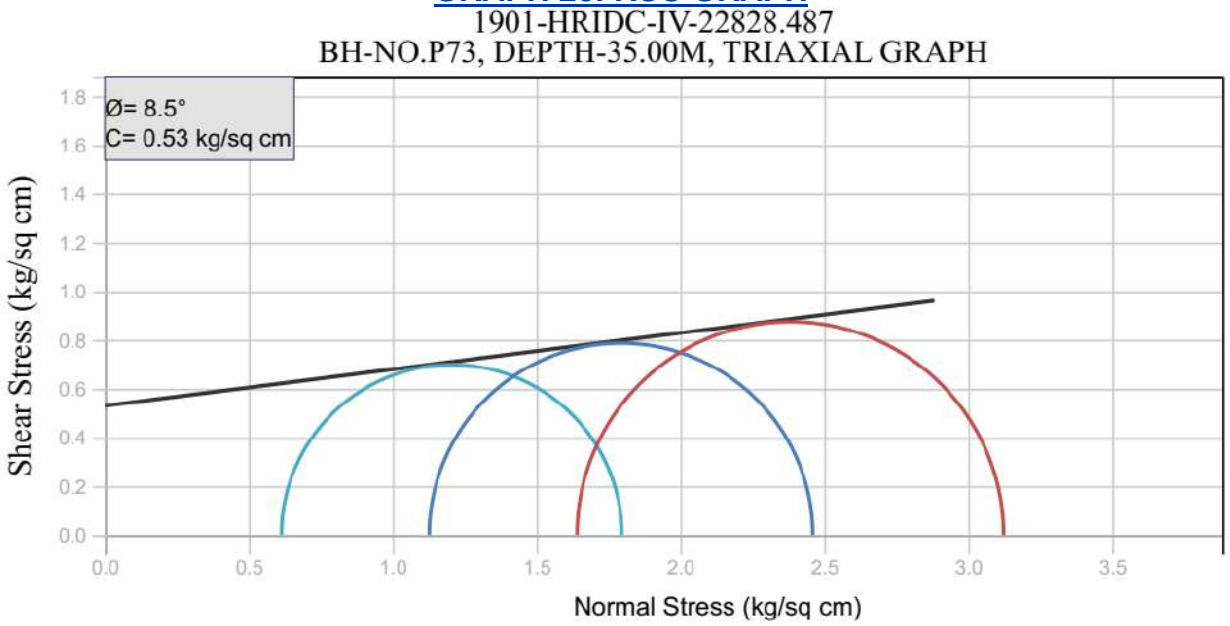


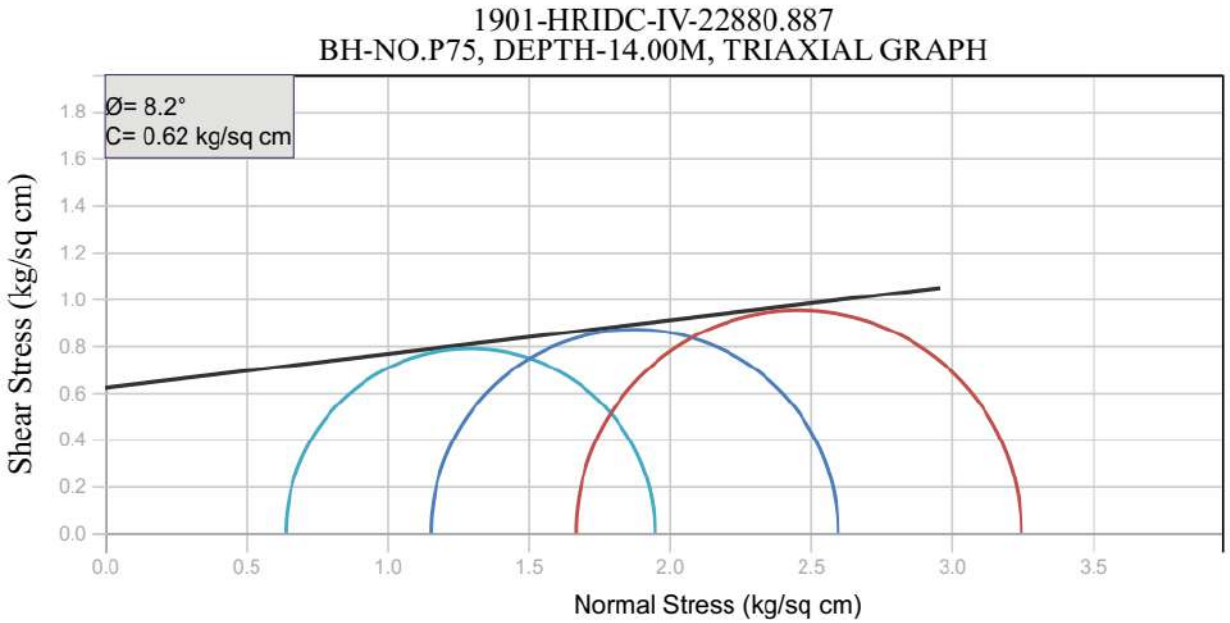
APPENDIX-G
GRAPH 25: RUU GRAPH





APPENDIX-G
GRAPH 26: RUU GRAPH





APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
BORE NO: P61, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	21.20	11.20	30.80	1.57	6.4	6.4	1.0	5.43	0	66	1.0	103.7	0	3.0	9.4	54	11.20	2.36	1.13	33.6	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	5.00	4.00	2.00	2.50	21.20	11.20	44.80	6.29	9.4	9.4	1.0	46.62	0	54	1.0	339.4	0	5.0	26.9	3	11.20	14.28	15.26	56.0	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.50	21.20	11.20	61.60	3.14	26.9	26.9	1.0	98.22	0	3	1.0	9.4	0	6.0	26.9	3	8.55	14.28	15.26	67.2	0	0.0	41.2	41.2	**0.00**	**13.74**
6.00	8.00	7.00	2.00	5.50	18.55	8.55	75.75	6.29	26.9	26.9	1.0	241.56	0	3	1.0	18.9	0	8.0	26.9	3	8.55	14.28	15.26	84.3	0	0.0	64.8	64.8	**0.00**	**21.60**
8.00	9.00	8.50	1.00	6.50	18.55	8.55	88.58	3.14	26.9	26.9	1.0	141.23	0	3	1.0	9.4	0	9.0	24.7	13	8.55	9.78	10.55	92.9	841.15	841.1	76.6	76.6	**336.46**	**25.53**
9.00	10.00	9.50	1.00	7.50	18.55	8.55	97.13	3.14	24.7	24.7	1.0	140.40	140.40	13	1.0	40.9	40.86	10.0	24.7	13	10.06	9.78	10.55	101.4	913.13	1094.4	88.4	269.6	**437.76**	**89.87**
10.00	11.00	10.50	1.00	8.50	20.06	10.06	106.43	3.14	24.7	24.7	1.0	153.85	294.25	13	1.0	40.9	81.71	11.0	24.7	10	10.06	9.78	10.55	111.5	969.25	1345.2	100.1	476.1	**538.09**	**158.70**
11.00	12.00	11.50	1.00	9.50	20.06	10.06	116.49	3.14	24.7	24.7	1.0	168.39	462.64	10	1.0	31.4	113.14	12.0	24.7	10	10.06	9.78	10.55	121.5	1046.59	1622.4	111.9	687.7	**648.95**	**229.23**
12.00	13.00	12.50	1.00	10.50	20.06	10.06	126.55	3.14	24.7	24.7	1.0	182.93	645.58	10	1.0	31.4	144.57	13.0	10.5	42	10.44	2.62	1.36	131.6	573.15	1363.3	123.7	913.8	**545.32**	**304.62**
13.00	14.50	13.75	1.50	12.00	20.44	10.44	139.41	4.71	10.5	10.5	1.0	121.81	767.38	42	1.0	198.0	342.57	14.5	11.2	52	11.03	2.82	1.56	147.2	701.05	1811.0	141.4	1251.3	**724.40**	**417.11**
14.50	17.50	16.00	3.00	15.00	21.03	11.03	139.41	9.43	11.2	11.2	1.0	260.27	1027.65	52	1.0	490.3	832.86	17.5	9.0	50	11.03	2.29	1.07	147.2	623.12	2483.6	176.7	2037.2	**993.45**	**679.07**
17.50	19.00	18.25	1.50	16.50	21.03	11.03	139.41	4.71	9.0	9.0	1.0	104.09	1131.74	50	1.0	235.7	1068.57	19.0	8.1	43	11.14	2.13	0.93	147.2	554.32	2754.6	194.4	2394.7	**1101.85**	**798.23**
19.00	20.50	19.75	1.50	18.00	21.14	11.14	139.41	4.71	8.1	8.1	1.0	93.54	1225.28	43	1.0	202.7	1271.29	20.5	8.1	43	11.14	2.13	0.93	147.2	554.32	3050.9	212.1	2708.6	**1220.35**	**902.87**
20.50	22.00	21.25	1.50	19.50	21.14	11.14	139.41	4.71	8.1	8.1	1.0	93.54	1318.82	43	1.0	202.7	1474.00	22.0	23.7	18	10.70	9.06	9.45	147.2	1215.62	4008.4	229.7	3022.5	**1603.37**	**1007.51**
22.00	23.50	22.75	1.50	21.00	20.70	10.70	139.41	4.71	23.7	23.7	1.0	288.50	1607.31	18	1.0	84.9	1558.86	23.5	23.7	18	10.70	9.06	9.45	147.2	1215.62	4381.8	247.4	3413.6	**1752.72**	**1137.86**
23.50	25.00	24.25	1.50	22.50	20.70	10.70	139.41	4.71	23.7	23.7	1.0	288.50	1895.81	18	1.0	84.9	1643.71	25.0	5.5	42	10.16	1.66	0.53	147.2	491.15	4030.7	265.1	3804.6	**1612.27**	**1268.20**
25.00	26.50	25.75	1.50	24.00	20.16	10.16	139.41	4.71	5.5	5.5	1.0	63.28	1959.10	42	1.0	198.0	1841.71	26.5	5.5	42	10.16	1.66	0.53	147.2	491.15	4292.0	282.7	4083.6	**1716.78**	**1361.18**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
26.50	27.50	27.00	1.00	25.00	20.16	10.16	139.41	3.14	5.5	5.5	1.0	42.19	2001.28	42	1.0	132.0	1973.71	27.5	5.5	42	10.16	1.66	0.53	147.2	491.15	4466.1	294.5	4269.5	**1786.46**	**1423.17**
27.50	28.00	27.75	0.50	25.50	20.16	10.16	139.41	1.57	5.5	5.5	1.0	21.09	2022.38	42	1.0	66.0	2039.71	28.0	8.5	72	11.03	2.20	0.99	147.2	767.94	4830.0	300.4	4362.5	**1932.01**	**1454.17**
28.00	29.50	28.75	1.50	27.00	21.03	11.03	139.41	4.71	8.5	8.5	1.0	98.22	2120.60	72	1.0	339.4	2379.14	29.5	23.0	10	11.03	8.56	8.68	147.2	1098.64	5598.4	318.1	4817.8	**2239.35**	**1605.94**
29.50	30.00	29.75	0.50	27.50	21.03	11.03	139.41	1.57	23.0	23.0	1.0	92.99	2213.59	10	1.0	15.7	2394.86	30.0	23.0	10	11.03	8.56	8.68	147.2	1098.64	5707.1	324.0	4932.4	**2282.83**	**1644.14**
30.00	31.00	30.50	1.00	28.50	21.03	11.03	139.41	3.14	23.0	23.0	1.0	185.98	2399.57	10	1.0	31.4	2426.29	31.0	12.8	49	11.03	3.29	2.02	147.2	736.06	5561.9	335.8	5161.6	**2224.77**	**1720.54**
31.00	32.50	31.75	1.50	30.00	21.03	11.03	139.41	4.71	12.8	12.8	1.0	149.32	2548.89	49	1.0	231.0	2657.29	32.5	13.5	49	8.70	3.50	2.22	147.2	759.00	5965.2	353.4	5559.6	**2386.07**	**1853.20**
32.50	34.00	33.25	1.50	31.50	18.70	8.70	139.41	4.71	13.5	13.5	1.0	157.78	2706.67	49	1.0	231.0	2888.29	34.0	13.5	49	8.84	3.50	2.22	147.2	759.12	6354.1	371.1	5966.1	**2541.63**	**1988.69**
34.00	35.00	34.50	1.00	32.50	18.84	8.84	139.41	3.14	13.5	13.5	1.0	105.19	2811.86	49	1.0	154.0	3042.29	35.0	13.5	49	8.84	3.50	2.22	147.2	759.12	6613.3	382.9	6237.0	**2645.31**	**2079.01**
35.00	35.50	35.25	0.50	33.00	18.84	8.84	139.41	1.57	13.5	13.5	1.0	52.59	2864.46	49	1.0	77.0	3119.29	35.5	13.5	49	9.35	3.50	2.22	147.2	759.57	6743.3	388.8	6372.5	**2697.33**	**2124.17**
35.50	37.00	36.25	1.50	34.50	19.35	9.35	139.41	4.71	13.5	13.5	1.0	157.78	3022.24	49	1.0	231.0	3350.29	37.0	9.3	60	9.02	2.34	1.11	147.2	699.40	7071.9	406.4	6779.0	**2828.77**	**2259.66**
37.00	37.50	37.25	0.50	35.00	19.02	9.02	139.41	1.57	9.3	9.3	1.0	35.87	3058.12	60	1.0	94.3	3444.57	37.5	8.0	60	9.02	2.11	0.91	147.2	671.62	7174.3	412.3	6915.0	**2869.72**	**2305.01**
37.50	38.50	38.00	1.00	36.00	19.02	9.02	139.41	3.14	8.0	8.0	1.0	61.58	3119.69	60	1.0	188.6	3633.14	38.5	8.0	60	8.60	2.11	0.91	147.2	671.47	7424.3	424.1	7177.0	**2969.72**	**2392.32**
38.50	40.00	39.25	1.50	37.50	18.60	8.60	139.41	4.71	8.0	8.0	1.0	92.37	3212.06	60	1.0	282.9	3916.00	40.0	8.0	60	8.60	2.11	0.91	147.2	671.47	7799.5	441.8	7569.8	**3119.81**	**2523.28**
BORE NO: P62, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.82	9.82	27.01	1.57	7.5	7.5	1.0	5.59	5.59	46	1.0	72.3	72.29	3.0	14.3	46	9.82	3.74	2.45	29.5	421.24	499.1	5.9	83.8	**199.64**	**27.92**
3.00	4.00	3.50	1.00	1.50	19.82	9.82	34.37	3.14	14.3	14.3	1.0	27.53	33.12	46	1.0	144.6	216.86	4.0	29.9	5	9.01	21.03	22.17	39.3	763.01	1013.0	17.7	267.6	**405.19**	**89.22**
4.00	6.00	5.00	2.00	3.50	19.01	9.01	48.29	6.29	29.9	29.9	1.0	174.54	207.66	5	1.0	31.4	248.29	6.0	29.9	5	9.01	21.03	22.17	57.3	1060.83	1516.8	41.2	497.2	**606.71**	**165.73**
6.00	7.00	6.50	1.00	4.50	19.01	9.01	61.81	3.14	29.9	29.9	1.0	111.70	319.36	5	1.0	15.7	264.00	7.0	28.2	0	9.01	17.21	18.25	66.3	961.06	1544.4	53.0	636.4	**617.77**	**212.12**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
7.00	9.00	8.00	2.00	6.50	19.01	9.01	75.32	6.29	28.2	28.2	1.0	253.86	573.21	0	1.0	0.0	264.00	9.0	25.2	11	8.08	10.45	11.34	84.3	806.22	1643.4	76.6	913.8	**657.37**	**304.60**
9.00	10.00	9.50	1.00	7.50	18.08	8.08	88.37	3.14	25.2	25.2	1.0	130.69	703.91	11	1.0	34.6	298.57	10.0	25.2	11	8.08	10.45	11.34	92.4	872.56	1875.0	88.4	1090.8	**750.02**	**363.61**
10.00	11.00	10.50	1.00	8.50	18.08	8.08	96.45	3.14	25.2	25.2	1.0	142.64	846.55	11	1.0	34.6	333.14	11.0	25.2	11	8.08	10.45	11.34	100.5	938.91	2118.6	100.1	1279.8	**847.44**	**426.61**
11.00	12.50	11.75	1.50	10.00	18.08	8.08	106.55	4.71	25.2	25.2	1.0	236.37	1082.92	11	1.0	51.9	385.00	12.5	25.2	11	8.08	10.45	11.34	112.6	1038.43	2506.3	117.8	1585.7	**1002.54**	**528.57**
12.50	14.00	13.25	1.50	11.50	18.08	8.08	118.67	4.71	25.2	25.2	1.0	263.25	1346.17	11	1.0	51.9	436.86	14.0	8.1	40	9.43	2.13	0.93	124.7	494.84	2277.9	135.5	1918.5	**911.15**	**639.50**
14.00	15.50	14.75	1.50	13.00	19.43	9.43	131.80	4.71	8.1	8.1	1.0	88.43	1434.60	40	1.0	188.6	625.43	15.5	8.7	40	9.43	2.24	1.02	124.7	505.77	2565.8	153.2	2213.2	**1026.32**	**737.73**
15.50	17.00	16.25	1.50	14.50	19.43	9.43	131.80	4.71	8.7	8.7	1.0	95.08	1529.68	40	1.0	188.6	814.00	17.0	11.3	40	11.01	2.85	1.59	124.7	569.26	2912.9	170.8	2514.5	**1165.18**	**838.17**
17.00	18.50	17.75	1.50	16.00	21.01	11.01	131.80	4.71	11.3	11.3	1.0	124.16	1653.84	40	1.0	188.6	1002.57	18.5	11.3	40	10.85	2.85	1.59	124.7	569.16	3225.6	188.5	2844.9	**1290.23**	**948.30**
18.50	21.50	20.00	3.00	19.00	20.85	10.85	131.80	9.43	11.3	11.3	1.0	248.32	1902.16	40	1.0	377.1	1379.71	21.5	11.0	45	8.53	2.76	1.51	124.7	594.14	3876.0	223.8	3505.7	**1550.40**	**1168.57**
21.50	24.50	23.00	3.00	22.00	18.53	8.53	131.80	9.43	11.0	11.0	1.0	241.56	2143.72	45	1.0	424.3	1804.00	24.5	9.6	45	8.53	2.40	1.16	124.7	557.11	4504.8	259.2	4206.9	**1801.93**	**1402.30**
24.50	26.00	25.25	1.50	23.50	18.53	8.53	131.80	4.71	9.6	9.6	1.0	105.09	2248.81	45	1.0	212.1	2016.14	26.0	25.7	14	9.19	11.58	12.49	124.7	1278.61	5543.6	276.9	4541.8	**2217.43**	**1513.94**
26.00	27.50	26.75	1.50	25.00	19.19	9.19	131.80	4.71	25.7	25.7	1.0	299.04	2547.85	14	1.0	66.0	2082.14	27.5	9.5	52	9.19	2.38	1.14	124.7	605.09	5235.1	294.5	4924.5	**2094.03**	**1641.51**
27.50	30.00	28.75	2.50	27.50	19.19	9.19	131.80	7.86	9.5	9.5	1.0	173.30	2721.15	52	1.0	408.6	2490.71	30.0	9.5	52	9.95	2.38	1.14	124.7	605.43	5817.3	324.0	5535.8	**2326.92**	**1845.28**
30.00	30.50	30.25	0.50	28.00	19.95	9.95	131.80	1.57	9.5	9.5	1.0	34.66	2755.81	52	1.0	81.7	2572.43	30.5	27.8	0	8.66	16.31	17.33	124.7	1656.92	6985.2	329.9	5658.1	**2794.06**	**1886.03**
30.50	32.50	31.50	2.00	30.00	18.66	8.66	131.80	6.29	27.8	27.8	1.0	436.80	3192.61	0	1.0	0.0	2572.43	32.5	28.3	0	8.66	17.43	18.48	124.7	1771.19	7536.2	353.4	6118.5	**3014.49**	**2039.49**
32.50	33.50	33.00	1.00	31.00	18.66	8.66	131.80	3.14	28.3	28.3	1.0	223.04	3415.65	0	1.0	0.0	2572.43	33.5	25.3	0	8.89	10.68	11.57	124.7	1086.64	7074.7	365.2	6353.3	**2829.89**	**2117.76**
33.50	35.00	34.25	1.50	32.50	18.89	8.89	131.80	4.71	25.3	25.3	1.0	293.71	3709.37	0	1.0	0.0	2572.43	35.0	25.3	0	8.89	10.68	11.57	124.7	1086.64	7368.4	382.9	6664.7	**2947.38**	**2221.56**
35.00	36.50	35.75	1.50	34.00	18.89	8.89	131.80	4.71	25.3	25.3	1.0	293.71	4003.08	0	1.0	0.0	2572.43	36.5	15.5	28	9.58	4.19	2.92	124.7	619.24	7194.8	400.6	6976.1	**2877.90**	**2325.35**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
36.50	37.50	37.00	1.00	35.00	19.58	9.58	131.80	3.14	15.5	15.5	1.0	114.88	4117.96	28	1.0	88.0	2660.43	37.5	15.5	28	9.58	4.19	2.92	124.7	619.24	7397.6	412.3	7190.7	**2959.05**	**2396.91**
37.50	38.00	37.75	0.50	35.50	19.58	9.58	131.80	1.57	15.5	15.5	1.0	57.44	4175.40	28	1.0	44.0	2704.43	38.0	23.0	10	9.58	8.56	8.68	124.7	942.30	7822.1	418.2	7298.1	**3128.85**	**2432.68**
38.00	40.00	39.00	2.00	37.50	19.58	9.58	131.80	6.29	23.0	23.0	1.0	351.67	4527.06	10	1.0	62.9	2767.29	40.0	8.1	45	9.58	2.13	0.93	124.7	530.25	7824.6	441.8	7736.1	**3129.84**	**2578.71**
BORE NO: P63, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	17.76	7.76	21.34	1.57	11.2	11.2	1.0	6.64	6.64	60	1.0	94.3	94.29	3.0	9.1	54	8.16	2.31	1.08	23.3	427.54	528.5	5.9	106.8	**211.39**	**35.61**
3.00	5.00	4.00	2.00	2.50	18.16	8.16	31.44	6.29	9.1	9.1	1.0	31.65	38.29	54	1.0	339.4	433.71	5.0	9.1	54	8.16	2.31	1.08	39.6	457.14	929.1	29.5	501.5	**371.66**	**167.15**
5.00	6.00	5.50	1.00	3.50	18.16	8.16	43.68	3.14	9.1	9.1	1.0	21.99	60.28	54	1.0	169.7	603.43	6.0	32.4	0	8.16	33.35	34.70	47.8	1362.70	2026.4	41.2	704.9	**810.57**	**234.98**
6.00	8.00	7.00	2.00	5.50	18.16	8.16	55.92	6.29	32.4	32.4	1.1	249.83	310.12	0	1.0	0.0	603.43	8.0	34.6	0	9.18	44.43	45.98	64.1	2402.90	3316.4	64.8	978.3	**1326.58**	**326.11**
8.00	9.00	8.50	1.00	6.50	19.18	9.18	68.67	3.14	34.6	34.6	1.2	183.13	493.25	0	1.0	0.0	603.43	9.0	34.6	0	9.18	44.43	45.98	73.3	2723.37	3820.0	76.6	1173.3	**1528.02**	**391.08**
9.00	10.00	9.50	1.00	7.50	19.18	9.18	77.85	3.14	34.6	34.6	1.2	207.61	700.85	0	1.0	0.0	603.43	10.0	25.0	12	9.18	10.00	10.88	82.4	771.84	2076.1	88.4	1392.6	**830.45**	**464.21**
10.00	11.00	10.50	1.00	8.50	19.18	9.18	87.03	3.14	25.0	25.0	1.0	127.55	828.40	12	1.0	37.7	641.14	11.0	25.0	12	9.18	10.00	10.88	91.6	843.97	2313.5	100.1	1569.7	**925.40**	**523.23**
11.00	12.00	11.50	1.00	9.50	19.18	9.18	96.21	3.14	25.0	25.0	1.0	141.00	969.40	12	1.0	37.7	678.86	12.0	7.5	55	9.18	2.02	0.84	100.8	551.92	2200.2	111.9	1760.2	**880.07**	**586.73**
12.00	13.00	12.50	1.00	10.50	19.18	9.18	105.39	3.14	7.5	7.5	1.0	43.61	1013.01	55	1.0	172.9	851.71	13.0	11.0	55	9.10	2.76	1.51	110.0	633.16	2497.9	123.7	1988.4	**999.15**	**662.81**
13.00	14.50	13.75	1.50	12.00	19.10	9.10	116.81	4.71	11.0	11.0	1.0	107.04	1120.04	55	1.0	259.3	1111.00	14.5	13.4	50	10.42	3.47	2.19	123.6	699.61	2930.7	141.4	2372.4	**1172.26**	**790.80**
14.50	17.50	16.00	3.00	15.00	20.42	10.42	116.81	9.43	13.4	13.4	1.0	262.37	1382.41	50	1.0	471.4	1582.43	17.5	13.4	50	10.42	3.47	2.19	123.6	699.61	3664.5	176.7	3141.6	**1465.78**	**1047.18**
17.50	19.00	18.25	1.50	16.50	20.42	10.42	116.81	4.71	13.4	13.4	1.0	131.18	1513.59	50	1.0	235.7	1818.14	19.0	25.3	22	8.75	10.68	11.57	123.6	1232.35	4564.1	194.4	3526.1	**1825.63**	**1175.37**
19.00	20.50	19.75	1.50	18.00	18.75	8.75	116.81	4.71	25.3	25.3	1.0	260.29	1773.89	22	1.0	103.7	1921.86	20.5	9.5	52	11.12	2.38	1.14	123.6	603.90	4299.6	212.1	3907.8	**1719.86**	**1302.60**
20.50	23.50	22.00	3.00	21.00	21.12	11.12	116.81	9.43	9.5	9.5	1.0	184.30	1958.18	52	1.0	490.3	2412.14	23.5	9.5	52	10.95	2.38	1.14	123.6	603.82	4974.1	247.4	4617.7	**1989.66**	**1539.24**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
23.50	26.50	25.00	3.00	24.00	20.95	10.95	116.81	9.43	9.5	9.5	1.0	184.30	2142.48	52	1.0	490.3	2902.43	26.5	10.7	51	10.95	2.68	1.42	123.6	626.67	5671.6	282.7	5327.6	**2268.63**	**1775.88**
26.50	27.50	27.00	1.00	25.00	20.95	10.95	116.81	3.14	10.7	10.7	1.0	69.36	2211.84	51	1.0	160.3	3062.71	27.5	10.7	51	10.95	2.68	1.42	123.6	626.67	5901.2	294.5	5569.1	**2360.49**	**1856.36**
27.50	28.00	27.75	0.50	25.50	20.95	10.95	116.81	1.57	10.7	10.7	1.0	34.68	2246.52	51	1.0	80.1	3142.86	28.0	27.6	7	7.80	15.85	16.87	123.6	1641.31	7030.7	300.4	5689.8	**2812.28**	**1896.60**
28.00	29.50	28.75	1.50	27.00	17.80	7.80	116.81	4.71	27.6	27.6	1.0	287.87	2534.40	7	1.0	33.0	3175.86	29.5	7.5	65	7.80	2.02	0.84	123.6	658.42	6368.7	318.1	6028.3	**2547.47**	**2009.45**
29.50	30.00	29.75	0.50	27.50	17.80	7.80	116.81	1.57	7.5	7.5	1.0	24.16	2558.56	65	1.0	102.1	3278.00	30.0	7.5	65	7.80	2.02	0.84	123.6	658.42	6495.0	324.0	6160.5	**2597.99**	**2053.51**
30.00	31.00	30.50	1.00	28.50	17.80	7.80	116.81	3.14	7.5	7.5	1.0	48.33	2606.89	65	1.0	204.3	3482.29	31.0	7.5	65	7.80	2.02	0.84	123.6	658.42	6747.6	335.8	6424.9	**2699.04**	**2141.64**
31.00	32.50	31.75	1.50	30.00	17.80	7.80	116.81	4.71	7.5	7.5	1.0	72.49	2679.39	65	1.0	306.4	3788.71	32.5	7.5	65	10.01	2.02	0.84	123.6	659.14	7127.2	353.4	6821.5	**2850.90**	**2273.84**
32.50	34.00	33.25	1.50	31.50	20.01	10.01	116.81	4.71	7.5	7.5	1.0	72.49	2751.88	65	1.0	306.4	4095.14	34.0	16.7	32	10.01	4.78	3.58	123.6	704.34	7551.4	371.1	7218.1	**3020.55**	**2406.04**
34.00	35.00	34.50	1.00	32.50	20.01	10.01	116.81	3.14	16.7	16.7	1.0	110.14	2862.02	32	1.0	100.6	4195.71	35.0	16.7	32	10.01	4.78	3.58	123.6	704.34	7762.1	382.9	7440.6	**3104.83**	**2480.20**
35.00	35.50	35.25	0.50	33.00	20.01	10.01	116.81	1.57	16.7	16.7	1.0	55.07	2917.08	32	1.0	50.3	4246.00	35.5	17.1	32	8.92	4.97	3.80	123.6	722.69	7885.8	388.8	7551.9	**3154.31**	**2517.29**
35.50	37.00	36.25	1.50	34.50	18.92	8.92	116.81	4.71	17.1	17.1	1.0	169.40	3086.49	32	1.0	150.9	4396.86	37.0	8.6	44	8.92	2.22	1.00	123.6	530.11	8013.5	406.4	7889.8	**3205.38**	**2629.93**
37.00	37.50	37.25	0.50	35.00	18.92	8.92	116.81	1.57	8.6	8.6	1.0	27.76	3114.25	44	1.0	69.1	4466.00	37.5	8.6	44	8.92	2.22	1.00	123.6	530.11	8110.4	412.3	7992.6	**3244.14**	**2664.19**
37.50	38.50	38.00	1.00	36.00	18.92	8.92	116.81	3.14	8.6	8.6	1.0	55.52	3169.77	44	1.0	138.3	4604.29	38.5	9.1	53	10.54	2.31	1.08	123.6	603.46	8377.5	424.1	8198.2	**3351.00**	**2732.72**
38.50	40.00	39.25	1.50	37.50	20.54	10.54	116.81	4.71	9.1	9.1	1.0	88.20	3257.97	53	1.0	249.9	4854.14	40.0	9.1	53	10.54	2.31	1.08	123.6	603.46	8715.6	441.8	8553.9	**3486.23**	**2851.30**
BORE NO: P64, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	20.96	10.96	30.14	1.57	23.1	23.1	1.0	20.20	0	0	1.0	0.0	0	3.0	23.1	0	10.96	8.63	8.79	32.9	260.87	260.9	5.9	5.9	**104.35**	**1.96**
3.00	4.00	3.50	1.00	1.50	20.96	10.96	38.36	3.14	23.1	23.1	1.0	51.42	51.42	0	1.0	0.0	0.00	4.0	27.7	0	10.96	16.08	17.10	43.8	627.52	678.9	17.7	69.1	**271.58**	**23.03**
4.00	6.00	5.00	2.00	3.50	20.96	10.96	54.80	6.29	27.7	27.7	1.0	180.84	232.27	0	1.0	0.0	0.00	6.0	27.9	0	9.23	16.53	17.56	65.8	917.79	1150.1	41.2	273.5	**460.02**	**91.17**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
6.00	7.00	6.50	1.00	4.50	19.23	9.23	70.38	3.14	27.9	27.9	1.0	117.11	349.38	0	1.0	0.0	0.00	7.0	26.7	7	9.23	13.83	14.80	75.0	917.92	1267.3	53.0	402.4	**506.92**	**134.13**
7.00	9.00	8.00	2.00	6.50	19.23	9.23	84.22	6.29	26.7	26.7	1.0	266.25	615.63	7	1.0	44.0	44.00	9.0	23.2	16	9.23	8.70	8.90	93.5	784.52	1444.1	76.6	736.2	**577.66**	**245.40**
9.00	10.00	9.50	1.00	7.50	19.23	9.23	98.07	3.14	23.2	23.2	1.0	132.10	747.72	16	1.0	50.3	94.29	10.0	23.2	16	9.59	8.70	8.90	102.7	848.90	1690.9	88.4	930.4	**676.36**	**310.12**
10.00	12.50	11.25	2.50	10.00	19.59	9.59	114.67	7.86	23.2	23.2	1.0	386.15	1133.88	16	1.0	125.7	220.00	12.5	23.0	16	9.80	8.56	8.68	126.7	998.42	2352.3	117.8	1471.7	**940.92**	**490.56**
12.50	15.50	14.00	3.00	13.00	19.80	9.80	141.36	9.43	23.0	23.0	1.0	565.73	1699.60	16	1.0	150.9	370.86	15.5	11.1	41	9.80	2.79	1.53	126.7	573.82	2644.3	153.2	2223.6	**1057.71**	**741.20**
15.50	17.00	16.25	1.50	14.50	19.80	9.80	141.36	4.71	11.1	11.1	1.0	130.74	1830.34	41	1.0	193.3	564.14	17.0	26.6	0	8.11	13.60	14.57	126.7	1400.11	3794.6	170.8	2565.3	**1517.84**	**855.10**
17.00	18.50	17.75	1.50	16.00	18.11	8.11	141.36	4.71	26.6	26.6	1.0	333.70	2164.05	0	1.0	0.0	564.14	18.5	15.6	33	8.11	4.24	2.98	126.7	664.31	3392.5	188.5	2916.7	**1357.00**	**972.23**
18.50	20.00	19.25	1.50	17.50	18.11	8.11	141.36	4.71	15.6	15.6	1.0	186.06	2350.11	33	1.0	155.6	719.71	20.0	11.2	46	9.79	2.82	1.56	126.7	612.21	3682.0	206.2	3276.0	**1472.81**	**1092.00**
20.00	21.50	20.75	1.50	19.00	19.79	9.79	141.36	4.71	11.2	11.2	1.0	131.95	2482.05	46	1.0	216.9	936.57	21.5	11.2	46	9.24	2.82	1.56	126.7	611.87	4030.5	223.8	3642.5	**1612.20**	**1214.15**
21.50	24.50	23.00	3.00	22.00	19.24	9.24	141.36	9.43	11.2	11.2	1.0	263.90	2745.95	46	1.0	433.7	1370.29	24.5	12.5	42	9.24	3.20	1.94	126.7	622.87	4739.1	259.2	4375.4	**1895.64**	**1458.47**
24.50	26.00	25.25	1.50	23.50	19.24	9.24	141.36	4.71	12.5	12.5	1.0	147.73	2893.69	42	1.0	198.0	1568.29	26.0	19.5	28	9.24	6.13	5.12	126.7	826.99	5289.0	276.9	4738.8	**2115.59**	**1579.61**
26.00	27.50	26.75	1.50	25.00	19.24	9.24	141.36	4.71	19.5	19.5	1.0	235.98	3129.67	28	1.0	132.0	1700.29	27.5	9.5	30	9.64	2.38	1.14	126.7	453.32	5283.3	294.5	5124.5	**2113.31**	**1708.16**
27.50	29.00	28.25	1.50	26.50	19.64	9.64	141.36	4.71	9.5	9.5	1.0	111.52	3241.18	30	1.0	141.4	1841.71	29.0	28.9	4	9.64	18.78	19.87	126.7	1972.65	7055.5	312.2	5395.1	**2822.22**	**1798.36**
29.00	30.00	29.50	1.00	27.50	19.64	9.64	141.36	3.14	28.9	28.9	1.0	245.24	3486.42	4	1.0	12.6	1854.29	30.0	28.8	0	9.64	18.56	19.64	126.7	1921.08	7261.8	324.0	5664.7	**2904.72**	**1888.23**
30.00	30.50	30.25	0.50	28.00	19.64	9.64	141.36	1.57	28.8	28.8	1.0	122.12	3608.54	0	1.0	0.0	1854.29	30.5	28.8	0	9.64	18.56	19.64	126.7	1921.08	7383.9	329.9	5792.7	**2953.56**	**1930.90**
30.50	32.00	31.25	1.50	29.50	19.64	9.64	141.36	4.71	28.8	28.8	1.0	366.35	3974.89	0	1.0	0.0	1854.29	32.0	9.5	32	9.64	2.38	1.14	126.7	467.46	6296.6	347.5	6176.7	**2518.65**	**2058.91**
32.00	32.50	32.25	0.50	30.00	19.64	9.64	141.36	1.57	9.5	9.5	1.0	37.17	4012.06	32	1.0	50.3	1904.57	32.5	9.5	32	8.64	2.38	1.14	126.7	467.01	6383.6	353.4	6270.1	**2553.46**	**2090.02**
32.50	33.50	33.00	1.00	31.00	18.64	8.64	141.36	3.14	9.5	9.5	1.0	74.34	4086.41	32	1.0	100.6	2005.14	33.5	8.7	48	7.55	2.24	1.02	126.7	564.97	6656.5	365.2	6456.8	**2662.61**	**2152.25**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
33.50	35.00	34.25	1.50	32.50	17.55	7.55	141.36	4.71	8.7	8.7	1.0	101.97	4188.38	48	1.0	226.3	2231.43	35.0	8.7	48	7.55	2.24	1.02	126.7	564.97	6984.8	382.9	6802.7	**2793.91**	**2267.56**
35.00	36.50	35.75	1.50	34.00	17.55	7.55	141.36	4.71	8.7	8.7	1.0	101.97	4290.35	48	1.0	226.3	2457.71	36.5	9.3	55	8.10	2.34	1.11	126.7	625.73	7373.8	400.6	7148.6	**2949.52**	**2382.87**
36.50	37.50	37.00	1.00	35.00	18.10	8.10	141.36	3.14	9.3	9.3	1.0	72.75	4363.10	55	1.0	172.9	2630.57	37.5	10.2	30	8.10	2.53	1.28	126.7	467.86	7461.5	412.3	7406.0	**2984.61**	**2468.67**
37.50	40.00	38.75	2.50	37.50	18.10	8.10	141.36	7.86	10.2	10.2	1.0	199.84	4562.94	30	1.0	235.7	2866.29	40.0	14.3	28	8.10	3.74	2.45	126.7	577.68	8006.9	441.8	7871.0	**3202.76**	**2623.67**
BORE NO: P65, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	20.11	10.11	27.80	1.57	24.5	24.5	1.0	19.91	0	0	1.0	0.0	0	3.0	13.8	31	10.11	3.59	2.31	30.3	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.50	20.11	10.11	35.39	3.14	13.8	13.8	1.0	27.32	0	31	1.0	97.4	0	4.0	32.7	0	9.10	34.86	36.24	40.4	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	5.00	4.50	1.00	2.50	19.10	9.10	44.99	3.14	32.7	32.7	1.1	103.03	0	0	1.0	0.0	0	5.0	30.5	0	9.10	23.78	24.96	49.5	1014.79	1014.8	29.5	29.5	**405.92**	**9.82**
5.00	6.00	5.50	1.00	3.50	19.10	9.10	54.09	3.14	30.5	30.5	1.0	102.64	102.64	0	1.0	0.0	0.00	6.0	30.5	0	9.97	23.78	24.96	58.6	1193.34	1296.0	41.2	143.9	**518.39**	**47.96**
6.00	8.00	7.00	2.00	5.50	19.97	9.97	68.61	6.29	30.5	30.5	1.0	260.38	363.02	0	1.0	0.0	0.00	8.0	30.5	0	9.97	23.78	24.96	78.6	1565.88	1928.9	64.8	427.8	**771.56**	**142.61**
8.00	9.00	8.50	1.00	6.50	19.97	9.97	83.57	3.14	30.5	30.5	1.0	158.57	521.59	0	1.0	0.0	0.00	9.0	25.3	12	9.61	10.68	11.57	88.6	871.30	1392.9	76.6	598.2	**557.16**	**199.39**
9.00	11.00	10.00	2.00	8.50	19.61	9.61	98.16	6.29	25.3	25.3	1.0	291.66	813.25	12	1.0	75.4	75.43	11.0	25.9	12	9.61	12.03	12.95	107.8	1152.14	2040.8	100.1	988.8	**816.33**	**329.61**
11.00	12.00	11.50	1.00	9.50	19.61	9.61	112.58	3.14	25.9	25.9	1.0	171.80	985.05	12	1.0	37.7	113.14	12.0	25.9	12	10.07	12.03	12.95	117.4	1245.29	2343.5	111.9	1210.1	**937.39**	**403.37**
12.00	14.50	13.25	2.50	12.00	20.07	10.07	129.97	7.86	25.9	25.9	1.0	495.86	1480.91	12	1.0	94.3	207.43	14.5	25.9	12	10.07	12.03	12.95	142.6	1483.18	3171.5	141.4	1829.7	**1268.61**	**609.90**
14.50	17.50	16.00	3.00	15.00	20.07	10.07	129.97	9.43	25.9	25.9	1.0	595.03	2075.93	12	1.0	113.1	320.57	17.5	24.0	12	9.92	9.28	9.78	142.6	1162.41	3558.9	176.7	2573.2	**1423.56**	**857.74**
17.50	20.50	19.00	3.00	18.00	19.92	9.92	129.97	9.43	24.0	24.0	1.0	545.59	2621.52	12	1.0	113.1	433.71	20.5	12.5	47	9.92	3.20	1.94	142.6	698.77	3754.0	212.1	3267.3	**1501.60**	**1089.10**
20.50	23.50	22.00	3.00	21.00	19.92	9.92	129.97	9.43	12.5	12.5	1.0	271.67	2893.18	47	1.0	443.1	876.86	23.5	12.6	47	10.99	3.23	1.96	142.6	702.98	4473.0	247.4	4017.4	**1789.21**	**1339.15**
23.50	26.50	25.00	3.00	24.00	20.99	10.99	129.97	9.43	12.6	12.6	1.0	273.91	3167.10	47	1.0	443.1	1320.00	26.5	12.2	47	10.99	3.12	1.85	142.6	689.40	5176.5	282.7	4769.8	**2070.60**	**1589.95**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
26.50	27.50	27.00	1.00	25.00	20.99	10.99	129.97	3.14	12.2	12.2	1.0	88.31	3255.41	47	1.0	147.7	1467.71	27.5	14.0	10	10.99	3.65	2.36	142.6	489.75	5212.9	294.5	5017.6	**2085.15**	**1672.55**
27.50	28.00	27.75	0.50	25.50	20.99	10.99	129.97	1.57	14.0	14.0	1.0	50.92	3306.33	10	1.0	15.7	1483.43	28.0	10.6	59	10.82	2.65	1.39	142.6	719.55	5509.3	300.4	5090.2	**2203.72**	**1696.72**
28.00	29.50	28.75	1.50	27.00	20.82	10.82	129.97	4.71	10.6	10.6	1.0	114.66	3421.00	59	1.0	278.1	1761.57	29.5	10.6	59	10.82	2.65	1.39	142.6	719.55	5902.1	318.1	5500.7	**2360.85**	**1833.55**
29.50	30.00	29.75	0.50	27.50	20.82	10.82	129.97	1.57	10.6	10.6	1.0	38.22	3459.22	59	1.0	92.7	1854.29	30.0	10.6	54	11.04	2.65	1.39	142.6	684.31	5997.8	324.0	5637.5	**2399.12**	**1879.16**
30.00	32.50	31.25	2.50	30.00	21.04	11.04	129.97	7.86	10.6	10.6	1.0	191.11	3650.32	54	1.0	424.3	2278.57	32.5	10.6	54	11.04	2.65	1.39	142.6	684.31	6613.2	353.4	6282.3	**2645.28**	**2094.11**
32.50	35.00	33.75	2.50	32.50	21.04	11.04	129.97	7.86	10.6	10.6	1.0	191.11	3841.43	54	1.0	424.3	2702.86	35.0	10.6	54	8.71	2.65	1.39	142.6	683.04	7227.3	382.9	6927.2	**2890.93**	**2309.06**
35.00	35.50	35.25	0.50	33.00	18.71	8.71	129.97	1.57	10.6	10.6	1.0	38.22	3879.65	54	1.0	84.9	2787.71	35.5	10.5	60	8.04	2.62	1.36	142.6	721.71	7389.1	388.8	7056.1	**2955.63**	**2352.05**
35.50	37.50	36.50	2.00	35.00	18.04	8.04	129.97	6.29	10.5	10.5	1.0	151.41	4031.06	60	1.0	377.1	3164.86	37.5	14.0	30	8.04	3.65	2.36	142.6	628.44	7824.4	412.3	7608.3	**3129.74**	**2536.09**
37.50	38.50	38.00	1.00	36.00	18.04	8.04	129.97	3.14	14.0	14.0	1.0	101.84	4132.91	30	1.0	94.3	3259.14	38.5	14.0	30	9.16	3.65	2.36	142.6	629.48	8021.5	424.1	7816.2	**3208.61**	**2605.39**
38.50	40.00	39.25	1.50	37.50	19.16	9.16	129.97	4.71	14.0	14.0	1.0	152.76	4285.67	30	1.0	141.4	3400.57	40.0	14.0	30	9.16	3.65	2.36	142.6	629.48	8315.7	441.8	8128.0	**3326.29**	**2709.34**
BORE NO: P66, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.30	9.30	25.58	1.57	12.0	12.0	1.0	8.54	0	5	1.0	7.9	0	3.0	8.1	34	9.30	2.13	0.93	27.9	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.50	19.30	9.30	32.55	3.14	8.1	8.1	1.0	14.56	0	34	1.0	106.9	0	4.0	8.1	34	10.30	2.13	0.93	37.2	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	5.00	4.50	1.00	2.50	20.30	10.30	42.35	3.14	8.1	8.1	1.0	18.94	0	34	1.0	106.9	0	5.0	27.6	0	10.30	15.85	16.87	47.5	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.50	20.30	10.30	52.65	3.14	27.6	27.6	1.0	86.51	0	0	1.0	0.0	0	6.0	27.6	0	10.30	15.85	16.87	57.8	0	0.0	41.2	41.2	**0.00**	**13.74**
6.00	7.00	6.50	1.00	4.50	20.30	10.30	62.95	3.14	27.6	27.6	1.0	103.43	0	0	1.0	0.0	0	7.0	33.8	0	10.30	40.40	41.88	68.1	0	0.0	53.0	53.0	**0.00**	**17.67**
7.00	8.00	7.50	1.00	5.50	20.30	10.30	73.25	3.14	33.8	33.8	1.2	183.40	0	0	1.0	0.0	0	8.0	28.5	0	10.31	17.88	18.94	78.4	1178.24	1178.2	64.8	64.8	**471.30**	**21.60**
8.00	9.00	8.50	1.00	6.50	20.31	10.31	83.56	3.14	28.5	28.5	1.0	142.58	142.58	0	1.0	0.0	0.00	9.0	25.3	17	10.31	10.68	11.57	88.7	911.18	1053.8	76.6	219.2	**421.50**	**73.05**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
9.00	10.00	9.50	1.00	7.50	20.31	10.31	93.87	3.14	25.3	25.3	1.0	139.45	282.03	17	1.0	53.4	53.43	10.0	25.3	17	10.31	10.68	11.57	99.0	997.66	1333.1	88.4	423.8	**533.25**	**141.27**
10.00	11.00	10.50	1.00	8.50	20.31	10.31	104.18	3.14	25.3	25.3	1.0	154.76	436.79	17	1.0	53.4	106.86	11.0	7.5	48	10.31	2.02	0.84	109.3	516.33	1060.0	100.1	643.8	**423.99**	**214.60**
11.00	12.00	11.50	1.00	9.50	20.31	10.31	114.49	3.14	7.5	7.5	1.0	47.37	484.16	48	1.0	150.9	257.71	12.0	7.5	48	10.10	2.02	0.84	119.6	532.63	1274.5	111.9	853.8	**509.80**	**284.60**
12.00	14.50	13.25	2.50	12.00	20.10	10.10	132.27	7.86	7.5	7.5	1.0	136.82	620.98	48	1.0	377.1	634.86	14.5	25.5	16	11.58	11.13	12.03	144.9	1434.48	2690.3	141.4	1397.2	**1076.13**	**465.74**
14.50	17.50	16.00	3.00	15.00	21.58	11.58	132.27	9.43	25.5	25.5	1.0	594.82	1215.80	16	1.0	150.9	785.71	17.5	25.0	16	11.58	10.00	10.88	144.9	1301.06	3302.6	176.7	2178.2	**1321.03**	**726.08**
17.50	19.00	18.25	1.50	16.50	21.58	11.58	132.27	4.71	25.0	25.0	1.0	290.76	1506.56	16	1.0	75.4	861.14	19.0	24.5	15	11.39	9.64	10.33	144.9	1249.74	3617.4	194.4	2562.1	**1446.98**	**854.03**
19.00	20.50	19.75	1.50	18.00	21.39	11.39	132.27	4.71	24.5	24.5	1.0	284.16	1790.72	15	1.0	70.7	931.86	20.5	24.5	15	11.39	9.64	10.33	144.9	1249.74	3972.3	212.1	2934.6	**1588.93**	**978.21**
20.50	22.00	21.25	1.50	19.50	21.39	11.39	132.27	4.71	24.5	24.5	1.0	284.16	2074.88	15	1.0	70.7	1002.57	22.0	23.6	10	11.39	8.99	9.34	144.9	1136.19	4213.6	229.7	3307.2	**1685.46**	**1102.39**
22.00	23.50	22.75	1.50	21.00	21.39	11.39	132.27	4.71	23.6	23.6	1.0	272.42	2347.30	10	1.0	47.1	1049.71	23.5	12.1	39	10.18	3.09	1.82	144.9	634.52	4031.5	247.4	3644.4	**1612.61**	**1214.80**
23.50	26.50	25.00	3.00	24.00	20.18	10.18	132.27	9.43	12.1	12.1	1.0	267.35	2614.65	39	1.0	367.7	1417.43	26.5	12.1	39	10.18	3.09	1.82	144.9	634.52	4666.6	282.7	4314.8	**1866.64**	**1438.27**
26.50	27.50	27.00	1.00	25.00	20.18	10.18	132.27	3.14	12.1	12.1	1.0	89.12	2703.76	39	1.0	122.6	1540.00	27.5	12.1	39	10.18	3.09	1.82	144.9	634.52	4878.3	294.5	4538.3	**1951.31**	**1512.76**
27.50	29.50	28.50	2.00	27.00	20.18	10.18	132.27	6.29	12.1	12.1	1.0	178.23	2882.00	39	1.0	245.1	1785.14	29.5	11.2	52	9.59	2.82	1.56	144.9	694.96	5362.1	318.1	4985.2	**2144.84**	**1661.74**
29.50	30.00	29.75	0.50	27.50	19.59	9.59	132.27	1.57	11.2	11.2	1.0	41.15	2923.15	52	1.0	81.7	1866.86	30.0	11.2	49	9.59	2.82	1.56	144.9	673.74	5463.8	324.0	5114.0	**2185.50**	**1704.66**
30.00	32.50	31.25	2.50	30.00	19.59	9.59	132.27	7.86	11.2	11.2	1.0	205.77	3128.92	49	1.0	385.0	2251.86	32.5	11.2	49	9.59	2.82	1.56	144.9	673.74	6054.5	353.4	5734.2	**2421.81**	**1911.40**
32.50	35.00	33.75	2.50	32.50	19.59	9.59	132.27	7.86	11.2	11.2	1.0	205.77	3334.70	49	1.0	385.0	2636.86	35.0	11.2	49	8.99	2.82	1.56	144.9	673.37	6644.9	382.9	6354.4	**2657.97**	**2118.14**
35.00	35.50	35.25	0.50	33.00	18.99	8.99	132.27	1.57	11.2	11.2	1.0	41.15	3375.85	49	1.0	77.0	2713.86	35.5	11.2	49	8.82	2.82	1.56	144.9	673.27	6763.0	388.8	6478.5	**2705.19**	**2159.49**
35.50	37.50	36.50	2.00	35.00	18.82	8.82	132.27	6.29	11.2	11.2	1.0	164.62	3540.47	49	1.0	308.0	3021.86	37.5	11.2	49	8.82	2.82	1.56	144.9	673.27	7235.6	412.3	6974.7	**2894.24**	**2324.89**
37.50	38.50	38.00	1.00	36.00	18.82	8.82	132.27	3.14	11.2	11.2	1.0	82.31	3622.78	49	1.0	154.0	3175.86	38.5	11.2	49	9.02	2.82	1.56	144.9	673.39	7472.0	424.1	7222.7	**2988.81**	**2407.58**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
38.50	40.00	39.25	1.50	37.50	19.02	9.02	132.27	4.71	11.2	11.2	1.0	123.46	3746.24	49	1.0	231.0	3406.86	40.0	11.2	49	9.02	2.82	1.56	144.9	673.39	7826.5	441.8	7594.9	**3130.60**	**2531.63**
BORE NO: P67, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	20.06	10.06	27.67	1.57	27.5	27.5	1.0	22.63	0	12	1.0	18.9	0	3.0	27.5	9	10.06	15.63	16.64	30.2	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.50	20.06	10.06	35.21	3.14	27.5	27.5	1.0	57.61	0	9	1.0	28.3	0	4.0	29.5	0	10.06	20.13	21.25	40.2	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	6.00	5.00	2.00	3.50	20.06	10.06	50.30	6.29	29.5	29.5	1.0	178.88	0	0	1.0	0.0	0	6.0	29.7	0	10.24	20.58	21.71	60.4	1063.54	1063.5	41.2	41.2	**425.42**	**13.74**
6.00	7.00	6.50	1.00	4.50	20.24	10.24	65.48	3.14	29.7	29.7	1.0	117.38	117.38	0	1.0	0.0	0.00	7.0	28.5	0	10.01	17.88	18.94	70.6	1066.42	1183.8	53.0	170.4	**473.52**	**56.80**
7.00	9.00	8.00	2.00	6.50	20.01	10.01	80.61	6.29	28.5	28.5	1.0	275.11	392.49	0	1.0	0.0	0.00	9.0	24.8	16	10.01	9.86	10.66	90.6	856.83	1249.3	76.6	469.1	**499.73**	**156.36**
9.00	10.00	9.50	1.00	7.50	20.01	10.01	95.63	3.14	24.8	24.8	1.0	138.87	531.36	16	1.0	50.3	50.29	10.0	24.8	16	10.01	9.86	10.66	100.6	934.34	1516.0	88.4	670.0	**606.40**	**223.33**
10.00	11.00	10.50	1.00	8.50	20.01	10.01	105.64	3.14	24.8	24.8	1.0	153.40	684.76	16	1.0	50.3	100.57	11.0	24.8	16	10.01	9.86	10.66	110.6	1011.86	1797.2	100.1	885.5	**718.88**	**295.16**
11.00	12.50	11.75	1.50	10.00	20.01	10.01	118.15	4.71	24.8	24.8	1.0	257.36	942.13	16	1.0	75.4	176.00	12.5	24.8	16	10.01	9.86	10.66	125.7	1128.14	2246.3	117.8	1235.9	**898.51**	**411.98**
12.50	14.00	13.25	1.50	11.50	20.01	10.01	133.16	4.71	24.8	24.8	1.0	290.07	1232.19	16	1.0	75.4	251.43	14.0	14.3	54	10.75	3.74	2.45	140.7	805.24	2288.9	135.5	1619.1	**915.55**	**539.70**
14.00	15.50	14.75	1.50	13.00	20.75	10.75	148.73	4.71	14.3	14.3	1.0	178.73	1410.92	54	1.0	254.6	506.00	15.5	14.3	54	10.61	3.74	2.45	140.7	805.11	2722.0	153.2	2070.1	**1088.81**	**690.02**
15.50	18.50	17.00	3.00	16.00	20.61	10.61	148.73	9.43	14.3	14.3	1.0	357.45	1768.37	54	1.0	509.1	1015.14	18.5	23.8	10	10.61	9.14	9.56	140.7	1120.34	3903.9	188.5	2972.0	**1561.54**	**990.67**
18.50	20.00	19.25	1.50	17.50	20.61	10.61	148.73	4.71	23.8	23.8	1.0	309.25	2077.62	10	1.0	47.1	1062.29	20.0	28.6	0	10.61	18.11	19.17	140.7	2081.21	5221.1	206.2	3346.1	**2088.45**	**1115.36**
20.00	21.50	20.75	1.50	19.00	20.61	10.61	148.73	4.71	28.6	28.6	1.0	382.29	2459.91	0	1.0	0.0	1062.29	21.5	12.2	46	10.81	3.12	1.85	140.7	677.58	4199.8	223.8	3746.0	**1679.91**	**1248.68**
21.50	24.50	23.00	3.00	22.00	20.81	10.81	148.73	9.43	12.2	12.2	1.0	303.20	2763.11	46	1.0	433.7	1496.00	24.5	12.2	46	10.81	3.12	1.85	140.7	677.58	4936.7	259.2	4518.3	**1974.68**	**1506.10**
24.50	27.50	26.00	3.00	25.00	20.81	10.81	148.73	9.43	12.2	12.2	1.0	303.20	3066.30	46	1.0	433.7	1929.71	27.5	8.0	40	11.18	2.11	0.91	140.7	520.07	5516.1	294.5	5290.5	**2206.44**	**1763.51**
27.50	29.00	28.25	1.50	26.50	21.18	11.18	148.73	4.71	8.0	8.0	1.0	98.54	3164.85	40	1.0	188.6	2118.29	29.0	24.0	14	11.18	9.28	9.78	140.7	1167.65	6450.8	312.2	5595.3	**2580.31**	**1865.11**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
29.00	30.00	29.50	1.00	27.50	21.18	11.18	148.73	3.14	24.0	24.0	1.0	208.12	3372.96	14	1.0	44.0	2162.29	30.0	24.0	14	11.18	9.28	9.78	140.7	1167.65	6702.9	324.0	5859.2	**2681.16**	**1953.08**
30.00	30.50	30.25	0.50	28.00	21.18	11.18	148.73	1.57	24.0	24.0	1.0	104.06	3477.02	14	1.0	22.0	2184.29	30.5	9.5	32	11.18	2.38	1.14	140.7	494.36	6155.7	329.9	5991.2	**2462.27**	**1997.06**
30.50	32.00	31.25	1.50	29.50	21.18	11.18	148.73	4.71	9.5	9.5	1.0	117.34	3594.36	32	1.0	150.9	2335.14	32.0	27.3	0	11.18	15.18	16.18	140.7	1748.78	7678.3	347.5	6277.0	**3071.31**	**2092.35**
32.00	32.50	32.25	0.50	30.00	21.18	11.18	148.73	1.57	27.3	27.3	1.0	120.63	3714.99	0	1.0	0.0	2335.14	32.5	27.3	0	8.86	15.18	16.18	140.7	1734.04	7784.2	353.4	6403.6	**3113.67**	**2134.52**
32.50	33.50	33.00	1.00	31.00	18.86	8.86	148.73	3.14	27.3	27.3	1.0	241.27	3956.26	0	1.0	0.0	2335.14	33.5	27.3	0	8.88	15.18	16.18	140.7	1734.17	8025.6	365.2	6656.6	**3210.23**	**2218.87**
33.50	35.00	34.25	1.50	32.50	18.88	8.88	148.73	4.71	27.3	27.3	1.0	361.90	4318.16	0	1.0	0.0	2335.14	35.0	15.1	48	8.36	3.99	2.70	140.7	789.22	7442.5	382.9	7036.2	**2977.01**	**2345.39**
35.00	36.50	35.75	1.50	34.00	18.36	8.36	148.73	4.71	15.1	15.1	1.0	189.19	4507.35	48	1.0	226.3	2561.43	36.5	28.8	0	8.52	18.56	19.64	140.7	2116.79	9185.6	400.6	7469.3	**3674.23**	**2489.78**
36.50	37.50	37.00	1.00	35.00	18.52	8.52	148.73	3.14	28.8	28.8	1.0	256.98	4764.33	0	1.0	0.0	2561.43	37.5	28.8	0	8.52	18.56	19.64	140.7	2116.79	9442.5	412.3	7738.1	**3777.02**	**2579.36**
37.50	38.00	37.75	0.50	35.50	18.52	8.52	148.73	1.57	28.8	28.8	1.0	128.49	4892.82	0	1.0	0.0	2561.43	38.0	28.8	0	8.62	18.56	19.64	140.7	2117.56	9571.8	418.2	7872.5	**3828.72**	**2624.16**
38.00	40.00	39.00	2.00	37.50	18.62	8.62	148.73	6.29	28.8	28.8	1.0	513.96	5406.78	0	1.0	0.0	2561.43	40.0	29.6	0	8.62	20.36	21.48	140.7	2322.92	10291.1	441.8	8410.0	**4116.45**	**2803.33**
BORE NO: P68, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.56	9.56	26.29	1.57	26.5	26.5	1.0	20.60	0	5	1.0	7.9	0	3.0	26.5	5	9.56	13.38	14.34	28.7	390.66	390.7	5.9	5.9	**156.26**	**1.96**
3.00	4.00	3.50	1.00	1.50	19.56	9.56	33.46	3.14	26.5	26.5	1.0	52.43	52.43	5	1.0	15.7	15.71	4.0	30.4	0	9.56	23.27	24.45	38.2	791.13	859.3	17.7	85.8	**343.71**	**28.61**
4.00	6.00	5.00	2.00	3.50	19.56	9.56	47.80	6.29	30.4	30.4	1.0	179.80	232.23	0	1.0	0.0	15.71	6.0	30.2	0	9.34	22.27	23.43	57.4	1089.50	1337.4	41.2	289.2	**534.98**	**96.39**
6.00	7.00	6.50	1.00	4.50	19.34	9.34	62.03	3.14	30.2	30.2	1.0	114.60	346.83	0	1.0	0.0	15.71	7.0	30.2	0	9.34	22.27	23.43	66.7	1252.90	1615.5	53.0	415.6	**646.18**	**138.52**
7.00	9.00	8.00	2.00	6.50	19.34	9.34	76.04	6.29	30.2	30.2	1.0	280.96	627.80	0	1.0	0.0	15.71	9.0	28.5	0	9.34	17.88	18.94	85.4	1269.09	1912.6	76.6	720.1	**765.04**	**240.03**
9.00	10.00	9.50	1.00	7.50	19.34	9.34	90.05	3.14	28.5	28.5	1.0	153.66	781.46	0	1.0	0.0	15.71	10.0	28.5	0	9.34	17.88	18.94	94.7	1400.32	2197.5	88.4	885.5	**879.00**	**295.18**
10.00	11.00	10.50	1.00	8.50	19.34	9.34	99.39	3.14	28.5	28.5	1.0	169.60	951.06	0	1.0	0.0	15.71	11.0	11.4	44	10.20	2.88	1.62	104.1	553.24	1520.0	100.1	1066.9	**608.01**	**355.64**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
11.00	12.50	11.75	1.50	10.00	20.20	10.20	111.71	4.71	11.4	11.4	1.0	106.19	1057.25	44	1.0	207.4	223.14	12.5	11.4	44	10.41	2.88	1.62	119.4	588.01	1868.4	117.8	1398.2	**747.36**	**466.07**
12.50	15.50	14.00	3.00	13.00	20.41	10.41	134.98	9.43	11.4	11.4	1.0	256.61	1313.86	44	1.0	414.9	638.00	15.5	9.7	57	10.23	2.42	1.17	119.4	634.37	2586.2	153.2	2105.0	**1034.49**	**701.67**
15.50	18.50	17.00	3.00	16.00	20.23	10.23	134.98	9.43	9.7	9.7	1.0	217.53	1531.39	57	1.0	537.4	1175.43	18.5	8.1	60	10.25	2.13	0.93	119.4	627.59	3334.4	188.5	2895.3	**1333.76**	**965.10**
18.50	21.50	20.00	3.00	19.00	20.25	10.25	134.98	9.43	8.1	8.1	1.0	181.12	1712.51	60	1.0	565.7	1741.14	21.5	7.8	62	10.60	2.07	0.88	119.4	636.60	4090.3	223.8	3677.5	**1636.10**	**1225.83**
21.50	24.50	23.00	3.00	22.00	20.60	10.60	134.98	9.43	7.8	7.8	1.0	174.33	1886.84	62	1.0	584.6	2325.71	24.5	7.8	62	10.28	2.07	0.88	119.4	636.49	4849.0	259.2	4471.7	**1939.62**	**1490.58**
24.50	27.50	26.00	3.00	25.00	20.28	10.28	134.98	9.43	7.8	7.8	1.0	174.33	2061.17	62	1.0	584.6	2910.29	27.5	4.5	96	10.28	1.51	0.41	119.4	822.39	5793.8	294.5	5266.0	**2317.54**	**1755.33**
27.50	29.00	28.25	1.50	26.50	20.28	10.28	134.98	4.71	4.5	4.5	1.0	50.08	2111.24	96	1.0	452.6	3362.86	29.0	9.3	57	10.28	2.34	1.11	119.4	627.39	6101.5	312.2	5786.3	**2440.60**	**1928.77**
29.00	30.00	29.50	1.00	27.50	20.28	10.28	134.98	3.14	9.3	9.3	1.0	69.47	2180.71	57	1.0	179.1	3542.00	30.0	9.3	57	8.82	2.34	1.11	119.4	626.75	6349.5	324.0	6046.7	**2539.79**	**2015.56**
30.00	30.50	30.25	0.50	28.00	18.82	8.82	134.98	1.57	9.3	9.3	1.0	34.73	2215.44	57	1.0	89.6	3631.57	30.5	9.3	57	9.81	2.34	1.11	119.4	627.18	6474.2	329.9	6176.9	**2589.68**	**2058.96**
30.50	32.00	31.25	1.50	29.50	19.81	9.81	134.98	4.71	9.3	9.3	1.0	104.20	2319.64	57	1.0	268.7	3900.29	32.0	9.3	57	9.91	2.34	1.11	119.4	627.23	6847.2	347.5	6567.5	**2738.86**	**2189.16**
32.00	32.50	32.25	0.50	30.00	19.91	9.91	134.98	1.57	9.3	9.3	1.0	34.73	2354.38	57	1.0	89.6	3989.86	32.5	14.0	28	9.91	3.65	2.36	119.4	549.51	6893.7	353.4	6697.7	**2757.50**	**2232.55**
32.50	33.50	33.00	1.00	31.00	19.91	9.91	134.98	3.14	14.0	14.0	1.0	105.77	2460.14	28	1.0	88.0	4077.86	33.5	28.3	0	9.01	17.43	18.48	119.4	1700.18	8238.2	365.2	6903.2	**3295.27**	**2301.07**
33.50	35.00	34.25	1.50	32.50	19.01	9.01	134.98	4.71	28.3	28.3	1.0	342.62	2802.76	0	1.0	0.0	4077.86	35.0	28.3	0	7.32	17.43	18.48	119.4	1687.91	8568.5	382.9	7263.5	**3427.41**	**2421.17**
35.00	36.50	35.75	1.50	34.00	17.32	7.32	134.98	4.71	28.3	28.3	1.0	342.62	3145.38	0	1.0	0.0	4077.86	36.5	14.3	49	9.74	3.74	2.45	119.4	706.34	7929.6	400.6	7623.8	**3171.83**	**2541.26**
36.50	37.50	37.00	1.00	35.00	19.74	9.74	134.98	3.14	14.3	14.3	1.0	108.13	3253.51	49	1.0	154.0	4231.86	37.5	11.5	49	9.74	2.91	1.65	119.4	625.81	8111.2	412.3	7897.7	**3244.47**	**2632.57**
37.50	38.00	37.75	0.50	35.50	19.74	9.74	134.98	1.57	11.5	11.5	1.0	43.15	3296.66	49	1.0	77.0	4308.86	38.0	11.5	55	9.52	2.91	1.65	119.4	668.10	8273.6	418.2	8023.7	**3309.45**	**2674.58**
38.00	40.00	39.00	2.00	37.50	19.52	9.52	134.98	6.29	11.5	11.5	1.0	172.61	3469.27	55	1.0	345.7	4654.57	40.0	11.5	55	9.52	2.91	1.65	119.4	668.10	8791.9	441.8	8565.6	**3516.78**	**2855.21**

BORE NO: P69, CUT OFF LENGTH: 2.50 m, Nc= 9

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
2.50	3.00	2.75	0.50	0.50	19.39	9.39	25.82	1.57	27.2	27.2	1.0	20.85	0	4	1.0	6.3	0	3.0	13.5	43	9.39	3.50	2.22	28.2	389.73	389.7	5.9	5.9	**155.89**	**1.96**
3.00	4.00	3.50	1.00	1.50	19.39	9.39	32.87	3.14	13.5	13.5	1.0	24.80	24.80	43	1.0	135.1	135.14	4.0	13.5	43	9.39	3.50	2.22	37.6	415.55	575.5	17.7	177.6	**230.20**	**59.20**
4.00	5.00	4.50	1.00	2.50	19.39	9.39	42.26	3.14	13.5	13.5	1.0	31.88	56.68	43	1.0	135.1	270.29	5.0	29.1	0	9.31	19.23	20.33	47.0	783.83	1110.8	29.5	356.4	**444.32**	**118.81**
5.00	6.00	5.50	1.00	3.50	19.31	9.31	51.61	3.14	29.1	29.1	1.0	90.27	146.95	0	1.0	0.0	270.29	6.0	28.8	0	9.31	18.56	19.64	56.3	892.13	1309.4	41.2	458.5	**523.75**	**152.82**
6.00	7.00	6.50	1.00	4.50	19.31	9.31	60.92	3.14	28.8	28.8	1.0	105.25	252.20	0	1.0	0.0	270.29	7.0	28.8	0	9.61	18.56	19.64	65.6	1030.19	1552.7	53.0	575.5	**621.07**	**191.83**
7.00	9.00	8.00	2.00	6.50	19.61	9.61	75.18	6.29	28.8	28.8	1.0	259.79	511.99	0	1.0	0.0	270.29	9.0	11.8	47	9.61	3.00	1.73	84.8	538.72	1321.0	76.6	858.9	**528.40**	**286.29**
9.00	10.00	9.50	1.00	7.50	19.61	9.61	89.60	3.14	11.8	11.8	1.0	58.83	570.82	47	1.0	147.7	418.00	10.0	7.2	35	9.61	1.97	0.79	94.4	396.30	1385.1	88.4	1077.2	**554.05**	**359.06**
10.00	11.00	10.50	1.00	8.50	19.61	9.61	99.21	3.14	7.2	7.2	1.0	39.39	610.21	35	1.0	110.0	528.00	11.0	11.8	47	10.16	3.00	1.73	104.0	584.38	1722.6	100.1	1238.3	**689.04**	**412.78**
11.00	12.50	11.75	1.50	10.00	20.16	10.16	111.63	4.71	11.8	11.8	1.0	109.94	720.15	47	1.0	221.6	749.57	12.5	11.8	47	10.37	3.00	1.73	119.3	620.44	2090.2	117.8	1587.5	**836.06**	**529.18**
12.50	15.50	14.00	3.00	13.00	20.37	10.37	134.81	9.43	11.8	11.8	1.0	265.53	985.68	47	1.0	443.1	1192.71	15.5	10.2	57	10.37	2.53	1.28	119.3	645.21	2823.6	153.2	2331.5	**1129.44**	**777.18**
15.50	17.00	16.25	1.50	14.50	20.37	10.37	134.81	4.71	10.2	10.2	1.0	114.35	1100.02	57	1.0	268.7	1461.43	17.0	24.7	8	9.63	9.78	10.55	119.3	1013.21	3574.7	170.8	2732.3	**1429.87**	**910.76**
17.00	18.50	17.75	1.50	16.00	19.63	9.63	134.81	4.71	24.7	24.7	1.0	292.30	1392.33	8	1.0	37.7	1499.14	18.5	12.0	48	10.10	3.06	1.79	119.3	633.06	3524.5	188.5	3080.0	**1409.81**	**1026.65**
18.50	21.50	20.00	3.00	19.00	20.10	10.10	134.81	9.43	12.0	12.0	1.0	270.16	1662.49	48	1.0	452.6	1951.71	21.5	12.0	48	10.10	3.06	1.79	119.3	633.06	4247.3	223.8	3838.0	**1698.91**	**1279.35**
21.50	23.00	22.25	1.50	20.50	20.10	10.10	134.81	4.71	12.0	12.0	1.0	135.08	1797.57	48	1.0	226.3	2178.00	23.0	11.3	44	10.30	2.85	1.59	119.3	584.82	4560.4	241.5	4217.1	**1824.16**	**1405.69**
23.00	24.50	23.75	1.50	22.00	20.30	10.30	134.81	4.71	11.3	11.3	1.0	126.99	1924.56	44	1.0	207.4	2385.43	24.5	8.2	65	10.30	2.15	0.94	119.3	664.53	4974.5	259.2	4569.2	**1989.81**	**1523.06**
24.50	26.00	25.25	1.50	23.50	20.30	10.30	134.81	4.71	8.2	8.2	1.0	91.58	2016.14	65	1.0	306.4	2691.86	26.0	8.2	65	10.40	2.15	0.94	119.3	664.57	5372.6	276.9	4984.8	**2149.02**	**1661.62**
26.00	27.50	26.75	1.50	25.00	20.40	10.40	134.81	4.71	8.2	8.2	1.0	91.58	2107.71	65	1.0	306.4	2998.29	27.5	8.2	65	10.40	2.15	0.94	119.3	664.57	5770.6	294.5	5400.5	**2308.23**	**1800.17**
27.50	29.00	28.25	1.50	26.50	20.40	10.40	134.81	4.71	8.2	8.2	1.0	91.58	2199.29	65	1.0	306.4	3304.71	29.0	14.0	30	10.40	3.65	2.36	119.3	563.79	6067.8	312.2	5816.2	**2427.12**	**1938.73**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)													
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
29.00	30.00	29.50	1.00	27.50	20.40	10.40	134.81	3.14	14.0	14.0	1.0	105.63	2304.93	30	1.0	94.3	3399.00	30.0	14.0	30	9.05	3.65	2.36	119.3	562.54	6266.5	324.0	6027.9	**2506.59**	**2009.30**
30.00	30.50	30.25	0.50	28.00	19.05	9.05	134.81	1.57	14.0	14.0	1.0	52.82	2357.74	30	1.0	47.1	3446.14	30.5	10.3	48	9.07	2.56	1.31	119.3	583.78	6387.7	329.9	6133.8	**2555.06**	**2044.58**
30.50	32.00	31.25	1.50	29.50	19.07	9.07	134.81	4.71	10.3	10.3	1.0	115.49	2473.23	48	1.0	226.3	3672.43	32.0	8.2	68	10.36	2.15	0.94	119.3	685.77	6831.4	347.5	6493.2	**2732.57**	**2164.40**
32.00	32.50	32.25	0.50	30.00	20.36	10.36	134.81	1.57	8.2	8.2	1.0	30.53	2503.76	68	1.0	106.9	3779.29	32.5	8.2	68	10.36	2.15	0.94	119.3	685.77	6968.8	353.4	6636.5	**2787.53**	**2212.16**
32.50	33.50	33.00	1.00	31.00	20.36	10.36	134.81	3.14	8.2	8.2	1.0	61.05	2564.81	68	1.0	213.7	3993.00	33.5	8.2	68	7.93	2.15	0.94	119.3	684.87	7242.7	365.2	6923.0	**2897.07**	**2307.67**
33.50	35.00	34.25	1.50	32.50	17.93	7.93	134.81	4.71	8.2	8.2	1.0	91.58	2656.39	68	1.0	320.6	4313.57	35.0	12.0	48	8.37	3.06	1.79	119.3	631.84	7601.8	382.9	7352.8	**3040.72**	**2450.95**
35.00	36.50	35.75	1.50	34.00	18.37	8.37	134.81	4.71	12.0	12.0	1.0	135.08	2791.47	48	1.0	226.3	4539.86	36.5	12.0	48	9.23	3.06	1.79	119.3	632.45	7963.8	400.6	7731.9	**3185.51**	**2577.29**
36.50	37.50	37.00	1.00	35.00	19.23	9.23	134.81	3.14	12.0	12.0	1.0	90.05	2881.53	48	1.0	150.9	4690.71	37.5	8.0	58	9.23	2.11	0.91	119.3	611.15	8183.4	412.3	7984.6	**3273.36**	**2661.53**
37.50	38.00	37.75	0.50	35.50	19.23	9.23	134.81	1.57	8.0	8.0	1.0	29.77	2911.30	58	1.0	91.1	4781.86	38.0	8.0	58	8.66	2.11	0.91	119.3	610.95	8304.1	418.2	8111.4	**3321.64**	**2703.79**
38.00	40.00	39.00	2.00	37.50	18.66	8.66	134.81	6.29	8.0	8.0	1.0	119.09	3030.39	58	1.0	364.6	5146.43	40.0	8.0	58	8.66	2.11	0.91	119.3	610.95	8787.8	441.8	8618.6	**3515.10**	**2872.87**
BORE NO: P70, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	20.39	10.39	28.57	1.57	24.5	24.5	1.0	20.46	0	7	1.0	11.0	0	3.0	15.0	16	10.39	3.94	2.65	31.2	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.50	20.39	10.39	36.37	3.14	15.0	15.0	1.0	30.62	0	16	1.0	50.3	0	4.0	28.5	3	8.60	17.88	18.94	41.6	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	5.00	4.50	1.00	2.50	18.60	8.60	45.86	3.14	28.5	28.5	1.0	78.26	0	3	1.0	9.4	0	5.0	26.1	0	8.60	12.48	13.41	50.2	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.50	18.60	8.60	54.46	3.14	26.1	26.1	1.0	83.85	0	0	1.0	0.0	0	6.0	26.8	0	8.60	14.05	15.03	58.8	0	0.0	41.2	41.2	**0.00**	**13.74**
6.00	8.00	7.00	2.00	5.50	18.60	8.60	67.36	6.29	26.8	26.8	1.0	213.88	0	0	1.0	0.0	0	8.0	29.0	0	10.38	19.01	20.10	76.0	0	0.0	64.8	64.8	**0.00**	**21.60**
8.00	9.00	8.50	1.00	6.50	20.38	10.38	81.15	3.14	29.0	29.0	1.0	141.37	0	0	1.0	0.0	0	9.0	29.0	0	10.38	19.01	20.10	86.3	1371.40	1371.4	76.6	76.6	**548.56**	**25.53**
9.00	10.00	9.50	1.00	7.50	20.38	10.38	91.53	3.14	29.0	29.0	1.0	159.46	159.46	0	1.0	0.0	0.00	10.0	25.8	8	10.38	11.80	12.72	96.7	1005.30	1164.8	88.4	247.8	**465.90**	**82.60**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
10.00	11.00	10.50	1.00	8.50	20.38	10.38	101.91	3.14	25.8	25.8	1.0	154.83	314.29	8	1.0	25.1	25.14	11.0	25.8	8	10.38	11.80	12.72	107.1	1101.55	1441.0	100.1	439.6	**576.39**	**146.52**
11.00	12.00	11.50	1.00	9.50	20.38	10.38	112.29	3.14	25.8	25.8	1.0	170.60	484.89	8	1.0	25.1	50.29	12.0	11.9	50	10.38	3.03	1.76	117.5	640.32	1175.5	111.9	647.1	**470.20**	**215.70**
12.00	13.00	12.50	1.00	10.50	20.38	10.38	122.67	3.14	11.9	11.9	1.0	81.24	566.14	50	1.0	157.1	207.43	13.0	8.1	46	10.60	2.13	0.93	127.9	542.93	1316.5	123.7	897.3	**526.60**	**299.09**
13.00	14.50	13.75	1.50	12.00	20.60	10.60	135.81	4.71	8.1	8.1	1.0	91.12	657.26	46	1.0	216.9	424.29	14.5	9.6	48	10.60	2.40	1.16	143.8	615.12	1696.7	141.4	1222.9	**678.66**	**407.64**
14.50	16.00	15.25	1.50	13.50	20.60	10.60	135.81	4.71	9.6	9.6	1.0	108.29	765.55	48	1.0	226.3	650.57	16.0	9.6	48	10.60	2.40	1.16	143.8	615.12	2031.2	159.0	1575.2	**812.49**	**525.05**
16.00	17.50	16.75	1.50	15.00	20.60	10.60	135.81	4.71	9.6	9.6	1.0	108.29	873.84	48	1.0	226.3	876.86	17.5	9.6	48	10.60	2.40	1.16	143.8	615.12	2365.8	176.7	1927.4	**946.32**	**642.47**
17.50	19.00	18.25	1.50	16.50	20.60	10.60	135.81	4.71	9.6	9.6	1.0	108.29	982.13	48	1.0	226.3	1103.14	19.0	27.2	0	10.69	14.95	15.95	143.8	1756.12	3841.4	194.4	2279.7	**1536.56**	**759.89**
19.00	20.50	19.75	1.50	18.00	20.69	10.69	135.81	4.71	27.2	27.2	1.0	329.04	1311.17	0	1.0	0.0	1103.14	20.5	9.5	56	9.87	2.38	1.14	143.8	669.26	3083.6	212.1	2626.4	**1233.43**	**875.46**
20.50	23.50	22.00	3.00	21.00	19.87	9.87	135.81	9.43	9.5	9.5	1.0	214.28	1525.45	56	1.0	528.0	1631.14	23.5	10.2	59	10.33	2.53	1.28	143.8	708.04	3864.6	247.4	3404.0	**1545.85**	**1134.66**
23.50	26.50	25.00	3.00	24.00	20.33	10.33	135.81	9.43	10.2	10.2	1.0	230.40	1755.85	59	1.0	556.3	2187.43	26.5	10.2	59	10.33	2.53	1.28	143.8	708.04	4651.3	282.7	4226.0	**1860.53**	**1408.67**
26.50	27.50	27.00	1.00	25.00	20.33	10.33	135.81	3.14	10.2	10.2	1.0	76.80	1832.65	59	1.0	185.4	2372.86	27.5	8.2	54	10.33	2.15	0.94	143.8	628.08	4833.6	294.5	4500.0	**1933.44**	**1500.01**
27.50	28.00	27.75	0.50	25.50	20.33	10.33	135.81	1.57	8.2	8.2	1.0	30.75	1863.40	54	1.0	84.9	2457.71	28.0	8.2	54	10.40	2.15	0.94	143.8	628.11	4949.2	300.4	4621.5	**1979.69**	**1540.51**
28.00	29.50	28.75	1.50	27.00	20.40	10.40	135.81	4.71	8.2	8.2	1.0	92.26	1955.66	54	1.0	254.6	2712.29	29.5	8.2	54	10.40	2.15	0.94	143.8	628.11	5296.1	318.1	4986.0	**2118.42**	**1662.01**
29.50	30.00	29.75	0.50	27.50	20.40	10.40	135.81	1.57	8.2	8.2	1.0	30.75	1986.42	54	1.0	84.9	2797.14	30.0	8.2	54	10.40	2.15	0.94	143.8	628.11	5411.7	324.0	5107.5	**2164.67**	**1702.51**
30.00	31.00	30.50	1.00	28.50	20.40	10.40	135.81	3.14	8.2	8.2	1.0	61.51	2047.92	54	1.0	169.7	2966.86	31.0	13.0	60	10.40	3.35	2.08	143.8	811.17	5826.0	335.8	5350.5	**2330.38**	**1783.51**
31.00	32.50	31.75	1.50	30.00	20.40	10.40	135.81	4.71	13.0	13.0	1.0	147.81	2195.74	60	1.0	282.9	3249.71	32.5	13.5	60	9.60	3.50	2.22	143.8	828.00	6273.5	353.4	5798.9	**2509.38**	**1932.96**
32.50	34.00	33.25	1.50	31.50	19.60	9.60	135.81	4.71	13.5	13.5	1.0	153.71	2349.45	60	1.0	282.9	3532.57	34.0	27.4	0	9.60	15.40	16.41	143.8	1801.90	7683.9	371.1	6253.1	**3073.57**	**2084.37**
34.00	35.00	34.50	1.00	32.50	19.60	9.60	135.81	3.14	27.4	27.4	1.0	221.25	2570.69	0	1.0	0.0	3532.57	35.0	27.4	0	9.60	15.40	16.41	143.8	1801.90	7905.2	382.9	6486.1	**3162.07**	**2162.05**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
35.00	35.50	35.25	0.50	33.00	19.60	9.60	135.81	1.57	27.4	27.4	1.0	110.62	2681.32	0	1.0	0.0	3532.57	35.5	27.4	0	9.60	15.40	16.41	143.8	1801.90	8015.8	388.8	6602.7	**3206.32**	**2200.89**
35.50	37.00	36.25	1.50	34.50	19.60	9.60	135.81	4.71	27.4	27.4	1.0	331.87	3013.19	0	1.0	0.0	3532.57	37.0	23.4	0	9.60	8.85	9.12	143.8	1033.83	7579.6	406.4	6952.2	**3031.84**	**2317.40**
37.00	37.50	37.25	0.50	35.00	19.60	9.60	135.81	1.57	23.4	23.4	1.0	92.35	3105.54	0	1.0	0.0	3532.57	37.5	23.0	0	9.26	8.56	8.68	143.8	998.48	7636.6	412.3	7050.4	**3054.64**	**2350.15**
37.50	38.50	38.00	1.00	36.00	19.26	9.26	135.81	3.14	23.0	23.0	1.0	181.18	3286.72	0	1.0	0.0	3532.57	38.5	21.0	0	9.14	7.12	6.49	143.8	827.53	7646.8	424.1	7243.4	**3058.73**	**2414.47**
38.50	40.00	39.25	1.50	37.50	19.14	9.14	135.81	4.71	21.0	21.0	1.0	245.77	3532.49	0	1.0	0.0	3532.57	40.0	21.0	0	9.14	7.12	6.49	143.8	827.53	7892.6	441.8	7506.8	**3157.04**	**2502.28**
BORE NO: P71, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	18.58	8.58	23.60	1.57	11.2	11.2	1.0	7.34	0	41	1.0	64.4	0	3.0	11.2	41	8.58	2.82	1.56	25.7	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.50	18.58	8.58	30.03	3.14	11.2	11.2	1.0	18.69	0	41	1.0	128.9	0	4.0	11.2	41	8.58	2.82	1.56	34.3	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	5.00	4.50	1.00	2.50	18.58	8.58	38.61	3.14	11.2	11.2	1.0	24.03	0	41	1.0	128.9	0	5.0	28.4	0	10.06	17.66	18.71	42.9	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.50	20.06	10.06	47.93	3.14	28.4	28.4	1.0	81.45	0	0	1.0	0.0	0	6.0	25.4	0	10.06	10.90	11.80	53.0	0	0.0	41.2	41.2	**0.00**	**13.74**
6.00	7.00	6.50	1.00	4.50	20.06	10.06	57.99	3.14	25.4	25.4	1.0	86.54	0	0	1.0	0.0	0	7.0	28.6	0	9.38	18.11	19.17	63.0	0	0.0	53.0	53.0	**0.00**	**17.67**
7.00	9.00	8.00	2.00	6.50	19.38	9.38	72.40	6.29	28.6	28.6	1.0	248.12	0	0	1.0	0.0	0	9.0	9.2	50	9.38	2.33	1.10	81.8	507.07	507.1	76.6	76.6	**202.83**	**25.53**
9.00	10.00	9.50	1.00	7.50	19.38	9.38	86.47	3.14	9.2	9.2	1.0	44.02	44.02	50	1.0	157.1	157.14	10.0	9.2	50	9.38	2.33	1.10	91.2	524.21	725.4	88.4	289.5	**290.15**	**96.51**
10.00	11.00	10.50	1.00	8.50	19.38	9.38	95.85	3.14	9.2	9.2	1.0	48.79	92.81	50	1.0	157.1	314.29	11.0	24.8	11	9.88	9.86	10.66	100.5	897.75	1304.8	100.1	507.2	**521.93**	**169.08**
11.00	12.50	11.75	1.50	10.00	19.88	9.88	107.95	4.71	24.8	24.8	1.0	235.15	327.95	11	1.0	51.9	366.14	12.5	24.8	11	9.88	9.86	10.66	115.4	1012.51	1706.6	117.8	811.9	**682.64**	**270.64**
12.50	14.00	13.25	1.50	11.50	19.88	9.88	122.77	4.71	24.8	24.8	1.0	267.43	595.39	11	1.0	51.9	418.00	14.0	9.2	58	10.96	2.33	1.10	130.2	652.78	1666.2	135.5	1148.9	**666.47**	**382.96**
14.00	15.50	14.75	1.50	13.00	20.96	10.96	138.40	4.71	9.2	9.2	1.0	105.67	701.06	58	1.0	273.4	691.43	15.5	9.2	58	10.96	2.33	1.10	130.2	652.78	2045.3	153.2	1545.6	**818.11**	**515.21**
15.50	17.00	16.25	1.50	14.50	20.96	10.96	138.40	4.71	9.2	9.2	1.0	105.67	806.74	58	1.0	273.4	964.86	17.0	27.2	0	9.61	14.95	15.95	130.2	1589.79	3361.4	170.8	1942.4	**1344.55**	**647.47**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
17.00	18.50	17.75	1.50	16.00	19.61	9.61	138.40	4.71	27.2	27.2	1.0	335.32	1142.05	0	1.0	0.0	964.86	18.5	10.3	51	9.61	2.56	1.31	130.2	627.24	2734.1	188.5	2295.4	**1093.66**	**765.14**
18.50	20.00	19.25	1.50	17.50	19.61	9.61	138.40	4.71	10.3	10.3	1.0	118.57	1260.62	51	1.0	240.4	1205.29	20.0	10.3	51	10.63	2.56	1.31	130.2	627.76	3093.7	206.2	2672.1	**1237.47**	**890.69**
20.00	21.50	20.75	1.50	19.00	20.63	10.63	138.40	4.71	10.3	10.3	1.0	118.57	1379.20	51	1.0	240.4	1445.71	21.5	10.3	51	10.63	2.56	1.31	130.2	627.76	3452.7	223.8	3048.7	**1381.07**	**1016.25**
21.50	23.00	22.25	1.50	20.50	20.63	10.63	138.40	4.71	10.3	10.3	1.0	118.57	1497.77	51	1.0	240.4	1686.14	23.0	18.5	32	10.63	5.64	4.57	130.2	822.45	4006.4	241.5	3425.4	**1602.54**	**1141.81**
23.00	24.50	23.75	1.50	22.00	20.63	10.63	138.40	4.71	18.5	18.5	1.0	218.31	1716.08	32	1.0	150.9	1837.00	24.5	26.2	7	9.72	12.70	13.64	130.2	1400.85	4953.9	259.2	3812.3	**1981.57**	**1270.75**
24.50	27.50	26.00	3.00	25.00	19.72	9.72	138.40	9.43	26.2	26.2	1.0	642.10	2358.17	7	1.0	66.0	1903.00	27.5	9.0	75	9.72	2.29	1.07	130.2	768.66	5029.8	294.5	4555.7	**2011.93**	**1518.57**
27.50	29.00	28.25	1.50	26.50	19.72	9.72	138.40	4.71	9.0	9.0	1.0	103.34	2461.51	75	1.0	353.6	2256.57	29.0	9.0	75	9.72	2.29	1.07	130.2	768.66	5486.7	312.2	5030.3	**2194.70**	**1676.76**
29.00	30.00	29.50	1.00	27.50	19.72	9.72	138.40	3.14	9.0	9.0	1.0	68.89	2530.41	75	1.0	235.7	2492.29	30.0	9.5	50	10.73	2.38	1.14	130.2	601.83	5624.5	324.0	5346.7	**2249.81**	**1782.22**
30.00	30.50	30.25	0.50	28.00	20.73	10.73	138.40	1.57	9.5	9.5	1.0	36.39	2566.80	50	1.0	78.6	2570.86	30.5	9.5	50	9.11	2.38	1.14	130.2	601.10	5738.8	329.9	5467.5	**2295.50**	**1822.51**
30.50	32.00	31.25	1.50	29.50	19.11	9.11	138.40	4.71	9.5	9.5	1.0	109.18	2675.98	50	1.0	235.7	2806.57	32.0	8.5	56	9.22	2.20	0.99	130.2	624.61	6107.2	347.5	5830.1	**2442.87**	**1943.36**
32.00	32.50	32.25	0.50	30.00	19.22	9.22	138.40	1.57	8.5	8.5	1.0	32.50	2708.49	56	1.0	88.0	2894.57	32.5	8.5	56	9.22	2.20	0.99	130.2	624.61	6227.7	353.4	5956.5	**2491.07**	**1985.50**
32.50	33.50	33.00	1.00	31.00	19.22	9.22	138.40	3.14	8.5	8.5	1.0	65.01	2773.49	56	1.0	176.0	3070.57	33.5	8.3	78	10.16	2.16	0.96	130.2	776.74	6620.8	365.2	6209.3	**2648.32**	**2069.76**
33.50	35.00	34.25	1.50	32.50	20.16	10.16	138.40	4.71	8.3	8.3	1.0	95.18	2868.68	78	1.0	367.7	3438.29	35.0	9.2	63	9.59	2.33	1.10	130.2	687.55	6994.5	382.9	6689.8	**2797.80**	**2229.95**
35.00	36.50	35.75	1.50	34.00	19.59	9.59	138.40	4.71	9.2	9.2	1.0	105.67	2974.35	63	1.0	297.0	3735.29	36.5	9.2	63	9.35	2.33	1.10	130.2	687.44	7397.1	400.6	7110.2	**2958.83**	**2370.06**
36.50	37.50	37.00	1.00	35.00	19.35	9.35	138.40	3.14	9.2	9.2	1.0	70.45	3044.80	63	1.0	198.0	3933.29	37.5	9.2	57	9.35	2.33	1.10	130.2	645.01	7623.1	412.3	7390.4	**3049.24**	**2463.47**
37.50	38.00	37.75	0.50	35.50	19.35	9.35	138.40	1.57	9.2	9.2	1.0	35.22	3080.03	57	1.0	89.6	4022.86	38.0	9.2	57	9.59	2.33	1.10	130.2	645.12	7748.0	418.2	7521.1	**3099.20**	**2507.04**
38.00	40.00	39.00	2.00	37.50	19.59	9.59	138.40	6.29	9.2	9.2	1.0	140.90	3220.93	57	1.0	358.3	4381.14	40.0	9.2	57	9.59	2.33	1.10	130.2	645.12	8247.2	441.8	8043.9	**3298.88**	**2681.29**

BORE NO: P72, CUT OFF LENGTH: 2.50 m, Nc= 9

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
2.50	3.00	2.75	0.50	0.50	19.98	9.98	27.45	1.57	23.4	23.4	1.0	18.66	0	0	1.0	0.0	0	3.0	28.5	0	9.98	17.88	18.94	29.9	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.50	19.98	9.98	34.93	3.14	28.5	28.5	1.0	59.61	0	0	1.0	0.0	0	4.0	28.5	0	9.37	17.88	18.94	39.9	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	6.00	5.00	2.00	3.50	19.37	9.37	49.29	6.29	28.5	28.5	1.0	168.22	0	0	1.0	0.0	0	6.0	28.4	0	9.37	17.66	18.71	58.7	0	0.0	41.2	41.2	**0.00**	**13.74**
6.00	7.00	6.50	1.00	4.50	19.37	9.37	63.35	3.14	28.4	28.4	1.0	107.64	0	0	1.0	0.0	0	7.0	27.2	0	9.37	14.95	15.95	68.0	0	0.0	53.0	53.0	**0.00**	**17.67**
7.00	9.00	8.00	2.00	6.50	19.37	9.37	77.40	6.29	27.2	27.2	1.0	250.03	0	0	1.0	0.0	0	9.0	28.2	0	10.25	17.21	18.25	86.8	0	0.0	76.6	76.6	**0.00**	**25.53**
9.00	10.00	9.50	1.00	7.50	20.25	10.25	91.90	3.14	28.2	28.2	1.0	154.86	0	0	1.0	0.0	0	10.0	11.1	22	10.25	2.79	1.53	97.0	374.69	374.7	88.4	88.4	**149.88**	**29.45**
10.00	11.00	10.50	1.00	8.50	20.25	10.25	102.15	3.14	11.1	11.1	1.0	62.98	62.98	22	1.0	69.1	69.14	11.0	11.6	44	10.25	2.94	1.68	107.3	565.73	697.9	100.1	232.3	**279.14**	**77.42**
11.00	12.50	11.75	1.50	10.00	20.25	10.25	114.96	4.71	11.6	11.6	1.0	111.24	174.23	44	1.0	207.4	276.57	12.5	11.0	40	10.17	2.76	1.51	122.6	555.22	1006.0	117.8	568.6	**402.41**	**189.54**
12.50	15.50	14.00	3.00	13.00	20.17	10.17	137.90	9.43	11.0	11.0	1.0	252.73	426.96	40	1.0	377.1	653.71	15.5	8.1	40	10.17	2.13	0.93	122.6	491.62	1572.3	153.2	1233.8	**628.92**	**411.28**
15.50	17.00	16.25	1.50	14.50	20.17	10.17	137.90	4.71	8.1	8.1	1.0	92.52	519.48	40	1.0	188.6	842.29	17.0	10.2	46	10.38	2.53	1.28	122.6	574.18	1935.9	170.8	1532.6	**774.38**	**510.86**
17.00	18.50	17.75	1.50	16.00	20.38	10.38	137.90	4.71	10.2	10.2	1.0	116.97	636.46	46	1.0	216.9	1059.14	18.5	15.3	23	10.38	4.09	2.81	122.6	568.02	2263.6	188.5	1884.1	**905.45**	**628.03**
18.50	20.00	19.25	1.50	17.50	20.38	10.38	137.90	4.71	15.3	15.3	1.0	177.85	814.30	23	1.0	108.4	1167.57	20.0	9.3	52	10.35	2.34	1.11	122.6	598.11	2580.0	206.2	2188.0	**1032.00**	**729.35**
20.00	21.50	20.75	1.50	19.00	20.35	10.35	137.90	4.71	9.3	9.3	1.0	106.46	920.76	52	1.0	245.1	1412.71	21.5	9.3	52	10.35	2.34	1.11	122.6	598.11	2931.6	223.8	2557.3	**1172.64**	**852.44**
21.50	23.00	22.25	1.50	20.50	20.35	10.35	137.90	4.71	9.3	9.3	1.0	106.46	1027.22	52	1.0	245.1	1657.86	23.0	29.6	0	10.35	20.36	21.48	122.6	2049.18	4734.3	241.5	2926.6	**1893.70**	**975.53**
23.00	24.50	23.75	1.50	22.00	20.35	10.35	137.90	4.71	29.6	29.6	1.0	369.31	1396.53	0	1.0	0.0	1657.86	24.5	20.0	48	10.09	6.40	5.39	122.6	977.52	4031.9	259.2	3313.6	**1612.76**	**1104.52**
24.50	26.00	25.25	1.50	23.50	20.09	10.09	137.90	4.71	20.0	20.0	1.0	236.62	1633.14	48	1.0	226.3	1884.14	26.0	9.5	53	10.09	2.38	1.14	122.6	608.66	4125.9	276.9	3794.1	**1650.38**	**1264.71**
26.00	27.50	26.75	1.50	25.00	20.09	10.09	137.90	4.71	9.5	9.5	1.0	108.79	1741.93	53	1.0	249.9	2134.00	27.5	9.5	53	10.09	2.38	1.14	122.6	608.66	4484.6	294.5	4170.5	**1793.84**	**1390.15**
27.50	29.00	28.25	1.50	26.50	20.09	10.09	137.90	4.71	9.5	9.5	1.0	108.79	1850.72	53	1.0	249.9	2383.86	29.0	25.2	0	10.21	10.45	11.34	122.6	1052.53	5287.1	312.2	4546.8	**2114.84**	**1515.59**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
29.00	30.00	29.50	1.00	27.50	20.21	10.21	137.90	3.14	25.2	25.2	1.0	203.94	2054.67	0	1.0	0.0	2383.86	30.0	25.2	0	10.21	10.45	11.34	122.6	1052.53	5491.1	324.0	4762.5	**2196.42**	**1587.50**
30.00	30.50	30.25	0.50	28.00	20.21	10.21	137.90	1.57	25.2	25.2	1.0	101.97	2156.64	0	1.0	0.0	2383.86	30.5	25.0	0	10.21	10.00	10.88	122.6	1007.28	5547.8	329.9	4870.4	**2219.11**	**1623.45**
30.50	32.50	31.50	2.00	30.00	20.21	10.21	137.90	6.29	25.0	25.0	1.0	404.20	2560.83	0	1.0	0.0	2383.86	32.5	21.5	15	9.11	7.48	7.04	122.6	852.06	5796.7	353.4	5298.1	**2318.70**	**1766.04**
32.50	33.50	33.00	1.00	31.00	19.11	9.11	137.90	3.14	21.5	21.5	1.0	170.72	2731.55	15	1.0	47.1	2431.00	33.5	17.5	39	10.37	5.17	4.02	122.6	790.36	5952.9	365.2	5527.8	**2381.17**	**1842.59**
33.50	35.00	34.25	1.50	32.50	20.37	10.37	137.90	4.71	17.5	17.5	1.0	204.98	2936.53	39	1.0	183.9	2614.86	35.0	14.3	48	10.37	3.74	2.45	122.6	709.52	6260.9	382.9	5934.3	**2504.36**	**1978.09**
35.00	36.50	35.75	1.50	34.00	20.37	10.37	137.90	4.71	14.3	14.3	1.0	165.71	3102.24	48	1.0	226.3	2841.14	36.5	14.3	48	10.37	3.74	2.45	122.6	709.52	6652.9	400.6	6343.9	**2661.16**	**2114.64**
36.50	37.50	37.00	1.00	35.00	20.37	10.37	137.90	3.14	14.3	14.3	1.0	110.47	3212.71	48	1.0	150.9	2992.00	37.5	14.3	48	10.37	3.74	2.45	122.6	709.52	6914.2	412.3	6617.0	**2765.69**	**2205.68**
37.50	38.00	37.75	0.50	35.50	20.37	10.37	137.90	1.57	14.3	14.3	1.0	55.24	3267.95	48	1.0	75.4	3067.43	38.0	27.1	0	10.37	14.73	15.72	122.6	1483.38	7818.8	418.2	6753.6	**3127.50**	**2251.20**
38.00	40.00	39.00	2.00	37.50	20.37	10.37	137.90	6.29	27.1	27.1	1.0	443.56	3711.51	0	1.0	0.0	3067.43	40.0	18.0	0	10.37	5.42	4.29	122.6	539.40	7318.3	441.8	7220.7	**2927.34**	**2406.91**
BORE NO: P73, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	16.68	6.68	18.37	1.57	21.0	21.0	1.0	11.08	0	10	1.0	15.7	0	3.0	12.8	70	6.68	3.29	2.02	20.0	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.50	16.68	6.68	23.38	3.14	12.8	12.8	1.0	16.69	0	70	1.0	220.0	0	4.0	24.5	12	9.67	9.64	10.33	26.7	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	6.00	5.00	2.00	3.50	19.67	9.67	36.39	6.29	24.5	24.5	1.0	104.24	0	12	1.0	75.4	0	6.0	24.5	12	9.67	9.64	10.33	46.1	0	0.0	41.2	41.2	**0.00**	**13.74**
6.00	7.00	6.50	1.00	4.50	19.67	9.67	50.90	3.14	24.5	24.5	1.0	72.90	0	12	1.0	37.7	0	7.0	24.5	12	9.67	9.64	10.33	55.7	0	0.0	53.0	53.0	**0.00**	**17.67**
7.00	8.00	7.50	1.00	5.50	19.67	9.67	60.57	3.14	24.5	24.5	1.0	86.75	0	12	1.0	37.7	0	8.0	29.0	0	9.40	19.01	20.10	65.4	0	0.0	64.8	64.8	**0.00**	**21.60**
8.00	9.00	8.50	1.00	6.50	19.40	9.40	70.10	3.14	29.0	29.0	1.0	122.12	0	0	1.0	0.0	0	9.0	29.0	0	9.40	19.01	20.10	74.8	0	0.0	76.6	76.6	**0.00**	**25.53**
9.00	10.00	9.50	1.00	7.50	19.40	9.40	79.50	3.14	29.0	29.0	1.0	138.50	0	0	1.0	0.0	0	10.0	9.5	44	9.80	2.38	1.14	84.2	473.00	473.0	88.4	88.4	**189.20**	**29.45**
10.00	12.50	11.25	2.50	10.00	19.80	9.80	96.45	7.86	9.5	9.5	1.0	126.82	126.82	44	1.0	345.7	345.71	12.5	9.0	46	10.00	2.29	1.07	108.7	525.06	997.6	117.8	590.3	**399.03**	**196.78**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
12.50	15.50	14.00	3.00	13.00	20.00	10.00	123.70	9.43	9.0	9.0	1.0	184.73	311.54	46	1.0	433.7	779.43	15.5	9.0	46	10.00	2.29	1.07	108.7	525.06	1616.0	153.2	1244.1	**646.41**	**414.71**
15.50	17.00	16.25	1.50	14.50	20.00	10.00	123.70	4.71	9.0	9.0	1.0	92.36	403.90	46	1.0	216.9	996.29	17.0	26.5	4	8.50	13.38	14.34	108.7	1218.72	2618.9	170.8	1571.0	**1047.57**	**523.67**
17.00	18.50	17.75	1.50	16.00	18.50	8.50	123.70	4.71	26.5	26.5	1.0	290.75	694.66	4	1.0	18.9	1015.14	18.5	26.5	4	8.10	13.38	14.34	108.7	1216.47	2926.3	188.5	1898.3	**1170.51**	**632.76**
18.50	21.50	20.00	3.00	19.00	18.10	8.10	123.70	9.43	26.5	26.5	1.0	581.50	1276.16	4	1.0	37.7	1052.86	21.5	11.5	42	8.10	2.91	1.65	108.7	550.87	2879.9	223.8	2552.9	**1151.95**	**850.95**
21.50	23.00	22.25	1.50	20.50	18.10	8.10	123.70	4.71	11.5	11.5	1.0	118.64	1394.80	42	1.0	198.0	1250.86	23.0	8.0	62	8.10	2.11	0.91	108.7	621.54	3267.2	241.5	2887.2	**1306.88**	**962.39**
23.00	24.50	23.75	1.50	22.00	18.10	8.10	123.70	4.71	8.0	8.0	1.0	81.96	1476.76	62	1.0	292.3	1543.14	24.5	29.0	0	9.37	19.01	20.10	108.7	1697.36	4717.3	259.2	3279.1	**1886.91**	**1093.03**
24.50	26.00	25.25	1.50	23.50	19.37	9.37	123.70	4.71	29.0	29.0	1.0	323.25	1800.01	0	1.0	0.0	1543.14	26.0	7.5	38	9.37	2.02	0.84	108.7	444.31	3787.5	276.9	3620.0	**1514.99**	**1206.67**
26.00	27.50	26.75	1.50	25.00	19.37	9.37	123.70	4.71	7.5	7.5	1.0	76.77	1876.78	38	1.0	179.1	1722.29	27.5	7.5	38	9.37	2.02	0.84	108.7	444.31	4043.4	294.5	3893.6	**1617.35**	**1297.86**
27.50	29.00	28.25	1.50	26.50	19.37	9.37	123.70	4.71	7.5	7.5	1.0	76.77	1953.56	38	1.0	179.1	1901.43	29.0	28.5	0	9.37	17.88	18.94	108.7	1596.96	5451.9	312.2	4167.2	**2180.78**	**1389.06**
29.00	30.00	29.50	1.00	27.50	19.37	9.37	123.70	3.14	28.5	28.5	1.0	211.09	2164.64	0	1.0	0.0	1901.43	30.0	28.5	0	9.37	17.88	18.94	108.7	1596.96	5663.0	324.0	4390.0	**2265.21**	**1463.35**
30.00	30.50	30.25	0.50	28.00	19.37	9.37	123.70	1.57	28.5	28.5	1.0	105.54	2270.19	0	1.0	0.0	1901.43	30.5	7.5	50	9.37	2.02	0.84	108.7	529.17	4700.8	329.9	4501.5	**1880.31**	**1500.49**
30.50	32.00	31.25	1.50	29.50	19.37	9.37	123.70	4.71	7.5	7.5	1.0	76.77	2346.96	50	1.0	235.7	2137.14	32.0	29.0	0	9.37	19.01	20.10	108.7	1697.36	6181.5	347.5	4831.6	**2472.59**	**1610.55**
32.00	32.50	32.25	0.50	30.00	19.37	9.37	123.70	1.57	29.0	29.0	1.0	107.75	2454.71	0	1.0	0.0	2137.14	32.5	29.0	0	10.08	19.01	20.10	108.7	1702.97	6294.8	353.4	4945.3	**2517.93**	**1648.43**
32.50	33.50	33.00	1.00	31.00	20.08	10.08	123.70	3.14	29.0	29.0	1.0	215.50	2670.21	0	1.0	0.0	2137.14	33.5	8.5	53	10.08	2.20	0.99	108.7	566.60	5374.0	365.2	5172.6	**2149.58**	**1724.19**
33.50	35.00	34.25	1.50	32.50	20.08	10.08	123.70	4.71	8.5	8.5	1.0	87.15	2757.36	53	1.0	249.9	2387.00	35.0	8.5	53	10.08	2.20	0.99	108.7	566.60	5711.0	382.9	5527.2	**2284.38**	**1842.42**
35.00	36.50	35.75	1.50	34.00	20.08	10.08	123.70	4.71	8.5	8.5	1.0	87.15	2844.52	53	1.0	249.9	2636.86	36.5	8.5	53	10.08	2.20	0.99	108.7	566.60	6048.0	400.6	5881.9	**2419.19**	**1960.64**
36.50	37.50	37.00	1.00	35.00	20.08	10.08	123.70	3.14	8.5	8.5	1.0	58.10	2902.62	53	1.0	166.6	2803.43	37.5	10.5	72	10.08	2.62	1.36	108.7	738.05	6444.1	412.3	6118.4	**2577.64**	**2039.46**
37.50	38.00	37.75	0.50	35.50	20.08	10.08	123.70	1.57	10.5	10.5	1.0	36.03	2938.65	72	1.0	113.1	2916.57	38.0	10.5	72	8.28	2.62	1.36	108.7	737.09	6592.3	418.2	6273.4	**2636.92**	**2091.15**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
38.00	40.00	39.00	2.00	37.50	18.28	8.28	123.70	6.29	10.5	10.5	1.0	144.11	3082.76	72	1.0	452.6	3369.14	40.0	10.5	72	8.28	2.62	1.36	108.7	737.09	7189.0	441.8	6893.7	**2875.59**	**2297.90**
BORE NO: P74, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.63	9.63	26.48	1.57	23.9	23.9	1.0	18.44	0	0	1.0	0.0	0	3.0	12.8	24	9.63	3.29	2.02	28.9	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.50	19.63	9.63	33.71	3.14	12.8	12.8	1.0	24.07	0	24	1.0	75.4	0	4.0	12.4	24	9.63	3.17	1.91	38.5	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	5.00	4.50	1.00	2.50	19.63	9.63	43.34	3.14	12.4	12.4	1.0	29.94	0	24	1.0	75.4	0	5.0	26.9	6	9.52	14.28	15.26	48.2	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.50	19.52	9.52	52.91	3.14	26.9	26.9	1.0	84.36	0	6	1.0	18.9	0	6.0	28.9	6	9.52	18.78	19.87	57.7	0	0.0	41.2	41.2	**0.00**	**13.74**
6.00	7.00	6.50	1.00	4.50	19.52	9.52	62.43	3.14	28.9	28.9	1.0	108.31	0	6	1.0	18.9	0	7.0	28.9	2	9.44	18.78	19.87	67.2	0	0.0	53.0	53.0	**0.00**	**17.67**
7.00	9.00	8.00	2.00	6.50	19.44	9.44	76.63	6.29	28.9	28.9	1.0	265.90	0	2	1.0	12.6	0	9.0	28.9	2	9.44	18.78	19.87	86.1	0	0.0	76.6	76.6	**0.00**	**25.53**
9.00	10.00	9.50	1.00	7.50	19.44	9.44	90.79	3.14	28.9	28.9	1.0	157.52	0	2	1.0	6.3	0	10.0	10.2	24	9.44	2.53	1.28	95.5	0	0.0	88.4	88.4	**0.00**	**29.45**
10.00	11.00	10.50	1.00	8.50	19.44	9.44	100.23	3.14	10.2	10.2	1.0	56.68	0	24	1.0	75.4	0	11.0	26.3	7	9.67	12.93	13.88	105.0	0	0.0	100.1	100.1	**0.00**	**33.38**
11.00	12.50	11.75	1.50	10.00	19.67	9.67	112.20	4.71	26.3	26.3	1.0	261.43	0	7	1.0	33.0	0	12.5	12.0	30	9.67	3.06	1.79	119.5	0	0.0	117.8	117.8	**0.00**	**39.27**
12.50	14.00	13.25	1.50	11.50	19.67	9.67	126.71	4.71	12.0	12.0	1.0	126.97	0	30	1.0	141.4	0	14.0	27.1	0	9.83	14.73	15.72	134.0	0	0.0	135.5	135.5	**0.00**	**45.16**
14.00	15.50	14.75	1.50	13.00	19.83	9.83	141.33	4.71	27.1	27.1	1.0	340.95	0	0	1.0	0.0	0	15.5	11.7	52	10.31	2.97	1.71	134.0	687.21	687.2	153.2	153.2	**274.88**	**51.05**
15.50	18.50	17.00	3.00	16.00	20.31	10.31	141.33	9.43	11.7	11.7	1.0	275.96	275.96	52	1.0	490.3	490.29	18.5	26.9	0	10.31	14.28	15.26	134.0	1564.68	2330.9	188.5	954.7	**932.37**	**318.25**
18.50	20.00	19.25	1.50	17.50	20.31	10.31	141.33	4.71	26.9	26.9	1.0	338.02	613.98	0	1.0	0.0	490.29	20.0	11.7	56	10.31	2.97	1.71	134.0	715.49	1819.8	206.2	1310.4	**727.91**	**436.81**
20.00	21.50	20.75	1.50	19.00	20.31	10.31	141.33	4.71	11.7	11.7	1.0	137.98	751.97	56	1.0	264.0	754.29	21.5	10.0	56	8.86	2.47	1.22	134.0	660.22	2166.5	223.8	1730.1	**866.59**	**576.70**
21.50	23.00	22.25	1.50	20.50	18.86	8.86	141.33	4.71	10.0	10.0	1.0	117.48	869.45	56	1.0	264.0	1018.29	23.0	8.2	58	8.59	2.15	0.94	134.0	639.20	2526.9	241.5	2129.2	**1010.77**	**709.75**
23.00	24.50	23.75	1.50	22.00	18.59	8.59	141.33	4.71	8.2	8.2	1.0	96.01	965.46	58	1.0	273.4	1291.71	24.5	7.0	81	10.87	1.93	0.76	134.0	779.16	3036.3	259.2	2516.4	**1214.54**	**838.79**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)													
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
24.50	26.00	25.25	1.50	23.50	20.87	10.87	141.33	4.71	7.0	7.0	1.0	81.81	1047.27	81	1.0	381.9	1673.57	26.0	7.0	81	8.59	1.93	0.76	134.0	778.48	3499.3	276.9	2997.7	**1399.73**	**999.23**
26.00	27.50	26.75	1.50	25.00	18.59	8.59	141.33	4.71	7.0	7.0	1.0	81.81	1129.08	81	1.0	381.9	2055.43	27.5	7.0	81	10.54	1.93	0.76	134.0	779.07	3963.6	294.5	3479.0	**1585.43**	**1159.68**
27.50	29.00	28.25	1.50	26.50	20.54	10.54	141.33	4.71	7.0	7.0	1.0	81.81	1210.89	81	1.0	381.9	2437.29	29.0	18.0	26	8.62	5.42	4.29	134.0	768.46	4416.6	312.2	3960.4	**1766.65**	**1320.12**
29.00	30.00	29.50	1.00	27.50	18.62	8.62	141.33	3.14	18.0	18.0	1.0	144.33	1355.21	26	1.0	81.7	2519.00	30.0	18.0	26	8.62	5.42	4.29	134.0	768.46	4642.7	324.0	4198.2	**1857.07**	**1399.40**
30.00	30.50	30.25	0.50	28.00	18.62	8.62	141.33	1.57	18.0	18.0	1.0	72.16	1427.38	26	1.0	40.9	2559.86	30.5	18.0	26	9.41	5.42	4.29	134.0	769.79	4757.0	329.9	4317.1	**1902.81**	**1439.03**
30.50	32.00	31.25	1.50	29.50	19.41	9.41	141.33	4.71	18.0	18.0	1.0	216.49	1643.86	26	1.0	122.6	2682.43	32.0	8.0	63	9.36	2.11	0.91	134.0	670.94	4997.2	347.5	4673.8	**1998.89**	**1557.94**
32.00	32.50	32.25	0.50	30.00	19.36	9.36	141.33	1.57	8.0	8.0	1.0	31.21	1675.08	63	1.0	99.0	2781.43	32.5	8.0	63	9.36	2.11	0.91	134.0	670.94	5127.4	353.4	4809.9	**2050.98**	**1603.31**
32.50	33.50	33.00	1.00	31.00	19.36	9.36	141.33	3.14	8.0	8.0	1.0	62.43	1737.50	63	1.0	198.0	2979.43	33.5	4.5	0	9.29	1.51	0.41	134.0	160.73	4877.7	365.2	5082.1	**1951.06**	**1694.05**
33.50	35.00	34.25	1.50	32.50	19.29	9.29	141.33	4.71	4.5	4.5	1.0	52.44	1789.94	0	1.0	0.0	2979.43	35.0	12.0	25	9.63	3.06	1.79	134.0	505.43	5274.8	382.9	5152.3	**2109.92**	**1717.42**
35.00	36.50	35.75	1.50	34.00	19.63	9.63	141.33	4.71	12.0	12.0	1.0	141.62	1931.56	25	1.0	117.9	3097.29	36.5	9.1	53	8.70	2.31	1.08	134.0	621.41	5650.3	400.6	5429.4	**2260.10**	**1809.80**
36.50	37.50	37.00	1.00	35.00	18.70	8.70	141.33	3.14	9.1	9.1	1.0	71.15	2002.71	53	1.0	166.6	3263.86	37.5	9.1	53	8.70	2.31	1.08	134.0	621.41	5888.0	412.3	5678.9	**2355.19**	**1892.97**
37.50	38.00	37.75	0.50	35.50	18.70	8.70	141.33	1.57	9.1	9.1	1.0	35.57	2038.29	53	1.0	83.3	3347.14	38.0	9.1	53	8.96	2.31	1.08	134.0	621.52	6006.9	418.2	5803.7	**2402.78**	**1934.55**
38.00	40.00	39.00	2.00	37.50	18.96	8.96	141.33	6.29	9.1	9.1	1.0	142.29	2180.58	53	1.0	333.1	3680.29	40.0	9.1	53	8.96	1.93	1.08	134.0	581.73	6442.6	441.8	6302.7	**2577.04**	**2100.88**
BORE NO: P75, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.69	9.69	26.65	1.57	23.4	23.4	1.0	18.12	0	0	1.0	0.0	0	3.0	25.8	6	9.69	11.80	12.72	29.1	360.42	360.4	5.9	5.9	**144.17**	**1.96**
3.00	4.00	3.50	1.00	1.50	19.69	9.69	33.92	3.14	25.8	25.8	1.0	51.53	51.53	6	1.0	18.9	18.86	4.0	25.8	6	9.69	11.80	12.72	38.8	450.27	520.7	17.7	88.1	**208.26**	**29.35**
4.00	5.00	4.50	1.00	2.50	19.69	9.69	43.61	3.14	25.8	25.8	1.0	66.25	117.78	6	1.0	18.9	37.71	5.0	25.8	6	9.76	11.80	12.72	48.5	540.47	696.0	29.5	184.9	**278.39**	**61.65**
5.00	6.00	5.50	1.00	3.50	19.76	9.76	53.33	3.14	25.8	25.8	1.0	81.03	198.80	6	1.0	18.9	56.57	6.0	25.8	6	9.76	11.80	12.72	58.2	630.97	886.3	41.2	296.6	**354.54**	**98.87**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
6.00	7.00	6.50	1.00	4.50	19.76	9.76	63.09	3.14	25.8	25.8	1.0	95.85	294.66	6	1.0	18.9	75.43	7.0	25.7	2	10.89	11.58	12.49	68.0	685.82	1055.9	53.0	423.1	**422.36**	**141.03**
7.00	9.00	8.00	2.00	6.50	20.89	10.89	78.86	6.29	25.7	25.7	1.0	238.56	533.22	2	1.0	12.6	88.00	9.0	24.6	2	10.89	9.71	10.44	89.8	743.68	1364.9	76.6	697.8	**545.96**	**232.60**
9.00	10.00	9.50	1.00	7.50	20.89	10.89	95.20	3.14	24.6	24.6	1.0	136.98	670.19	2	1.0	6.3	94.29	10.0	13.5	24	9.80	3.50	2.22	100.6	455.03	1219.5	88.4	852.8	**487.80**	**284.28**
10.00	12.50	11.25	2.50	10.00	19.80	9.80	112.89	7.86	13.5	13.5	1.0	212.95	883.14	24	1.0	188.6	282.86	12.5	13.5	24	9.80	3.50	2.22	125.1	522.40	1688.4	117.8	1283.8	**675.36**	**427.94**
12.50	14.00	13.25	1.50	11.50	19.80	9.80	132.49	4.71	13.5	13.5	1.0	149.95	1033.09	24	1.0	113.1	396.00	14.0	8.2	62	10.26	2.15	0.94	139.8	678.02	2107.1	135.5	1564.6	**842.85**	**521.53**
14.00	15.50	14.75	1.50	13.00	20.26	10.26	147.54	4.71	8.2	8.2	1.0	100.23	1133.32	62	1.0	292.3	688.29	15.5	8.2	62	10.26	2.15	0.94	139.8	678.02	2499.6	153.2	1974.8	**999.85**	**658.25**
15.50	17.00	16.25	1.50	14.50	20.26	10.26	147.54	4.71	8.2	8.2	1.0	100.23	1233.55	62	1.0	292.3	980.57	17.0	26.7	0	9.48	13.83	14.80	139.8	1574.48	3788.6	170.8	2384.9	**1515.44**	**794.98**
17.00	18.50	17.75	1.50	16.00	19.48	9.48	147.54	4.71	26.7	26.7	1.0	349.81	1583.36	0	1.0	0.0	980.57	18.5	31.0	0	9.48	26.30	27.53	139.8	2991.87	5555.8	188.5	2752.4	**2222.32**	**917.47**
18.50	21.50	20.00	3.00	19.00	19.48	9.48	147.54	9.43	31.0	31.0	1.1	877.61	2460.97	0	1.0	0.0	980.57	21.5	9.3	56	10.41	2.34	1.11	139.8	658.09	4099.6	223.8	3665.4	**1639.86**	**1221.79**
21.50	24.50	23.00	3.00	22.00	20.41	10.41	147.54	9.43	9.3	9.3	1.0	227.79	2688.76	56	1.0	528.0	1508.57	24.5	27.0	0	10.41	14.50	15.49	139.8	1656.94	5854.3	259.2	4456.5	**2341.71**	**1485.51**
24.50	26.00	25.25	1.50	23.50	20.41	10.41	147.54	4.71	27.0	27.0	1.0	354.39	3043.15	0	1.0	0.0	1508.57	26.0	24.3	5	10.41	9.50	10.11	139.8	1120.08	5671.8	276.9	4828.6	**2268.72**	**1609.53**
26.00	27.50	26.75	1.50	25.00	20.41	10.41	147.54	4.71	24.3	24.3	1.0	314.04	3357.19	5	1.0	23.6	1532.14	27.5	10.5	28	9.64	2.62	1.36	139.8	490.70	5380.0	294.5	5183.9	**2152.01**	**1727.95**
27.50	29.00	28.25	1.50	26.50	19.64	9.64	147.54	4.71	10.5	10.5	1.0	128.91	3486.10	28	1.0	132.0	1664.14	29.0	28.7	0	9.64	18.33	19.40	139.8	2087.71	7238.0	312.2	5462.4	**2895.18**	**1820.81**
29.00	30.00	29.50	1.00	27.50	19.64	9.64	147.54	3.14	28.7	28.7	1.0	253.86	3739.96	0	1.0	0.0	1664.14	30.0	28.0	0	9.64	16.76	17.79	139.8	1908.40	7312.5	324.0	5728.1	**2925.00**	**1909.36**
30.00	30.50	30.25	0.50	28.00	19.64	9.64	147.54	1.57	28.0	28.0	1.0	123.27	3863.23	0	1.0	0.0	1664.14	30.5	7.0	70	9.64	1.93	0.76	139.8	709.93	6237.3	329.9	5857.2	**2494.92**	**1952.41**
30.50	32.00	31.25	1.50	29.50	19.64	9.64	147.54	4.71	7.0	7.0	1.0	85.40	3948.63	70	1.0	330.0	1994.14	32.0	27.6	0	9.86	15.85	16.87	139.8	1807.40	7750.2	347.5	6290.3	**3100.07**	**2096.77**
32.00	32.50	32.25	0.50	30.00	19.86	9.86	147.54	1.57	27.6	27.6	1.0	121.20	4069.83	0	1.0	0.0	1994.14	32.5	27.6	0	9.86	15.85	16.87	139.8	1807.40	7871.4	353.4	6417.4	**3148.55**	**2139.13**
32.50	33.50	33.00	1.00	31.00	19.86	9.86	147.54	3.14	27.6	27.6	1.0	242.41	4312.24	0	1.0	0.0	1994.14	33.5	7.2	74	9.86	1.97	0.79	139.8	742.35	7048.7	365.2	6671.6	**2819.49**	**2223.86**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
33.50	35.00	34.25	1.50	32.50	19.86	9.86	147.54	4.71	7.2	7.2	1.0	87.86	4400.10	74	1.0	348.9	2343.00	35.0	16.2	43	9.86	4.53	3.31	139.8	814.66	7557.8	382.9	7126.0	**3023.10**	**2375.33**
35.00	36.50	35.75	1.50	34.00	19.86	9.86	147.54	4.71	16.2	16.2	1.0	202.07	4602.17	43	1.0	202.7	2545.71	36.5	28.1	0	9.00	16.98	18.02	139.8	1929.49	9077.4	400.6	7548.4	**3630.95**	**2516.15**
36.50	37.50	37.00	1.00	35.00	19.00	9.00	147.54	3.14	28.1	28.1	1.0	247.58	4849.75	0	1.0	0.0	2545.71	37.5	28.8	0	9.00	18.56	19.64	139.8	2108.39	9503.9	412.3	7807.8	**3801.54**	**2602.60**
37.50	38.00	37.75	0.50	35.50	19.00	9.00	147.54	1.57	28.8	28.8	1.0	127.46	4977.21	0	1.0	0.0	2545.71	38.0	29.2	0	8.87	19.46	20.56	139.8	2209.57	9732.5	418.2	7941.1	**3893.00**	**2647.05**
38.00	40.00	39.00	2.00	37.50	18.87	8.87	147.54	6.29	29.2	29.2	1.0	518.29	5495.50	0	1.0	0.0	2545.71	40.0	29.2	0	8.87	19.46	20.56	139.8	2209.57	10250.8	441.8	8483.0	**4100.31**	**2827.67**
BORE NO: P76, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	16.08	6.08	16.72	1.57	15.0	15.0	1.0	7.04	7.04	41	1.0	64.4	64.43	3.0	12.4	50	9.18	3.17	1.91	18.2	405.95	477.4	5.9	77.4	**190.97**	**25.79**
3.00	5.00	4.00	2.00	2.50	19.18	9.18	27.42	6.29	12.4	12.4	1.0	37.89	44.93	50	1.0	314.3	378.71	5.0	10.5	47	9.18	2.62	1.36	36.6	412.53	836.2	29.5	453.1	**334.47**	**151.03**
5.00	6.00	5.50	1.00	3.50	19.18	9.18	41.19	3.14	10.5	10.5	1.0	23.99	68.93	47	1.0	147.7	526.43	6.0	10.5	47	9.18	2.62	1.36	45.8	431.41	1026.8	41.2	636.6	**410.70**	**212.20**
6.00	7.00	6.50	1.00	4.50	19.18	9.18	50.37	3.14	10.5	10.5	1.0	29.34	98.27	47	1.0	147.7	674.14	7.0	10.5	47	10.30	2.62	1.36	55.0	450.88	1223.3	53.0	825.4	**489.32**	**275.14**
7.00	8.00	7.50	1.00	5.50	20.30	10.30	60.11	3.14	10.5	10.5	1.0	35.01	133.28	47	1.0	147.7	821.86	8.0	10.5	47	10.30	2.62	1.36	65.3	472.06	1427.2	64.8	1019.9	**570.88**	**339.98**
8.00	9.00	8.50	1.00	6.50	20.30	10.30	70.41	3.14	10.5	10.5	1.0	41.01	174.30	47	1.0	147.7	969.57	9.0	9.0	50	10.30	2.29	1.07	75.6	493.84	1637.7	76.6	1220.4	**655.08**	**406.81**
9.00	10.00	9.50	1.00	7.50	20.30	10.30	80.71	3.14	9.0	9.0	1.0	40.18	214.47	50	1.0	157.1	1126.71	10.0	26.5	9	9.60	13.38	14.34	85.9	1020.20	2361.4	88.4	1429.5	**944.55**	**476.51**
10.00	11.00	10.50	1.00	8.50	19.60	9.60	90.66	3.14	26.5	26.5	1.0	142.06	356.53	9	1.0	28.3	1155.00	11.0	27.0	12	9.60	14.50	15.49	95.5	1231.12	2742.6	100.1	1611.7	**1097.06**	**537.22**
11.00	12.00	11.50	1.00	9.50	19.60	9.60	100.26	3.14	27.0	27.0	1.0	160.55	517.09	12	1.0	37.7	1192.71	12.0	27.0	12	10.30	14.50	15.49	105.1	1344.78	3054.6	111.9	1821.7	**1221.83**	**607.24**
12.00	14.50	13.25	2.50	12.00	20.30	10.30	117.94	7.86	27.0	27.0	1.0	472.14	989.23	12	1.0	94.3	1287.00	14.5	12.5	38	10.40	3.20	1.94	130.8	605.92	2882.2	141.4	2417.6	**1152.86**	**805.87**
14.50	17.50	16.00	3.00	15.00	20.40	10.40	117.94	9.43	12.5	12.5	1.0	246.52	1235.74	38	1.0	358.3	1645.29	17.5	16.8	32	10.40	4.83	3.64	130.8	737.11	3618.1	176.7	3057.7	**1447.26**	**1019.25**
17.50	19.00	18.25	1.50	16.50	20.40	10.40	117.94	4.71	16.8	16.8	1.0	167.86	1403.60	32	1.0	150.9	1796.14	19.0	7.6	68	10.40	2.04	0.85	130.8	693.80	3893.5	194.4	3394.1	**1557.42**	**1131.38**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
19.00	20.50	19.75	1.50	18.00	20.40	10.40	117.94	4.71	7.6	7.6	1.0	74.18	1477.79	68	1.0	320.6	2116.71	20.5	15.3	78	9.80	4.09	2.81	130.8	982.53	4577.0	212.1	3806.6	**1830.81**	**1268.85**
20.50	23.50	22.00	3.00	21.00	19.80	9.80	117.94	9.43	15.3	15.3	1.0	304.20	1781.98	78	1.0	735.4	2852.14	23.5	15.3	78	9.80	4.09	2.81	130.8	982.53	5616.7	247.4	4881.5	**2246.66**	**1627.18**
23.50	25.00	24.25	1.50	22.50	19.80	9.80	117.94	4.71	15.3	15.3	1.0	152.10	1934.08	78	1.0	367.7	3219.86	25.0	28.3	0	9.80	17.43	18.48	130.8	1862.74	7016.7	265.1	5419.0	**2806.67**	**1806.34**
25.00	26.50	25.75	1.50	24.00	19.80	9.80	117.94	4.71	28.3	28.3	1.0	299.36	2233.45	0	1.0	0.0	3219.86	26.5	11.2	54	9.80	2.82	1.56	130.8	678.00	6131.3	282.7	5736.0	**2452.52**	**1912.02**
26.50	27.50	27.00	1.00	25.00	19.80	9.80	117.94	3.14	11.2	11.2	1.0	73.39	2306.84	54	1.0	169.7	3389.57	27.5	12.5	60	10.80	3.20	1.94	130.8	761.80	6458.2	294.5	5990.9	**2583.28**	**1996.98**
27.50	29.50	28.50	2.00	27.00	20.80	10.80	117.94	6.29	12.5	12.5	1.0	164.34	2471.18	60	1.0	377.1	3766.71	29.5	12.5	60	10.80	3.20	1.94	130.8	761.80	6999.7	318.1	6556.0	**2799.88**	**2185.33**
29.50	30.00	29.75	0.50	27.50	20.80	10.80	117.94	1.57	12.5	12.5	1.0	41.09	2512.27	60	1.0	94.3	3861.00	30.0	10.0	50	10.80	2.47	1.22	130.8	612.61	6985.9	324.0	6697.2	**2794.35**	**2232.41**
30.00	31.00	30.50	1.00	28.50	20.80	10.80	117.94	3.14	10.0	10.0	1.0	65.36	2577.62	50	1.0	157.1	4018.14	31.0	18.0	7	10.80	5.42	4.29	130.8	624.37	7220.1	335.8	6931.5	**2888.06**	**2310.51**
31.00	32.50	31.75	1.50	30.00	20.80	10.80	117.94	4.71	18.0	18.0	1.0	180.65	2758.27	7	1.0	33.0	4051.14	32.5	23.5	7	9.55	8.92	9.23	130.8	1000.93	7810.3	353.4	7162.8	**3124.14**	**2387.61**
32.50	34.00	33.25	1.50	31.50	19.55	9.55	117.94	4.71	23.5	23.5	1.0	241.75	3000.02	7	1.0	33.0	4084.14	34.0	21.5	7	9.55	7.48	7.04	130.8	844.69	7928.9	371.1	7455.3	**3171.54**	**2485.09**
34.00	35.00	34.50	1.00	32.50	19.55	9.55	117.94	3.14	21.5	21.5	1.0	146.00	3146.02	7	1.0	22.0	4106.14	35.0	21.5	20	9.55	7.48	7.04	130.8	936.62	8188.8	382.9	7635.0	**3275.51**	**2545.02**
35.00	35.50	35.25	0.50	33.00	19.55	9.55	117.94	1.57	21.5	21.5	1.0	73.00	3219.03	20	1.0	31.4	4137.57	35.5	21.5	20	9.55	7.48	7.04	130.8	936.62	8293.2	388.8	7745.4	**3317.29**	**2581.79**
35.50	37.00	36.25	1.50	34.50	19.55	9.55	117.94	4.71	21.5	21.5	1.0	219.01	3438.03	20	1.0	94.3	4231.86	37.0	20.5	48	9.55	6.76	5.94	130.8	1056.50	8726.4	406.4	8076.3	**3490.55**	**2692.11**
37.00	37.50	37.25	0.50	35.00	19.55	9.55	117.94	1.57	20.5	20.5	1.0	69.29	3507.32	48	1.0	75.4	4307.29	37.5	20.5	48	8.99	6.76	5.94	130.8	1055.19	8869.8	412.3	8226.9	**3547.92**	**2742.31**
37.50	38.50	38.00	1.00	36.00	18.99	8.99	117.94	3.14	20.5	20.5	1.0	138.58	3645.90	48	1.0	150.9	4458.14	38.5	14.3	52	9.13	3.74	2.45	130.8	760.59	8864.6	424.1	8528.2	**3545.85**	**2842.72**
38.50	40.00	39.25	1.50	37.50	19.13	9.13	117.94	4.71	14.3	14.3	1.0	141.72	3787.62	52	1.0	245.1	4703.29	40.0	10.2	54	9.13	2.53	1.28	130.8	646.35	9137.3	441.8	8932.7	**3654.90**	**2977.56**
BORE NO: P77, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	18.20	8.20	22.55	1.57	12.9	12.9	1.0	8.12	8.12	28	1.0	44.0	44.00	3.0	10.0	37	8.20	2.47	1.22	24.6	313.31	365.4	5.9	58.0	**146.17**	**19.34**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
3.00	4.00	3.50	1.00	1.50	18.20	8.20	28.70	3.14	10.0	10.0	1.0	15.90	24.02	37	1.0	116.3	160.29	4.0	23.6	18	9.99	8.99	9.34	32.8	395.69	580.0	17.7	202.0	**232.00**	**67.33**
4.00	5.00	4.50	1.00	2.50	19.99	9.99	37.80	3.14	23.6	23.6	1.0	51.90	75.92	18	1.0	56.6	216.86	5.0	25.5	13	9.99	11.13	12.03	42.8	513.21	806.0	29.5	322.2	**322.39**	**107.41**
5.00	6.00	5.50	1.00	3.50	19.99	9.99	47.79	3.14	25.5	25.5	1.0	71.63	147.55	13	1.0	40.9	257.71	6.0	25.5	13	9.80	11.13	12.03	52.8	599.65	1004.9	41.2	446.5	**401.96**	**148.83**
6.00	8.00	7.00	2.00	5.50	19.80	9.80	62.58	6.29	25.5	25.5	1.0	187.62	335.17	13	1.0	81.7	339.43	8.0	12.5	38	9.80	3.20	1.94	72.4	458.38	1133.0	64.8	739.4	**453.19**	**246.47**
8.00	9.00	8.50	1.00	6.50	19.80	9.80	77.28	3.14	12.5	12.5	1.0	53.85	389.02	38	1.0	119.4	458.86	9.0	12.5	38	9.80	3.20	1.94	82.2	483.05	1330.9	76.6	924.5	**532.37**	**308.15**
9.00	10.00	9.50	1.00	7.50	19.80	9.80	87.08	3.14	12.5	12.5	1.0	60.67	449.69	38	1.0	119.4	578.29	10.0	12.5	38	11.20	3.20	1.94	92.0	508.78	1536.8	88.4	1116.3	**614.70**	**372.11**
10.00	11.00	10.50	1.00	8.50	21.20	11.20	97.58	3.14	12.5	12.5	1.0	67.99	517.68	38	1.0	119.4	697.71	11.0	24.2	18	11.20	9.42	10.00	103.2	935.30	2150.7	100.1	1315.5	**860.28**	**438.51**
11.00	12.00	11.50	1.00	9.50	21.20	11.20	108.78	3.14	24.2	24.2	1.0	153.65	671.33	18	1.0	56.6	754.29	12.0	7.1	72	10.40	1.95	0.77	114.4	687.37	2113.0	111.9	1537.5	**845.19**	**512.51**
12.00	14.50	13.25	2.50	12.00	20.40	10.40	127.38	7.86	7.1	7.1	1.0	124.66	795.99	72	1.0	565.7	1320.00	14.5	28.0	0	10.40	16.76	17.79	140.4	1920.82	4036.8	141.4	2257.4	**1614.73**	**752.45**
14.50	16.00	15.25	1.50	13.50	20.40	10.40	127.38	4.71	28.0	28.0	1.0	319.29	1115.28	0	1.0	0.0	1320.00	16.0	13.2	37	10.40	3.41	2.14	140.4	646.48	3081.8	159.0	2594.3	**1232.71**	**864.78**
16.00	17.50	16.75	1.50	15.00	20.40	10.40	127.38	4.71	13.2	13.2	1.0	140.85	1256.13	37	1.0	174.4	1494.43	17.5	18.0	37	10.00	5.42	4.29	140.4	875.89	3626.4	176.7	2927.3	**1450.58**	**975.76**
17.50	19.00	18.25	1.50	16.50	20.00	10.00	127.38	4.71	18.0	18.0	1.0	195.12	1451.25	37	1.0	174.4	1668.86	19.0	11.6	56	10.00	2.94	1.68	140.4	726.91	3847.0	194.4	3314.5	**1538.81**	**1104.83**
19.00	20.50	19.75	1.50	18.00	20.00	10.00	127.38	4.71	11.6	11.6	1.0	123.27	1574.51	56	1.0	264.0	1932.86	20.5	17.6	40	10.00	5.22	4.07	140.4	874.54	4381.9	212.1	3719.4	**1752.76**	**1239.81**
20.50	22.00	21.25	1.50	19.50	20.00	10.00	127.38	4.71	17.6	17.6	1.0	190.49	1765.00	40	1.0	188.6	2121.43	22.0	12.5	44	10.60	3.20	1.94	140.4	672.60	4559.0	229.7	4116.2	**1823.61**	**1372.05**
22.00	23.50	22.75	1.50	21.00	20.60	10.60	127.38	4.71	12.5	12.5	1.0	133.13	1898.13	44	1.0	207.4	2328.86	23.5	12.5	44	10.60	3.20	1.94	140.4	672.60	4899.6	247.4	4474.4	**1959.84**	**1491.46**
23.50	25.00	24.25	1.50	22.50	20.60	10.60	127.38	4.71	12.5	12.5	1.0	133.13	2031.26	44	1.0	207.4	2536.29	25.0	25.6	0	9.25	11.35	12.26	140.4	1296.58	5864.1	265.1	4832.6	**2345.65**	**1610.87**
25.00	26.50	25.75	1.50	24.00	19.25	9.25	127.38	4.71	25.6	25.6	1.0	287.71	2318.98	0	1.0	0.0	2536.29	26.5	25.6	0	9.25	11.35	12.26	140.4	1296.58	6151.8	282.7	5138.0	**2460.74**	**1712.67**
26.50	27.50	27.00	1.00	25.00	19.25	9.25	127.38	3.14	25.6	25.6	1.0	191.81	2510.79	0	1.0	0.0	2536.29	27.5	25.6	0	9.25	11.35	12.26	140.4	1296.58	6343.6	294.5	5341.6	**2537.46**	**1780.53**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
27.50	28.00	27.75	0.50	25.50	19.25	9.25	127.38	1.57	25.6	25.6	1.0	95.90	2606.69	0	1.0	0.0	2536.29	28.0	10.1	59	10.60	2.50	1.25	140.4	698.09	5841.1	300.4	5443.4	**2336.43**	**1814.46**
28.00	29.50	28.75	1.50	27.00	20.60	10.60	127.38	4.71	10.1	10.1	1.0	106.97	2713.66	59	1.0	278.1	2814.43	29.5	23.0	10	10.60	8.56	8.68	140.4	1051.03	6579.1	318.1	5846.2	**2631.65**	**1948.72**
29.50	30.00	29.75	0.50	27.50	20.60	10.60	127.38	1.57	23.0	23.0	1.0	84.97	2798.62	10	1.0	15.7	2830.14	30.0	23.0	10	10.60	8.56	8.68	140.4	1051.03	6679.8	324.0	5952.7	**2671.92**	**1984.25**
30.00	31.00	30.50	1.00	28.50	20.60	10.60	127.38	3.14	23.0	23.0	1.0	169.93	2968.56	10	1.0	31.4	2861.57	31.0	22.5	0	10.60	8.20	8.14	140.4	938.32	6768.5	335.8	6165.9	**2707.38**	**2055.30**
31.00	32.50	31.75	1.50	30.00	20.60	10.60	127.38	4.71	22.5	22.5	1.0	248.74	3217.29	0	1.0	0.0	2861.57	32.5	15.5	48	10.33	4.19	2.92	140.4	813.00	6891.9	353.4	6432.3	**2756.75**	**2144.10**
32.50	34.00	33.25	1.50	31.50	20.33	10.33	127.38	4.71	15.5	15.5	1.0	166.53	3383.83	48	1.0	226.3	3087.86	34.0	24.3	0	10.33	9.50	10.11	140.4	1088.43	7560.1	371.1	6842.8	**3024.05**	**2280.93**
34.00	35.00	34.50	1.00	32.50	20.33	10.33	127.38	3.14	24.3	24.3	1.0	180.76	3564.59	0	1.0	0.0	3087.86	35.0	24.3	0	10.33	9.50	10.11	140.4	1088.43	7740.9	382.9	7035.3	**3096.35**	**2345.11**
35.00	35.50	35.25	0.50	33.00	20.33	10.33	127.38	1.57	24.3	24.3	1.0	90.38	3654.97	0	1.0	0.0	3087.86	35.5	24.0	15	10.33	9.28	9.78	140.4	1169.34	7912.2	388.8	7131.6	**3164.87**	**2377.20**
35.50	37.00	36.25	1.50	34.50	20.33	10.33	127.38	4.71	24.0	24.0	1.0	267.36	3922.33	15	1.0	70.7	3158.57	37.0	13.1	35	10.33	3.38	2.11	140.4	628.86	7709.8	406.4	7487.3	**3083.90**	**2495.78**
37.00	37.50	37.25	0.50	35.00	20.33	10.33	127.38	1.57	13.1	13.1	1.0	46.58	3968.91	35	1.0	55.0	3213.57	37.5	13.8	44	9.70	3.59	2.31	140.4	715.91	7898.4	412.3	7594.8	**3159.35**	**2531.61**
37.50	38.50	38.00	1.00	36.00	19.70	9.70	127.38	3.14	13.8	13.8	1.0	98.33	4067.24	44	1.0	138.3	3351.86	38.5	14.5	48	8.63	3.80	2.51	140.4	766.51	8185.6	424.1	7843.2	**3274.24**	**2614.41**
38.50	40.00	39.25	1.50	37.50	18.63	8.63	127.38	4.71	14.5	14.5	1.0	155.30	4222.54	48	1.0	226.3	3578.14	40.0	14.5	48	8.63	3.80	2.51	140.4	766.51	8567.2	441.8	8242.5	**3426.88**	**2747.49**
BORE NO: P78, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.70	9.70	26.68	1.57	22.5	22.5	1.0	17.36	0	17	1.0	26.7	0	3.0	22.5	17	9.70	8.20	8.14	29.1	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.50	19.70	9.70	33.95	3.14	22.5	22.5	1.0	44.20	0	17	1.0	53.4	0	4.0	12.4	19	9.70	3.17	1.91	38.8	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	5.00	4.50	1.00	2.50	19.70	9.70	43.65	3.14	12.4	12.4	1.0	30.16	0	19	1.0	59.7	0	5.0	24.2	16	9.90	9.42	10.00	48.5	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.50	19.90	9.90	53.45	3.14	24.2	24.2	1.0	75.50	0	16	1.0	50.3	0	6.0	24.6	0	9.90	9.71	10.44	58.4	486.25	486.2	41.2	41.2	**194.50**	**13.74**
6.00	7.00	6.50	1.00	4.50	19.90	9.90	63.35	3.14	24.6	24.6	1.0	91.16	91.16	0	1.0	0.0	0.00	7.0	11.5	40	10.48	2.91	1.65	68.3	445.86	537.0	53.0	144.2	**214.81**	**48.06**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
7.00	9.00	8.00	2.00	6.50	20.48	10.48	78.78	6.29	11.5	11.5	1.0	100.75	191.90	40	1.0	251.4	251.43	9.0	10.5	44	10.48	2.62	1.36	89.3	500.29	943.6	76.6	519.9	**377.45**	**173.30**
9.00	10.00	9.50	1.00	7.50	20.48	10.48	94.50	3.14	10.5	10.5	1.0	55.05	246.95	44	1.0	138.3	389.71	10.0	10.5	44	10.48	2.62	1.36	99.7	521.84	1158.5	88.4	725.0	**463.40**	**241.67**
10.00	11.00	10.50	1.00	8.50	20.48	10.48	104.98	3.14	10.5	10.5	1.0	61.15	308.10	44	1.0	138.3	528.00	11.0	10.5	44	10.24	2.62	1.36	110.2	543.26	1379.4	100.1	936.2	**551.74**	**312.08**
11.00	12.50	11.75	1.50	10.00	20.24	10.24	117.90	4.71	10.5	10.5	1.0	103.01	411.11	44	1.0	207.4	735.43	12.5	7.0	54	10.24	1.93	0.76	125.6	575.34	1721.9	117.8	1264.4	**688.75**	**421.45**
12.50	14.00	13.25	1.50	11.50	20.24	10.24	133.26	4.71	7.0	7.0	1.0	77.14	488.25	54	1.0	254.6	990.00	14.0	25.2	13	9.90	10.45	11.34	140.9	1293.30	2771.5	135.5	1613.7	**1108.62**	**537.91**
14.00	15.50	14.75	1.50	13.00	19.90	9.90	148.37	4.71	25.2	25.2	1.0	329.13	817.38	13	1.0	61.3	1051.29	15.5	24.6	15	10.40	9.71	10.44	140.9	1224.22	3092.9	153.2	2021.8	**1237.15**	**673.94**
15.50	18.50	17.00	3.00	16.00	20.40	10.40	148.37	9.43	24.6	24.6	1.0	640.45	1457.83	15	1.0	141.4	1192.71	18.5	24.0	15	10.40	9.28	9.78	140.9	1173.69	3824.2	188.5	2839.0	**1529.69**	**946.35**
18.50	20.00	19.25	1.50	17.50	20.40	10.40	148.37	4.71	24.0	24.0	1.0	311.41	1769.24	15	1.0	70.7	1263.43	20.0	11.0	48	9.60	2.76	1.51	140.9	651.19	3683.9	206.2	3238.8	**1473.54**	**1079.61**
20.00	21.50	20.75	1.50	19.00	19.60	9.60	148.37	4.71	11.0	11.0	1.0	135.96	1905.20	48	1.0	226.3	1489.71	21.5	11.0	48	9.60	2.76	1.51	140.9	651.19	4046.1	223.8	3618.7	**1618.44**	**1206.25**
21.50	23.00	22.25	1.50	20.50	19.60	9.60	148.37	4.71	11.0	11.0	1.0	135.96	2041.15	48	1.0	226.3	1716.00	23.0	13.5	35	9.60	3.50	2.22	140.9	643.46	4400.6	241.5	3998.7	**1760.25**	**1332.89**
23.00	24.50	23.75	1.50	22.00	19.60	9.60	148.37	4.71	13.5	13.5	1.0	167.92	2209.07	35	1.0	165.0	1881.00	24.5	13.5	35	9.80	3.50	2.22	140.9	643.64	4733.7	259.2	4349.3	**1893.48**	**1449.75**
24.50	26.00	25.25	1.50	23.50	19.80	9.80	148.37	4.71	13.5	13.5	1.0	167.92	2376.99	35	1.0	165.0	2046.00	26.0	26.0	7	9.80	12.25	13.18	140.9	1457.02	5880.0	276.9	4699.8	**2352.00**	**1566.61**
26.00	27.50	26.75	1.50	25.00	19.80	9.80	148.37	4.71	26.0	26.0	1.0	341.14	2718.13	7	1.0	33.0	2079.00	27.5	23.5	46	9.80	8.92	9.23	140.9	1348.62	6145.7	294.5	5091.7	**2458.30**	**1697.22**
27.50	29.00	28.25	1.50	26.50	19.80	9.80	148.37	4.71	23.5	23.5	1.0	304.12	3022.25	46	1.0	216.9	2295.86	29.0	29.2	0	9.80	19.46	20.56	140.9	2233.90	7552.0	312.2	5630.3	**3020.80**	**1876.77**
29.00	30.00	29.50	1.00	27.50	19.80	9.80	148.37	3.14	29.2	29.2	1.0	260.60	3282.85	0	1.0	0.0	2295.86	30.0	30.0	0	10.05	21.26	22.40	140.9	2442.69	8021.4	324.0	5902.7	**3208.56**	**1967.56**
30.00	30.50	30.25	0.50	28.00	20.05	10.05	148.37	1.57	30.0	30.0	1.0	134.61	3417.46	0	1.0	0.0	2295.86	30.5	29.6	0	10.05	20.36	21.48	140.9	2339.30	8052.6	329.9	6043.2	**3221.05**	**2014.39**
30.50	32.00	31.25	1.50	29.50	20.05	10.05	148.37	4.71	29.6	29.6	1.0	397.33	3814.79	0	1.0	0.0	2295.86	32.0	29.6	0	10.05	20.36	21.48	140.9	2339.30	8450.0	347.5	6458.2	**3379.98**	**2152.73**
32.00	32.50	32.25	0.50	30.00	20.05	10.05	148.37	1.57	29.6	29.6	1.0	132.44	3947.24	0	1.0	0.0	2295.86	32.5	29.6	0	10.05	20.36	21.48	140.9	2339.30	8582.4	353.4	6596.5	**3432.96**	**2198.84**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
32.50	33.50	33.00	1.00	31.00	20.05	10.05	148.37	3.14	29.6	29.6	1.0	264.89	4212.13	0	1.0	0.0	2295.86	33.5	24.5	46	10.05	9.64	10.33	140.9	1433.59	7941.6	365.2	6873.2	**3176.63**	**2291.06**
33.50	35.00	34.25	1.50	32.50	20.05	10.05	148.37	4.71	24.5	24.5	1.0	318.75	4530.88	46	1.0	216.9	2512.71	35.0	27.1	5	10.05	14.73	15.72	140.9	1728.49	8772.1	382.9	7426.5	**3508.83**	**2475.49**
35.00	36.50	35.75	1.50	34.00	20.05	10.05	148.37	4.71	27.1	27.1	1.0	357.92	4888.80	5	1.0	23.6	2536.29	36.5	27.1	5	9.25	14.73	15.72	140.9	1723.55	9148.6	400.6	7825.6	**3659.45**	**2608.55**
36.50	37.50	37.00	1.00	35.00	19.25	9.25	148.37	3.14	27.1	27.1	1.0	238.61	5127.41	5	1.0	15.7	2552.00	37.5	26.0	10	9.25	12.25	13.18	140.9	1475.38	9154.8	412.3	8091.7	**3661.92**	**2697.25**
37.50	38.00	37.75	0.50	35.50	19.25	9.25	148.37	1.57	26.0	26.0	1.0	113.71	5241.12	10	1.0	15.7	2567.71	38.0	15.3	53	9.05	4.09	2.81	140.9	837.45	8646.3	418.2	8227.1	**3458.51**	**2742.35**
38.00	40.00	39.00	2.00	37.50	19.05	9.05	148.37	6.29	15.3	15.3	1.0	255.13	5496.25	53	1.0	333.1	2900.86	40.0	15.3	53	9.05	4.09	2.81	140.9	837.45	9234.6	441.8	8838.9	**3693.82**	**2946.30**
BORE NO: P79, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	18.44	8.44	23.21	1.57	23.5	23.5	1.0	15.86	15.86	9	1.0	14.1	14.14	3.0	23.5	9	9.60	8.92	9.23	25.3	275.92	305.9	5.9	35.9	**122.37**	**11.96**
3.00	5.00	4.00	2.00	2.50	19.60	9.60	34.92	6.29	23.5	23.5	1.0	95.44	111.30	9	1.0	56.6	70.71	5.0	8.6	42	9.60	2.22	1.00	44.5	378.37	560.4	29.5	211.5	**224.15**	**70.49**
5.00	6.00	5.50	1.00	3.50	19.60	9.60	49.32	3.14	8.6	8.6	1.0	23.44	134.74	42	1.0	132.0	202.71	6.0	8.6	42	9.60	2.22	1.00	54.1	395.10	732.6	41.2	378.7	**293.02**	**126.23**
6.00	7.00	6.50	1.00	4.50	19.60	9.60	58.92	3.14	8.6	8.6	1.0	28.01	162.75	42	1.0	132.0	334.71	7.0	13.0	51	10.10	3.35	2.08	63.7	536.61	1034.1	53.0	550.5	**413.63**	**183.49**
7.00	8.00	7.50	1.00	5.50	20.10	10.10	68.77	3.14	13.0	13.0	1.0	49.90	212.65	51	1.0	160.3	495.00	8.0	10.3	41	10.10	2.56	1.31	73.8	443.49	1151.1	64.8	772.4	**460.45**	**257.48**
8.00	9.00	8.50	1.00	6.50	20.10	10.10	78.87	3.14	10.3	10.3	1.0	45.05	257.69	41	1.0	128.9	623.86	9.0	10.3	40	8.80	2.56	1.31	83.9	456.05	1337.6	76.6	958.1	**535.04**	**319.38**
9.00	11.00	10.00	2.00	8.50	18.80	8.80	92.72	6.29	10.3	10.3	1.0	105.91	363.61	40	1.0	251.4	875.29	11.0	23.8	21	8.80	9.14	9.56	101.5	910.30	2149.2	100.1	1339.0	**859.68**	**446.34**
11.00	12.00	11.50	1.00	9.50	18.80	8.80	105.92	3.14	23.8	23.8	1.0	146.82	510.43	21	1.0	66.0	941.29	12.0	23.8	21	8.80	9.14	9.56	110.3	973.47	2425.2	111.9	1563.6	**970.07**	**521.21**
12.00	13.00	12.50	1.00	10.50	18.80	8.80	114.72	3.14	23.8	23.8	1.0	159.02	669.45	21	1.0	66.0	1007.29	13.0	12.5	38	9.00	3.20	1.94	119.1	575.43	2252.2	123.7	1800.4	**900.87**	**600.15**
13.00	14.50	13.75	1.50	12.00	19.00	9.00	125.87	4.71	12.5	12.5	1.0	131.55	801.00	38	1.0	179.1	1186.43	14.5	11.9	38	9.00	3.03	1.76	132.6	590.53	2578.0	141.4	2128.8	**1031.19**	**709.60**
14.50	16.00	15.25	1.50	13.50	19.00	9.00	125.87	4.71	11.9	11.9	1.0	125.05	926.05	38	1.0	179.1	1365.57	16.0	11.9	38	10.20	3.03	1.76	132.6	591.36	2883.0	159.0	2450.7	**1153.19**	**816.89**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
16.00	17.50	16.75	1.50	15.00	20.20	10.20	125.87	4.71	11.9	11.9	1.0	125.05	1051.09	38	1.0	179.1	1544.71	17.5	24.3	0	10.20	9.50	10.11	132.6	1030.01	3625.8	176.7	2772.5	**1450.33**	**924.17**
17.50	19.00	18.25	1.50	16.50	20.20	10.20	125.87	4.71	24.3	24.3	1.0	267.92	1319.02	0	1.0	0.0	1544.71	19.0	26.2	0	8.10	12.70	13.64	132.6	1367.02	4230.7	194.4	3058.1	**1692.30**	**1019.37**
19.00	20.50	19.75	1.50	18.00	18.10	8.10	125.87	4.71	26.2	26.2	1.0	291.98	1611.00	0	1.0	0.0	1544.71	20.5	26.0	7	9.82	12.25	13.18	132.6	1377.03	4532.7	212.1	3367.8	**1813.10**	**1122.59**
20.50	23.50	22.00	3.00	21.00	19.82	9.82	125.87	9.43	26.0	26.0	1.0	578.83	2189.83	7	1.0	66.0	1610.71	23.5	12.5	54	9.80	3.20	1.94	132.6	723.17	4523.7	247.4	4047.9	**1809.48**	**1349.31**
23.50	26.50	25.00	3.00	24.00	19.80	9.80	125.87	9.43	12.5	12.5	1.0	263.10	2452.93	54	1.0	509.1	2119.86	26.5	11.3	66	9.80	2.85	1.59	132.6	770.05	5342.8	282.7	4855.5	**2137.13**	**1618.51**
26.50	27.50	27.00	1.00	25.00	19.80	9.80	125.87	3.14	11.3	11.3	1.0	79.05	2531.98	66	1.0	207.4	2327.29	27.5	10.0	69	9.80	2.47	1.22	132.6	750.00	5609.3	294.5	5153.8	**2243.71**	**1717.93**
27.50	29.50	28.50	2.00	27.00	19.80	9.80	125.87	6.29	10.0	10.0	1.0	139.51	2671.48	69	1.0	433.7	2761.00	29.5	27.6	0	8.93	15.85	16.87	132.6	1711.29	7143.8	318.1	5750.6	**2857.51**	**1916.86**
29.50	30.00	29.75	0.50	27.50	18.93	8.93	125.87	1.57	27.6	27.6	1.0	103.41	2774.89	0	1.0	0.0	2761.00	30.0	27.6	0	9.78	15.85	16.87	132.6	1716.93	7252.8	324.0	5859.9	**2901.13**	**1953.29**
30.00	31.00	30.50	1.00	28.50	19.78	9.78	125.87	3.14	27.6	27.6	1.0	206.81	2981.70	0	1.0	0.0	2761.00	31.0	24.8	0	9.78	9.86	10.66	132.6	1067.97	6810.7	335.8	6078.5	**2724.27**	**2026.15**
31.00	32.50	31.75	1.50	30.00	19.78	9.78	125.87	4.71	24.8	24.8	1.0	274.18	3255.88	0	1.0	0.0	2761.00	32.5	27.0	10	9.78	14.50	15.49	132.6	1641.54	7658.4	353.4	6370.3	**3063.37**	**2123.44**
32.50	35.00	33.75	2.50	32.50	19.78	9.78	125.87	7.86	27.0	27.0	1.0	503.91	3759.79	10	1.0	78.6	2839.57	35.0	27.4	10	9.78	15.40	16.41	132.6	1738.94	8338.3	382.9	6982.2	**3335.32**	**2327.42**
35.00	35.50	35.25	0.50	33.00	19.78	9.78	125.87	1.57	27.4	27.4	1.0	102.53	3862.32	10	1.0	15.7	2855.29	35.5	26.3	10	9.78	12.93	13.88	132.6	1471.09	8188.7	388.8	7106.4	**3275.48**	**2368.79**
35.50	37.50	36.50	2.00	35.00	19.78	9.78	125.87	6.29	26.3	26.3	1.0	391.03	4253.35	10	1.0	62.9	2918.14	37.5	11.5	49	8.82	2.91	1.65	132.6	655.54	7827.0	412.3	7583.8	**3130.81**	**2527.94**
37.50	38.50	38.00	1.00	36.00	18.82	8.82	125.87	3.14	11.5	11.5	1.0	80.48	4333.83	49	1.0	154.0	3072.14	38.5	7.5	60	8.29	2.02	0.84	132.6	637.49	8043.5	424.1	7830.1	**3217.39**	**2610.03**
38.50	40.00	39.25	1.50	37.50	18.29	8.29	125.87	4.71	7.5	7.5	1.0	78.12	4411.95	60	1.0	282.9	3355.00	40.0	7.5	60	8.29	2.02	0.84	132.6	637.49	8404.4	441.8	8208.7	**3361.78**	**2736.25**
BORE NO: P80, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	20.8	10.80	29.70	1.57	12.3	12.3	1.0	10.18	0	29	1.0	45.6	0	3.0	28.4	2	9.64	17.66	18.71	32.4	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	5.00	4.00	2.00	2.50	19.6	9.64	42.04	6.29	28.4	28.4	1.0	142.88	0	2	1.0	12.6	0	5.0	7.2	41	9.64	1.97	0.79	51.7	372.75	372.7	29.5	29.5	**149.10**	**9.82**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
5.00	6.00	5.50	1.00	3.50	19.6	9.64	56.50	3.14	7.2	7.2	1.0	22.43	22.43	41	1.0	128.9	128.86	6.0	11.9	21	9.64	3.03	1.76	61.3	301.10	452.4	41.2	192.5	**180.95**	**64.17**
6.00	7.00	6.50	1.00	4.50	19.6	9.64	66.14	3.14	11.9	11.9	1.0	43.80	66.24	21	1.0	66.0	194.86	7.0	29.2	2	9.65	19.46	20.56	71.0	1176.94	1438.0	53.0	314.1	**575.21**	**104.70**
7.00	8.00	7.50	1.00	5.50	19.7	9.65	75.79	3.14	29.2	29.2	1.0	133.12	199.35	2	1.0	6.3	201.14	8.0	9.5	42	9.65	2.38	1.14	80.6	452.07	852.6	64.8	465.3	**341.03**	**155.10**
8.00	9.00	8.50	1.00	6.50	19.7	9.65	85.44	3.14	9.5	9.5	1.0	44.93	244.29	42	1.0	132.0	333.14	9.0	9.5	42	9.65	2.38	1.14	90.3	470.12	1047.5	76.6	654.0	**419.02**	**218.00**
9.00	10.00	9.50	1.00	7.50	19.7	9.65	95.09	3.14	9.5	9.5	1.0	50.01	294.29	42	1.0	132.0	465.14	10.0	9.5	42	10.04	2.38	1.14	99.9	488.34	1247.8	88.4	847.8	**499.11**	**282.60**
10.00	11.00	10.50	1.00	8.50	20.0	10.04	104.93	3.14	9.5	9.5	1.0	55.19	349.48	42	1.0	132.0	597.14	11.0	9.5	42	10.04	2.38	1.14	110.0	507.11	1453.7	100.1	1046.8	**581.50**	**348.92**
11.00	12.00	11.50	1.00	9.50	20.0	10.04	114.97	3.14	9.5	9.5	1.0	60.47	409.95	42	1.0	132.0	729.14	12.0	8.2	54	10.41	2.15	0.94	120.0	588.03	1727.1	111.9	1251.0	**690.85**	**417.00**
12.00	14.50	13.25	2.50	12.00	20.4	10.41	133.00	7.86	8.2	8.2	1.0	150.59	560.54	54	1.0	424.3	1153.43	14.5	8.2	54	10.41	2.15	0.94	146.0	631.92	2345.9	141.4	1855.3	**938.35**	**618.45**
14.50	16.00	15.25	1.50	13.50	20.4	10.41	133.00	4.71	8.2	8.2	1.0	90.35	650.89	54	1.0	254.6	1408.00	16.0	10.3	52	10.12	2.56	1.31	146.0	666.40	2725.3	159.0	2217.9	**1090.12**	**739.31**
16.00	17.50	16.75	1.50	15.00	20.1	10.12	133.00	4.71	10.3	10.3	1.0	113.95	764.84	52	1.0	245.1	1653.14	17.5	10.3	52	10.12	2.56	1.31	146.0	666.40	3084.4	176.7	2594.7	**1233.75**	**864.90**
17.50	19.00	18.25	1.50	16.50	20.1	10.12	133.00	4.71	10.3	10.3	1.0	113.95	878.78	52	1.0	245.1	1898.29	19.0	27.8	0	9.60	16.31	17.33	146.0	1936.01	4713.1	194.4	2971.5	**1885.23**	**990.49**
19.00	20.50	19.75	1.50	18.00	19.6	9.60	133.00	4.71	27.8	27.8	1.0	330.59	1209.37	0	1.0	0.0	1898.29	20.5	27.0	0	9.60	14.50	15.49	146.0	1722.38	4830.0	212.1	3319.7	**1932.01**	**1106.57**
20.50	22.00	21.25	1.50	19.50	19.6	9.60	133.00	4.71	27.0	27.0	1.0	319.48	1528.85	0	1.0	0.0	1898.29	22.0	9.5	47	9.89	2.38	1.14	146.0	609.85	4037.0	229.7	3656.9	**1614.79**	**1218.95**
22.00	23.50	22.75	1.50	21.00	19.9	9.89	133.00	4.71	9.5	9.5	1.0	104.93	1633.78	47	1.0	221.6	2119.86	23.5	9.5	47	9.89	2.38	1.14	146.0	609.85	4363.5	247.4	4001.0	**1745.39**	**1333.68**
23.50	25.00	24.25	1.50	22.50	19.9	9.89	133.00	4.71	9.5	9.5	1.0	104.93	1738.70	47	1.0	221.6	2341.43	25.0	14.0	32	9.89	3.65	2.36	146.0	654.22	4734.4	265.1	4345.2	**1893.74**	**1448.40**
25.00	26.50	25.75	1.50	24.00	19.9	9.89	133.00	4.71	14.0	14.0	1.0	156.33	1895.03	32	1.0	150.9	2492.29	26.5	15.5	32	9.24	4.19	2.92	146.0	717.14	5104.5	282.7	4670.1	**2041.78**	**1556.69**
26.50	27.50	27.00	1.00	25.00	19.2	9.24	133.00	3.14	15.5	15.5	1.0	115.92	2010.96	32	1.0	100.6	2592.86	27.5	15.5	32	9.24	4.19	2.92	146.0	717.14	5321.0	294.5	4898.3	**2128.38**	**1632.78**
27.50	28.00	27.75	0.50	25.50	19.2	9.24	133.00	1.57	15.5	15.5	1.0	57.96	2068.92	32	1.0	50.3	2643.14	28.0	24.5	7	8.97	9.64	10.33	146.0	1191.87	5903.9	300.4	5012.5	**2361.57**	**1670.83**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
28.00	29.50	28.75	1.50	27.00	19.0	8.97	133.00	4.71	24.5	24.5	1.0	285.75	2354.66	7	1.0	33.0	2676.14	29.5	24.5	7	9.01	9.64	10.33	146.0	1192.03	6222.8	318.1	5348.9	**2489.13**	**1782.96**
29.50	30.00	29.75	0.50	27.50	19.0	9.01	133.00	1.57	24.5	24.5	1.0	95.25	2449.91	7	1.0	11.0	2687.14	30.0	24.5	7	9.01	9.64	10.33	146.0	1192.03	6329.1	324.0	5461.0	**2531.63**	**1820.34**
30.00	31.00	30.50	1.00	28.50	19.0	9.01	133.00	3.14	24.5	24.5	1.0	190.50	2640.41	7	1.0	22.0	2709.14	31.0	19.5	30	9.08	6.13	5.12	146.0	934.12	6283.7	335.8	5685.3	**2513.47**	**1895.10**
31.00	32.50	31.75	1.50	30.00	19.1	9.08	133.00	4.71	19.5	19.5	1.0	222.04	2862.45	30	1.0	141.4	2850.57	32.5	10.0	45	8.59	2.47	1.22	146.0	605.70	6318.7	353.4	6066.4	**2527.49**	**2022.15**
32.50	34.00	33.25	1.50	31.50	18.6	8.59	133.00	4.71	10.0	10.0	1.0	110.56	2973.01	45	1.0	212.1	3062.71	34.0	18.0	48	9.27	5.42	4.29	146.0	976.42	7012.1	371.1	6406.8	**2804.86**	**2135.61**
34.00	35.00	34.50	1.00	32.50	19.3	9.27	133.00	3.14	18.0	18.0	1.0	135.82	3108.82	48	1.0	150.9	3213.57	35.0	18.0	48	9.27	5.42	4.29	146.0	976.42	7298.8	382.9	6705.3	**2919.53**	**2235.09**
35.00	35.50	35.25	0.50	33.00	19.3	9.27	133.00	1.57	18.0	18.0	1.0	67.91	3176.73	48	1.0	75.4	3289.00	35.5	22.5	15	9.14	8.20	8.14	146.0	1076.04	7541.8	388.8	6854.5	**3016.71**	**2284.84**
35.50	37.00	36.25	1.50	34.50	19.1	9.14	133.00	4.71	22.5	22.5	1.0	259.72	3436.45	15	1.0	70.7	3359.71	37.0	22.5	15	9.52	8.20	8.14	146.0	1077.25	7873.4	406.4	7202.6	**3149.37**	**2400.87**
37.00	37.50	37.25	0.50	35.00	19.5	9.52	133.00	1.57	22.5	22.5	1.0	86.57	3523.02	15	1.0	23.6	3383.29	37.5	22.5	15	9.52	8.20	8.14	146.0	1077.25	7983.6	412.3	7318.6	**3193.42**	**2439.55**
37.50	38.50	38.00	1.00	36.00	19.5	9.52	133.00	3.14	22.5	22.5	1.0	173.14	3696.17	15	1.0	47.1	3430.43	38.5	22.5	15	9.41	8.20	8.14	146.0	1076.90	8203.5	424.1	7550.7	**3281.40**	**2516.90**
38.50	40.00	39.25	1.50	37.50	19.4	9.41	133.00	4.71	22.5	22.5	1.0	259.72	3955.88	15	1.0	70.7	3501.14	40.0	22.5	15	9.41	8.20	8.14	146.0	1076.90	8533.9	441.8	7898.8	**3413.57**	**2632.94**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
BORE NO: P61, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	21.20	11.20	30.80	1.89	6.4	6.4	1.0	6.51	0	66	1.0	124.5	0	3.0	9.4	54	11.20	2.36	1.13	33.6	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	5.00	4.00	2.00	2.50	21.20	11.20	44.80	7.54	9.4	9.4	1.0	55.94	0	54	1.0	407.3	0	5.0	26.9	3	11.20	14.28	15.26	56.0	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.50	21.20	11.20	61.60	3.77	26.9	26.9	1.0	117.86	0	3	1.0	11.3	0	6.0	26.9	3	8.55	14.28	15.26	67.2	0	0.0	59.4	59.4	**0.00**	**19.79**
6.00	8.00	7.00	2.00	5.50	18.55	8.55	75.75	7.54	26.9	26.9	1.0	289.87	0	3	1.0	22.6	0	8.0	26.9	3	8.55	14.28	15.26	84.3	0	0.0	93.3	93.3	**0.00**	**31.10**
8.00	9.00	8.50	1.00	6.50	18.55	8.55	88.58	3.77	26.9	26.9	1.0	169.48	0	3	1.0	11.3	0	9.0	24.7	13	8.55	9.78	10.55	92.9	1221.46	1221.5	110.3	110.3	**488.58**	**36.76**
9.00	10.00	9.50	1.00	7.50	18.55	8.55	97.13	3.77	24.7	24.7	1.0	168.48	168.48	13	1.0	49.0	49.03	10.0	24.7	13	10.06	9.78	10.55	101.4	1326.92	1544.4	127.2	344.7	**617.77**	**114.91**
10.00	11.00	10.50	1.00	8.50	20.06	10.06	106.43	3.77	24.7	24.7	1.0	184.62	353.10	13	1.0	49.0	98.06	11.0	24.7	10	10.06	9.78	10.55	111.5	1407.73	1858.9	144.2	595.4	**743.56**	**198.45**
11.00	12.00	11.50	1.00	9.50	20.06	10.06	116.49	3.77	24.7	24.7	1.0	202.07	555.17	10	1.0	37.7	135.77	12.0	24.7	10	10.06	9.78	10.55	121.5	1519.10	2210.0	161.2	852.1	**884.01**	**284.04**
12.00	13.00	12.50	1.00	10.50	20.06	10.06	126.55	3.77	24.7	24.7	1.0	219.52	774.69	10	1.0	37.7	173.49	13.0	10.5	42	10.44	2.62	1.36	131.6	826.94	1775.1	178.1	1126.3	**710.05**	**375.44**
13.00	14.50	13.75	1.50	12.00	20.44	10.44	139.41	5.66	10.5	10.5	1.0	146.17	920.86	42	1.0	237.6	411.09	14.5	11.2	52	11.03	2.82	1.56	147.2	1011.47	2343.4	203.6	1535.5	**937.37**	**511.84**
14.50	17.50	16.00	3.00	15.00	21.03	11.03	163.79	11.31	11.2	11.2	1.0	366.93	1287.79	52	1.0	588.3	999.43	17.5	9.0	50	11.03	2.29	1.07	180.3	984.35	3271.6	254.5	2541.7	**1308.63**	**847.23**
17.50	19.00	18.25	1.50	16.50	21.03	11.03	163.79	5.66	9.0	9.0	1.0	146.75	1434.54	50	1.0	282.9	1282.29	19.0	8.1	43	11.14	2.13	0.93	180.3	879.05	3595.9	279.9	2996.7	**1438.35**	**998.91**
19.00	20.50	19.75	1.50	18.00	21.14	11.14	163.79	5.66	8.1	8.1	1.0	131.87	1566.41	43	1.0	243.3	1525.54	20.5	8.1	43	11.14	2.13	0.93	180.3	879.05	3971.0	305.4	3397.3	**1588.40**	**1132.44**
20.50	22.00	21.25	1.50	19.50	21.14	11.14	163.79	5.66	8.1	8.1	1.0	131.87	1698.28	43	1.0	243.3	1768.80	22.0	23.7	18	10.70	9.06	9.45	180.3	2101.29	5568.4	330.8	3797.9	**2227.34**	**1265.96**
22.00	23.50	22.75	1.50	21.00	20.70	10.70	163.79	5.66	23.7	23.7	1.0	406.73	2105.01	18	1.0	101.8	1870.63	23.5	23.7	18	10.70	9.06	9.45	180.3	2101.29	6076.9	356.3	4331.9	**2430.77**	**1443.96**
23.50	25.00	24.25	1.50	22.50	20.70	10.70	163.79	5.66	23.7	23.7	1.0	406.73	2511.73	18	1.0	101.8	1972.46	25.0	5.5	42	10.16	1.66	0.53	180.3	770.01	5254.2	381.7	4865.9	**2101.68**	**1621.97**
25.00	26.50	25.75	1.50	24.00	20.16	10.16	163.79	5.66	5.5	5.5	1.0	89.22	2600.95	42	1.0	237.6	2210.06	26.5	5.5	42	10.16	1.66	0.53	180.3	770.01	5581.0	407.2	5218.2	**2232.41**	**1739.39**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
26.50	27.50	27.00	1.00	25.00	20.16	10.16	163.79	3.77	5.5	5.5	1.0	59.48	2660.43	42	1.0	158.4	2368.46	27.5	5.5	42	10.16	1.66	0.53	180.3	770.01	5798.9	424.1	5453.0	**2319.56**	**1817.67**
27.50	28.00	27.75	0.50	25.50	20.16	10.16	163.79	1.89	5.5	5.5	1.0	29.74	2690.17	42	1.0	79.2	2447.66	28.0	8.5	72	11.03	2.20	0.99	180.3	1189.44	6327.3	432.6	5570.4	**2530.91**	**1856.81**
28.00	29.50	28.75	1.50	27.00	21.03	11.03	163.79	5.66	8.5	8.5	1.0	138.47	2828.64	72	1.0	407.3	2854.97	29.5	23.0	10	11.03	8.56	8.68	180.3	1913.35	7597.0	458.0	6141.7	**3038.79**	**2047.22**
29.50	30.00	29.75	0.50	27.50	21.03	11.03	163.79	1.89	23.0	23.0	1.0	131.10	2959.74	10	1.0	18.9	2873.83	30.0	23.0	10	11.03	8.56	8.68	180.3	1913.35	7746.9	466.5	6300.1	**3098.77**	**2100.03**
30.00	31.00	30.50	1.00	28.50	21.03	11.03	163.79	3.77	23.0	23.0	1.0	262.20	3221.94	10	1.0	37.7	2911.54	31.0	12.8	49	11.03	3.29	2.02	180.3	1185.68	7319.2	483.5	6617.0	**2927.67**	**2205.66**
31.00	32.50	31.75	1.50	30.00	21.03	11.03	163.79	5.66	12.8	12.8	1.0	210.51	3432.45	49	1.0	277.2	3188.74	32.5	13.5	49	8.70	3.50	2.22	180.3	1226.18	7847.4	508.9	7130.1	**3138.95**	**2376.71**
32.50	34.00	33.25	1.50	31.50	18.70	8.70	163.79	5.66	13.5	13.5	1.0	222.45	3654.90	49	1.0	277.2	3465.94	34.0	13.5	49	8.84	3.50	2.22	180.3	1226.40	8347.2	534.4	7655.2	**3338.89**	**2551.74**
34.00	35.00	34.50	1.00	32.50	18.84	8.84	163.79	3.77	13.5	13.5	1.0	148.30	3803.19	49	1.0	184.8	3650.74	35.0	13.5	49	8.84	3.50	2.22	180.3	1226.40	8680.3	551.3	8005.3	**3472.13**	**2668.43**
35.00	35.50	35.25	0.50	33.00	18.84	8.84	163.79	1.89	13.5	13.5	1.0	74.15	3877.34	49	1.0	92.4	3743.14	35.5	13.5	49	9.35	3.50	2.22	180.3	1227.16	8847.7	559.8	8180.3	**3539.06**	**2726.77**
35.50	37.00	36.25	1.50	34.50	19.35	9.35	163.79	5.66	13.5	13.5	1.0	222.45	4099.79	49	1.0	277.2	4020.34	37.0	9.3	60	9.02	2.34	1.11	180.3	1096.03	9216.2	585.3	8705.4	**3686.46**	**2901.80**
37.00	37.50	37.25	0.50	35.00	19.02	9.02	163.79	1.89	9.3	9.3	1.0	50.58	4150.37	60	1.0	113.1	4133.49	37.5	8.0	60	9.02	2.11	0.91	180.3	1047.06	9330.9	593.8	8877.6	**3732.36**	**2959.20**
37.50	38.50	38.00	1.00	36.00	19.02	9.02	163.79	3.77	8.0	8.0	1.0	86.81	4237.18	60	1.0	226.3	4359.77	38.5	8.0	60	8.60	2.11	0.91	180.3	1046.80	9643.8	610.7	9207.7	**3857.50**	**3069.23**
38.50	40.00	39.25	1.50	37.50	18.60	8.60	163.79	5.66	8.0	8.0	1.0	130.22	4367.40	60	1.0	339.4	4699.20	40.0	8.0	60	8.60	2.11	0.91	180.3	1046.80	10113.4	636.2	9702.8	**4045.36**	**3234.26**
BORE NO: P62, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.82	9.82	27.01	1.89	7.5	7.5	1.0	6.70	6.70	46	1.0	86.7	86.74	3.0	14.3	46	9.82	3.74	2.45	29.5	609.30	702.8	8.5	101.9	**281.10**	**33.98**
3.00	4.00	3.50	1.00	1.50	19.82	9.82	34.37	3.77	14.3	14.3	1.0	33.04	39.74	46	1.0	173.5	260.23	4.0	29.9	5	9.01	21.03	22.17	39.3	1121.33	1421.3	25.4	325.4	**568.52**	**108.47**
4.00	6.00	5.00	2.00	3.50	19.01	9.01	48.29	7.54	29.9	29.9	1.0	209.45	249.19	5	1.0	37.7	297.94	6.0	29.9	5	9.01	21.03	22.17	57.3	1550.19	2097.3	59.4	606.5	**838.93**	**202.17**
6.00	7.00	6.50	1.00	4.50	19.01	9.01	61.81	3.77	29.9	29.9	1.0	134.03	383.23	5	1.0	18.9	316.80	7.0	28.2	0	9.01	17.21	18.25	66.3	1402.53	2102.6	76.3	776.4	**841.02**	**258.79**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
7.00	9.00	8.00	2.00	6.50	19.01	9.01	75.32	7.54	28.2	28.2	1.0	304.63	687.86	0	1.0	0.0	316.80	9.0	25.2	11	8.08	10.45	11.34	84.3	1171.32	2176.0	110.3	1114.9	**870.39**	**371.64**
9.00	10.00	9.50	1.00	7.50	18.08	8.08	88.37	3.77	25.2	25.2	1.0	156.83	844.69	11	1.0	41.5	358.29	10.0	25.2	11	8.08	10.45	11.34	92.4	1266.86	2469.8	127.2	1330.2	**987.93**	**443.40**
10.00	11.00	10.50	1.00	8.50	18.08	8.08	96.45	3.77	25.2	25.2	1.0	171.17	1015.86	11	1.0	41.5	399.77	11.0	25.2	11	8.08	10.45	11.34	100.5	1362.40	2778.0	144.2	1559.8	**1111.21**	**519.94**
11.00	12.50	11.75	1.50	10.00	18.08	8.08	106.55	5.66	25.2	25.2	1.0	283.64	1299.50	11	1.0	62.2	462.00	12.5	25.2	11	8.08	10.45	11.34	112.6	1505.70	3267.2	169.6	1931.1	**1306.88**	**643.71**
12.50	14.00	13.25	1.50	11.50	18.08	8.08	118.67	5.66	25.2	25.2	1.0	315.91	1615.40	11	1.0	62.2	524.23	14.0	8.1	40	9.43	2.13	0.93	124.7	713.56	2853.2	195.1	2334.7	**1141.28**	**778.24**
14.00	15.50	14.75	1.50	13.00	19.43	9.43	131.80	5.66	8.1	8.1	1.0	106.12	1721.52	40	1.0	226.3	750.51	15.5	8.7	40	9.43	2.24	1.02	138.9	765.18	3237.2	220.5	2692.6	**1294.89**	**897.53**
15.50	17.00	16.25	1.50	14.50	19.43	9.43	145.95	5.66	8.7	8.7	1.0	126.34	1847.86	40	1.0	226.3	976.80	17.0	11.3	40	11.01	2.85	1.59	153.0	913.02	3737.7	246.0	3070.7	**1495.07**	**1023.55**
17.00	18.50	17.75	1.50	16.00	21.01	11.01	161.28	5.66	11.3	11.3	1.0	182.31	2030.17	40	1.0	226.3	1203.09	18.5	11.3	40	10.85	2.85	1.59	153.0	912.84	4146.1	271.4	3504.7	**1658.44**	**1168.23**
18.50	21.50	20.00	3.00	19.00	20.85	10.85	161.28	11.31	11.3	11.3	1.0	364.62	2394.79	40	1.0	452.6	1655.66	21.5	11.0	45	8.53	2.76	1.51	153.0	945.48	4995.9	322.3	4372.8	**1998.37**	**1457.59**
21.50	24.50	23.00	3.00	22.00	18.53	8.53	161.28	11.31	11.0	11.0	1.0	354.69	2749.49	45	1.0	509.1	2164.80	24.5	9.6	45	8.53	2.40	1.16	153.0	880.11	5794.4	373.2	5287.5	**2317.76**	**1762.50**
24.50	26.00	25.25	1.50	23.50	18.53	8.53	161.28	5.66	9.6	9.6	1.0	154.32	2903.80	45	1.0	254.6	2419.37	26.0	25.7	14	9.19	11.58	12.49	153.0	2224.72	7547.9	398.7	5721.8	**3019.16**	**1907.28**
26.00	27.50	26.75	1.50	25.00	19.19	9.19	161.28	5.66	25.7	25.7	1.0	439.09	3342.90	14	1.0	79.2	2498.57	27.5	9.5	52	9.19	2.38	1.14	153.0	948.69	6790.2	424.1	6265.6	**2716.06**	**2088.53**
27.50	30.00	28.75	2.50	27.50	19.19	9.19	161.28	9.43	9.5	9.5	1.0	254.46	3597.36	52	1.0	490.3	2988.86	30.0	9.5	52	9.95	2.38	1.14	153.0	949.28	7535.5	466.5	7052.7	**3014.20**	**2350.91**
30.00	30.50	30.25	0.50	28.00	19.95	9.95	161.28	1.89	9.5	9.5	1.0	50.89	3648.25	52	1.0	98.1	3086.91	30.5	27.8	0	8.66	16.31	17.33	153.0	2924.85	9660.0	475.0	7210.2	**3864.01**	**2403.39**
30.50	32.50	31.50	2.00	30.00	18.66	8.66	161.28	7.54	27.8	27.8	1.0	641.38	4289.64	0	1.0	0.0	3086.91	32.5	28.3	0	8.66	17.43	18.48	153.0	3126.56	10503.1	508.9	7885.5	**4201.24**	**2628.50**
32.50	33.50	33.00	1.00	31.00	18.66	8.66	161.28	3.77	28.3	28.3	1.0	327.51	4617.14	0	1.0	0.0	3086.91	33.5	25.3	0	8.89	10.68	11.57	153.0	1918.11	9622.2	525.9	8230.0	**3848.87**	**2743.32**
33.50	35.00	34.25	1.50	32.50	18.89	8.89	161.28	5.66	25.3	25.3	1.0	431.28	5048.42	0	1.0	0.0	3086.91	35.0	25.3	0	8.89	10.68	11.57	153.0	1918.11	10053.4	551.3	8686.7	**4021.38**	**2895.56**
35.00	36.50	35.75	1.50	34.00	18.89	8.89	161.28	5.66	25.3	25.3	1.0	431.28	5479.69	0	1.0	0.0	3086.91	36.5	15.5	28	9.58	4.19	2.92	153.0	1028.86	9595.5	576.8	9143.4	**3838.19**	**3047.80**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
36.50	37.50	37.00	1.00	35.00	19.58	9.58	161.28	3.77	15.5	15.5	1.0	168.68	5648.38	28	1.0	105.6	3192.51	37.5	15.5	28	9.58	4.19	2.92	153.0	1028.86	9869.8	593.8	9434.7	**3947.90**	**3144.88**
37.50	38.00	37.75	0.50	35.50	19.58	9.58	161.28	1.89	15.5	15.5	1.0	84.34	5732.72	28	1.0	52.8	3245.31	38.0	23.0	10	9.58	8.56	8.68	153.0	1640.31	10618.3	602.2	9580.3	**4247.34**	**3193.42**
38.00	40.00	39.00	2.00	37.50	19.58	9.58	161.28	7.54	23.0	23.0	1.0	516.37	6249.09	10	1.0	75.4	3320.74	40.0	8.1	45	9.58	2.13	0.93	153.0	832.68	10402.5	636.2	10206.0	**4161.01**	**3402.00**
BORE NO: P63, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	17.76	7.76	21.34	1.89	11.2	11.2	1.0	7.97	7.97	60	1.0	113.1	113.14	3.0	9.1	54	8.16	2.31	1.08	23.3	616.66	737.8	8.5	129.6	**295.11**	**43.20**
3.00	5.00	4.00	2.00	2.50	18.16	8.16	31.44	7.54	9.1	9.1	1.0	37.98	45.95	54	1.0	407.3	520.46	5.0	9.1	54	8.16	2.31	1.08	39.6	659.27	1225.7	42.4	608.8	**490.27**	**202.94**
5.00	6.00	5.50	1.00	3.50	18.16	8.16	43.68	3.77	9.1	9.1	1.0	26.39	72.34	54	1.0	203.7	724.11	6.0	32.4	0	8.16	33.35	34.70	47.8	1994.33	2790.8	59.4	855.8	**1116.31**	**285.28**
6.00	8.00	7.00	2.00	5.50	18.16	8.16	55.92	7.54	32.4	32.4	1.1	299.80	372.14	0	1.0	0.0	724.11	8.0	34.6	0	9.18	44.43	45.98	64.1	3507.93	4604.2	93.3	1189.6	**1841.67**	**396.52**
8.00	9.00	8.50	1.00	6.50	19.18	9.18	68.67	3.77	34.6	34.6	1.2	219.75	591.89	0	1.0	0.0	724.11	9.0	34.6	0	9.18	44.43	45.98	73.3	3969.42	5285.4	110.3	1426.3	**2114.17**	**475.43**
9.00	10.00	9.50	1.00	7.50	19.18	9.18	77.85	3.77	34.6	34.6	1.2	249.13	841.02	0	1.0	0.0	724.11	10.0	25.0	12	9.18	10.00	10.88	82.4	1122.75	2687.9	127.2	1692.4	**1075.15**	**564.12**
10.00	11.00	10.50	1.00	8.50	19.18	9.18	87.03	3.77	25.0	25.0	1.0	153.05	994.08	12	1.0	45.3	769.37	11.0	25.0	12	9.18	10.00	10.88	91.6	1226.61	2990.1	144.2	1907.7	**1196.03**	**635.88**
11.00	12.00	11.50	1.00	9.50	19.18	9.18	96.21	3.77	25.0	25.0	1.0	169.20	1163.28	12	1.0	45.3	814.63	12.0	7.5	55	9.18	2.02	0.84	100.8	795.64	2773.5	161.2	2139.1	**1109.42**	**713.02**
12.00	13.00	12.50	1.00	10.50	19.18	9.18	105.39	3.77	7.5	7.5	1.0	52.33	1215.61	55	1.0	207.4	1022.06	13.0	11.0	55	9.10	2.76	1.51	110.0	913.30	3151.0	178.1	2415.8	**1260.38**	**805.26**
13.00	14.50	13.75	1.50	12.00	19.10	9.10	116.81	5.66	11.0	11.0	1.0	128.44	1344.05	55	1.0	311.1	1333.20	14.5	13.4	50	10.42	3.47	2.19	123.6	1010.03	3687.3	203.6	2880.8	**1474.91**	**960.28**
14.50	17.50	16.00	3.00	15.00	20.42	10.42	139.26	11.31	13.4	13.4	1.0	375.37	1719.42	50	1.0	565.7	1898.91	17.5	13.4	50	10.42	3.47	2.19	154.9	1132.76	4751.1	254.5	3872.8	**1900.44**	**1290.93**
17.50	19.00	18.25	1.50	16.50	20.42	10.42	139.26	5.66	13.4	13.4	1.0	187.68	1907.10	50	1.0	282.9	2181.77	19.0	25.3	22	8.75	10.68	11.57	154.9	2163.62	6252.5	279.9	4368.8	**2501.00**	**1456.26**
19.00	20.50	19.75	1.50	18.00	18.75	8.75	139.26	5.66	25.3	25.3	1.0	372.40	2279.50	22	1.0	124.5	2306.23	20.5	9.5	52	11.12	2.38	1.14	154.9	955.22	5541.0	305.4	4891.1	**2216.38**	**1630.36**
20.50	23.50	22.00	3.00	21.00	21.12	11.12	139.26	11.31	9.5	9.5	1.0	263.67	2543.17	52	1.0	588.3	2894.57	23.5	9.5	52	10.95	2.38	1.14	154.9	955.09	6392.8	356.3	5794.0	**2557.13**	**1931.33**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)										Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)		ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
23.50	26.50	25.00	3.00	24.00	20.95	10.95	139.26	11.31		9.5	9.5	1.0	263.67	2806.84	52	1.0	588.3	3482.91	26.5	10.7	51	10.95	2.68	1.42	154.9	998.81	7288.6	407.2	6696.9	**2915.42**	**2232.30**
26.50	27.50	27.00	1.00	25.00	20.95	10.95	139.26	3.77		10.7	10.7	1.0	99.24	2906.08	51	1.0	192.3	3675.26	27.5	10.7	51	10.95	2.68	1.42	154.9	998.81	7580.1	424.1	7005.4	**3032.06**	**2335.15**
27.50	28.00	27.75	0.50	25.50	20.95	10.95	139.26	1.89		10.7	10.7	1.0	49.62	2955.70	51	1.0	96.2	3771.43	28.0	27.6	7	7.80	15.85	16.87	154.9	2939.14	9666.3	432.6	7159.7	**3866.51**	**2386.57**
28.00	29.50	28.75	1.50	27.00	17.80	7.80	139.26	5.66		27.6	27.6	1.0	411.86	3367.56	7	1.0	39.6	3811.03	29.5	7.5	65	7.80	2.02	0.84	154.9	1020.31	8198.9	458.0	7636.6	**3279.56**	**2545.54**
29.50	30.00	29.75	0.50	27.50	17.80	7.80	139.26	1.89		7.5	7.5	1.0	34.57	3402.13	65	1.0	122.6	3933.60	30.0	7.5	65	7.80	2.02	0.84	154.9	1020.31	8356.0	466.5	7802.3	**3342.41**	**2600.75**
30.00	31.00	30.50	1.00	28.50	17.80	7.80	139.26	3.77		7.5	7.5	1.0	69.15	3471.27	65	1.0	245.1	4178.74	31.0	7.5	65	7.80	2.02	0.84	154.9	1020.31	8670.3	483.5	8133.5	**3468.13**	**2711.17**
31.00	32.50	31.75	1.50	30.00	17.80	7.80	139.26	5.66		7.5	7.5	1.0	103.72	3574.99	65	1.0	367.7	4546.46	32.5	7.5	65	10.01	2.02	0.84	154.9	1021.56	9143.0	508.9	8630.4	**3657.20**	**2876.80**
32.50	34.00	33.25	1.50	31.50	20.01	10.01	139.26	5.66		7.5	7.5	1.0	103.72	3678.71	65	1.0	367.7	4914.17	34.0	16.7	32	10.01	4.78	3.58	154.9	1187.24	9780.1	534.4	9127.3	**3912.05**	**3042.42**
34.00	35.00	34.50	1.00	32.50	20.01	10.01	139.26	3.77		16.7	16.7	1.0	157.57	3836.28	32	1.0	120.7	5034.86	35.0	16.7	32	10.01	4.78	3.58	154.9	1187.24	10058.4	551.3	9422.5	**4023.35**	**3140.83**
35.00	35.50	35.25	0.50	33.00	20.01	10.01	139.26	1.89		16.7	16.7	1.0	78.79	3915.06	32	1.0	60.3	5095.20	35.5	17.1	32	8.92	4.97	3.80	154.9	1220.41	10230.7	559.8	9570.1	**4092.27**	**3190.03**
35.50	37.00	36.25	1.50	34.50	18.92	8.92	139.26	5.66		17.1	17.1	1.0	242.36	4157.43	32	1.0	181.0	5276.23	37.0	8.6	44	8.92	2.22	1.00	154.9	842.83	10276.5	585.3	10018.9	**4110.59**	**3339.65**
37.00	37.50	37.25	0.50	35.00	18.92	8.92	139.26	1.89		8.6	8.6	1.0	39.72	4197.14	44	1.0	83.0	5359.20	37.5	8.6	44	8.92	2.22	1.00	154.9	842.83	10399.2	593.8	10150.1	**4159.67**	**3383.37**
37.50	38.50	38.00	1.00	36.00	18.92	8.92	139.26	3.77		8.6	8.6	1.0	79.43	4276.57	44	1.0	165.9	5525.14	38.5	9.1	53	10.54	2.31	1.08	154.9	951.90	10753.6	610.7	10412.4	**4301.45**	**3470.81**
38.50	40.00	39.25	1.50	37.50	20.54	10.54	139.26	5.66		9.1	9.1	1.0	126.19	4402.76	53	1.0	299.8	5824.97	40.0	9.1	53	10.54	2.31	1.08	154.9	951.90	11179.6	636.2	10863.9	**4471.85**	**3621.30**
BORE NO: P64, CUT OFF LENGTH: 2.50 m, Nc= 9																															
2.50	3.00	2.75	0.50	0.50	20.96	10.96	30.14	1.89		23.1	23.1	1.0	24.24	0	0	1.0	0.0	0	3.0	23.1	0	10.96	8.63	8.79	32.9	386.55	386.6	8.5	8.5	**154.62**	**2.83**
3.00	4.00	3.50	1.00	1.50	20.96	10.96	38.36	3.77		23.1	23.1	1.0	61.71	61.71	0	1.0	0.0	0.00	4.0	27.7	0	10.96	16.08	17.10	43.8	924.84	986.5	25.4	87.2	**394.62**	**29.05**
4.00	6.00	5.00	2.00	3.50	20.96	10.96	54.80	7.54		27.7	27.7	1.0	217.01	278.72	0	1.0	0.0	0.00	6.0	27.9	0	9.23	16.53	17.56	65.8	1339.95	1618.7	59.4	338.1	**647.47**	**112.70**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
6.00	7.00	6.50	1.00	4.50	19.23	9.23	70.38	3.77	27.9	27.9	1.0	140.53	419.25	0	1.0	0.0	0.00	7.0	26.7	7	9.23	13.83	14.80	75.0	1337.26	1756.5	76.3	495.6	**702.61**	**165.20**
7.00	9.00	8.00	2.00	6.50	19.23	9.23	84.22	7.54	26.7	26.7	1.0	319.50	738.75	7	1.0	52.8	52.80	9.0	23.2	16	9.23	8.70	8.90	93.5	1139.01	1930.6	110.3	901.8	**772.22**	**300.61**
9.00	10.00	9.50	1.00	7.50	19.23	9.23	98.07	3.77	23.2	23.2	1.0	158.52	897.27	16	1.0	60.3	113.14	10.0	23.2	16	9.59	8.70	8.90	102.7	1232.08	2242.5	127.2	1137.6	**897.00**	**379.22**
10.00	12.50	11.25	2.50	10.00	19.59	9.59	114.67	9.43	23.2	23.2	1.0	463.38	1360.65	16	1.0	150.9	264.00	12.5	23.0	16	9.80	8.56	8.68	126.7	1447.36	3072.0	169.6	1794.3	**1228.80**	**598.10**
12.50	15.50	14.00	3.00	13.00	19.80	9.80	141.36	11.31	23.0	23.0	1.0	678.88	2039.53	16	1.0	181.0	445.03	15.5	11.1	41	9.80	2.79	1.53	156.1	920.92	3405.5	220.5	2705.1	**1362.19**	**901.70**
15.50	17.00	16.25	1.50	14.50	19.80	9.80	163.41	5.66	11.1	11.1	1.0	181.36	2220.89	41	1.0	231.9	676.97	17.0	26.6	0	8.11	13.60	14.57	170.8	2708.27	5606.1	246.0	3143.8	**2242.45**	**1047.95**
17.00	18.50	17.75	1.50	16.00	18.11	8.11	176.84	5.66	26.6	26.6	1.0	500.96	2721.85	0	1.0	0.0	676.97	18.5	15.6	33	8.11	4.24	2.98	170.8	1170.66	4569.5	271.4	3670.3	**1827.79**	**1223.42**
18.50	20.00	19.25	1.50	17.50	18.11	8.11	176.84	5.66	15.6	15.6	1.0	279.32	3001.16	33	1.0	186.7	863.66	20.0	11.2	46	9.79	2.82	1.56	170.8	1024.16	4889.0	296.9	4161.7	**1955.59**	**1387.23**
20.00	21.50	20.75	1.50	19.00	19.79	9.79	176.84	5.66	11.2	11.2	1.0	198.08	3199.25	46	1.0	260.2	1123.89	21.5	11.2	46	9.24	2.82	1.56	170.8	1023.57	5346.7	322.3	4645.5	**2138.68**	**1548.49**
21.50	24.50	23.00	3.00	22.00	19.24	9.24	176.84	11.31	11.2	11.2	1.0	396.17	3595.41	46	1.0	520.5	1644.34	24.5	12.5	42	9.24	3.20	1.94	170.8	1058.82	6298.6	373.2	5613.0	**2519.43**	**1870.99**
24.50	26.00	25.25	1.50	23.50	19.24	9.24	176.84	5.66	12.5	12.5	1.0	221.78	3817.20	42	1.0	237.6	1881.94	26.0	19.5	28	9.24	6.13	5.12	170.8	1502.28	7201.4	398.7	6097.8	**2880.57**	**2032.60**
26.00	27.50	26.75	1.50	25.00	19.24	9.24	176.84	5.66	19.5	19.5	1.0	354.26	4171.45	28	1.0	158.4	2040.34	27.5	9.5	30	9.64	2.38	1.14	170.8	772.77	6984.6	424.1	6635.9	**2793.83**	**2211.97**
27.50	29.00	28.25	1.50	26.50	19.64	9.64	176.84	5.66	9.5	9.5	1.0	167.41	4338.86	30	1.0	169.7	2210.06	29.0	28.9	4	9.64	18.78	19.87	170.8	3799.45	10348.4	449.6	6998.5	**4139.35**	**2332.83**
29.00	30.00	29.50	1.00	27.50	19.64	9.64	176.84	3.77	28.9	28.9	1.0	368.17	4707.03	4	1.0	15.1	2225.14	30.0	28.8	0	9.64	18.56	19.64	170.8	3713.70	10645.9	466.5	7398.7	**4258.35**	**2466.23**
30.00	30.50	30.25	0.50	28.00	19.64	9.64	176.84	1.89	28.8	28.8	1.0	183.32	4890.35	0	1.0	0.0	2225.14	30.5	28.8	0	9.64	18.56	19.64	170.8	3713.70	10829.2	475.0	7590.5	**4331.68**	**2530.17**
30.50	32.00	31.25	1.50	29.50	19.64	9.64	176.84	5.66	28.8	28.8	1.0	549.97	5440.32	0	1.0	0.0	2225.14	32.0	9.5	32	9.64	2.38	1.14	170.8	793.14	8458.6	500.5	8165.9	**3383.44**	**2721.97**
32.00	32.50	32.25	0.50	30.00	19.64	9.64	176.84	1.89	9.5	9.5	1.0	55.80	5496.13	32	1.0	60.3	2285.49	32.5	9.5	32	8.64	2.38	1.14	170.8	792.36	8574.0	508.9	8290.6	**3429.59**	**2763.52**
32.50	33.50	33.00	1.00	31.00	18.64	8.64	176.84	3.77	9.5	9.5	1.0	111.61	5607.73	32	1.0	120.7	2406.17	33.5	8.7	48	7.55	2.24	1.02	170.8	925.99	8939.9	525.9	8539.8	**3575.96**	**2846.60**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)										Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
33.50	35.00	34.25	1.50	32.50	17.55	7.55	176.84	5.66	8.7	8.7	1.0	153.08	5760.81	48	1.0	271.5	2677.71	35.0	8.7	48	7.55	2.24	1.02	170.8	925.99	9364.5	551.3	8989.9	**3745.81**	**2996.63**
35.00	36.50	35.75	1.50	34.00	17.55	7.55	176.84	5.66	8.7	8.7	1.0	153.08	5913.90	48	1.0	271.5	2949.26	36.5	9.3	55	8.10	2.34	1.11	170.8	1019.03	9882.2	576.8	9439.9	**3952.87**	**3146.65**
36.50	37.50	37.00	1.00	35.00	18.10	8.10	176.84	3.77	9.3	9.3	1.0	109.21	6023.11	55	1.0	207.4	3156.69	37.5	10.2	30	8.10	2.53	1.28	170.8	801.07	9980.9	593.8	9773.6	**3992.34**	**3257.85**
37.50	40.00	38.75	2.50	37.50	18.10	8.10	176.84	9.43	10.2	10.2	1.0	300.00	6323.11	30	1.0	282.9	3439.54	40.0	14.3	28	8.10	3.74	2.45	170.8	1020.57	10783.2	636.2	10398.8	**4313.29**	**3466.27**
BORE NO: P65, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	20.11	10.11	27.80	1.89	24.5	24.5	1.0	23.89	0	0	1.0	0.0	0	3.0	13.8	31	10.11	3.59	2.31	30.3	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.50	20.11	10.11	35.39	3.77	13.8	13.8	1.0	32.78	0	31	1.0	116.9	0	4.0	32.7	0	9.10	34.86	36.24	40.4	0	0.0	25.4	25.4	**0.00**	**8.48**
4.00	5.00	4.50	1.00	2.50	19.10	9.10	44.99	3.77	32.7	32.7	1.1	123.64	0	0	1.0	0.0	0	5.0	30.5	0	9.10	23.78	24.96	49.5	1487.01	1487.0	42.4	42.4	**594.80**	**14.14**
5.00	6.00	5.50	1.00	3.50	19.10	9.10	54.09	3.77	30.5	30.5	1.0	123.17	123.17	0	1.0	0.0	0.00	6.0	30.5	0	9.97	23.78	24.96	58.6	1746.57	1869.7	59.4	182.5	**747.89**	**60.85**
6.00	8.00	7.00	2.00	5.50	19.97	9.97	68.61	7.54	30.5	30.5	1.0	312.46	435.63	0	1.0	0.0	0.00	8.0	30.5	0	9.97	23.78	24.96	78.6	2283.02	2718.7	93.3	528.9	**1087.46**	**176.31**
8.00	9.00	8.50	1.00	6.50	19.97	9.97	83.57	3.77	30.5	30.5	1.0	190.28	625.91	0	1.0	0.0	0.00	9.0	25.3	12	9.61	10.68	11.57	88.6	1267.25	1893.2	110.3	736.2	**757.26**	**245.39**
9.00	11.00	10.00	2.00	8.50	19.61	9.61	98.16	7.54	25.3	25.3	1.0	349.99	975.90	12	1.0	90.5	90.51	11.0	25.9	12	9.61	12.03	12.95	107.8	1673.17	2739.6	144.2	1210.6	**1095.83**	**403.54**
11.00	12.00	11.50	1.00	9.50	19.61	9.61	112.58	3.77	25.9	25.9	1.0	206.16	1182.06	12	1.0	45.3	135.77	12.0	25.9	12	10.07	12.03	12.95	117.4	1807.98	3125.8	161.2	1479.0	**1250.32**	**493.00**
12.00	14.50	13.25	2.50	12.00	20.07	10.07	129.97	9.43	25.9	25.9	1.0	595.03	1777.09	12	1.0	113.1	248.91	14.5	25.9	12	10.07	12.03	12.95	142.6	2150.54	4176.5	203.6	2229.6	**1670.62**	**743.19**
14.50	17.50	16.00	3.00	15.00	20.07	10.07	157.66	11.31	25.9	25.9	1.0	866.17	2643.26	12	1.0	135.8	384.69	17.5	24.0	12	9.92	9.28	9.78	172.8	2002.04	5030.0	254.5	3282.4	**2011.99**	**1094.14**
17.50	20.50	19.00	3.00	18.00	19.92	9.92	157.66	11.31	24.0	24.0	1.0	794.20	3437.46	12	1.0	135.8	520.46	20.5	12.5	47	9.92	3.20	1.94	172.8	1117.91	5075.8	305.4	4263.3	**2030.33**	**1421.09**
20.50	23.50	22.00	3.00	21.00	19.92	9.92	157.66	11.31	12.5	12.5	1.0	395.46	3832.92	47	1.0	531.8	1052.23	23.5	12.6	47	10.99	3.23	1.96	172.8	1125.24	6010.4	356.3	5241.4	**2404.16**	**1747.14**
23.50	26.50	25.00	3.00	24.00	20.99	10.99	157.66	11.31	12.6	12.6	1.0	398.73	4231.65	47	1.0	531.8	1584.00	26.5	12.2	47	10.99	3.12	1.85	172.8	1101.56	6917.2	407.2	6222.8	**2766.88**	**2074.27**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
26.50	27.50	27.00	1.00	25.00	20.99	10.99	157.66	3.77	12.2	12.2	1.0	128.56	4360.21	47	1.0	177.3	1761.26	27.5	14.0	10	10.99	3.65	2.36	172.8	832.94	6954.4	424.1	6545.6	**2781.76**	**2181.86**
27.50	28.00	27.75	0.50	25.50	20.99	10.99	157.66	1.89	14.0	14.0	1.0	74.13	4434.34	10	1.0	18.9	1780.11	28.0	10.6	59	10.82	2.65	1.39	172.8	1128.31	7342.8	432.6	6647.0	**2937.10**	**2215.68**
28.00	29.50	28.75	1.50	27.00	20.82	10.82	157.66	5.66	10.6	10.6	1.0	166.92	4601.25	59	1.0	333.8	2113.89	29.5	10.6	59	10.82	2.65	1.39	172.8	1128.31	7843.4	458.0	7173.2	**3137.38**	**2391.06**
29.50	30.00	29.75	0.50	27.50	20.82	10.82	157.66	1.89	10.6	10.6	1.0	55.64	4656.89	59	1.0	111.3	2225.14	30.0	10.6	54	11.04	2.65	1.39	172.8	1077.60	7959.6	466.5	7348.6	**3183.85**	**2449.52**
30.00	32.50	31.25	2.50	30.00	21.04	11.04	157.66	9.43	10.6	10.6	1.0	278.19	4935.08	54	1.0	509.1	2734.29	32.5	10.6	54	11.04	2.65	1.39	172.8	1077.60	8747.0	508.9	8178.3	**3498.79**	**2726.10**
32.50	35.00	33.75	2.50	32.50	21.04	11.04	157.66	9.43	10.6	10.6	1.0	278.19	5213.27	54	1.0	509.1	3243.43	35.0	10.6	54	8.71	2.65	1.39	172.8	1075.40	9532.1	551.3	9008.1	**3812.84**	**3002.68**
35.00	35.50	35.25	0.50	33.00	18.71	8.71	157.66	1.89	10.6	10.6	1.0	55.64	5268.91	54	1.0	101.8	3345.26	35.5	10.5	60	8.04	2.62	1.36	172.8	1129.96	9744.1	559.8	9174.0	**3897.65**	**3058.00**
35.50	37.50	36.50	2.00	35.00	18.04	8.04	157.66	7.54	10.5	10.5	1.0	220.41	5489.32	60	1.0	452.6	3797.83	37.5	14.0	30	8.04	3.65	2.36	172.8	1031.86	10319.0	593.8	9880.9	**4127.60**	**3293.64**
37.50	38.50	38.00	1.00	36.00	18.04	8.04	157.66	3.77	14.0	14.0	1.0	148.25	5637.57	30	1.0	113.1	3910.97	38.5	14.0	30	9.16	3.65	2.36	172.8	1033.66	10582.2	610.7	10159.3	**4232.88**	**3386.42**
38.50	40.00	39.25	1.50	37.50	19.16	9.16	157.66	5.66	14.0	14.0	1.0	222.38	5859.95	30	1.0	169.7	4080.69	40.0	14.0	30	9.16	3.65	2.36	172.8	1033.66	10974.3	636.2	10576.8	**4389.72**	**3525.60**
BORE NO: P66, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.30	9.30	25.58	1.89	12.0	12.0	1.0	10.25	0	5	1.0	9.4	0	3.0	8.1	34	9.30	2.13	0.93	27.9	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.50	19.30	9.30	32.55	3.77	8.1	8.1	1.0	17.47	0	34	1.0	128.2	0	4.0	8.1	34	10.30	2.13	0.93	37.2	0	0.0	25.4	25.4	**0.00**	**8.48**
4.00	5.00	4.50	1.00	2.50	20.30	10.30	42.35	3.77	8.1	8.1	1.0	22.73	0	34	1.0	128.2	0	5.0	27.6	0	10.30	15.85	16.87	47.5	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.50	20.30	10.30	52.65	3.77	27.6	27.6	1.0	103.81	0	0	1.0	0.0	0	6.0	27.6	0	10.30	15.85	16.87	57.8	0	0.0	59.4	59.4	**0.00**	**19.79**
6.00	7.00	6.50	1.00	4.50	20.30	10.30	62.95	3.77	27.6	27.6	1.0	124.12	0	0	1.0	0.0	0	7.0	33.8	0	10.30	40.40	41.88	68.1	0	0.0	76.3	76.3	**0.00**	**25.45**
7.00	8.00	7.50	1.00	5.50	20.30	10.30	73.25	3.77	33.8	33.8	1.2	220.08	0	0	1.0	0.0	0	8.0	28.5	0	10.31	17.88	18.94	78.4	1718.76	1718.8	93.3	93.3	**687.51**	**31.10**
8.00	9.00	8.50	1.00	6.50	20.31	10.31	83.56	3.77	28.5	28.5	1.0	171.10	171.10	0	1.0	0.0	0.00	9.0	25.3	17	10.31	10.68	11.57	88.7	1325.59	1496.7	110.3	281.4	**598.68**	**93.79**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
9.00	10.00	9.50	1.00	7.50	20.31	10.31	93.87	3.77	25.3	25.3	1.0	167.34	338.43	17	1.0	64.1	64.11	10.0	25.3	17	10.31	10.68	11.57	99.0	1450.12	1852.7	127.2	529.8	**741.07**	**176.59**
10.00	11.00	10.50	1.00	8.50	20.31	10.31	104.18	3.77	25.3	25.3	1.0	185.72	524.15	17	1.0	64.1	128.23	11.0	7.5	48	10.31	2.02	0.84	109.3	744.49	1396.9	144.2	796.6	**558.75**	**265.53**
11.00	12.00	11.50	1.00	9.50	20.31	10.31	114.49	3.77	7.5	7.5	1.0	56.84	581.00	48	1.0	181.0	309.26	12.0	7.5	48	10.10	2.02	0.84	119.6	767.94	1658.2	161.2	1051.4	**663.28**	**350.47**
12.00	14.50	13.25	2.50	12.00	20.10	10.10	132.27	9.43	7.5	7.5	1.0	164.18	745.18	48	1.0	452.6	761.83	14.5	25.5	16	11.58	11.13	12.03	144.9	2081.42	3588.4	203.6	1710.6	**1435.37**	**570.19**
14.50	17.50	16.00	3.00	15.00	21.58	11.58	162.26	11.31	25.5	25.5	1.0	875.66	1620.83	16	1.0	181.0	942.86	17.5	25.0	16	11.58	10.00	10.88	179.6	2280.84	4844.5	254.5	2818.2	**1937.81**	**939.39**
17.50	19.00	18.25	1.50	16.50	21.58	11.58	162.26	5.66	25.0	25.0	1.0	428.04	2048.87	16	1.0	90.5	1033.37	19.0	24.5	15	11.39	9.64	10.33	179.6	2191.84	5274.1	279.9	3362.2	**2109.63**	**1120.72**
19.00	20.50	19.75	1.50	18.00	21.39	11.39	162.26	5.66	24.5	24.5	1.0	418.32	2467.20	15	1.0	84.9	1118.23	20.5	24.5	15	11.39	9.64	10.33	179.6	2191.84	5777.3	305.4	3890.8	**2310.91**	**1296.93**
20.50	22.00	21.25	1.50	19.50	21.39	11.39	162.26	5.66	24.5	24.5	1.0	418.32	2885.52	15	1.0	84.9	1203.09	22.0	23.6	10	11.39	8.99	9.34	179.6	2001.59	6090.2	330.8	4419.4	**2436.08**	**1473.14**
22.00	23.50	22.75	1.50	21.00	21.39	11.39	162.26	5.66	23.6	23.6	1.0	401.03	3286.55	10	1.0	56.6	1259.66	23.5	12.1	39	10.18	3.09	1.82	179.6	1037.15	5583.4	356.3	4902.5	**2233.34**	**1634.16**
23.50	26.50	25.00	3.00	24.00	20.18	10.18	162.26	11.31	12.1	12.1	1.0	393.57	3680.13	39	1.0	441.3	1700.91	26.5	12.1	39	10.18	3.09	1.82	179.6	1037.15	6418.2	407.2	5788.2	**2567.28**	**1929.40**
26.50	27.50	27.00	1.00	25.00	20.18	10.18	162.26	3.77	12.1	12.1	1.0	131.19	3811.32	39	1.0	147.1	1848.00	27.5	12.1	39	10.18	3.09	1.82	179.6	1037.15	6696.5	424.1	6083.4	**2678.59**	**2027.81**
27.50	29.50	28.50	2.00	27.00	20.18	10.18	162.26	7.54	12.1	12.1	1.0	262.38	4073.70	39	1.0	294.2	2142.17	29.5	11.2	52	9.59	2.82	1.56	179.6	1113.39	7329.3	458.0	6673.9	**2931.70**	**2224.64**
29.50	30.00	29.75	0.50	27.50	19.59	9.59	162.26	1.89	11.2	11.2	1.0	60.58	4134.28	52	1.0	98.1	2240.23	30.0	11.2	49	9.59	2.82	1.56	179.6	1082.84	7457.4	466.5	6841.0	**2982.94**	**2280.35**
30.00	32.50	31.25	2.50	30.00	19.59	9.59	162.26	9.43	11.2	11.2	1.0	302.92	4437.21	49	1.0	462.0	2702.23	32.5	11.2	49	9.59	2.82	1.56	179.6	1082.84	8222.3	508.9	7648.4	**3288.91**	**2549.46**
32.50	35.00	33.75	2.50	32.50	19.59	9.59	162.26	9.43	11.2	11.2	1.0	302.92	4740.13	49	1.0	462.0	3164.23	35.0	11.2	49	8.99	2.82	1.56	179.6	1082.20	8986.6	551.3	8455.7	**3594.63**	**2818.57**
35.00	35.50	35.25	0.50	33.00	18.99	8.99	162.26	1.89	11.2	11.2	1.0	60.58	4800.72	49	1.0	92.4	3256.63	35.5	11.2	49	8.82	2.82	1.56	179.6	1082.02	9139.4	559.8	8617.2	**3655.75**	**2872.39**
35.50	37.50	36.50	2.00	35.00	18.82	8.82	162.26	7.54	11.2	11.2	1.0	242.34	5043.06	49	1.0	369.6	3626.23	37.5	11.2	49	8.82	2.82	1.56	179.6	1082.02	9751.3	593.8	9263.0	**3900.52**	**3087.68**
37.50	38.50	38.00	1.00	36.00	18.82	8.82	162.26	3.77	11.2	11.2	1.0	121.17	5164.23	49	1.0	184.8	3811.03	38.5	11.2	49	9.02	2.82	1.56	179.6	1082.23	10057.5	610.7	9586.0	**4023.00**	**3195.33**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
38.50	40.00	39.25	1.50	37.50	19.02	9.02	162.26	5.66	11.2	11.2	1.0	181.75	5345.98	49	1.0	277.2	4088.23	40.0	11.2	49	9.02	2.82	1.56	179.6	1082.23	10516.4	636.2	10070.4	**4206.58**	**3356.79**
BORE NO: P67, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	20.06	10.06	27.67	1.89	27.5	27.5	1.0	27.16	0	12	1.0	22.6	0	3.0	27.5	9	10.06	15.63	16.64	30.2	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.50	20.06	10.06	35.21	3.77	27.5	27.5	1.0	69.13	0	9	1.0	33.9	0	4.0	29.5	0	10.06	20.13	21.25	40.2	0	0.0	25.4	25.4	**0.00**	**8.48**
4.00	6.00	5.00	2.00	3.50	20.06	10.06	50.30	7.54	29.5	29.5	1.0	214.66	0	0	1.0	0.0	0	6.0	29.7	0	10.24	20.58	21.71	60.4	1556.65	1556.6	59.4	59.4	**622.66**	**19.79**
6.00	7.00	6.50	1.00	4.50	20.24	10.24	65.48	3.77	29.7	29.7	1.0	140.86	140.86	0	1.0	0.0	0.00	7.0	28.5	0	10.01	17.88	18.94	70.6	1557.10	1698.0	76.3	217.2	**679.18**	**72.40**
7.00	9.00	8.00	2.00	6.50	20.01	10.01	80.61	7.54	28.5	28.5	1.0	330.13	470.99	0	1.0	0.0	0.00	9.0	24.8	16	10.01	9.86	10.66	90.6	1245.90	1716.9	110.3	581.3	**686.76**	**193.75**
9.00	10.00	9.50	1.00	7.50	20.01	10.01	95.63	3.77	24.8	24.8	1.0	166.64	637.63	16	1.0	60.3	60.34	10.0	24.8	16	10.01	9.86	10.66	100.6	1357.53	2055.5	127.2	825.2	**822.20**	**275.07**
10.00	11.00	10.50	1.00	8.50	20.01	10.01	105.64	3.77	24.8	24.8	1.0	184.08	821.72	16	1.0	60.3	120.69	11.0	24.8	16	10.01	9.86	10.66	110.6	1469.15	2411.6	144.2	1086.6	**964.62**	**362.20**
11.00	12.50	11.75	1.50	10.00	20.01	10.01	118.15	5.66	24.8	24.8	1.0	308.83	1130.55	16	1.0	90.5	211.20	12.5	24.8	16	10.01	9.86	10.66	125.7	1636.59	2978.3	169.6	1511.4	**1191.34**	**503.80**
12.50	14.00	13.25	1.50	11.50	20.01	10.01	133.16	5.66	24.8	24.8	1.0	348.08	1478.63	16	1.0	90.5	301.71	14.0	14.3	54	10.75	3.74	2.45	140.7	1162.53	2942.9	195.1	1975.4	**1177.15**	**658.48**
14.00	15.50	14.75	1.50	13.00	20.75	10.75	148.73	5.66	14.3	14.3	1.0	214.47	1693.10	54	1.0	305.5	607.20	15.5	14.3	54	10.61	3.74	2.45	156.8	1230.47	3530.8	220.5	2520.8	**1412.31**	**840.28**
15.50	18.50	17.00	3.00	16.00	20.61	10.61	172.71	11.31	14.3	14.3	1.0	498.09	2191.20	54	1.0	611.0	1218.17	18.5	23.8	10	10.61	9.14	9.56	156.8	1791.45	5200.8	271.4	3680.8	**2080.33**	**1226.93**
18.50	20.00	19.25	1.50	17.50	20.61	10.61	172.71	5.66	23.8	23.8	1.0	430.93	2622.12	10	1.0	56.6	1274.74	20.0	28.6	0	10.61	18.11	19.17	156.8	3350.31	7247.2	296.9	4193.7	**2898.87**	**1397.92**
20.00	21.50	20.75	1.50	19.00	20.61	10.61	172.71	5.66	28.6	28.6	1.0	532.70	3154.83	0	1.0	0.0	1274.74	21.5	12.2	46	10.81	3.12	1.85	156.8	1034.84	5464.4	322.3	4751.9	**2185.76**	**1583.97**
21.50	24.50	23.00	3.00	22.00	20.81	10.81	172.71	11.31	12.2	12.2	1.0	422.49	3577.32	46	1.0	520.5	1795.20	24.5	12.2	46	10.81	3.12	1.85	156.8	1034.84	6407.4	373.2	5745.7	**2562.94**	**1915.25**
24.50	27.50	26.00	3.00	25.00	20.81	10.81	172.71	11.31	12.2	12.2	1.0	422.49	3999.80	46	1.0	520.5	2315.66	27.5	8.0	40	11.18	2.11	0.91	156.8	788.55	7104.0	424.1	6739.6	**2841.61**	**2246.53**
27.50	29.00	28.25	1.50	26.50	21.18	11.18	172.71	5.66	8.0	8.0	1.0	137.31	4137.12	40	1.0	226.3	2541.94	29.0	24.0	14	11.18	9.28	9.78	156.8	1863.10	8542.2	449.6	7128.6	**3416.86**	**2376.21**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
29.00	30.00	29.50	1.00	27.50	21.18	11.18	172.71	3.77	24.0	24.0	1.0	290.01	4427.12	14	1.0	52.8	2594.74	30.0	24.0	14	11.18	9.28	9.78	156.8	1863.10	8885.0	466.5	7488.4	**3553.99**	**2496.13**
30.00	30.50	30.25	0.50	28.00	21.18	11.18	172.71	1.89	24.0	24.0	1.0	145.00	4572.13	14	1.0	26.4	2621.14	30.5	9.5	32	11.18	2.38	1.14	156.8	756.74	7950.0	475.0	7668.3	**3180.01**	**2556.09**
30.50	32.00	31.25	1.50	29.50	21.18	11.18	172.71	5.66	9.5	9.5	1.0	163.50	4735.63	32	1.0	181.0	2802.17	32.0	27.3	0	11.18	15.18	16.18	156.8	2815.65	10353.5	500.5	8038.3	**4141.38**	**2679.42**
32.00	32.50	32.25	0.50	30.00	21.18	11.18	172.71	1.89	27.3	27.3	1.0	168.10	4903.73	0	1.0	0.0	2802.17	32.5	27.3	0	8.86	15.18	16.18	156.8	2790.17	10496.1	508.9	8214.8	**4198.43**	**2738.28**
32.50	33.50	33.00	1.00	31.00	18.86	8.86	172.71	3.77	27.3	27.3	1.0	336.19	5239.92	0	1.0	0.0	2802.17	33.5	27.3	0	8.88	15.18	16.18	156.8	2790.39	10832.5	525.9	8568.0	**4332.99**	**2856.00**
33.50	35.00	34.25	1.50	32.50	18.88	8.88	172.71	5.66	27.3	27.3	1.0	504.29	5744.21	0	1.0	0.0	2802.17	35.0	15.1	48	8.36	3.99	2.70	156.8	1211.82	9758.2	551.3	9097.7	**3903.28**	**3032.58**
35.00	36.50	35.75	1.50	34.00	18.36	8.36	172.71	5.66	15.1	15.1	1.0	263.63	6007.84	48	1.0	271.5	3073.71	36.5	28.8	0	8.52	18.56	19.64	156.8	3405.67	12487.2	576.8	9658.3	**4994.89**	**3219.45**
36.50	37.50	37.00	1.00	35.00	18.52	8.52	172.71	3.77	28.8	28.8	1.0	358.09	6365.93	0	1.0	0.0	3073.71	37.5	28.8	0	8.52	18.56	19.64	156.8	3405.67	12845.3	593.8	10033.4	**5138.12**	**3344.47**
37.50	38.00	37.75	0.50	35.50	18.52	8.52	172.71	1.89	28.8	28.8	1.0	179.05	6544.97	0	1.0	0.0	3073.71	38.0	28.8	0	8.62	18.56	19.64	156.8	3407.00	13025.7	602.2	10220.9	**5210.27**	**3406.98**
38.00	40.00	39.00	2.00	37.50	18.62	8.62	172.71	7.54	28.8	28.8	1.0	716.18	7261.15	0	1.0	0.0	3073.71	40.0	29.6	0	8.62	20.36	21.48	156.8	3737.38	14072.2	636.2	10971.0	**5628.90**	**3657.01**
BORE NO: P68, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.56	9.56	26.29	1.89	26.5	26.5	1.0	24.72	0	5	1.0	9.4	0	3.0	26.5	5	9.56	13.38	14.34	28.7	578.06	578.1	8.5	8.5	**231.22**	**2.83**
3.00	4.00	3.50	1.00	1.50	19.56	9.56	33.46	3.77	26.5	26.5	1.0	62.92	62.92	5	1.0	18.9	18.86	4.0	30.4	0	9.56	23.27	24.45	38.2	1165.67	1247.4	25.4	107.2	**498.98**	**35.74**
4.00	6.00	5.00	2.00	3.50	19.56	9.56	47.80	7.54	30.4	30.4	1.0	215.76	278.68	0	1.0	0.0	18.86	6.0	30.2	0	9.34	22.27	23.43	57.4	1593.63	1891.2	59.4	356.9	**756.47**	**118.97**
6.00	7.00	6.50	1.00	4.50	19.34	9.34	62.03	3.77	30.2	30.2	1.0	137.52	416.20	0	1.0	0.0	18.86	7.0	30.2	0	9.34	22.27	23.43	66.7	1828.94	2264.0	76.3	511.4	**905.60**	**170.47**
7.00	9.00	8.00	2.00	6.50	19.34	9.34	76.04	7.54	30.2	30.2	1.0	337.16	753.36	0	1.0	0.0	18.86	9.0	28.5	0	9.34	17.88	18.94	85.4	1847.51	2619.7	110.3	882.5	**1047.89**	**294.16**
9.00	10.00	9.50	1.00	7.50	19.34	9.34	90.05	3.77	28.5	28.5	1.0	184.40	937.75	0	1.0	0.0	18.86	10.0	28.5	0	9.34	17.88	18.94	94.7	2036.47	2993.1	127.2	1083.8	**1197.23**	**361.28**
10.00	11.00	10.50	1.00	8.50	19.34	9.34	99.39	3.77	28.5	28.5	1.0	203.52	1141.28	0	1.0	0.0	18.86	11.0	11.4	44	10.20	2.88	1.62	104.1	798.54	1958.7	144.2	1304.3	**783.47**	**434.78**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
11.00	12.50	11.75	1.50	10.00	20.20	10.20	111.71	5.66	11.4	11.4	1.0	127.43	1268.70	44	1.0	248.9	267.77	12.5	11.4	44	10.41	2.88	1.62	119.4	848.65	2385.1	169.6	1706.1	**954.05**	**568.71**
12.50	15.50	14.00	3.00	13.00	20.41	10.41	134.98	11.31	11.4	11.4	1.0	307.93	1576.63	44	1.0	497.8	765.60	15.5	9.7	57	10.23	2.42	1.17	150.6	1000.22	3342.4	220.5	2562.8	**1336.98**	**854.26**
15.50	18.50	17.00	3.00	16.00	20.23	10.23	165.94	11.31	9.7	9.7	1.0	320.92	1897.54	57	1.0	644.9	1410.51	18.5	8.1	60	10.25	2.13	0.93	150.6	980.00	4288.1	271.4	3579.5	**1715.22**	**1193.16**
18.50	21.50	20.00	3.00	19.00	20.25	10.25	165.94	11.31	8.1	8.1	1.0	267.20	2164.74	60	1.0	678.9	2089.37	21.5	7.8	62	10.60	2.07	0.88	150.6	991.05	5245.2	322.3	4576.4	**2098.07**	**1525.48**
21.50	24.50	23.00	3.00	22.00	20.60	10.60	165.94	11.31	7.8	7.8	1.0	257.18	2421.92	62	1.0	701.5	2790.86	24.5	7.8	62	10.28	2.07	0.88	150.6	990.86	6203.6	373.2	5586.0	**2481.45**	**1862.00**
24.50	27.50	26.00	3.00	25.00	20.28	10.28	165.94	11.31	7.8	7.8	1.0	257.18	2679.10	62	1.0	701.5	3492.34	27.5	4.5	96	10.28	1.51	0.41	150.6	1238.17	7409.6	424.1	6595.6	**2963.84**	**2198.52**
27.50	29.00	28.25	1.50	26.50	20.28	10.28	165.94	5.66	4.5	4.5	1.0	73.88	2752.98	96	1.0	543.1	4035.43	29.0	9.3	57	10.28	2.34	1.11	150.6	987.56	7776.0	449.6	7238.0	**3110.39**	**2412.66**
29.00	30.00	29.50	1.00	27.50	20.28	10.28	165.94	3.77	9.3	9.3	1.0	102.48	2855.46	57	1.0	215.0	4250.40	30.0	9.3	57	8.82	2.34	1.11	150.6	986.46	8092.3	466.5	7572.4	**3236.93**	**2524.13**
30.00	30.50	30.25	0.50	28.00	18.82	8.82	165.94	1.89	9.3	9.3	1.0	51.24	2906.70	57	1.0	107.5	4357.89	30.5	9.3	57	9.81	2.34	1.11	150.6	987.20	8251.8	475.0	7739.6	**3300.71**	**2579.86**
30.50	32.00	31.25	1.50	29.50	19.81	9.81	165.94	5.66	9.3	9.3	1.0	153.72	3060.42	57	1.0	322.5	4680.34	32.0	9.3	57	9.91	2.34	1.11	150.6	987.28	8728.0	500.5	8241.2	**3491.22**	**2747.07**
32.00	32.50	32.25	0.50	30.00	19.91	9.91	165.94	1.89	9.3	9.3	1.0	51.24	3111.66	57	1.0	107.5	4787.83	32.5	14.0	28	9.91	3.65	2.36	150.6	922.92	8822.4	508.9	8408.4	**3528.96**	**2802.81**
32.50	33.50	33.00	1.00	31.00	19.91	9.91	165.94	3.77	14.0	14.0	1.0	156.03	3267.69	28	1.0	105.6	4893.43	33.5	28.3	0	9.01	17.43	18.48	150.6	3083.03	11244.1	525.9	8687.0	**4497.66**	**2895.67**
33.50	35.00	34.25	1.50	32.50	19.01	9.01	165.94	5.66	28.3	28.3	1.0	505.45	3773.14	0	1.0	0.0	4893.43	35.0	28.3	0	7.32	17.43	18.48	150.6	3061.82	11728.4	551.3	9217.9	**4691.36**	**3072.64**
35.00	36.50	35.75	1.50	34.00	17.32	7.32	165.94	5.66	28.3	28.3	1.0	505.45	4278.59	0	1.0	0.0	4893.43	36.5	14.3	49	9.74	3.74	2.45	150.6	1151.88	10323.9	576.8	9748.8	**4129.56**	**3249.60**
36.50	37.50	37.00	1.00	35.00	19.74	9.74	165.94	3.77	14.3	14.3	1.0	159.52	4438.10	49	1.0	184.8	5078.23	37.5	11.5	49	9.74	2.91	1.65	150.6	1005.84	10522.2	593.8	10110.1	**4208.87**	**3370.03**
37.50	38.00	37.75	0.50	35.50	19.74	9.74	165.94	1.89	11.5	11.5	1.0	63.66	4501.76	49	1.0	92.4	5170.63	38.0	11.5	55	9.52	2.91	1.65	150.6	1066.70	10739.1	602.2	10274.6	**4295.64**	**3424.88**
38.00	40.00	39.00	2.00	37.50	19.52	9.52	165.94	7.54	11.5	11.5	1.0	254.65	4756.41	55	1.0	414.9	5585.49	40.0	11.5	55	9.52	2.91	1.65	150.6	1066.70	11408.6	636.2	10978.1	**4563.44**	**3659.36**

BORE NO: P69, CUT OFF LENGTH: 2.50 m, Nc= 9

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
2.50	3.00	2.75	0.50	0.50	19.39	9.39	25.82	1.89	27.2	27.2	1.0	25.03	0	4	1.0	7.5	0	3.0	13.5	43	9.39	3.50	2.22	28.2	563.57	563.6	8.5	8.5	**225.43**	**2.83**
3.00	4.00	3.50	1.00	1.50	19.39	9.39	32.87	3.77	13.5	13.5	1.0	29.76	29.76	43	1.0	162.2	162.17	4.0	13.5	43	9.39	3.50	2.22	37.6	600.76	792.7	25.4	217.4	**317.07**	**72.46**
4.00	5.00	4.50	1.00	2.50	19.39	9.39	42.26	3.77	13.5	13.5	1.0	38.26	68.02	43	1.0	162.2	324.34	5.0	29.1	0	9.31	19.23	20.33	47.0	1150.12	1542.5	42.4	434.8	**616.99**	**144.92**
5.00	6.00	5.50	1.00	3.50	19.31	9.31	51.61	3.77	29.1	29.1	1.0	108.33	176.34	0	1.0	0.0	324.34	6.0	28.8	0	9.31	18.56	19.64	56.3	1305.34	1806.0	59.4	560.1	**722.41**	**186.69**
6.00	7.00	6.50	1.00	4.50	19.31	9.31	60.92	3.77	28.8	28.8	1.0	126.30	302.64	0	1.0	0.0	324.34	7.0	28.8	0	9.61	18.56	19.64	65.6	1504.82	2131.8	76.3	703.3	**852.72**	**234.44**
7.00	9.00	8.00	2.00	6.50	19.61	9.61	75.18	7.54	28.8	28.8	1.0	311.75	614.39	0	1.0	0.0	324.34	9.0	11.8	47	9.61	3.00	1.73	84.8	777.64	1716.4	110.3	1049.0	**686.55**	**349.67**
9.00	10.00	9.50	1.00	7.50	19.61	9.61	89.60	3.77	11.8	11.8	1.0	70.59	684.98	47	1.0	177.3	501.60	10.0	7.2	35	9.61	1.97	0.79	94.4	571.53	1758.1	127.2	1313.8	**703.24**	**437.94**
10.00	11.00	10.50	1.00	8.50	19.61	9.61	99.21	3.77	7.2	7.2	1.0	47.27	732.25	35	1.0	132.0	633.60	11.0	11.8	47	10.16	3.00	1.73	104.0	843.51	2209.4	144.2	1510.0	**883.74**	**503.35**
11.00	12.50	11.75	1.50	10.00	20.16	10.16	111.63	5.66	11.8	11.8	1.0	131.93	864.18	47	1.0	265.9	899.49	12.5	11.8	47	10.37	3.00	1.73	119.3	895.47	2659.1	169.6	1933.3	**1063.65**	**644.44**
12.50	15.50	14.00	3.00	13.00	20.37	10.37	134.81	11.31	11.8	11.8	1.0	318.64	1182.81	47	1.0	531.8	1431.26	15.5	10.2	57	10.37	2.53	1.28	150.4	1019.62	3633.7	220.5	2834.6	**1453.48**	**944.87**
15.50	17.00	16.25	1.50	14.50	20.37	10.37	158.14	5.66	10.2	10.2	1.0	160.97	1343.78	57	1.0	322.5	1753.71	17.0	24.7	8	9.63	9.78	10.55	165.9	1987.10	5084.6	246.0	3343.5	**2033.84**	**1114.49**
17.00	18.50	17.75	1.50	16.00	19.63	9.63	173.14	5.66	24.7	24.7	1.0	450.50	1794.28	8	1.0	45.3	1798.97	18.5	12.0	48	10.10	3.06	1.79	165.9	1075.11	4668.4	271.4	3864.7	**1867.35**	**1288.23**
18.50	21.50	20.00	3.00	19.00	20.10	10.10	173.14	11.31	12.0	12.0	1.0	416.38	2210.66	48	1.0	543.1	2342.06	21.5	12.0	48	10.10	3.06	1.79	165.9	1075.11	5627.8	322.3	4875.0	**2251.13**	**1625.02**
21.50	23.00	22.25	1.50	20.50	20.10	10.10	173.14	5.66	12.0	12.0	1.0	208.19	2418.86	48	1.0	271.5	2613.60	23.0	11.3	44	10.30	2.85	1.59	165.9	994.59	6027.0	347.8	5380.2	**2410.82**	**1793.41**
23.00	24.50	23.75	1.50	22.00	20.30	10.30	173.14	5.66	11.3	11.3	1.0	195.72	2614.57	44	1.0	248.9	2862.51	24.5	8.2	65	10.30	2.15	0.94	165.9	1071.33	6548.4	373.2	5850.3	**2619.37**	**1950.10**
24.50	26.00	25.25	1.50	23.50	20.30	10.30	173.14	5.66	8.2	8.2	1.0	141.14	2755.71	65	1.0	367.7	3230.23	26.0	8.2	65	10.40	2.15	0.94	165.9	1071.39	7057.3	398.7	6384.6	**2822.93**	**2128.20**
26.00	27.50	26.75	1.50	25.00	20.40	10.40	173.14	5.66	8.2	8.2	1.0	141.14	2896.86	65	1.0	367.7	3597.94	27.5	8.2	65	10.40	2.15	0.94	165.9	1071.39	7566.2	424.1	6918.9	**3026.48**	**2306.31**
27.50	29.00	28.25	1.50	26.50	20.40	10.40	173.14	5.66	8.2	8.2	1.0	141.14	3038.00	65	1.0	367.7	3965.66	29.0	14.0	30	10.40	3.65	2.36	165.9	1007.36	8011.0	449.6	7453.2	**3204.41**	**2484.41**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
29.00	30.00	29.50	1.00	27.50	20.40	10.40	173.14	3.77	14.0	14.0	1.0	162.81	3200.81	30	1.0	113.1	4078.80	30.0	14.0	30	9.05	3.65	2.36	165.9	1005.19	8284.8	466.5	7746.1	**3313.92**	**2582.04**
30.00	30.50	30.25	0.50	28.00	19.05	9.05	173.14	1.89	14.0	14.0	1.0	81.40	3282.21	30	1.0	56.6	4135.37	30.5	10.3	48	9.07	2.56	1.31	165.9	977.05	8394.6	475.0	7892.6	**3357.85**	**2630.86**
30.50	32.00	31.25	1.50	29.50	19.07	9.07	173.14	5.66	10.3	10.3	1.0	178.00	3460.21	48	1.0	271.5	4406.91	32.0	8.2	68	10.36	2.15	0.94	165.9	1101.91	8969.0	500.5	8367.6	**3587.61**	**2789.19**
32.00	32.50	32.25	0.50	30.00	20.36	10.36	173.14	1.89	8.2	8.2	1.0	47.05	3507.25	68	1.0	128.2	4535.14	32.5	8.2	68	10.36	2.15	0.94	165.9	1101.91	9144.3	508.9	8551.3	**3657.72**	**2850.45**
32.50	33.50	33.00	1.00	31.00	20.36	10.36	173.14	3.77	8.2	8.2	1.0	94.10	3601.35	68	1.0	256.5	4791.60	33.5	8.2	68	7.93	2.15	0.94	165.9	1100.36	9493.3	525.9	8918.9	**3797.32**	**2972.95**
33.50	35.00	34.25	1.50	32.50	17.93	7.93	173.14	5.66	8.2	8.2	1.0	141.14	3742.49	68	1.0	384.7	5176.29	35.0	12.0	48	8.37	3.06	1.79	165.9	1073.01	9991.8	551.3	9470.1	**3996.72**	**3156.71**
35.00	36.50	35.75	1.50	34.00	18.37	8.37	173.14	5.66	12.0	12.0	1.0	208.19	3950.68	48	1.0	271.5	5447.83	36.5	12.0	48	9.23	3.06	1.79	165.9	1074.06	10472.6	576.8	9975.3	**4189.03**	**3325.10**
36.50	37.50	37.00	1.00	35.00	19.23	9.23	173.14	3.77	12.0	12.0	1.0	138.79	4089.48	48	1.0	181.0	5628.86	37.5	8.0	58	9.23	2.11	0.91	165.9	992.41	10710.7	593.8	10312.1	**4284.30**	**3437.37**
37.50	38.00	37.75	0.50	35.50	19.23	9.23	173.14	1.89	8.0	8.0	1.0	45.88	4135.36	58	1.0	109.4	5738.23	38.0	8.0	58	8.66	2.11	0.91	165.9	992.06	10865.7	602.2	10475.8	**4346.26**	**3491.94**
38.00	40.00	39.00	2.00	37.50	18.66	8.66	173.14	7.54	8.0	8.0	1.0	183.54	4318.90	58	1.0	437.5	6175.71	40.0	8.0	58	8.66	2.11	0.91	165.9	992.06	11486.7	636.2	11130.8	**4594.67**	**3710.26**
BORE NO: P70, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	20.39	10.39	28.57	1.89	24.5	24.5	1.0	24.55	0	7	1.0	13.2	0	3.0	15.0	16	10.39	3.94	2.65	31.2	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.50	20.39	10.39	36.37	3.77	15.0	15.0	1.0	36.75	0	16	1.0	60.3	0	4.0	28.5	3	8.60	17.88	18.94	41.6	0	0.0	25.4	25.4	**0.00**	**8.48**
4.00	5.00	4.50	1.00	2.50	18.60	8.60	45.86	3.77	28.5	28.5	1.0	93.91	0	3	1.0	11.3	0	5.0	26.1	0	8.60	12.48	13.41	50.2	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.50	18.60	8.60	54.46	3.77	26.1	26.1	1.0	100.62	0	0	1.0	0.0	0	6.0	26.8	0	8.60	14.05	15.03	58.8	0	0.0	59.4	59.4	**0.00**	**19.79**
6.00	8.00	7.00	2.00	5.50	18.60	8.60	67.36	7.54	26.8	26.8	1.0	256.65	0	0	1.0	0.0	0	8.0	29.0	0	10.38	19.01	20.10	76.0	0	0.0	93.3	93.3	**0.00**	**31.10**
8.00	9.00	8.50	1.00	6.50	20.38	10.38	81.15	3.77	29.0	29.0	1.0	169.65	0	0	1.0	0.0	0	9.0	29.0	0	10.38	19.01	20.10	86.3	1998.42	1998.4	110.3	110.3	**799.37**	**36.76**
9.00	10.00	9.50	1.00	7.50	20.38	10.38	91.53	3.77	29.0	29.0	1.0	191.35	191.35	0	1.0	0.0	0.00	10.0	25.8	8	10.38	11.80	12.72	96.7	1462.58	1653.9	127.2	318.6	**661.57**	**106.19**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 1.13 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
10.00	11.00	10.50	1.00	8.50	20.38	10.38	101.91	3.77	25.8	25.8	1.0	185.80	377.15	8	1.0	30.2	30.17	11.0	25.8	8	10.38	11.80	12.72	107.1	1601.18	2008.5	144.2	551.5	**803.40**	**183.84**
11.00	12.00	11.50	1.00	9.50	20.38	10.38	112.29	3.77	25.8	25.8	1.0	204.72	581.87	8	1.0	30.2	60.34	12.0	11.9	50	10.38	3.03	1.76	117.5	924.13	1566.3	161.2	803.4	**626.54**	**267.79**
12.00	13.00	12.50	1.00	10.50	20.38	10.38	122.67	3.77	11.9	11.9	1.0	97.49	679.37	50	1.0	188.6	248.91	13.0	8.1	46	10.60	2.13	0.93	127.9	782.93	1711.2	178.1	1106.4	**684.48**	**368.80**
13.00	14.50	13.75	1.50	12.00	20.60	10.60	135.81	5.66	8.1	8.1	1.0	109.34	788.71	46	1.0	260.2	509.14	14.5	9.6	48	10.60	2.40	1.16	143.8	887.16	2185.0	203.6	1501.4	**874.00**	**500.48**
14.50	16.00	15.25	1.50	13.50	20.60	10.60	151.71	5.66	9.6	9.6	1.0	145.16	933.87	48	1.0	271.5	780.69	16.0	9.6	48	10.60	2.40	1.16	159.7	930.30	2644.9	229.0	1943.6	**1057.94**	**647.86**
16.00	17.50	16.75	1.50	15.00	20.60	10.60	167.61	5.66	9.6	9.6	1.0	160.37	1094.25	48	1.0	271.5	1052.23	17.5	9.6	48	10.60	2.40	1.16	175.6	973.44	3119.9	254.5	2400.9	**1247.96**	**800.31**
17.50	19.00	18.25	1.50	16.50	20.60	10.60	167.61	5.66	9.6	9.6	1.0	160.37	1254.62	48	1.0	271.5	1323.77	19.0	27.2	0	10.69	14.95	15.95	175.6	3086.15	5664.5	279.9	2858.3	**2265.82**	**952.77**
19.00	20.50	19.75	1.50	18.00	20.69	10.69	167.61	5.66	27.2	27.2	1.0	487.31	1741.93	0	1.0	0.0	1323.77	20.5	9.5	56	9.87	2.38	1.14	175.6	1050.65	4116.3	305.4	3371.1	**1646.54**	**1123.69**
20.50	23.50	22.00	3.00	21.00	19.87	9.87	167.61	11.31	9.5	9.5	1.0	317.35	2059.27	56	1.0	633.6	1957.37	23.5	10.2	59	10.33	2.53	1.28	175.6	1112.05	5128.7	356.3	4372.9	**2051.48**	**1457.63**
23.50	26.50	25.00	3.00	24.00	20.33	10.33	167.61	11.31	10.2	10.2	1.0	341.21	2400.49	59	1.0	667.5	2624.91	26.5	10.2	59	10.33	2.53	1.28	175.6	1112.05	6137.5	407.2	5432.6	**2454.98**	**1810.85**
26.50	27.50	27.00	1.00	25.00	20.33	10.33	167.61	3.77	10.2	10.2	1.0	113.74	2514.23	59	1.0	222.5	2847.43	27.5	8.2	54	10.33	2.15	0.94	175.6	982.75	6344.4	424.1	5785.8	**2537.76**	**1928.59**
27.50	28.00	27.75	0.50	25.50	20.33	10.33	167.61	1.89	8.2	8.2	1.0	45.55	2559.77	54	1.0	101.8	2949.26	28.0	8.2	54	10.40	2.15	0.94	175.6	982.80	6491.8	432.6	5941.6	**2596.73**	**1980.54**
28.00	29.50	28.75	1.50	27.00	20.40	10.40	167.61	5.66	8.2	8.2	1.0	136.64	2696.41	54	1.0	305.5	3254.74	29.5	8.2	54	10.40	2.15	0.94	175.6	982.80	6933.9	458.0	6409.2	**2773.58**	**2136.40**
29.50	30.00	29.75	0.50	27.50	20.40	10.40	167.61	1.89	8.2	8.2	1.0	45.55	2741.95	54	1.0	101.8	3356.57	30.0	8.2	54	10.40	2.15	0.94	175.6	982.80	7081.3	466.5	6565.1	**2832.53**	**2188.35**
30.00	31.00	30.50	1.00	28.50	20.40	10.40	167.61	3.77	8.2	8.2	1.0	91.09	2833.04	54	1.0	203.7	3560.23	31.0	13.0	60	10.40	3.35	2.08	175.6	1291.06	7684.3	483.5	6876.8	**3073.74**	**2292.25**
31.00	32.50	31.75	1.50	30.00	20.40	10.40	167.61	5.66	13.0	13.0	1.0	218.91	3051.95	60	1.0	339.4	3899.66	32.5	13.5	60	9.60	3.50	2.22	175.6	1320.66	8272.3	508.9	7460.5	**3308.91**	**2486.85**
32.50	34.00	33.25	1.50	31.50	19.60	9.60	167.61	5.66	13.5	13.5	1.0	227.64	3279.59	60	1.0	339.4	4239.09	34.0	27.4	0	9.60	15.40	16.41	175.6	3166.81	10685.5	534.4	8053.1	**4274.19**	**2684.35**
34.00	35.00	34.50	1.00	32.50	19.60	9.60	167.61	3.77	27.4	27.4	1.0	327.66	3607.26	0	1.0	0.0	4239.09	35.0	27.4	0	9.60	15.40	16.41	175.6	3166.81	11013.2	551.3	8397.7	**4405.26**	**2799.23**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)										Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)		ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
35.00	35.50	35.25	0.50	33.00	19.60	9.60	167.61	1.89		27.4	27.4	1.0	163.83	3771.09	0	1.0	0.0	4239.09	35.5	27.4	0	9.60	15.40	16.41	175.6	3166.81	11177.0	559.8	8570.0	**4470.79**	**2856.67**
35.50	37.00	36.25	1.50	34.50	19.60	9.60	167.61	5.66		27.4	27.4	1.0	491.50	4262.59	0	1.0	0.0	4239.09	37.0	23.4	0	9.60	8.85	9.12	175.6	1816.97	10318.6	585.3	9087.0	**4127.46**	**3028.98**
37.00	37.50	37.25	0.50	35.00	19.60	9.60	167.61	1.89		23.4	23.4	1.0	136.77	4399.36	0	1.0	0.0	4239.09	37.5	23.0	0	9.26	8.56	8.68	175.6	1754.89	10393.3	593.8	9232.2	**4157.34**	**3077.40**
37.50	38.50	38.00	1.00	36.00	19.26	9.26	167.61	3.77		23.0	23.0	1.0	268.32	4667.68	0	1.0	0.0	4239.09	38.5	21.0	0	9.14	7.12	6.49	175.6	1454.53	10361.3	610.7	9517.5	**4144.52**	**3172.50**
38.50	40.00	39.25	1.50	37.50	19.14	9.14	167.61	5.66		21.0	21.0	1.0	363.98	5031.66	0	1.0	0.0	4239.09	40.0	21.0	0	9.14	7.12	6.49	175.6	1454.53	10725.3	636.2	9906.9	**4290.11**	**3302.31**
BORE NO: P71, CUT OFF LENGTH: 2.50 m, Nc= 9																															
2.50	3.00	2.75	0.50	0.50	18.58	8.58	23.60	1.89		11.2	11.2	1.0	8.81	0	41	1.0	77.3	0	3.0	11.2	41	8.58	2.82	1.56	25.7	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.50	18.58	8.58	30.03	3.77		11.2	11.2	1.0	22.43	0	41	1.0	154.6	0	4.0	11.2	41	8.58	2.82	1.56	34.3	0	0.0	25.4	25.4	**0.00**	**8.48**
4.00	5.00	4.50	1.00	2.50	18.58	8.58	38.61	3.77		11.2	11.2	1.0	28.83	0	41	1.0	154.6	0	5.0	28.4	0	10.06	17.66	18.71	42.9	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.50	20.06	10.06	47.93	3.77		28.4	28.4	1.0	97.74	0	0	1.0	0.0	0	6.0	25.4	0	10.06	10.90	11.80	53.0	0	0.0	59.4	59.4	**0.00**	**19.79**
6.00	7.00	6.50	1.00	4.50	20.06	10.06	57.99	3.77		25.4	25.4	1.0	103.85	0	0	1.0	0.0	0	7.0	28.6	0	9.38	18.11	19.17	63.0	0	0.0	76.3	76.3	**0.00**	**25.45**
7.00	9.00	8.00	2.00	6.50	19.38	9.38	72.40	7.54		28.6	28.6	1.0	297.74	0	0	1.0	0.0	0	9.0	9.2	50	9.38	2.33	1.10	81.8	731.35	731.3	110.3	110.3	**292.54**	**36.76**
9.00	10.00	9.50	1.00	7.50	19.38	9.38	86.47	3.77		9.2	9.2	1.0	52.82	52.82	50	1.0	188.6	188.57	10.0	9.2	50	9.38	2.33	1.10	91.2	756.03	997.4	127.2	368.6	**398.97**	**122.88**
10.00	11.00	10.50	1.00	8.50	19.38	9.38	95.85	3.77		9.2	9.2	1.0	58.55	111.37	50	1.0	188.6	377.14	11.0	24.8	11	9.88	9.86	10.66	100.5	1304.67	1793.2	144.2	632.7	**717.27**	**210.90**
11.00	12.50	11.75	1.50	10.00	19.88	9.88	107.95	5.66		24.8	24.8	1.0	282.18	393.55	11	1.0	62.2	439.37	12.5	24.8	11	9.88	9.86	10.66	115.4	1469.93	2302.8	169.6	1002.6	**921.14**	**334.19**
12.50	14.00	13.25	1.50	11.50	19.88	9.88	122.77	5.66		24.8	24.8	1.0	320.92	714.46	11	1.0	62.2	501.60	14.0	9.2	58	10.96	2.33	1.10	130.2	941.36	2157.4	195.1	1411.2	**862.97**	**470.39**
14.00	15.50	14.75	1.50	13.00	20.96	10.96	138.40	5.66		9.2	9.2	1.0	126.81	841.27	58	1.0	328.1	829.71	15.5	9.2	58	10.96	2.33	1.10	146.6	984.63	2655.6	220.5	1891.5	**1062.25**	**630.51**
15.50	17.00	16.25	1.50	14.50	20.96	10.96	154.84	5.66		9.2	9.2	1.0	141.87	983.15	58	1.0	328.1	1157.83	17.0	27.2	0	9.61	14.95	15.95	163.1	2862.96	5003.9	246.0	2387.0	**2001.57**	**795.65**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
17.00	18.50	17.75	1.50	16.00	19.61	9.61	170.27	5.66	27.2	27.2	1.0	495.03	1478.18	0	1.0	0.0	1157.83	18.5	10.3	51	9.61	2.56	1.31	163.1	999.81	3635.8	271.4	2907.4	**1454.33**	**969.15**
18.50	20.00	19.25	1.50	17.50	19.61	9.61	170.27	5.66	10.3	10.3	1.0	175.05	1653.23	51	1.0	288.5	1446.34	20.0	10.3	51	10.63	2.56	1.31	163.1	1000.71	4100.3	296.9	3396.4	**1640.11**	**1132.15**
20.00	21.50	20.75	1.50	19.00	20.63	10.63	170.27	5.66	10.3	10.3	1.0	175.05	1828.27	51	1.0	288.5	1734.86	21.5	10.3	51	10.63	2.56	1.31	163.1	1000.71	4563.8	322.3	3885.5	**1825.54**	**1295.15**
21.50	23.00	22.25	1.50	20.50	20.63	10.63	170.27	5.66	10.3	10.3	1.0	175.05	2003.32	51	1.0	288.5	2023.37	23.0	18.5	32	10.63	5.64	4.57	163.1	1399.71	5426.4	347.8	4374.5	**2170.56**	**1458.16**
23.00	24.50	23.75	1.50	22.00	20.63	10.63	170.27	5.66	18.5	18.5	1.0	322.29	2325.61	32	1.0	181.0	2204.40	24.5	26.2	7	9.72	12.70	13.64	163.1	2504.77	7034.8	373.2	4903.2	**2813.91**	**1634.41**
24.50	27.50	26.00	3.00	25.00	19.72	9.72	170.27	11.31	26.2	26.2	1.0	947.93	3273.55	7	1.0	79.2	2283.60	27.5	9.0	75	9.72	2.29	1.07	163.1	1193.23	6750.4	424.1	5981.3	**2700.15**	**1993.75**
27.50	29.00	28.25	1.50	26.50	19.72	9.72	170.27	5.66	9.0	9.0	1.0	152.56	3426.11	75	1.0	424.3	2707.89	29.0	9.0	75	9.72	2.29	1.07	163.1	1193.23	7327.2	449.6	6583.6	**2930.89**	**2194.52**
29.00	30.00	29.50	1.00	27.50	19.72	9.72	170.27	3.77	9.0	9.0	1.0	101.71	3527.81	75	1.0	282.9	2990.74	30.0	9.5	50	10.73	2.38	1.14	163.1	956.56	7475.1	466.5	6985.1	**2990.05**	**2328.36**
30.00	30.50	30.25	0.50	28.00	20.73	10.73	170.27	1.89	9.5	9.5	1.0	53.73	3581.54	50	1.0	94.3	3085.03	30.5	9.5	50	9.11	2.38	1.14	163.1	955.30	7621.9	475.0	7141.6	**3048.75**	**2380.53**
30.50	32.00	31.25	1.50	29.50	19.11	9.11	170.27	5.66	9.5	9.5	1.0	161.19	3742.73	50	1.0	282.9	3367.89	32.0	8.5	56	9.22	2.20	0.99	163.1	982.31	8092.9	500.5	7611.1	**3237.17**	**2537.02**
32.00	32.50	32.25	0.50	30.00	19.22	9.22	170.27	1.89	8.5	8.5	1.0	47.99	3790.72	56	1.0	105.6	3473.49	32.5	8.5	56	9.22	2.20	0.99	163.1	982.31	8246.5	508.9	7773.1	**3298.61**	**2591.05**
32.50	33.50	33.00	1.00	31.00	19.22	9.22	170.27	3.77	8.5	8.5	1.0	95.97	3886.69	56	1.0	211.2	3684.69	33.5	8.3	78	10.16	2.16	0.96	163.1	1200.11	8771.5	525.9	8097.3	**3508.59**	**2699.09**
33.50	35.00	34.25	1.50	32.50	20.16	10.16	170.27	5.66	8.3	8.3	1.0	140.52	4027.21	78	1.0	441.3	4125.94	35.0	9.2	63	9.59	2.33	1.10	163.1	1077.79	9230.9	551.3	8704.5	**3692.37**	**2901.50**
35.00	36.50	35.75	1.50	34.00	19.59	9.59	170.27	5.66	9.2	9.2	1.0	156.01	4183.22	63	1.0	356.4	4482.34	36.5	9.2	63	9.35	2.33	1.10	163.1	1077.61	9743.2	576.8	9242.4	**3897.27**	**3080.79**
36.50	37.50	37.00	1.00	35.00	19.35	9.35	170.27	3.77	9.2	9.2	1.0	104.01	4287.22	63	1.0	237.6	4719.94	37.5	9.2	57	9.35	2.33	1.10	163.1	1016.51	10023.7	593.8	9600.9	**4009.47**	**3200.31**
37.50	38.00	37.75	0.50	35.50	19.35	9.35	170.27	1.89	9.2	9.2	1.0	52.00	4339.23	57	1.0	107.5	4827.43	38.0	9.2	57	9.59	2.33	1.10	163.1	1016.69	10183.3	602.2	9768.9	**4073.34**	**3256.30**
38.00	40.00	39.00	2.00	37.50	19.59	9.59	170.27	7.54	9.2	9.2	1.0	208.01	4547.24	57	1.0	429.9	5257.37	40.0	9.2	57	9.59	2.33	1.10	163.1	1016.69	10821.3	636.2	10440.8	**4328.52**	**3480.26**

BORE NO: P72, CUT OFF LENGTH: 2.50 m, Nc= 9

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
2.50	3.00	2.75	0.50	0.50	19.98	9.98	27.45	1.89	23.4	23.4	1.0	22.40	0	0	1.0	0.0	0	3.0	28.5	0	9.98	17.88	18.94	29.9	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.50	19.98	9.98	34.93	3.77	28.5	28.5	1.0	71.53	0	0	1.0	0.0	0	4.0	28.5	0	9.37	17.88	18.94	39.9	0	0.0	25.4	25.4	**0.00**	**8.48**
4.00	6.00	5.00	2.00	3.50	19.37	9.37	49.29	7.54	28.5	28.5	1.0	201.86	0	0	1.0	0.0	0	6.0	28.4	0	9.37	17.66	18.71	58.7	0	0.0	59.4	59.4	**0.00**	**19.79**
6.00	7.00	6.50	1.00	4.50	19.37	9.37	63.35	3.77	28.4	28.4	1.0	129.17	0	0	1.0	0.0	0	7.0	27.2	0	9.37	14.95	15.95	68.0	0	0.0	76.3	76.3	**0.00**	**25.45**
7.00	9.00	8.00	2.00	6.50	19.37	9.37	77.40	7.54	27.2	27.2	1.0	300.04	0	0	1.0	0.0	0	9.0	28.2	0	10.25	17.21	18.25	86.8	0	0.0	110.3	110.3	**0.00**	**36.76**
9.00	10.00	9.50	1.00	7.50	20.25	10.25	91.90	3.77	28.2	28.2	1.0	185.83	0	0	1.0	0.0	0	10.0	11.1	22	10.25	2.79	1.53	97.0	541.34	541.3	127.2	127.2	**216.53**	**42.41**
10.00	11.00	10.50	1.00	8.50	20.25	10.25	102.15	3.77	11.1	11.1	1.0	75.58	75.58	22	1.0	83.0	82.97	11.0	11.6	44	10.25	2.94	1.68	107.3	816.59	975.1	144.2	302.8	**390.06**	**100.92**
11.00	12.50	11.75	1.50	10.00	20.25	10.25	114.96	5.66	11.6	11.6	1.0	133.49	209.07	44	1.0	248.9	331.89	12.5	11.0	40	10.17	2.76	1.51	122.6	801.26	1342.2	169.6	710.6	**536.89**	**236.87**
12.50	15.50	14.00	3.00	13.00	20.17	10.17	137.90	11.31	11.0	11.0	1.0	303.28	512.35	40	1.0	452.6	784.46	15.5	8.1	40	10.17	2.13	0.93	153.2	782.47	2079.3	220.5	1517.4	**831.71**	**505.78**
15.50	17.00	16.25	1.50	14.50	20.17	10.17	160.78	5.66	8.1	8.1	1.0	129.45	641.80	40	1.0	226.3	1010.74	17.0	10.2	46	10.38	2.53	1.28	168.4	959.26	2611.8	246.0	1898.5	**1044.72**	**632.84**
17.00	18.50	17.75	1.50	16.00	20.38	10.38	176.20	5.66	10.2	10.2	1.0	179.35	821.15	46	1.0	260.2	1270.97	18.5	15.3	23	10.38	4.09	2.81	168.4	1032.90	3125.0	271.4	2363.6	**1250.01**	**787.85**
18.50	20.00	19.25	1.50	17.50	20.38	10.38	176.20	5.66	15.3	15.3	1.0	272.68	1093.83	23	1.0	130.1	1401.09	20.0	9.3	52	10.35	2.34	1.11	168.4	983.96	3478.9	296.9	2791.8	**1391.55**	**930.60**
20.00	21.50	20.75	1.50	19.00	20.35	10.35	176.20	5.66	9.3	9.3	1.0	163.23	1257.06	52	1.0	294.2	1695.26	21.5	9.3	52	10.35	2.34	1.11	168.4	983.96	3936.3	322.3	3274.6	**1574.51**	**1091.55**
21.50	23.00	22.25	1.50	20.50	20.35	10.35	176.20	5.66	9.3	9.3	1.0	163.23	1420.28	52	1.0	294.2	1989.43	23.0	29.6	0	10.35	20.36	21.48	168.4	4030.15	7439.9	347.8	3757.5	**2975.94**	**1252.50**
23.00	24.50	23.75	1.50	22.00	20.35	10.35	176.20	5.66	29.6	29.6	1.0	566.24	1986.52	0	1.0	0.0	1989.43	24.5	20.0	48	10.09	6.40	5.39	168.4	1745.18	5721.1	373.2	4349.2	**2288.45**	**1449.72**
24.50	26.00	25.25	1.50	23.50	20.09	10.09	176.20	5.66	20.0	20.0	1.0	362.79	2349.31	48	1.0	271.5	2260.97	26.0	9.5	53	10.09	2.38	1.14	168.4	1001.02	5611.3	398.7	5009.0	**2244.52**	**1669.65**
26.00	27.50	26.75	1.50	25.00	20.09	10.09	176.20	5.66	9.5	9.5	1.0	166.80	2516.11	53	1.0	299.8	2560.80	27.5	9.5	53	10.09	2.38	1.14	168.4	1001.02	6077.9	424.1	5501.0	**2431.17**	**1833.68**
27.50	29.00	28.25	1.50	26.50	20.09	10.09	176.20	5.66	9.5	9.5	1.0	166.80	2682.91	53	1.0	299.8	2860.63	29.0	25.2	0	10.21	10.45	11.34	168.4	2069.86	7613.4	449.6	5993.1	**3045.36**	**1997.70**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
29.00	30.00	29.50	1.00	27.50	20.21	10.21	176.20	3.77	25.2	25.2	1.0	312.69	2995.61	0	1.0	0.0	2860.63	30.0	25.2	0	10.21	10.45	11.34	168.4	2069.86	7926.1	466.5	6322.8	**3170.44**	**2107.59**
30.00	30.50	30.25	0.50	28.00	20.21	10.21	176.20	1.89	25.2	25.2	1.0	156.35	3151.95	0	1.0	0.0	2860.63	30.5	25.0	0	10.21	10.00	10.88	168.4	1980.85	7993.4	475.0	6487.6	**3197.37**	**2162.53**
30.50	32.50	31.50	2.00	30.00	20.21	10.21	176.20	7.54	25.0	25.0	1.0	619.73	3771.68	0	1.0	0.0	2860.63	32.5	21.5	15	9.11	7.48	7.04	168.4	1621.53	8253.8	508.9	7141.3	**3301.54**	**2380.42**
32.50	33.50	33.00	1.00	31.00	19.11	9.11	176.20	3.77	21.5	21.5	1.0	261.76	4033.44	15	1.0	56.6	2917.20	33.5	17.5	39	10.37	5.17	4.02	168.4	1410.54	8361.2	525.9	7476.5	**3344.47**	**2492.18**
33.50	35.00	34.25	1.50	32.50	20.37	10.37	176.20	5.66	17.5	17.5	1.0	314.28	4347.72	39	1.0	220.6	3137.83	35.0	14.3	48	10.37	3.74	2.45	168.4	1218.09	8703.6	551.3	8036.9	**3481.45**	**2678.97**
35.00	36.50	35.75	1.50	34.00	20.37	10.37	176.20	5.66	14.3	14.3	1.0	254.07	4601.79	48	1.0	271.5	3409.37	36.5	14.3	48	10.37	3.74	2.45	168.4	1218.09	9229.2	576.8	8588.0	**3691.70**	**2862.65**
36.50	37.50	37.00	1.00	35.00	20.37	10.37	176.20	3.77	14.3	14.3	1.0	169.38	4771.17	48	1.0	181.0	3590.40	37.5	14.3	48	10.37	3.74	2.45	168.4	1218.09	9579.7	593.8	8955.3	**3831.86**	**2985.11**
37.50	38.00	37.75	0.50	35.50	20.37	10.37	176.20	1.89	14.3	14.3	1.0	84.69	4855.86	48	1.0	90.5	3680.91	38.0	27.1	0	10.37	14.73	15.72	168.4	2917.17	11453.9	602.2	9139.0	**4581.58**	**3046.34**
38.00	40.00	39.00	2.00	37.50	20.37	10.37	176.20	7.54	27.1	27.1	1.0	680.09	5535.95	0	1.0	0.0	3680.91	40.0	18.0	0	10.37	5.42	4.29	168.4	1062.21	10279.1	636.2	9853.0	**4111.63**	**3284.35**
BORE NO: P73, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	16.68	6.68	18.37	1.89	21.0	21.0	1.0	13.30	0	10	1.0	18.9	0	3.0	12.8	70	6.68	3.29	2.02	20.0	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.50	16.68	6.68	23.38	3.77	12.8	12.8	1.0	20.03	0	70	1.0	264.0	0	4.0	24.5	12	9.67	9.64	10.33	26.7	0	0.0	25.4	25.4	**0.00**	**8.48**
4.00	6.00	5.00	2.00	3.50	19.67	9.67	36.39	7.54	24.5	24.5	1.0	125.09	0	12	1.0	90.5	0	6.0	24.5	12	9.67	9.64	10.33	46.1	0	0.0	59.4	59.4	**0.00**	**19.79**
6.00	7.00	6.50	1.00	4.50	19.67	9.67	50.90	3.77	24.5	24.5	1.0	87.48	0	12	1.0	45.3	0	7.0	24.5	12	9.67	9.64	10.33	55.7	0	0.0	76.3	76.3	**0.00**	**25.45**
7.00	8.00	7.50	1.00	5.50	19.67	9.67	60.57	3.77	24.5	24.5	1.0	104.10	0	12	1.0	45.3	0	8.0	29.0	0	9.40	19.01	20.10	65.4	0	0.0	93.3	93.3	**0.00**	**31.10**
8.00	9.00	8.50	1.00	6.50	19.40	9.40	70.10	3.77	29.0	29.0	1.0	146.55	0	0	1.0	0.0	0	9.0	29.0	0	9.40	19.01	20.10	74.8	0	0.0	110.3	110.3	**0.00**	**36.76**
9.00	10.00	9.50	1.00	7.50	19.40	9.40	79.50	3.77	29.0	29.0	1.0	166.20	0	0	1.0	0.0	0	10.0	9.5	44	9.80	2.38	1.14	84.2	682.38	682.4	127.2	127.2	**272.95**	**42.41**
10.00	12.50	11.25	2.50	10.00	19.80	9.80	96.45	9.43	9.5	9.5	1.0	152.18	152.18	44	1.0	414.9	414.86	12.5	9.0	46	10.00	2.29	1.07	108.7	757.29	1324.3	169.6	736.7	**529.73**	**245.56**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)										Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)		ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
12.50	15.50	14.00	3.00	13.00	20.00	10.00	123.70	11.31		9.0	9.0	1.0	221.67	373.85	46	1.0	520.5	935.31	15.5	9.0	46	10.00	2.29	1.07	138.7	835.02	2144.2	220.5	1529.7	**857.67**	**509.90**
15.50	17.00	16.25	1.50	14.50	20.00	10.00	146.20	5.66		9.0	9.0	1.0	131.00	504.85	46	1.0	260.2	1195.54	17.0	26.5	4	8.50	13.38	14.34	153.7	2449.87	4150.3	246.0	1946.4	**1660.10**	**648.79**
17.00	18.50	17.75	1.50	16.00	18.50	8.50	160.08	5.66		26.5	26.5	1.0	451.50	956.35	4	1.0	22.6	1218.17	18.5	26.5	4	8.10	13.38	14.34	153.7	2445.98	4620.5	271.4	2446.0	**1848.20**	**815.32**
18.50	21.50	20.00	3.00	19.00	18.10	8.10	160.08	11.31		26.5	26.5	1.0	903.00	1859.34	4	1.0	45.3	1263.43	21.5	11.5	42	8.10	2.91	1.65	153.7	942.97	4065.7	322.3	3445.1	**1626.30**	**1148.37**
21.50	23.00	22.25	1.50	20.50	18.10	8.10	160.08	5.66		11.5	11.5	1.0	184.24	2043.58	42	1.0	237.6	1501.03	23.0	8.0	62	8.10	2.11	0.91	153.7	1003.28	4547.9	347.8	3892.4	**1819.16**	**1297.46**
23.00	24.50	23.75	1.50	22.00	18.10	8.10	160.08	5.66		8.0	8.0	1.0	127.27	2170.85	62	1.0	350.7	1851.77	24.5	29.0	0	9.37	19.01	20.10	153.7	3433.26	7455.9	373.2	4395.8	**2982.36**	**1465.28**
24.50	26.00	25.25	1.50	23.50	19.37	9.37	160.08	5.66		29.0	29.0	1.0	501.96	2672.82	0	1.0	0.0	1851.77	26.0	7.5	38	9.37	2.02	0.84	153.7	743.54	5268.1	398.7	4923.3	**2107.25**	**1641.09**
26.00	27.50	26.75	1.50	25.00	19.37	9.37	160.08	5.66		7.5	7.5	1.0	119.22	2792.04	38	1.0	215.0	2066.74	27.5	7.5	38	9.37	2.02	0.84	153.7	743.54	5602.3	424.1	5282.9	**2240.93**	**1760.96**
27.50	29.00	28.25	1.50	26.50	19.37	9.37	160.08	5.66		7.5	7.5	1.0	119.22	2911.26	38	1.0	215.0	2281.71	29.0	28.5	0	9.37	17.88	18.94	153.7	3230.13	8423.1	449.6	5642.5	**3369.24**	**1880.84**
29.00	30.00	29.50	1.00	27.50	19.37	9.37	160.08	3.77		28.5	28.5	1.0	327.79	3239.05	0	1.0	0.0	2281.71	30.0	28.5	0	9.37	17.88	18.94	153.7	3230.13	8750.9	466.5	5987.3	**3500.36**	**1995.76**
30.00	30.50	30.25	0.50	28.00	19.37	9.37	160.08	1.89		28.5	28.5	1.0	163.89	3402.94	0	1.0	0.0	2281.71	30.5	7.5	50	9.37	2.02	0.84	153.7	865.73	6550.4	475.0	6159.7	**2620.15**	**2053.22**
30.50	32.00	31.25	1.50	29.50	19.37	9.37	160.08	5.66		7.5	7.5	1.0	119.22	3522.16	50	1.0	282.9	2564.57	32.0	29.0	0	9.37	19.01	20.10	153.7	3433.26	9520.0	500.5	6587.2	**3808.00**	**2195.73**
32.00	32.50	32.25	0.50	30.00	19.37	9.37	160.08	1.89		29.0	29.0	1.0	167.32	3689.48	0	1.0	0.0	2564.57	32.5	29.0	0	10.08	19.01	20.10	153.7	3442.95	9697.0	508.9	6763.0	**3878.80**	**2254.33**
32.50	33.50	33.00	1.00	31.00	20.08	10.08	160.08	3.77		29.0	29.0	1.0	334.64	4024.12	0	1.0	0.0	2564.57	33.5	8.5	53	10.08	2.20	0.99	153.7	929.04	7517.7	525.9	7114.6	**3007.09**	**2371.53**
33.50	35.00	34.25	1.50	32.50	20.08	10.08	160.08	5.66		8.5	8.5	1.0	135.34	4159.46	53	1.0	299.8	2864.40	35.0	8.5	53	10.08	2.20	0.99	153.7	929.04	7952.9	551.3	7575.2	**3181.16**	**2525.07**
35.00	36.50	35.75	1.50	34.00	20.08	10.08	160.08	5.66		8.5	8.5	1.0	135.34	4294.80	53	1.0	299.8	3164.23	36.5	8.5	53	10.08	2.20	0.99	153.7	929.04	8388.1	576.8	8035.8	**3355.23**	**2678.61**
36.50	37.50	37.00	1.00	35.00	20.08	10.08	160.08	3.77		8.5	8.5	1.0	90.23	4385.02	53	1.0	199.9	3364.11	37.5	10.5	72	10.08	2.62	1.36	153.7	1197.59	8946.7	593.8	8342.9	**3578.69**	**2780.97**
37.50	38.00	37.75	0.50	35.50	20.08	10.08	160.08	1.89		10.5	10.5	1.0	55.95	4440.97	72	1.0	135.8	3499.89	38.0	10.5	72	8.28	2.62	1.36	153.7	1195.92	9136.8	602.2	8543.1	**3654.71**	**2847.70**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)										Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)		ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
38.00	40.00	39.00	2.00	37.50	18.28	8.28	160.08	7.54		10.5	10.5	1.0	223.78	4664.75	72	1.0	543.1	4042.97	40.0	10.5	72	8.28	2.62	1.36	153.7	1195.92	9903.6	636.2	9343.9	**3961.46**	**3114.63**
BORE NO: P74, CUT OFF LENGTH: 2.50 m, Nc= 9																															
2.50	3.00	2.75	0.50	0.50	19.63	9.63	26.48	1.89		23.9	23.9	1.0	22.13	0	0	1.0	0.0	0	3.0	12.8	24	9.63	3.29	2.02	28.9	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.50	19.63	9.63	33.71	3.77		12.8	12.8	1.0	28.88	0	24	1.0	90.5	0	4.0	12.4	24	9.63	3.17	1.91	38.5	0	0.0	25.4	25.4	**0.00**	**8.48**
4.00	5.00	4.50	1.00	2.50	19.63	9.63	43.34	3.77		12.4	12.4	1.0	35.93	0	24	1.0	90.5	0	5.0	26.9	6	9.52	14.28	15.26	48.2	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.50	19.52	9.52	52.91	3.77		26.9	26.9	1.0	101.24	0	6	1.0	22.6	0	6.0	28.9	6	9.52	18.78	19.87	57.7	0	0.0	59.4	59.4	**0.00**	**19.79**
6.00	7.00	6.50	1.00	4.50	19.52	9.52	62.43	3.77		28.9	28.9	1.0	129.98	0	6	1.0	22.6	0	7.0	28.9	2	9.44	18.78	19.87	67.2	0	0.0	76.3	76.3	**0.00**	**25.45**
7.00	9.00	8.00	2.00	6.50	19.44	9.44	76.63	7.54		28.9	28.9	1.0	319.08	0	2	1.0	15.1	0	9.0	28.9	2	9.44	18.78	19.87	86.1	0	0.0	110.3	110.3	**0.00**	**36.76**
9.00	10.00	9.50	1.00	7.50	19.44	9.44	90.79	3.77		28.9	28.9	1.0	189.02	0	2	1.0	7.5	0	10.0	10.2	24	9.44	2.53	1.28	95.5	0	0.0	127.2	127.2	**0.00**	**42.41**
10.00	11.00	10.50	1.00	8.50	19.44	9.44	100.23	3.77		10.2	10.2	1.0	68.01	0	24	1.0	90.5	0	11.0	26.3	7	9.67	12.93	13.88	105.0	0	0.0	144.2	144.2	**0.00**	**48.07**
11.00	12.50	11.75	1.50	10.00	19.67	9.67	112.20	5.66		26.3	26.3	1.0	313.71	0	7	1.0	39.6	0	12.5	12.0	30	9.67	3.06	1.79	119.5	0	0.0	169.6	169.6	**0.00**	**56.55**
12.50	14.00	13.25	1.50	11.50	19.67	9.67	126.71	5.66		12.0	12.0	1.0	152.36	0	30	1.0	169.7	0	14.0	27.1	0	9.83	14.73	15.72	134.0	0	0.0	195.1	195.1	**0.00**	**65.03**
14.00	15.50	14.75	1.50	13.00	19.83	9.83	141.33	5.66		27.1	27.1	1.0	409.14	0	0	1.0	0.0	0	15.5	11.7	52	10.31	2.97	1.71	148.7	1041.12	1041.1	220.5	220.5	**416.45**	**73.51**
15.50	18.50	17.00	3.00	16.00	20.31	10.31	164.17	11.31		11.7	11.7	1.0	384.66	384.66	52	1.0	588.3	588.34	18.5	26.9	0	10.31	14.28	15.26	148.7	2509.15	3482.2	271.4	1244.4	**1392.86**	**414.81**
18.50	20.00	19.25	1.50	17.50	20.31	10.31	164.17	5.66		26.9	26.9	1.0	471.17	855.84	0	1.0	0.0	588.34	20.0	11.7	56	10.31	2.97	1.71	148.7	1081.85	2526.0	296.9	1741.1	**1010.41**	**580.35**
20.00	21.50	20.75	1.50	19.00	20.31	10.31	164.17	5.66		11.7	11.7	1.0	192.33	1048.17	56	1.0	316.8	905.14	21.5	10.0	56	8.86	2.47	1.22	148.7	993.15	2946.5	322.3	2275.6	**1178.59**	**758.55**
21.50	23.00	22.25	1.50	20.50	18.86	8.86	164.17	5.66		10.0	10.0	1.0	163.76	1211.93	56	1.0	316.8	1221.94	23.0	8.2	58	8.59	2.15	0.94	148.7	957.17	3391.0	347.8	2781.6	**1356.41**	**927.22**
23.00	24.50	23.75	1.50	22.00	18.59	8.59	164.17	5.66		8.2	8.2	1.0	133.83	1345.76	58	1.0	328.1	1550.06	24.5	7.0	81	10.87	1.93	0.76	148.7	1155.13	4050.9	373.2	3269.0	**1620.38**	**1089.68**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
24.50	26.00	25.25	1.50	23.50	20.87	10.87	164.17	5.66	7.0	7.0	1.0	114.03	1459.79	81	1.0	458.2	2008.29	26.0	7.0	81	8.59	1.93	0.76	148.7	1153.95	4622.0	398.7	3866.7	**1848.81**	**1288.92**
26.00	27.50	26.75	1.50	25.00	18.59	8.59	164.17	5.66	7.0	7.0	1.0	114.03	1573.83	81	1.0	458.2	2466.51	27.5	7.0	81	10.54	1.93	0.76	148.7	1154.96	5195.3	424.1	4464.5	**2078.12**	**1488.15**
27.50	29.00	28.25	1.50	26.50	20.54	10.54	164.17	5.66	7.0	7.0	1.0	114.03	1687.86	81	1.0	458.2	2924.74	29.0	18.0	26	8.62	5.42	4.29	148.7	1201.12	5813.7	449.6	5062.2	**2325.49**	**1687.39**
29.00	30.00	29.50	1.00	27.50	18.62	8.62	164.17	3.77	18.0	18.0	1.0	201.18	1889.04	26	1.0	98.1	3022.80	30.0	18.0	26	8.62	5.42	4.29	148.7	1201.12	6113.0	466.5	5378.4	**2445.18**	**1792.79**
30.00	30.50	30.25	0.50	28.00	18.62	8.62	164.17	1.89	18.0	18.0	1.0	100.59	1989.63	26	1.0	49.0	3071.83	30.5	18.0	26	9.41	5.42	4.29	148.7	1203.42	6264.9	475.0	5536.5	**2505.95**	**1845.49**
30.50	32.00	31.25	1.50	29.50	19.41	9.41	164.17	5.66	18.0	18.0	1.0	301.76	2291.39	26	1.0	147.1	3218.91	32.0	8.0	63	9.36	2.11	0.91	148.7	1002.32	6512.6	500.5	6010.8	**2605.05**	**2003.59**
32.00	32.50	32.25	0.50	30.00	19.36	9.36	164.17	1.89	8.0	8.0	1.0	43.51	2334.90	63	1.0	118.8	3337.71	32.5	8.0	63	9.36	2.11	0.91	148.7	1002.32	6674.9	508.9	6181.6	**2669.97**	**2060.52**
32.50	33.50	33.00	1.00	31.00	19.36	9.36	164.17	3.77	8.0	8.0	1.0	87.02	2421.92	63	1.0	237.6	3575.31	33.5	4.5	0	9.29	1.51	0.41	148.7	257.12	6254.3	525.9	6523.1	**2501.74**	**2174.38**
33.50	35.00	34.25	1.50	32.50	19.29	9.29	164.17	5.66	4.5	4.5	1.0	73.09	2495.01	0	1.0	0.0	3575.31	35.0	12.0	25	9.63	3.06	1.79	148.7	780.79	6851.1	551.3	6621.7	**2740.45**	**2207.22**
35.00	36.50	35.75	1.50	34.00	19.63	9.63	164.17	5.66	12.0	12.0	1.0	197.41	2692.42	25	1.0	141.4	3716.74	36.5	9.1	53	8.70	2.31	1.08	148.7	934.40	7343.6	576.8	6986.0	**2937.42**	**2328.65**
36.50	37.50	37.00	1.00	35.00	18.70	8.70	164.17	3.77	9.1	9.1	1.0	99.17	2791.59	53	1.0	199.9	3916.63	37.5	9.1	53	8.70	2.31	1.08	148.7	934.40	7642.6	593.8	7302.0	**3057.05**	**2433.99**
37.50	38.00	37.75	0.50	35.50	18.70	8.70	164.17	1.89	9.1	9.1	1.0	49.59	2841.18	53	1.0	99.9	4016.57	38.0	9.1	53	8.96	2.31	1.08	148.7	934.59	7792.3	602.2	7460.0	**3116.93**	**2486.66**
38.00	40.00	39.00	2.00	37.50	18.96	8.96	164.17	7.54	9.1	9.1	1.0	198.35	3039.52	53	1.0	399.8	4416.34	40.0	9.1	53	8.96	1.93	1.08	148.7	870.99	8326.9	636.2	8092.0	**3330.74**	**2697.35**
BORE NO: P75, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.69	9.69	26.65	1.89	23.4	23.4	1.0	21.74	0	0	1.0	0.0	0	3.0	25.8	6	9.69	11.80	12.72	29.1	532.95	533.0	8.5	8.5	**213.18**	**2.83**
3.00	4.00	3.50	1.00	1.50	19.69	9.69	33.92	3.77	25.8	25.8	1.0	61.83	61.83	6	1.0	22.6	22.63	4.0	25.8	6	9.69	11.80	12.72	38.8	662.34	746.8	25.4	109.9	**298.72**	**36.64**
4.00	5.00	4.50	1.00	2.50	19.69	9.69	43.61	3.77	25.8	25.8	1.0	79.50	141.33	6	1.0	22.6	45.26	5.0	25.8	6	9.76	11.80	12.72	48.5	792.33	978.9	42.4	229.0	**391.57**	**76.33**
5.00	6.00	5.50	1.00	3.50	19.76	9.76	53.33	3.77	25.8	25.8	1.0	97.23	238.56	6	1.0	22.6	67.89	6.0	25.8	6	9.76	11.80	12.72	58.2	922.65	1229.1	59.4	365.8	**491.64**	**121.94**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
6.00	7.00	6.50	1.00	4.50	19.76	9.76	63.09	3.77	25.8	25.8	1.0	115.02	353.59	6	1.0	22.6	90.51	7.0	25.7	2	10.89	11.58	12.49	68.0	1002.98	1447.1	76.3	520.4	**578.83**	**173.48**
7.00	9.00	8.00	2.00	6.50	20.89	10.89	78.86	7.54	25.7	25.7	1.0	286.27	639.86	2	1.0	15.1	105.60	9.0	24.6	2	10.89	9.71	10.44	89.8	1083.76	1829.2	110.3	855.7	**731.69**	**285.24**
9.00	10.00	9.50	1.00	7.50	20.89	10.89	95.20	3.77	24.6	24.6	1.0	164.37	804.23	2	1.0	7.5	113.14	10.0	13.5	24	9.80	3.50	2.22	100.6	657.70	1575.1	127.2	1044.6	**630.03**	**348.20**
10.00	12.50	11.25	2.50	10.00	19.80	9.80	112.89	9.43	13.5	13.5	1.0	255.54	1059.77	24	1.0	226.3	339.43	12.5	13.5	24	9.80	3.50	2.22	125.1	754.72	2153.9	169.6	1568.8	**861.57**	**522.95**
12.50	14.00	13.25	1.50	11.50	19.80	9.80	132.49	5.66	13.5	13.5	1.0	179.94	1239.71	24	1.0	135.8	475.20	14.0	8.2	62	10.26	2.15	0.94	139.8	977.44	2692.4	195.1	1910.0	**1076.94**	**636.67**
14.00	15.50	14.75	1.50	13.00	20.26	10.26	147.54	5.66	8.2	8.2	1.0	120.27	1359.98	62	1.0	350.7	825.94	15.5	8.2	62	10.26	2.15	0.94	155.2	1014.81	3200.7	220.5	2406.5	**1280.29**	**802.16**
15.50	17.00	16.25	1.50	14.50	20.26	10.26	162.93	5.66	8.2	8.2	1.0	132.82	1492.80	62	1.0	350.7	1176.69	17.0	26.7	0	9.48	13.83	14.80	170.6	2764.69	5434.2	246.0	2915.5	**2173.67**	**971.82**
17.00	18.50	17.75	1.50	16.00	19.48	9.48	177.73	5.66	26.7	26.7	1.0	505.69	1998.49	0	1.0	0.0	1176.69	18.5	31.0	0	9.48	26.30	27.53	170.6	5253.62	8428.8	271.4	3446.6	**3371.52**	**1148.87**
18.50	21.50	20.00	3.00	19.00	19.48	9.48	177.73	11.31	31.0	31.0	1.1	1268.68	3267.16	0	1.0	0.0	1176.69	21.5	9.3	56	10.41	2.34	1.11	170.6	1030.60	5474.4	322.3	4766.2	**2189.78**	**1588.73**
21.50	24.50	23.00	3.00	22.00	20.41	10.41	177.73	11.31	9.3	9.3	1.0	329.30	3596.46	56	1.0	633.6	1810.29	24.5	27.0	0	10.41	14.50	15.49	170.6	2909.33	8316.1	373.2	5780.0	**3326.43**	**1926.66**
24.50	26.00	25.25	1.50	23.50	20.41	10.41	177.73	5.66	27.0	27.0	1.0	512.30	4108.76	0	1.0	0.0	1810.29	26.0	24.3	5	10.41	9.50	10.11	170.6	1955.52	7874.6	398.7	6317.7	**3149.83**	**2105.90**
26.00	27.50	26.75	1.50	25.00	20.41	10.41	177.73	5.66	24.3	24.3	1.0	453.98	4562.73	5	1.0	28.3	1838.57	27.5	10.5	28	9.64	2.62	1.36	170.6	799.24	7200.5	424.1	6825.4	**2880.22**	**2275.14**
27.50	29.00	28.25	1.50	26.50	19.64	9.64	177.73	5.66	10.5	10.5	1.0	186.35	4749.08	28	1.0	158.4	1996.97	29.0	28.7	0	9.64	18.33	19.40	170.6	3665.89	10411.9	449.6	7195.6	**4164.78**	**2398.54**
29.00	30.00	29.50	1.00	27.50	19.64	9.64	177.73	3.77	28.7	28.7	1.0	366.98	5116.06	0	1.0	0.0	1996.97	30.0	28.0	0	9.64	16.76	17.79	170.6	3351.03	10464.1	466.5	7579.6	**4185.62**	**2526.52**
30.00	30.50	30.25	0.50	28.00	19.64	9.64	177.73	1.89	28.0	28.0	1.0	178.20	5294.26	0	1.0	0.0	1996.97	30.5	7.0	70	9.64	1.93	0.76	170.6	1090.34	8381.6	475.0	7766.2	**3352.63**	**2588.75**
30.50	32.00	31.25	1.50	29.50	19.64	9.64	177.73	5.66	7.0	7.0	1.0	123.45	5417.71	70	1.0	396.0	2392.97	32.0	27.6	0	9.86	15.85	16.87	170.6	3173.63	10984.3	500.5	8311.1	**4393.73**	**2770.38**
32.00	32.50	32.25	0.50	30.00	19.86	9.86	177.73	1.89	27.6	27.6	1.0	175.21	5592.92	0	1.0	0.0	2392.97	32.5	27.6	0	9.86	15.85	16.87	170.6	3173.63	11159.5	508.9	8494.8	**4463.81**	**2831.61**
32.50	33.50	33.00	1.00	31.00	19.86	9.86	177.73	3.77	27.6	27.6	1.0	350.42	5943.35	0	1.0	0.0	2392.97	33.5	7.2	74	9.86	1.97	0.79	170.6	1138.34	9474.7	525.9	8862.2	**3789.86**	**2954.07**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
33.50	35.00	34.25	1.50	32.50	19.86	9.86	177.73	5.66	7.2	7.2	1.0	127.02	6070.36	74	1.0	418.6	2811.60	35.0	16.2	43	9.86	4.53	3.31	170.6	1334.57	10216.5	551.3	9433.3	**4086.61**	**3144.44**
35.00	36.50	35.75	1.50	34.00	19.86	9.86	177.73	5.66	16.2	16.2	1.0	292.11	6362.47	43	1.0	243.3	3054.86	36.5	28.1	0	9.00	16.98	18.02	170.6	3388.18	12805.5	576.8	9994.1	**5122.20**	**3331.38**
36.50	37.50	37.00	1.00	35.00	19.00	9.00	177.73	3.77	28.1	28.1	1.0	357.90	6720.38	0	1.0	0.0	3054.86	37.5	28.8	0	9.00	18.56	19.64	170.6	3702.34	13477.6	593.8	10369.0	**5391.03**	**3456.33**
37.50	38.00	37.75	0.50	35.50	19.00	9.00	177.73	1.89	28.8	28.8	1.0	184.25	6904.63	0	1.0	0.0	3054.86	38.0	29.2	0	8.87	19.46	20.56	170.6	3880.04	13839.5	602.2	10561.7	**5535.81**	**3520.58**
38.00	40.00	39.00	2.00	37.50	18.87	8.87	177.73	7.54	29.2	29.2	1.0	749.23	7653.86	0	1.0	0.0	3054.86	40.0	29.2	0	8.87	19.46	20.56	170.6	3880.04	14588.8	636.2	11344.9	**5835.50**	**3781.63**
BORE NO: P76, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	16.08	6.08	16.72	1.89	15.0	15.0	1.0	8.45	8.45	41	1.0	77.3	77.31	3.0	12.4	50	9.18	3.17	1.91	18.2	586.54	672.3	8.5	94.2	**268.92**	**31.41**
3.00	5.00	4.00	2.00	2.50	19.18	9.18	27.42	7.54	12.4	12.4	1.0	45.47	53.92	50	1.0	377.1	454.46	5.0	10.5	47	9.18	2.62	1.36	36.6	595.46	1103.8	42.4	550.8	**441.54**	**183.60**
5.00	6.00	5.50	1.00	3.50	19.18	9.18	41.19	3.77	10.5	10.5	1.0	28.79	82.71	47	1.0	177.3	631.71	6.0	10.5	47	9.18	2.62	1.36	45.8	622.64	1337.1	59.4	773.8	**534.83**	**257.93**
6.00	7.00	6.50	1.00	4.50	19.18	9.18	50.37	3.77	10.5	10.5	1.0	35.21	117.92	47	1.0	177.3	808.97	7.0	10.5	47	10.30	2.62	1.36	55.0	650.86	1577.8	76.3	1003.2	**631.10**	**334.41**
7.00	8.00	7.50	1.00	5.50	20.30	10.30	60.11	3.77	10.5	10.5	1.0	42.02	159.94	47	1.0	177.3	986.23	8.0	10.5	47	10.30	2.62	1.36	65.3	681.36	1827.5	93.3	1239.5	**731.01**	**413.16**
8.00	9.00	8.50	1.00	6.50	20.30	10.30	70.41	3.77	10.5	10.5	1.0	49.22	209.15	47	1.0	177.3	1163.49	9.0	9.0	50	10.30	2.29	1.07	75.6	712.37	2085.0	110.3	1482.9	**834.00**	**494.30**
9.00	10.00	9.50	1.00	7.50	20.30	10.30	80.71	3.77	9.0	9.0	1.0	48.21	257.36	50	1.0	188.6	1352.06	10.0	26.5	9	9.60	13.38	14.34	85.9	1484.66	3094.1	127.2	1736.7	**1237.63**	**578.89**
10.00	11.00	10.50	1.00	8.50	19.60	9.60	90.66	3.77	26.5	26.5	1.0	170.47	427.84	9	1.0	33.9	1386.00	11.0	27.0	12	9.60	14.50	15.49	95.5	1789.63	3603.5	144.2	1958.0	**1441.39**	**652.68**
11.00	12.00	11.50	1.00	9.50	19.60	9.60	100.26	3.77	27.0	27.0	1.0	192.66	620.50	12	1.0	45.3	1431.26	12.0	27.0	12	10.30	14.50	15.49	105.1	1954.53	4006.3	161.2	2212.9	**1602.51**	**737.64**
12.00	14.50	13.25	2.50	12.00	20.30	10.30	117.94	9.43	27.0	27.0	1.0	566.57	1187.07	12	1.0	113.1	1544.40	14.5	12.5	38	10.40	3.20	1.94	130.8	874.81	3606.3	203.6	2935.0	**1442.51**	**978.35**
14.50	17.50	16.00	3.00	15.00	20.40	10.40	146.41	11.31	12.5	12.5	1.0	367.24	1554.32	38	1.0	429.9	1974.34	17.5	16.8	32	10.40	4.83	3.64	162.0	1236.07	4764.7	254.5	3783.1	**1905.89**	**1261.04**
17.50	19.00	18.25	1.50	16.50	20.40	10.40	146.41	5.66	16.8	16.8	1.0	250.07	1804.38	32	1.0	181.0	2155.37	19.0	7.6	68	10.40	2.04	0.85	162.0	1072.01	5031.8	279.9	4239.7	**2012.71**	**1413.22**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)										
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	N_γ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
19.00	20.50	19.75	1.50	18.00	20.40	10.40	146.41	5.66	7.6	7.6	1.0	110.51	1914.90	68	1.0	384.7	2540.06	20.5	15.3	78	9.80	4.09	2.81	162.0	1562.25	6017.2	305.4	4760.3	**2406.88**	**1586.77**
20.50	23.50	22.00	3.00	21.00	19.80	9.80	146.41	11.31	15.3	15.3	1.0	453.17	2368.07	78	1.0	882.5	3422.57	23.5	15.3	78	9.80	4.09	2.81	162.0	1562.25	7352.9	356.3	6146.9	**2941.16**	**2048.97**
23.50	25.00	24.25	1.50	22.50	19.80	9.80	146.41	5.66	15.3	15.3	1.0	226.59	2594.66	78	1.0	441.3	3863.83	25.0	28.3	0	9.80	17.43	18.48	162.0	3318.17	9776.7	381.7	6840.2	**3910.66**	**2280.06**
25.00	26.50	25.75	1.50	24.00	19.80	9.80	146.41	5.66	28.3	28.3	1.0	445.97	3040.63	0	1.0	0.0	3863.83	26.5	11.2	54	9.80	2.82	1.56	162.0	1077.70	7982.2	407.2	7311.6	**3192.86**	**2437.20**
26.50	27.50	27.00	1.00	25.00	19.80	9.80	146.41	3.77	11.2	11.2	1.0	109.33	3149.96	54	1.0	203.7	4067.49	27.5	12.5	60	10.80	3.20	1.94	162.0	1212.46	8429.9	424.1	7641.6	**3371.96**	**2547.19**
27.50	29.50	28.50	2.00	27.00	20.80	10.80	146.41	7.54	12.5	12.5	1.0	244.83	3394.79	60	1.0	452.6	4520.06	29.5	12.5	60	10.80	3.20	1.94	162.0	1212.46	9127.3	458.0	8372.9	**3650.92**	**2790.96**
29.50	30.00	29.75	0.50	27.50	20.80	10.80	146.41	1.89	12.5	12.5	1.0	61.21	3456.00	60	1.0	113.1	4633.20	30.0	10.0	50	10.80	2.47	1.22	162.0	970.85	9060.0	466.5	8555.7	**3624.02**	**2851.91**
30.00	31.00	30.50	1.00	28.50	20.80	10.80	146.41	3.77	10.0	10.0	1.0	97.36	3553.36	50	1.0	188.6	4821.77	31.0	18.0	7	10.80	5.42	4.29	162.0	1095.53	9470.7	483.5	8858.6	**3788.27**	**2952.88**
31.00	32.50	31.75	1.50	30.00	20.80	10.80	146.41	5.66	18.0	18.0	1.0	269.12	3822.48	7	1.0	39.6	4861.37	32.5	23.5	7	9.55	8.92	9.23	162.0	1766.20	10450.1	508.9	9192.8	**4180.02**	**3064.26**
32.50	34.00	33.25	1.50	31.50	19.55	9.55	146.41	5.66	23.5	23.5	1.0	360.14	4182.62	7	1.0	39.6	4900.97	34.0	21.5	7	9.55	7.48	7.04	162.0	1488.01	10571.6	534.4	9618.0	**4228.64**	**3205.99**
34.00	35.00	34.50	1.00	32.50	19.55	9.55	146.41	3.77	21.5	21.5	1.0	217.51	4400.13	7	1.0	26.4	4927.37	35.0	21.5	20	9.55	7.48	7.04	162.0	1620.38	10947.9	551.3	9878.8	**4379.15**	**3292.95**
35.00	35.50	35.25	0.50	33.00	19.55	9.55	146.41	1.89	21.5	21.5	1.0	108.75	4508.88	20	1.0	37.7	4965.09	35.5	21.5	20	9.55	7.48	7.04	162.0	1620.38	11094.4	559.8	10033.8	**4437.74**	**3344.60**
35.50	37.00	36.25	1.50	34.50	19.55	9.55	146.41	5.66	21.5	21.5	1.0	326.26	4835.14	20	1.0	113.1	5078.23	37.0	20.5	48	9.55	6.76	5.94	162.0	1766.41	11679.8	585.3	10498.7	**4671.91**	**3499.55**
37.00	37.50	37.25	0.50	35.00	19.55	9.55	146.41	1.89	20.5	20.5	1.0	103.22	4938.37	48	1.0	90.5	5168.74	37.5	20.5	48	8.99	6.76	5.94	162.0	1764.15	11871.3	593.8	10700.9	**4748.50**	**3566.96**
37.50	38.50	38.00	1.00	36.00	18.99	8.99	146.41	3.77	20.5	20.5	1.0	206.45	5144.82	48	1.0	181.0	5349.77	38.5	14.3	52	9.13	3.74	2.45	162.0	1229.69	11724.3	610.7	11105.3	**4689.71**	**3701.77**
38.50	40.00	39.25	1.50	37.50	19.13	9.13	146.41	5.66	14.3	14.3	1.0	211.12	5355.94	52	1.0	294.2	5643.94	40.0	10.2	54	9.13	2.53	1.28	162.0	1021.33	12021.2	636.2	11636.1	**4808.48**	**3878.68**
BORE NO: P77, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	18.20	8.20	22.55	1.89	12.9	12.9	1.0	9.74	9.74	28	1.0	52.8	52.80	3.0	10.0	37	8.20	2.47	1.22	24.6	452.30	514.8	8.5	71.0	**205.94**	**23.67**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
3.00	4.00	3.50	1.00	1.50	18.20	8.20	28.70	3.77	10.0	10.0	1.0	19.09	28.82	37	1.0	139.5	192.34	4.0	23.6	18	9.99	8.99	9.34	32.8	580.35	801.5	25.4	246.6	**320.61**	**82.20**
4.00	5.00	4.50	1.00	2.50	19.99	9.99	37.80	3.77	23.6	23.6	1.0	62.27	91.10	18	1.0	67.9	260.23	5.0	25.5	13	9.99	11.13	12.03	42.8	752.63	1104.0	42.4	393.7	**441.58**	**131.25**
5.00	6.00	5.50	1.00	3.50	19.99	9.99	47.79	3.77	25.5	25.5	1.0	85.96	177.06	13	1.0	49.0	309.26	6.0	25.5	13	9.80	11.13	12.03	52.8	876.83	1363.1	59.4	545.7	**545.26**	**181.90**
6.00	8.00	7.00	2.00	5.50	19.80	9.80	62.58	7.54	25.5	25.5	1.0	225.15	402.21	13	1.0	98.1	407.31	8.0	12.5	38	9.80	3.20	1.94	72.4	662.21	1471.7	93.3	902.8	**588.69**	**300.94**
8.00	9.00	8.50	1.00	6.50	19.80	9.80	77.28	3.77	12.5	12.5	1.0	64.61	466.82	38	1.0	143.3	550.63	9.0	12.5	38	9.80	3.20	1.94	82.2	697.73	1715.2	110.3	1127.7	**686.07**	**375.91**
9.00	10.00	9.50	1.00	7.50	19.80	9.80	87.08	3.77	12.5	12.5	1.0	72.81	539.63	38	1.0	143.3	693.94	10.0	12.5	38	11.20	3.20	1.94	92.0	735.10	1968.7	127.2	1360.8	**787.47**	**453.60**
10.00	11.00	10.50	1.00	8.50	21.20	11.20	97.58	3.77	12.5	12.5	1.0	81.59	621.22	38	1.0	143.3	837.26	11.0	24.2	18	11.20	9.42	10.00	103.2	1359.50	2818.0	144.2	1602.7	**1127.19**	**534.22**
11.00	12.00	11.50	1.00	9.50	21.20	11.20	108.78	3.77	24.2	24.2	1.0	184.38	805.59	18	1.0	67.9	905.14	12.0	7.1	72	10.40	1.95	0.77	114.4	990.72	2701.5	161.2	1871.9	**1080.58**	**623.97**
12.00	14.50	13.25	2.50	12.00	20.40	10.40	127.38	9.43	7.1	7.1	1.0	149.59	955.19	72	1.0	678.9	1584.00	14.5	28.0	0	10.40	16.76	17.79	140.4	2786.92	5326.1	203.6	2742.8	**2130.44**	**914.25**
14.50	16.00	15.25	1.50	13.50	20.40	10.40	148.18	5.66	28.0	28.0	1.0	445.72	1400.91	0	1.0	0.0	1584.00	16.0	13.2	37	10.40	3.41	2.14	156.0	993.64	3978.5	229.0	3213.9	**1591.42**	**1071.31**
16.00	17.50	16.75	1.50	15.00	20.40	10.40	163.78	5.66	13.2	13.2	1.0	217.31	1618.22	37	1.0	209.3	1793.31	17.5	18.0	37	10.00	5.42	4.29	171.6	1457.33	4868.9	254.5	3666.0	**1947.54**	**1222.00**
17.50	19.00	18.25	1.50	16.50	20.00	10.00	163.78	5.66	18.0	18.0	1.0	301.05	1919.27	37	1.0	209.3	2002.63	19.0	11.6	56	10.00	2.94	1.68	171.6	1152.45	5074.3	279.9	4201.8	**2029.74**	**1400.60**
19.00	20.50	19.75	1.50	18.00	20.00	10.00	163.78	5.66	11.6	11.6	1.0	190.19	2109.46	56	1.0	316.8	2319.43	20.5	17.6	40	10.00	5.22	4.07	171.6	1448.18	5877.1	305.4	4734.2	**2350.83**	**1578.08**
20.50	22.00	21.25	1.50	19.50	20.00	10.00	163.78	5.66	17.6	17.6	1.0	293.91	2403.37	40	1.0	226.3	2545.71	22.0	12.5	44	10.60	3.20	1.94	171.6	1083.96	6033.0	330.8	5279.9	**2413.22**	**1759.96**
22.00	23.50	22.75	1.50	21.00	20.60	10.60	163.78	5.66	12.5	12.5	1.0	205.41	2608.77	44	1.0	248.9	2794.63	23.5	12.5	44	10.60	3.20	1.94	171.6	1083.96	6487.4	356.3	5759.7	**2594.95**	**1919.89**
23.50	25.00	24.25	1.50	22.50	20.60	10.60	163.78	5.66	12.5	12.5	1.0	205.41	2814.18	44	1.0	248.9	3043.54	25.0	25.6	0	9.25	11.35	12.26	171.6	2280.60	8138.3	381.7	6239.4	**3255.33**	**2079.81**
25.00	26.50	25.75	1.50	24.00	19.25	9.25	163.78	5.66	25.6	25.6	1.0	443.92	3258.10	0	1.0	0.0	3043.54	26.5	25.6	0	9.25	11.35	12.26	171.6	2280.60	8582.2	407.2	6708.8	**3432.90**	**2236.26**
26.50	27.50	27.00	1.00	25.00	19.25	9.25	163.78	3.77	25.6	25.6	1.0	295.94	3554.04	0	1.0	0.0	3043.54	27.5	25.6	0	9.25	11.35	12.26	171.6	2280.60	8878.2	424.1	7021.7	**3551.28**	**2340.57**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
27.50	28.00	27.75	0.50	25.50	19.25	9.25	163.78	1.89	25.6	25.6	1.0	147.97	3702.01	0	1.0	0.0	3043.54	28.0	10.1	59	10.60	2.50	1.25	171.6	1094.98	7840.5	432.6	7178.2	**3136.22**	**2392.72**
28.00	29.50	28.75	1.50	27.00	20.60	10.60	163.78	5.66	10.1	10.1	1.0	165.04	3867.05	59	1.0	333.8	3377.31	29.5	23.0	10	10.60	8.56	8.68	171.6	1826.07	9070.4	458.0	7702.4	**3628.18**	**2567.47**
29.50	30.00	29.75	0.50	27.50	20.60	10.60	163.78	1.89	23.0	23.0	1.0	131.10	3998.15	10	1.0	18.9	3396.17	30.0	23.0	10	10.60	8.56	8.68	171.6	1826.07	9220.4	466.5	7860.8	**3688.16**	**2620.28**
30.00	31.00	30.50	1.00	28.50	20.60	10.60	163.78	3.77	23.0	23.0	1.0	262.19	4260.34	10	1.0	37.7	3433.89	31.0	22.5	0	10.60	8.20	8.14	171.6	1650.41	9344.6	483.5	8177.7	**3737.85**	**2725.91**
31.00	32.50	31.75	1.50	30.00	20.60	10.60	163.78	5.66	22.5	22.5	1.0	383.78	4644.12	0	1.0	0.0	3433.89	32.5	15.5	48	10.33	4.19	2.92	171.6	1321.91	9399.9	508.9	8586.9	**3759.97**	**2862.31**
32.50	34.00	33.25	1.50	31.50	20.33	10.33	163.78	5.66	15.5	15.5	1.0	256.95	4901.07	48	1.0	271.5	3705.43	34.0	24.3	0	10.33	9.50	10.11	171.6	1914.37	10520.9	534.4	9140.9	**4208.35**	**3046.96**
34.00	35.00	34.50	1.00	32.50	20.33	10.33	163.78	3.77	24.3	24.3	1.0	278.90	5179.96	0	1.0	0.0	3705.43	35.0	24.3	0	10.33	9.50	10.11	171.6	1914.37	10799.8	551.3	9436.7	**4319.91**	**3145.58**
35.00	35.50	35.25	0.50	33.00	20.33	10.33	163.78	1.89	24.3	24.3	1.0	139.45	5319.41	0	1.0	0.0	3705.43	35.5	24.0	15	10.33	9.28	9.78	171.6	2022.87	11047.7	559.8	9584.7	**4419.08**	**3194.89**
35.50	37.00	36.25	1.50	34.50	20.33	10.33	163.78	5.66	24.0	24.0	1.0	412.52	5731.93	15	1.0	84.9	3790.29	37.0	13.1	35	10.33	3.38	2.11	171.6	1027.33	10549.5	585.3	10107.5	**4219.82**	**3369.16**
37.00	37.50	37.25	0.50	35.00	20.33	10.33	163.78	1.89	13.1	13.1	1.0	71.87	5803.80	35	1.0	66.0	3856.29	37.5	13.8	44	9.70	3.59	2.31	171.6	1160.16	10820.2	593.8	10253.8	**4328.10**	**3417.95**
37.50	38.50	38.00	1.00	36.00	19.70	9.70	163.78	3.77	13.8	13.8	1.0	151.72	5955.52	44	1.0	165.9	4022.23	38.5	14.5	48	8.63	3.80	2.51	171.6	1240.19	11217.9	610.7	10588.5	**4487.17**	**3529.49**
38.50	40.00	39.25	1.50	37.50	18.63	8.63	163.78	5.66	14.5	14.5	1.0	239.62	6195.13	48	1.0	271.5	4293.77	40.0	14.5	48	8.63	3.80	2.51	171.6	1240.19	11729.1	636.2	11125.1	**4691.64**	**3708.36**
BORE NO: P78, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.70	9.70	26.68	1.89	22.5	22.5	1.0	20.84	0	17	1.0	32.1	0	3.0	22.5	17	9.70	8.20	8.14	29.1	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.50	19.70	9.70	33.95	3.77	22.5	22.5	1.0	53.04	0	17	1.0	64.1	0	4.0	12.4	19	9.70	3.17	1.91	38.8	0	0.0	25.4	25.4	**0.00**	**8.48**
4.00	5.00	4.50	1.00	2.50	19.70	9.70	43.65	3.77	12.4	12.4	1.0	36.19	0	19	1.0	71.7	0	5.0	24.2	16	9.90	9.42	10.00	48.5	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.50	19.90	9.90	53.45	3.77	24.2	24.2	1.0	90.59	0	16	1.0	60.3	0	6.0	24.6	0	9.90	9.71	10.44	58.4	711.89	711.9	59.4	59.4	**284.76**	**19.79**
6.00	7.00	6.50	1.00	4.50	19.90	9.90	63.35	3.77	24.6	24.6	1.0	109.39	109.39	0	1.0	0.0	0.00	7.0	11.5	40	10.48	2.91	1.65	68.3	644.00	753.4	76.3	185.7	**301.35**	**61.91**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
7.00	9.00	8.00	2.00	6.50	20.48	10.48	78.78	7.54	11.5	11.5	1.0	120.90	230.28	40	1.0	301.7	301.71	9.0	10.5	44	10.48	2.62	1.36	89.3	722.04	1254.0	110.3	642.3	**501.61**	**214.09**
9.00	10.00	9.50	1.00	7.50	20.48	10.48	94.50	3.77	10.5	10.5	1.0	66.05	296.34	44	1.0	165.9	467.66	10.0	10.5	44	10.48	2.62	1.36	99.7	753.07	1517.1	127.2	891.2	**606.82**	**297.08**
10.00	11.00	10.50	1.00	8.50	20.48	10.48	104.98	3.77	10.5	10.5	1.0	73.38	369.72	44	1.0	165.9	633.60	11.0	10.5	44	10.24	2.62	1.36	110.2	783.88	1787.2	144.2	1147.5	**714.88**	**382.51**
11.00	12.50	11.75	1.50	10.00	20.24	10.24	117.90	5.66	10.5	10.5	1.0	123.62	493.33	44	1.0	248.9	882.51	12.5	7.0	54	10.24	1.93	0.76	125.6	829.37	2205.2	169.6	1545.5	**882.09**	**515.17**
12.50	14.00	13.25	1.50	11.50	20.24	10.24	133.26	5.66	7.0	7.0	1.0	92.56	585.90	54	1.0	305.5	1188.00	14.0	25.2	13	9.90	10.45	11.34	140.9	1875.05	3648.9	195.1	1969.0	**1459.58**	**656.33**
14.00	15.50	14.75	1.50	13.00	19.90	9.90	148.37	5.66	25.2	25.2	1.0	394.95	980.85	13	1.0	73.5	1261.54	15.5	24.6	15	10.40	9.71	10.44	155.8	1938.34	4180.7	220.5	2462.9	**1672.30**	**820.98**
15.50	18.50	17.00	3.00	16.00	20.40	10.40	171.39	11.31	24.6	24.6	1.0	887.81	1868.67	15	1.0	169.7	1431.26	18.5	24.0	15	10.40	9.28	9.78	155.8	1857.55	5157.5	271.4	3571.4	**2062.99**	**1190.45**
18.50	20.00	19.25	1.50	17.50	20.40	10.40	171.39	5.66	24.0	24.0	1.0	431.68	2300.35	15	1.0	84.9	1516.11	20.0	11.0	48	9.60	2.76	1.51	155.8	985.79	4802.3	296.9	4113.3	**1920.90**	**1371.12**
20.00	21.50	20.75	1.50	19.00	19.60	9.60	171.39	5.66	11.0	11.0	1.0	188.47	2488.82	48	1.0	271.5	1787.66	21.5	11.0	48	9.60	2.76	1.51	155.8	985.79	5262.3	322.3	4598.8	**2104.91**	**1532.93**
21.50	23.00	22.25	1.50	20.50	19.60	9.60	171.39	5.66	11.0	11.0	1.0	188.47	2677.29	48	1.0	271.5	2059.20	23.0	13.5	35	9.60	3.50	2.22	155.8	987.80	5724.3	347.8	5084.3	**2289.72**	**1694.75**
23.00	24.50	23.75	1.50	22.00	19.60	9.60	171.39	5.66	13.5	13.5	1.0	232.78	2910.06	35	1.0	198.0	2257.20	24.5	13.5	35	9.80	3.50	2.22	155.8	988.10	6155.4	373.2	5540.5	**2462.15**	**1846.83**
24.50	26.00	25.25	1.50	23.50	19.80	9.80	171.39	5.66	13.5	13.5	1.0	232.78	3142.84	35	1.0	198.0	2455.20	26.0	26.0	7	9.80	12.25	13.18	155.8	2318.58	7916.6	398.7	5996.7	**3166.64**	**1998.90**
26.00	27.50	26.75	1.50	25.00	19.80	9.80	171.39	5.66	26.0	26.0	1.0	472.89	3615.73	7	1.0	39.6	2494.80	27.5	23.5	46	9.80	8.92	9.23	155.8	2102.12	8212.7	424.1	6534.6	**3285.06**	**2178.22**
27.50	29.00	28.25	1.50	26.50	19.80	9.80	171.39	5.66	23.5	23.5	1.0	421.58	4037.31	46	1.0	260.2	2755.03	29.0	29.2	0	9.80	19.46	20.56	155.8	3566.53	10358.9	449.6	7241.9	**4143.55**	**2413.97**
29.00	30.00	29.50	1.00	27.50	19.80	9.80	171.39	3.77	29.2	29.2	1.0	361.25	4398.57	0	1.0	0.0	2755.03	30.0	30.0	0	10.05	21.26	22.40	155.8	3900.14	11053.7	466.5	7620.1	**4421.49**	**2540.04**
30.00	30.50	30.25	0.50	28.00	20.05	10.05	171.39	1.89	30.0	30.0	1.0	186.60	4585.16	0	1.0	0.0	2755.03	30.5	29.6	0	10.05	20.36	21.48	155.8	3735.08	11075.3	475.0	7815.2	**4430.11**	**2605.07**
30.50	32.00	31.25	1.50	29.50	20.05	10.05	171.39	5.66	29.6	29.6	1.0	550.80	5135.96	0	1.0	0.0	2755.03	32.0	29.6	0	10.05	20.36	21.48	155.8	3735.08	11626.1	500.5	8391.4	**4650.43**	**2797.15**
32.00	32.50	32.25	0.50	30.00	20.05	10.05	171.39	1.89	29.6	29.6	1.0	183.60	5319.56	0	1.0	0.0	2755.03	32.5	29.6	0	10.05	20.36	21.48	155.8	3735.08	11809.7	508.9	8583.5	**4723.87**	**2861.17**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
32.50	33.50	33.00	1.00	31.00	20.05	10.05	171.39	3.77	29.6	29.6	1.0	367.20	5686.76	0	1.0	0.0	2755.03	33.5	24.5	46	10.05	9.64	10.33	155.8	2238.09	10679.9	525.9	8967.7	**4271.95**	**2989.23**
33.50	35.00	34.25	1.50	32.50	20.05	10.05	171.39	5.66	24.5	24.5	1.0	441.86	6128.62	46	1.0	260.2	3015.26	35.0	27.1	5	10.05	14.73	15.72	155.8	2754.36	11898.2	551.3	9695.2	**4759.30**	**3231.74**
35.00	36.50	35.75	1.50	34.00	20.05	10.05	171.39	5.66	27.1	27.1	1.0	496.16	6624.78	5	1.0	28.3	3043.54	36.5	27.1	5	9.25	14.73	15.72	155.8	2745.83	12414.1	576.8	10245.1	**4965.66**	**3415.04**
36.50	37.50	37.00	1.00	35.00	19.25	9.25	171.39	3.77	27.1	27.1	1.0	330.77	6955.55	5	1.0	18.9	3062.40	37.5	26.0	10	9.25	12.25	13.18	155.8	2344.20	12362.1	593.8	10611.7	**4944.86**	**3537.24**
37.50	38.00	37.75	0.50	35.50	19.25	9.25	171.39	1.89	26.0	26.0	1.0	157.63	7113.18	10	1.0	18.9	3081.26	38.0	15.3	53	9.05	4.09	2.81	155.8	1277.48	11471.9	602.2	10796.7	**4588.77**	**3598.89**
38.00	40.00	39.00	2.00	37.50	19.05	9.05	171.39	7.54	15.3	15.3	1.0	353.66	7466.84	53	1.0	399.8	3481.03	40.0	15.3	53	9.05	4.09	2.81	155.8	1277.48	12225.4	636.2	11584.0	**4890.14**	**3861.35**
BORE NO: P79, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	18.44	8.44	23.21	1.89	23.5	23.5	1.0	19.03	19.03	9	1.0	17.0	16.97	3.0	23.5	9	9.60	8.92	9.23	25.3	407.36	443.4	8.5	44.5	**177.34**	**14.83**
3.00	5.00	4.00	2.00	2.50	19.60	9.60	34.92	7.54	23.5	23.5	1.0	114.53	133.56	9	1.0	67.9	84.86	5.0	8.6	42	9.60	2.22	1.00	44.5	545.95	764.4	42.4	260.8	**305.75**	**86.94**
5.00	6.00	5.50	1.00	3.50	19.60	9.60	49.32	3.77	8.6	8.6	1.0	28.13	161.69	42	1.0	158.4	243.26	6.0	8.6	42	9.60	2.22	1.00	54.1	570.04	975.0	59.4	464.3	**389.99**	**154.77**
6.00	7.00	6.50	1.00	4.50	19.60	9.60	58.92	3.77	8.6	8.6	1.0	33.61	195.30	42	1.0	158.4	401.66	7.0	13.0	51	10.10	3.35	2.08	63.7	775.09	1372.0	76.3	673.3	**548.82**	**224.43**
7.00	8.00	7.50	1.00	5.50	20.10	10.10	68.77	3.77	13.0	13.0	1.0	59.88	255.17	51	1.0	192.3	594.00	8.0	10.3	41	10.10	2.56	1.31	73.8	640.12	1489.3	93.3	942.5	**595.72**	**314.16**
8.00	9.00	8.50	1.00	6.50	20.10	10.10	78.87	3.77	10.3	10.3	1.0	54.06	309.23	41	1.0	154.6	748.63	9.0	10.3	40	8.80	2.56	1.31	83.9	658.01	1715.9	110.3	1168.1	**686.35**	**389.38**
9.00	11.00	10.00	2.00	8.50	18.80	8.80	92.72	7.54	10.3	10.3	1.0	127.10	436.33	40	1.0	301.7	1050.34	11.0	23.8	21	8.80	9.14	9.56	101.5	1320.35	2807.0	144.2	1630.9	**1122.81**	**543.62**
11.00	12.00	11.50	1.00	9.50	18.80	8.80	105.92	3.77	23.8	23.8	1.0	176.19	612.52	21	1.0	79.2	1129.54	12.0	23.8	21	8.80	9.14	9.56	110.3	1411.31	3153.4	161.2	1903.2	**1261.35**	**634.41**
12.00	13.00	12.50	1.00	10.50	18.80	8.80	114.72	3.77	23.8	23.8	1.0	190.83	803.34	21	1.0	79.2	1208.74	13.0	12.5	38	9.00	3.20	1.94	119.1	830.59	2842.7	178.1	2190.2	**1137.07**	**730.07**
13.00	14.50	13.75	1.50	12.00	19.00	9.00	125.87	5.66	12.5	12.5	1.0	157.86	961.20	38	1.0	215.0	1423.71	14.5	11.9	38	9.00	3.03	1.76	132.6	852.16	3237.1	203.6	2588.5	**1294.83**	**862.83**
14.50	16.00	15.25	1.50	13.50	19.00	9.00	139.37	5.66	11.9	11.9	1.0	166.15	1127.35	38	1.0	215.0	1638.69	16.0	11.9	38	10.20	3.03	1.76	146.1	899.86	3665.9	229.0	2995.1	**1466.36**	**998.35**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
16.00	17.50	16.75	1.50	15.00	20.20	10.20	153.77	5.66	11.9	11.9	1.0	183.32	1310.67	38	1.0	215.0	1853.66	17.5	24.3	0	10.20	9.50	10.11	161.4	1804.32	4968.6	254.5	3418.8	**1987.46**	**1139.60**
17.50	19.00	18.25	1.50	16.50	20.20	10.20	153.77	5.66	24.3	24.3	1.0	392.77	1703.44	0	1.0	0.0	1853.66	19.0	26.2	0	8.10	12.70	13.64	161.4	2394.91	5952.0	279.9	3837.0	**2380.81**	**1279.00**
19.00	20.50	19.75	1.50	18.00	18.10	8.10	153.77	5.66	26.2	26.2	1.0	428.04	2131.49	0	1.0	0.0	1853.66	20.5	26.0	7	9.82	12.25	13.18	161.4	2396.80	6381.9	305.4	4290.5	**2552.78**	**1430.17**
20.50	23.50	22.00	3.00	21.00	19.82	9.82	153.77	11.31	26.0	26.0	1.0	848.56	2980.04	7	1.0	79.2	1932.86	23.5	12.5	54	9.80	3.20	1.94	161.4	1147.91	6060.8	356.3	5269.2	**2424.32**	**1756.38**
23.50	26.50	25.00	3.00	24.00	19.80	9.80	153.77	11.31	12.5	12.5	1.0	385.70	3365.75	54	1.0	611.0	2543.83	26.5	11.3	66	9.80	2.85	1.59	161.4	1203.57	7113.1	407.2	6316.7	**2845.26**	**2105.57**
26.50	27.50	27.00	1.00	25.00	19.80	9.80	153.77	3.77	11.3	11.3	1.0	115.88	3481.63	66	1.0	248.9	2792.74	27.5	10.0	69	9.80	2.47	1.22	161.4	1161.84	7436.2	424.1	6698.5	**2974.48**	**2232.83**
27.50	29.50	28.50	2.00	27.00	19.80	9.80	153.77	7.54	10.0	10.0	1.0	204.52	3686.14	69	1.0	520.5	3313.20	29.5	27.6	0	8.93	15.85	16.87	161.4	2997.94	9997.3	458.0	7457.4	**3998.91**	**2485.80**
29.50	30.00	29.75	0.50	27.50	18.93	8.93	153.77	1.89	27.6	27.6	1.0	151.59	3837.73	0	1.0	0.0	3313.20	30.0	27.6	0	9.78	15.85	16.87	161.4	3007.68	10158.6	466.5	7617.5	**4063.44**	**2539.15**
30.00	31.00	30.50	1.00	28.50	19.78	9.78	153.77	3.77	27.6	27.6	1.0	303.18	4140.91	0	1.0	0.0	3313.20	31.0	24.8	0	9.78	9.86	10.66	161.4	1870.83	9324.9	483.5	7937.6	**3729.98**	**2645.87**
31.00	32.50	31.75	1.50	30.00	19.78	9.78	153.77	5.66	24.8	24.8	1.0	401.95	4542.86	0	1.0	0.0	3313.20	32.5	27.0	10	9.78	14.50	15.49	161.4	2853.56	10709.6	508.9	8365.0	**4283.85**	**2788.33**
32.50	35.00	33.75	2.50	32.50	19.78	9.78	153.77	9.43	27.0	27.0	1.0	738.73	5281.59	10	1.0	94.3	3407.49	35.0	27.4	10	9.78	15.40	16.41	161.4	3024.19	11713.3	551.3	9240.4	**4685.31**	**3080.14**
35.00	35.50	35.25	0.50	33.00	19.78	9.78	153.77	1.89	27.4	27.4	1.0	150.30	5431.89	10	1.0	18.9	3426.34	35.5	26.3	10	9.78	12.93	13.88	161.4	2554.96	11413.2	559.8	9418.1	**4565.28**	**3139.36**
35.50	37.50	36.50	2.00	35.00	19.78	9.78	153.77	7.54	26.3	26.3	1.0	573.24	6005.14	10	1.0	75.4	3501.77	37.5	11.5	49	8.82	2.91	1.65	161.4	1040.48	10547.4	593.8	10100.7	**4218.96**	**3366.89**
37.50	38.50	38.00	1.00	36.00	18.82	8.82	153.77	3.77	11.5	11.5	1.0	117.99	6123.12	49	1.0	184.8	3686.57	38.5	7.5	60	8.29	2.02	0.84	161.4	984.59	10794.3	610.7	10420.4	**4317.72**	**3473.47**
38.50	40.00	39.25	1.50	37.50	18.29	8.29	153.77	5.66	7.5	7.5	1.0	114.52	6237.65	60	1.0	339.4	4026.00	40.0	7.5	60	8.29	2.02	0.84	161.4	984.59	11248.2	636.2	10899.8	**4499.30**	**3633.27**
BORE NO: P80, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	20.8	10.80	29.70	1.89	12.3	12.3	1.0	12.21	0	29	1.0	54.7	0	3.0	28.4	2	9.64	17.66	18.71	32.4	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	5.00	4.00	2.00	2.50	19.6	9.64	42.04	7.54	28.4	28.4	1.0	171.46	0	2	1.0	15.1	0	5.0	7.2	41	9.64	1.97	0.79	51.7	537.62	537.6	42.4	42.4	**215.05**	**14.14**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
5.00	6.00	5.50	1.00	3.50	19.6	9.64	56.50	3.77	7.2	7.2	1.0	26.92	26.92	41	1.0	154.6	154.63	6.0	11.9	21	9.64	3.03	1.76	61.3	435.50	617.0	59.4	240.9	**246.82**	**80.31**
6.00	7.00	6.50	1.00	4.50	19.6	9.64	66.14	3.77	11.9	11.9	1.0	52.57	79.48	21	1.0	79.2	233.83	7.0	29.2	2	9.65	19.46	20.56	71.0	1717.24	2030.6	76.3	389.7	**812.22**	**129.88**
7.00	8.00	7.50	1.00	5.50	19.7	9.65	75.79	3.77	29.2	29.2	1.0	159.74	239.22	2	1.0	7.5	241.37	8.0	9.5	42	9.65	2.38	1.14	80.6	652.23	1132.8	93.3	573.9	**453.13**	**191.30**
8.00	9.00	8.50	1.00	6.50	19.7	9.65	85.44	3.77	9.5	9.5	1.0	53.92	293.14	42	1.0	158.4	399.77	9.0	9.5	42	9.65	2.38	1.14	90.3	678.22	1371.1	110.3	803.2	**548.45**	**267.73**
9.00	10.00	9.50	1.00	7.50	19.7	9.65	95.09	3.77	9.5	9.5	1.0	60.01	353.15	42	1.0	158.4	558.17	10.0	9.5	42	10.04	2.38	1.14	99.9	704.51	1615.8	127.2	1038.6	**646.33**	**346.19**
10.00	11.00	10.50	1.00	8.50	20.0	10.04	104.93	3.77	9.5	9.5	1.0	66.22	419.38	42	1.0	158.4	716.57	11.0	9.5	42	10.04	2.38	1.14	110.0	731.54	1867.5	144.2	1280.1	**747.00**	**426.72**
11.00	12.00	11.50	1.00	9.50	20.0	10.04	114.97	3.77	9.5	9.5	1.0	72.56	491.94	42	1.0	158.4	874.97	12.0	8.2	54	10.41	2.15	0.94	120.0	847.88	2214.8	161.2	1528.1	**885.91**	**509.36**
12.00	14.50	13.25	2.50	12.00	20.4	10.41	133.00	9.43	8.2	8.2	1.0	180.71	672.64	54	1.0	509.1	1384.11	14.5	8.2	54	10.41	2.15	0.94	146.0	911.07	2967.8	203.6	2260.3	**1187.13**	**753.44**
14.50	16.00	15.25	1.50	13.50	20.4	10.41	153.82	5.66	8.2	8.2	1.0	125.40	798.04	54	1.0	305.5	1689.60	16.0	10.3	52	10.12	2.56	1.31	161.6	1006.30	3493.9	229.0	2716.7	**1397.58**	**905.55**
16.00	17.50	16.75	1.50	15.00	20.1	10.12	169.22	5.66	10.3	10.3	1.0	173.97	972.01	52	1.0	294.2	1983.77	17.5	10.3	52	10.12	2.56	1.31	176.8	1050.24	4006.0	254.5	3210.3	**1602.41**	**1070.08**
17.50	19.00	18.25	1.50	16.50	20.1	10.12	169.22	5.66	10.3	10.3	1.0	173.97	1145.98	52	1.0	294.2	2277.94	19.0	27.8	0	9.60	16.31	17.33	176.8	3374.80	6798.7	279.9	3703.8	**2719.49**	**1234.61**
19.00	20.50	19.75	1.50	18.00	19.6	9.60	169.22	5.66	27.8	27.8	1.0	504.73	1650.71	0	1.0	0.0	2277.94	20.5	27.0	0	9.60	14.50	15.49	176.8	3002.39	6931.0	305.4	4234.0	**2772.42**	**1411.34**
20.50	22.00	21.25	1.50	19.50	19.6	9.60	169.22	5.66	27.0	27.0	1.0	487.77	2138.48	0	1.0	0.0	2277.94	22.0	9.5	47	9.89	2.38	1.14	176.8	962.38	5378.8	330.8	4747.2	**2151.52**	**1582.41**
22.00	23.50	22.75	1.50	21.00	19.9	9.89	169.22	5.66	9.5	9.5	1.0	160.20	2298.68	47	1.0	265.9	2543.83	23.5	9.5	47	9.89	2.38	1.14	176.8	962.38	5804.9	356.3	5198.8	**2321.96**	**1732.92**
23.50	25.00	24.25	1.50	22.50	19.9	9.89	169.22	5.66	9.5	9.5	1.0	160.20	2458.88	47	1.0	265.9	2809.71	25.0	14.0	32	9.89	3.65	2.36	176.8	1071.90	6340.5	381.7	5650.3	**2536.20**	**1883.43**
25.00	26.50	25.75	1.50	24.00	19.9	9.89	169.22	5.66	14.0	14.0	1.0	238.68	2697.56	32	1.0	181.0	2990.74	26.5	15.5	32	9.24	4.19	2.92	176.8	1181.59	6869.9	407.2	6095.5	**2747.96**	**2031.82**
26.50	27.50	27.00	1.00	25.00	19.2	9.24	169.22	3.77	15.5	15.5	1.0	176.99	2874.55	32	1.0	120.7	3111.43	27.5	15.5	32	9.24	4.19	2.92	176.8	1181.59	7167.6	424.1	6410.1	**2867.03**	**2136.70**
27.50	28.00	27.75	0.50	25.50	19.2	9.24	169.22	1.89	15.5	15.5	1.0	88.49	2963.04	32	1.0	60.3	3171.77	28.0	24.5	7	8.97	9.64	10.33	176.8	2062.65	8197.5	432.6	6567.4	**3278.99**	**2189.14**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
28.00	29.50	28.75	1.50	27.00	19.0	8.97	169.22	5.66	24.5	24.5	1.0	436.27	3399.31	7	1.0	39.6	3211.37	29.5	24.5	7	9.01	9.64	10.33	176.8	2062.93	8673.6	458.0	7068.7	**3469.44**	**2356.24**
29.50	30.00	29.75	0.50	27.50	19.0	9.01	169.22	1.89	24.5	24.5	1.0	145.42	3544.73	7	1.0	13.2	3224.57	30.0	24.5	7	9.01	9.64	10.33	176.8	2062.93	8832.2	466.5	7235.8	**3532.89**	**2411.94**
30.00	31.00	30.50	1.00	28.50	19.0	9.01	169.22	3.77	24.5	24.5	1.0	290.85	3835.58	7	1.0	26.4	3250.97	31.0	19.5	30	9.08	6.13	5.12	176.8	1564.11	8650.7	483.5	7570.0	**3460.26**	**2523.35**
31.00	32.50	31.75	1.50	30.00	19.1	9.08	169.22	5.66	19.5	19.5	1.0	339.00	4174.57	30	1.0	169.7	3420.69	32.5	10.0	45	8.59	2.47	1.22	176.8	959.46	8554.7	508.9	8104.2	**3421.89**	**2701.40**
32.50	34.00	33.25	1.50	31.50	18.6	8.59	169.22	5.66	10.0	10.0	1.0	168.80	4343.37	45	1.0	254.6	3675.26	34.0	18.0	48	9.27	5.42	4.29	176.8	1599.26	9617.9	534.4	8553.0	**3847.16**	**2851.00**
34.00	35.00	34.50	1.00	32.50	19.3	9.27	169.22	3.77	18.0	18.0	1.0	207.36	4550.74	48	1.0	181.0	3856.29	35.0	18.0	48	9.27	5.42	4.29	176.8	1599.26	10006.3	551.3	8958.4	**4002.51**	**2986.12**
35.00	35.50	35.25	0.50	33.00	19.3	9.27	169.22	1.89	18.0	18.0	1.0	103.68	4654.42	48	1.0	90.5	3946.80	35.5	22.5	15	9.14	8.20	8.14	176.8	1843.61	10444.8	559.8	9161.1	**4177.93**	**3053.68**
35.50	37.00	36.25	1.50	34.50	19.1	9.14	169.22	5.66	22.5	22.5	1.0	396.53	5050.95	15	1.0	84.9	4031.66	37.0	22.5	15	9.52	8.20	8.14	176.8	1845.71	10928.3	585.3	9667.9	**4371.33**	**3222.63**
37.00	37.50	37.25	0.50	35.00	19.5	9.52	169.22	1.89	22.5	22.5	1.0	132.18	5183.12	15	1.0	28.3	4059.94	37.5	22.5	15	9.52	8.20	8.14	176.8	1845.71	11088.8	593.8	9836.8	**4435.51**	**3278.94**
37.50	38.50	38.00	1.00	36.00	19.5	9.52	169.22	3.77	22.5	22.5	1.0	264.35	5447.47	15	1.0	56.6	4116.51	38.5	22.5	15	9.41	8.20	8.14	176.8	1845.10	11409.1	610.7	10174.7	**4563.64**	**3391.57**
38.50	40.00	39.25	1.50	37.50	19.4	9.41	169.22	5.66	22.5	22.5	1.0	396.53	5844.00	15	1.0	84.9	4201.37	40.0	22.5	15	9.41	8.20	8.14	176.8	1845.10	11890.5	636.2	10681.5	**4756.19**	**3560.51**

APPENDIX-H

TABLE 3: COMPUTATION OF LATERAL PILE LOAD CAPACITY (Dia. 1000 mm)

Bore No.	Dia. of pile (m)	Cut-off length (m)	Scour depth (m)	Concrete Grade	Young's Modulus (kN/m^2)	Moment of Inertia (m^4)	Average SPT	Modulus of sub grade (k_1)	Stiffness Factor (T)	Cantilever length	L_1/T	L_f/T	Permissible deflection (m)	Depth of Fixity (m)	Allowable Load capacity of pile(kN)
P61	1.00	2.50	0.00	35	29580399	0.0491	22	3128	3.41	6.50	1.90	1.94	0.005	6.64	38
P62	1.00	2.50	0.00	35	29580399	0.0491	21	2984	3.45	0.00	0.00	2.23	0.005	7.69	192
P63	1.00	2.50	0.00	35	29580399	0.0491	12	1688	3.86	0.00	0.00	2.23	0.005	8.61	136
P64	1.00	2.50	0.00	35	29580399	0.0491	17	2408	3.60	0.50	0.14	2.21	0.005	7.95	144
P65	1.00	2.50	0.00	35	29580399	0.0491	17	2408	3.60	2.50	0.69	2.13	0.005	7.65	83
P66	1.00	2.50	0.00	35	29580399	0.0491	20	2840	3.48	5.50	1.58	1.99	0.005	6.94	45
P67	1.00	2.50	0.00	35	29580399	0.0491	18	2552	3.56	3.50	0.98	2.08	0.005	7.41	67
P68	1.00	2.50	0.00	35	29580399	0.0491	17	2408	3.60	0.50	0.14	2.21	0.005	7.95	144
P69	1.00	2.50	0.00	35	29580399	0.0491	14	1976	3.74	0.50	0.13	2.21	0.005	8.27	129
P70	1.00	2.50	0.00	35	29580399	0.0491	15	2120	3.69	6.50	1.76	1.97	0.005	7.26	33
P71	1.00	2.50	0.00	35	29580399	0.0491	21	2984	3.45	6.50	1.89	1.95	0.005	6.71	38
P72	1.00	2.50	0.00	35	29580399	0.0491	12	1688	3.86	7.50	1.94	1.94	0.005	7.49	26
P73	1.00	2.50	0.00	35	29580399	0.0491	19	2696	3.52	7.50	2.13	1.93	0.005	6.78	30
P74	1.00	2.50	0.00	35	29580399	0.0491	26	3704	3.30	13.00	3.94	1.88	0.005	6.21	12
P75	1.00	2.50	0.00	35	29580399	0.0491	14	1976	3.74	0.50	0.13	2.21	0.005	8.27	129
P76	1.00	2.50	0.00	35	29580399	0.0491	11	1544	3.93	0.00	0.00	2.23	0.005	8.77	129
P77	1.00	2.50	0.00	35	29580399	0.0491	18	2552	3.56	0.00	0.00	2.23	0.005	7.93	175
P78	1.00	2.50	0.00	35	29580399	0.0491	16	2264	3.64	3.50	0.96	2.09	0.005	7.60	64
P79	1.00	2.50	0.00	35	29580399	0.0491	10	1400	4.01	0.00	0.00	2.23	0.005	8.94	122
P80	1.00	2.50	0.00	35	29580399	0.0491	19	2696	3.52	2.50	0.71	2.12	0.005	7.47	88

APPENDIX-H

TABLE 4: COMPUTATION OF LATERAL PILE LOAD CAPACITY (Dia. 1200 mm)

Bore No.	Dia. of pile (m)	Cut-off length (m)	Scour depth (m)	Concrete Grade	Young's Modulus (kN/m^2)	Moment of Inertia (m^4)	Average SPT	Modulus of sub grade (k_1)	Stiffness Factor (T)	Cantilever length	L_1/T	L_f/T	Permissible deflection (m)	Depth of Fixity (m)	Allowable Load capacity of pile(kN)
P61	1.20	2.50	0.00	35	29580399	0.1018	22	3128	3.95	6.50	1.65	1.98	0.005	7.84	61
P62	1.20	2.50	0.00	35	29580399	0.1018	22	3128	3.95	0.00	0.00	2.23	0.005	8.81	264
P63	1.20	2.50	0.00	35	29580399	0.1018	13	1832	4.40	0.00	0.00	2.23	0.005	9.81	192
P64	1.20	2.50	0.00	35	29580399	0.1018	19	2696	4.07	0.50	0.12	2.21	0.005	9.00	211
P65	1.20	2.50	0.00	35	29580399	0.1018	17	2408	4.16	2.50	0.60	2.14	0.005	8.91	122
P66	1.20	2.50	0.00	35	29580399	0.1018	20	2840	4.03	5.50	1.37	2.03	0.005	8.16	71
P67	1.20	2.50	0.00	35	29580399	0.1018	17	2408	4.16	3.50	0.84	2.10	0.005	8.76	98
P68	1.20	2.50	0.00	35	29580399	0.1018	17	2408	4.16	0.50	0.12	2.21	0.005	9.21	197
P69	1.20	2.50	0.00	35	29580399	0.1018	14	1976	4.33	0.50	0.12	2.21	0.005	9.58	176
P70	1.20	2.50	0.00	35	29580399	0.1018	15	2120	4.27	6.50	1.52	2.00	0.005	8.55	53
P71	1.20	2.50	0.00	35	29580399	0.1018	22	3128	3.95	6.50	1.65	1.98	0.005	7.84	61
P72	1.20	2.50	0.00	35	29580399	0.1018	13	1832	4.40	7.50	1.71	1.97	0.005	8.68	43
P73	1.20	2.50	0.00	35	29580399	0.1018	20	2840	4.03	7.50	1.86	1.95	0.005	7.86	50
P74	1.20	2.50	0.00	35	29580399	0.1018	27	3848	3.79	13.00	3.43	1.89	0.005	7.18	22
P75	1.20	2.50	0.00	35	29580399	0.1018	15	2120	4.27	0.50	0.12	2.21	0.005	9.45	183
P76	1.20	2.50	0.00	35	29580399	0.1018	10	1400	4.64	0.00	0.00	2.23	0.005	10.35	163
P77	1.20	2.50	0.00	35	29580399	0.1018	18	2552	4.11	0.00	0.00	2.23	0.005	9.18	234
P78	1.20	2.50	0.00	35	29580399	0.1018	16	2264	4.21	3.50	0.83	2.11	0.005	8.87	95
P79	1.20	2.50	0.00	35	29580399	0.1018	11	1544	4.55	0.00	0.00	2.23	0.005	10.15	173
P80	1.20	2.50	0.00	35	29580399	0.1018	20	2840	4.03	2.50	0.62	2.14	0.005	8.61	132

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60cs}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
P61	0.50	SM	42	5.00	10.60	5.00	5.60	1.00	0.294	1.70	8.50	5.00	1.20	15.20	0.16	1.00	0.193	0.657	Liquefiable
	1.00	CI	67	5.00	21.20	10.00	11.20	0.99	0.293	1.70	8.50	5.00	1.20	15.20	0.16	1.00	-	-	Non-liquefiable
	2.00	CI	67	5.00	42.40	20.00	22.40	0.98	0.291	1.70	8.50	5.00	1.20	15.20	0.16	1.00	-	-	Non-liquefiable
	3.00	CL	76	6.00	63.60	30.00	33.60	0.98	0.289	1.70	10.20	5.00	1.20	17.24	0.18	1.00	-	-	Non-liquefiable
	5.00	SM	37	15.00	106.00	50.00	56.00	0.96	0.284	1.34	20.04	5.00	1.20	29.05	0.41	1.00	0.492	1.734	Non-liquefiable
	6.00	SM	37	21.00	127.20	60.00	67.20	0.95	0.282	1.22	25.62	5.00	1.20	35.74	0.52	1.00	0.620	2.201	Non-liquefiable
	8.00	SM	16	15.00	148.00	80.00	68.00	0.94	0.319	1.21	18.19	2.77	1.05	21.94	0.24	1.00	0.288	0.902	Liquefiable
	9.00	CL	90	25.00	166.50	90.00	76.50	0.93	0.316	1.14	28.58	5.00	1.20	39.30	0.52	1.00	-	-	Non-liquefiable
	10.00	CL-ML	94	25.00	201.00	100.00	101.00	0.91	0.282	1.00	24.88	5.00	1.20	34.85	0.52	1.00	-	-	Non-liquefiable
	11.00	CL-ML	94	24.00	221.10	110.00	111.10	0.88	0.273	0.95	22.77	5.00	1.20	32.32	0.52	1.00	-	-	Non-liquefiable
	12.00	CL-ML	94	28.00	241.20	120.00	121.20	0.85	0.265	0.91	25.43	5.00	1.20	35.52	0.52	1.00	-	-	Non-liquefiable
	13.00	CL	79	28.00	265.20	130.00	135.20	0.83	0.253	0.86	24.08	5.00	1.20	33.90	0.52	1.00	-	-	Non-liquefiable
	14.50	CL	79	32.00	295.80	145.00	150.80	0.79	0.241	0.81	26.06	5.00	1.20	36.27	0.52	1.00	-	-	Non-liquefiable
	17.50	CL	81	25.00	367.50	175.00	192.50	0.71	0.210	0.72	18.02	5.00	1.20	26.62	0.33	0.81	-	-	Non-liquefiable
	19.00	CL-ML	74	25.00	400.90	190.00	210.90	0.67	0.198	0.69	17.21	5.00	1.20	25.66	0.31	0.79	-	-	Non-liquefiable
	20.50	CL-ML	74	52.00	432.55	205.00	227.55	0.63	0.186	0.66	34.47	5.00	1.20	46.37	0.52	0.76	-	-	Non-liquefiable
	22.00	CL	70	52.00	455.40	220.00	235.40	0.59	0.177	0.65	33.89	5.00	1.20	45.67	0.52	0.77	-	-	Non-liquefiable
	23.50	CL	70	58.00	486.45	235.00	251.45	0.56	0.169	0.63	36.58	5.00	1.20	48.89	0.52	0.75	-	-	Non-liquefiable

APPENDIX-H

TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60cs}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	25.00	ML	89	58.00	505.00	250.00	255.00	0.56	0.173	0.63	36.32	5.00	1.20	48.59	0.52	0.79	0.490	2.833	Non-liquefiable
	26.50	ML	89	50.00	535.30	265.00	270.30	0.56	0.173	0.61	30.41	5.00	1.20	41.49	0.52	0.78	0.484	2.797	Non-liquefiable
	28.00	MI	93	50.00	588.00	280.00	308.00	0.56	0.167	0.57	28.49	5.00	1.20	39.19	0.52	0.79	-	-	Non-liquefiable
	29.50	ML	54	68.00	619.50	295.00	324.50	0.56	0.167	0.56	37.75	5.00	1.20	50.30	0.52	0.78	0.484	2.901	Non-liquefiable
	31.00	CL	73	74.00	651.00	310.00	341.00	0.56	0.167	0.54	40.07	5.00	1.20	53.09	0.52	0.77	-	-	Non-liquefiable
	32.50	CL	73	61.00	682.50	325.00	357.50	0.56	0.167	0.53	32.26	5.00	1.20	43.71	0.52	0.76	-	-	Non-liquefiable
	34.00	CL	73	85.00	714.00	340.00	374.00	0.56	0.167	0.52	43.95	5.00	1.20	57.74	0.52	0.75	-	-	Non-liquefiable
	35.50	CL	73	64.00	745.50	355.00	390.50	0.56	0.167	0.51	32.39	5.00	1.20	43.86	0.52	0.74	-	-	Non-liquefiable
	37.00	CL	84	83.00	777.00	370.00	407.00	0.56	0.167	0.50	41.14	5.00	1.20	54.37	0.52	0.74	-	-	Non-liquefiable
	38.50	CL	85	89.00	808.50	385.00	423.50	0.56	0.167	0.49	43.25	5.00	1.20	56.90	0.52	0.73	-	-	Non-liquefiable
	40.00	CL	85	101.00	840.00	400.00	440.00	0.56	0.167	0.48	48.15	5.00	1.20	62.78	0.52	0.72	-	-	Non-liquefiable
P62	0.50	SM	39	5.00	9.90	5.00	4.90	1.00	0.314	1.70	8.50	5.00	1.20	15.20	0.16	1.00	0.193	0.616	Liquefiable
	1.00	CI	86	5.00	19.80	10.00	9.80	0.99	0.313	1.70	8.50	5.00	1.20	15.20	0.16	1.00	-	-	Non-liquefiable
	2.00	CL	65	5.00	39.60	20.00	19.60	0.98	0.310	1.70	8.50	5.00	1.20	15.20	0.16	1.00	-	-	Non-liquefiable
	3.00	CL	70	16.00	59.40	30.00	29.40	0.98	0.308	1.70	27.20	5.00	1.20	37.64	0.52	1.00	-	-	Non-liquefiable
	4.00	SM	31	25.00	79.20	40.00	39.20	0.97	0.306	1.60	39.93	4.77	1.16	51.19	0.52	1.00	0.620	2.030	Non-liquefiable
	6.00	SM	29	30.00	114.00	60.00	54.00	0.95	0.314	1.36	40.82	4.64	1.15	51.43	0.52	1.00	0.620	1.974	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60cs}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	7.00	SM	29	36.00	133.00	70.00	63.00	0.95	0.312	1.26	45.36	4.64	1.15	56.62	0.52	1.00	0.620	1.990	Non-liquefiable
	9.00	ML	85	19.00	171.00	90.00	81.00	0.93	0.307	1.11	21.11	5.00	1.20	30.33	0.49	1.00	0.588	1.917	Non-liquefiable
	10.00	ML	85	25.00	190.00	100.00	90.00	0.91	0.299	1.05	26.35	5.00	1.20	36.62	0.52	1.00	0.620	2.076	Non-liquefiable
	11.00	CL-ML	77	25.00	199.10	110.00	89.10	0.88	0.307	1.06	26.49	5.00	1.20	36.78	0.52	1.00	-	-	Non-liquefiable
	12.50	CL-ML	77	28.00	226.25	125.00	101.25	0.84	0.293	0.99	27.83	5.00	1.20	38.39	0.52	1.00	-	-	Non-liquefiable
	14.00	CL	70	28.00	271.60	140.00	131.60	0.80	0.258	0.87	24.41	5.00	1.20	34.29	0.52	1.00	-	-	Non-liquefiable
	15.50	CL-ML	72	33.00	300.70	155.00	145.70	0.76	0.245	0.83	27.34	5.00	1.20	37.81	0.52	0.96	-	-	Non-liquefiable
	17.00	CL	61	33.00	357.00	170.00	187.00	0.72	0.214	0.73	24.13	5.00	1.20	33.96	0.52	0.85	-	-	Non-liquefiable
	18.50	CL	61	36.00	388.50	185.00	203.50	0.68	0.203	0.70	25.24	5.00	1.20	35.28	0.52	0.81	-	-	Non-liquefiable
	21.50	CL	69	39.00	447.20	215.00	232.20	0.60	0.180	0.66	25.59	5.00	1.20	35.71	0.52	0.75	-	-	Non-liquefiable
	24.50	CL	72	62.00	453.25	245.00	208.25	0.56	0.190	0.69	42.96	5.00	1.20	56.56	0.52	0.94	-	-	Non-liquefiable
	26.00	ML	72	62.00	499.20	260.00	239.20	0.56	0.182	0.65	40.09	5.00	1.20	53.11	0.52	0.86	0.533	2.926	Non-liquefiable
	27.50	CL	81	50.00	528.00	275.00	253.00	0.56	0.182	0.63	31.43	5.00	1.20	42.72	0.52	0.86	-	-	Non-liquefiable
	30.50	SM	49	56.00	585.60	305.00	280.60	0.56	0.182	0.60	33.43	5.00	1.20	45.12	0.52	0.84	0.521	2.858	Non-liquefiable
	33.50	ML	52	62.00	643.20	335.00	308.20	0.56	0.182	0.57	35.32	5.00	1.20	47.38	0.52	0.83	0.515	2.824	Non-liquefiable
	36.50	CL-ML	69	69.00	700.80	365.00	335.80	0.56	0.182	0.55	37.65	5.00	1.20	50.18	0.52	0.82	-	-	Non-liquefiable
	38.00	ML	54	69.00	729.60	380.00	349.60	0.56	0.182	0.53	36.90	5.00	1.20	49.28	0.52	0.82	0.509	2.790	Non-liquefiable
	40.00	CL	83	62.00	768.00	400.00	368.00	0.56	0.182	0.52	32.32	5.00	1.20	43.78	0.52	0.81	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60cs}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
P63	0.50	ML	78	3.00	8.90	5.00	3.90	1.00	0.355	1.70	5.10	5.00	1.20	11.12	0.12	1.00	0.147	0.41	Liquefiable
	1.00	CI	68	3.00	17.80	10.00	7.80	0.99	0.353	1.70	5.10	5.00	1.20	11.12	0.12	1.00	-	-	Non-liquefiable
	2.00	CI	68	3.00	35.60	20.00	15.60	0.98	0.351	1.70	5.10	5.00	1.20	11.12	0.12	1.00	-	-	Non-liquefiable
	3.00	CI	68	6.00	53.40	30.00	23.40	0.98	0.348	1.70	10.20	5.00	1.20	17.24	0.18	1.00	-	-	Non-liquefiable
	5.00	CI	64	12.00	91.00	50.00	41.00	0.96	0.333	1.56	18.74	5.00	1.20	27.49	0.35	1.00	-	-	Non-liquefiable
	6.00	SM	48	18.00	109.20	60.00	49.20	0.95	0.330	1.43	25.66	5.00	1.20	35.79	0.52	1.00	0.620	1.88	Non-liquefiable
	8.00	SP-ML	11	26.00	145.60	80.00	65.60	0.94	0.325	1.23	32.10	1.21	1.03	34.16	0.52	1.00	0.620	1.91	Non-liquefiable
	9.00	SP-ML	11	31.00	163.80	90.00	73.80	0.93	0.322	1.16	36.09	1.21	1.03	38.25	0.52	1.00	0.620	1.92	Non-liquefiable
	10.00	CL-ML	85	31.00	192.00	100.00	92.00	0.91	0.295	1.04	32.32	5.00	1.20	43.78	0.52	1.00	-	-	Non-liquefiable
	11.00	CL-ML	85	37.00	211.20	110.00	101.20	0.88	0.287	0.99	36.78	5.00	1.20	49.14	0.52	1.00	-	-	Non-liquefiable
	12.00	CL-ML	85	41.00	230.40	120.00	110.40	0.85	0.278	0.95	39.02	5.00	1.20	51.83	0.52	1.00	-	-	Non-liquefiable
	13.00	CL	78	41.00	248.30	130.00	118.30	0.83	0.271	0.92	37.70	5.00	1.20	50.23	0.52	1.00	-	-	Non-liquefiable
	14.50	CL	78	32.00	276.95	145.00	131.95	0.79	0.258	0.87	27.86	5.00	1.20	38.43	0.52	1.00	-	-	Non-liquefiable
	17.50	CL	83	44.00	357.00	175.00	182.00	0.71	0.216	0.74	32.61	5.00	1.20	44.14	0.52	0.86	-	-	Non-liquefiable
	19.00	ML	56	44.00	355.30	190.00	165.30	0.67	0.224	0.78	34.22	5.00	1.20	46.07	0.52	0.77	0.478	2.14	Non-liquefiable
	20.50	CL	85	49.00	383.35	205.00	178.35	0.63	0.210	0.75	36.69	5.00	1.20	49.03	0.52	0.75	-	-	Non-liquefiable
	23.50	CL	83	42.00	495.85	235.00	260.85	0.56	0.166	0.62	26.00	5.00	1.20	36.21	0.52	0.78	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60cs}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	26.50	CL	80	46.00	553.85	265.00	288.85	0.56	0.167	0.59	27.07	5.00	1.20	37.48	0.52	0.71	-	-	Non-liquefiable
	28.00	ML	55	46.00	498.40	280.00	218.40	0.56	0.199	0.68	31.13	5.00	1.20	42.35	0.52	0.87	0.540	2.71	Non-liquefiable
	29.50	MI	85	49.00	525.10	295.00	230.10	0.56	0.199	0.66	32.30	5.00	1.20	43.76	0.52	0.87	-	-	Non-liquefiable
	31.00	MI	85	52.00	551.80	310.00	241.80	0.56	0.199	0.64	33.44	5.00	1.20	45.13	0.52	0.86	-	-	Non-liquefiable
	32.50	MI	85	57.00	578.50	325.00	253.50	0.56	0.199	0.63	35.80	5.00	1.20	47.96	0.52	0.86	-	-	Non-liquefiable
	34.00	CL-ML	63	57.00	605.20	340.00	265.20	0.56	0.199	0.61	35.00	5.00	1.20	47.00	0.52	0.86	-	-	Non-liquefiable
	35.50	CL-ML	62	58.00	631.90	355.00	276.90	0.56	0.199	0.60	34.86	5.00	1.20	46.83	0.52	0.85	-	-	Non-liquefiable
	37.00	MI	89	58.00	658.60	370.00	288.60	0.56	0.199	0.59	34.14	5.00	1.20	45.97	0.52	0.85	-	-	Non-liquefiable
	38.50	MI	89	60.00	685.30	385.00	300.30	0.56	0.199	0.58	34.62	5.00	1.20	46.55	0.52	0.85	-	-	Non-liquefiable
	40.00	CL	83	65.00	712.00	400.00	312.00	0.56	0.199	0.57	36.80	5.00	1.20	49.16	0.52	0.84	-	-	Non-liquefiable
P64	0.50	ML	55	4.00	10.50	5.00	5.50	1.00	0.297	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.571	Liquefiable
	1.00	CL	63	4.00	21.00	10.00	11.00	0.99	0.296	1.70	6.80	5.00	1.20	13.16	0.14	1.00	-	-	Non-liquefiable
	2.00	ML	54	4.00	42.00	20.00	22.00	0.98	0.293	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.578	Liquefiable
	3.00	ML	56	13.00	63.00	30.00	33.00	0.98	0.291	1.70	22.10	5.00	1.20	31.52	0.52	1.00	0.620	2.131	Non-liquefiable
	4.00	SM	31	20.00	84.00	40.00	44.00	0.97	0.289	1.51	30.15	4.77	1.16	39.82	0.52	1.00	0.620	2.148	Non-liquefiable
	6.00	SM	31	13.00	126.00	60.00	66.00	0.95	0.284	1.23	16.00	4.77	1.16	23.37	0.26	1.00	0.314	1.103	Non-liquefiable
	7.00	SM	30	15.00	147.00	70.00	77.00	0.95	0.282	1.14	17.09	4.71	1.15	24.44	0.28	1.00	0.335	1.190	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60cs}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	9.00	CL	84	24.00	172.80	90.00	82.80	0.93	0.303	1.10	26.38	5.00	1.20	36.65	0.52	1.00	-	-	Non-liquefiable
	10.00	CL	84	31.00	192.00	100.00	92.00	0.91	0.295	1.04	32.32	5.00	1.20	43.78	0.52	1.00	-	-	Non-liquefiable
	12.50	CL	80	27.00	245.00	125.00	120.00	0.84	0.268	0.91	24.65	5.00	1.20	34.58	0.52	1.00	-	-	Non-liquefiable
	15.50	CL	82	32.00	306.90	155.00	151.90	0.76	0.240	0.81	25.96	5.00	1.20	36.16	0.52	0.88	-	-	Non-liquefiable
	17.00	SM	45	32.00	307.70	170.00	137.70	0.72	0.251	0.85	27.27	5.00	1.20	37.72	0.52	0.90	0.558	2.224	Non-liquefiable
	18.50	CL-ML	61	29.00	334.85	185.00	149.85	0.68	0.237	0.82	23.69	5.00	1.20	33.43	0.52	0.90	-	-	Non-liquefiable
	20.00	CL	83	29.00	396.00	200.00	196.00	0.64	0.202	0.71	20.71	5.00	1.20	29.86	0.46	0.82	-	-	Non-liquefiable
	21.50	CL	83	33.00	425.70	215.00	210.70	0.60	0.189	0.69	22.73	5.00	1.20	32.28	0.52	0.81	-	-	Non-liquefiable
	24.50	CL	80	66.00	470.40	245.00	225.40	0.56	0.182	0.67	43.96	5.00	1.20	57.75	0.52	0.82	-	-	Non-liquefiable
	26.00	CL-ML	61	66.00	499.20	260.00	239.20	0.56	0.182	0.65	42.67	5.00	1.20	56.21	0.52	0.81	-	-	Non-liquefiable
	27.50	CL-ML	85	56.00	528.00	275.00	253.00	0.56	0.182	0.63	35.21	5.00	1.20	47.25	0.52	0.80	-	-	Non-liquefiable
	29.00	SM	45	56.00	568.40	290.00	278.40	0.56	0.178	0.60	33.56	5.00	1.20	45.27	0.52	0.71	0.440	2.469	Non-liquefiable
	30.50	SM	45	59.00	597.80	305.00	292.80	0.56	0.178	0.58	34.48	5.00	1.20	46.38	0.52	0.70	0.434	2.435	Non-liquefiable
	32.00	CL-ML	81	59.00	627.20	320.00	307.20	0.56	0.178	0.57	33.66	5.00	1.20	45.39	0.52	0.69	-	-	Non-liquefiable
	33.50	CL	86	63.00	656.60	335.00	321.60	0.56	0.178	0.56	35.13	5.00	1.20	47.16	0.52	0.68	-	-	Non-liquefiable
	36.50	CL	86	67.00	715.40	365.00	350.40	0.56	0.178	0.53	35.79	5.00	1.20	47.95	0.52	0.66	-	-	Non-liquefiable
	40.00	CL-ML	79	83.00	784.00	400.00	384.00	0.56	0.178	0.51	42.36	5.00	1.20	55.83	0.52	0.64	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60cs}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
P65	0.50	ML	59	5.00	10.05	5.00	5.05	1.00	0.309	1.70	8.50	5.00	1.20	15.20	0.16	1.00	0.193	0.625	Liquefiable
	1.00	CL	52	5.00	20.10	10.00	10.10	0.99	0.308	1.70	8.50	5.00	1.20	15.20	0.16	1.00	-	-	Non-liquefiable
	2.00	SM	42	5.00	40.20	20.00	20.20	0.98	0.306	1.70	8.50	5.00	1.20	15.20	0.16	1.00	0.193	0.632	Liquefiable
	3.00	CL	54	10.00	60.30	30.00	30.30	0.98	0.303	1.70	17.00	5.00	1.20	25.40	0.30	1.00	-	-	Non-liquefiable
	4.00	SM	18	10.00	76.40	40.00	36.40	0.97	0.317	1.66	16.57	3.23	1.07	20.91	0.23	1.00	0.271	0.853	Liquefiable
	5.00	SM	18	15.00	95.50	50.00	45.50	0.96	0.315	1.48	22.24	3.23	1.07	26.95	0.34	1.00	0.402	1.276	Non-liquefiable
	6.00	SM	18	20.00	114.60	60.00	54.60	0.95	0.312	1.35	27.07	3.23	1.07	32.10	0.52	1.00	0.620	1.985	Non-liquefiable
	8.00	SM	20	25.00	160.00	80.00	80.00	0.94	0.293	1.12	27.95	3.61	1.08	33.79	0.52	1.00	0.620	2.118	Non-liquefiable
	9.00	ML	77	16.00	180.00	90.00	90.00	0.93	0.291	1.05	16.87	5.00	1.20	25.24	0.30	1.00	0.354	1.218	Non-liquefiable
	11.00	ML	87	16.00	215.60	110.00	105.60	0.88	0.280	0.97	15.57	5.00	1.20	23.68	0.27	1.00	0.320	1.140	Non-liquefiable
	12.00	CL	87	17.00	235.20	120.00	115.20	0.85	0.272	0.93	15.84	5.00	1.20	24.01	0.27	1.00	-	-	Non-liquefiable
	14.50	CL	84	30.00	291.45	145.00	146.45	0.79	0.244	0.83	24.79	5.00	1.20	34.75	0.52	1.00	-	-	Non-liquefiable
	17.50	CL	84	23.00	351.75	175.00	176.75	0.71	0.219	0.75	17.30	5.00	1.20	25.76	0.31	0.86	-	-	Non-liquefiable
	20.50	CL	87	27.00	412.05	205.00	207.05	0.63	0.195	0.69	18.76	5.00	1.20	27.52	0.35	0.81	-	-	Non-liquefiable
	23.50	CL	72	52.00	467.65	235.00	232.65	0.56	0.176	0.66	34.09	5.00	1.20	45.91	0.52	0.77	-	-	Non-liquefiable
	26.50	ML	73	41.00	556.50	265.00	291.50	0.56	0.167	0.59	24.01	5.00	1.20	33.82	0.52	0.74	0.459	2.752	Non-liquefiable
	28.00	CL	72	41.00	582.40	280.00	302.40	0.56	0.168	0.58	23.58	5.00	1.20	33.29	0.52	0.69	-	-	Non-liquefiable
	29.50	CL	72	22.00	613.60	295.00	318.60	0.56	0.168	0.56	12.33	5.00	1.20	19.79	0.21	0.67	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60cs}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	32.50	CL	54	50.00	682.50	325.00	357.50	0.56	0.167	0.53	26.44	5.00	1.20	36.73	0.52	0.62	-	-	Non-liquefiable
	35.50	CL	79	59.00	745.50	355.00	390.50	0.56	0.167	0.51	29.86	5.00	1.20	40.83	0.52	0.60	-	-	Non-liquefiable
	38.50	ML	69	44.00	808.50	385.00	423.50	0.56	0.167	0.49	21.38	5.00	1.20	30.66	0.52	0.57	0.354	2.120	Non-liquefiable
	40.00	CL-ML	77	56.00	840.00	400.00	440.00	0.56	0.167	0.48	26.70	5.00	1.20	37.04	0.52	0.56	-	-	Non-liquefiable
P66	0.50	ML	53	6.00	9.65	5.00	4.65	0.56	0.181	1.70	10.20	5.00	1.20	17.24	0.18	1.00	0.219	1.207	Non-liquefiable
	1.00	SM	36	6.00	19.30	10.00	9.30	0.56	0.181	1.70	10.20	5.00	1.20	17.24	0.18	1.00	0.219	1.207	Non-liquefiable
	2.00	ML	52	6.00	38.60	20.00	18.60	0.56	0.181	1.70	10.20	5.00	1.20	17.24	0.18	1.00	0.219	1.207	Non-liquefiable
	3.00	ML	52	4.00	57.90	30.00	27.90	0.56	0.181	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.935	Liquefiable
	4.00	CL	53	4.00	81.20	40.00	41.20	0.56	0.172	1.56	6.23	5.00	1.20	12.48	0.14	1.00	-	-	Non-liquefiable
	5.00	SM	21	14.00	101.50	50.00	51.50	0.56	0.172	1.39	19.51	3.78	1.09	24.97	0.29	1.00	0.347	2.018	Non-liquefiable
	6.00	SM	21	8.00	121.80	60.00	61.80	0.56	0.172	1.27	10.18	3.78	1.09	14.83	0.16	1.00	0.189	1.097	Non-liquefiable
	7.00	SP-ML	9	8.00	142.10	70.00	72.10	0.56	0.172	1.18	9.42	0.56	1.02	10.14	0.11	1.00	0.136	0.792	Liquefiable
	8.00	SM	15	46.00	162.40	80.00	82.40	0.56	0.172	1.10	50.68	2.50	1.05	55.61	0.52	1.00	0.620	3.603	Non-liquefiable
	9.00	CL	74	15.00	182.70	90.00	92.70	0.56	0.172	1.04	15.58	5.00	1.20	23.70	0.27	1.00	-	-	Non-liquefiable
	10.00	ML	80	15.00	203.00	100.00	103.00	0.56	0.172	0.99	14.78	5.00	1.20	22.74	0.25	1.00	0.302	1.752	Non-liquefiable
	11.00	ML	80	23.00	223.30	110.00	113.30	0.56	0.172	0.94	21.61	5.00	1.20	30.93	0.52	1.00	0.620	3.603	Non-liquefiable
	12.00	CL	90	22.00	243.60	120.00	123.60	0.56	0.172	0.90	19.79	5.00	1.20	28.75	0.40	1.00	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60cs}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	14.50	CL	90	14.00	291.45	145.00	146.45	0.56	0.174	0.83	11.57	5.00	1.20	18.88	0.20	1.00	-	-	Non-liquefiable
	17.50	CL	65	57.00	378.00	175.00	203.00	0.56	0.163	0.70	40.01	5.00	1.20	53.01	0.52	0.82	-	-	Non-liquefiable
	19.00	CL-ML	52	57.00	406.60	190.00	216.60	0.56	0.164	0.68	38.73	5.00	1.20	51.48	0.52	0.79	-	-	Non-liquefiable
	20.50	CL-ML	52	64.00	438.70	205.00	233.70	0.56	0.164	0.65	41.86	5.00	1.20	55.24	0.52	0.76	-	-	Non-liquefiable
	22.00	ML	55	58.00	470.80	220.00	250.80	0.56	0.164	0.63	36.62	5.00	1.20	48.95	0.52	0.73	0.453	2.761	Non-liquefiable
	23.50	CL	85	63.00	502.90	235.00	267.90	0.56	0.164	0.61	38.49	5.00	1.20	51.19	0.52	0.71	-	-	Non-liquefiable
	26.50	CL	88	52.00	535.30	265.00	270.30	0.56	0.173	0.61	31.63	5.00	1.20	42.95	0.52	0.69	-	-	Non-liquefiable
	29.50	CL	81	49.00	595.90	295.00	300.90	0.56	0.173	0.58	28.25	5.00	1.20	38.90	0.52	0.66	-	-	Non-liquefiable
	32.50	CL-ML	68	59.00	637.00	325.00	312.00	0.56	0.178	0.57	33.40	5.00	1.20	45.08	0.52	0.70	-	-	Non-liquefiable
	35.50	CL-ML	58	57.00	695.80	355.00	340.80	0.56	0.178	0.54	30.88	5.00	1.20	42.05	0.52	0.69	-	-	Non-liquefiable
	38.50	CL	78	60.00	754.60	385.00	369.60	0.56	0.178	0.52	31.21	5.00	1.20	42.45	0.52	0.67	-	-	Non-liquefiable
	40.00	CL	78	73.00	784.00	400.00	384.00	0.56	0.178	0.51	37.25	5.00	1.20	49.70	0.52	0.66	-	-	Non-liquefiable
P67	0.50	ML	54	8.00	10.05	5.00	5.05	1.00	0.309	1.70	13.60	5.00	1.20	21.32	0.23	1.00	0.277	0.897	Liquefiable
	1.00	CL	63	8.00	20.10	10.00	10.10	0.99	0.308	1.70	13.60	5.00	1.20	21.32	0.23	1.00	-	-	Non-liquefiable
	2.00	CL-ML	56	8.00	40.20	20.00	20.20	0.98	0.306	1.70	13.60	5.00	1.20	21.32	0.23	1.00	-	-	Non-liquefiable
	3.00	ML	69	5.00	60.30	30.00	30.30	0.98	0.303	1.70	8.50	5.00	1.20	15.20	0.16	1.00	0.193	0.637	Liquefiable
	4.00	SM	18	7.00	80.40	40.00	40.40	0.97	0.301	1.57	11.01	3.23	1.07	14.98	0.16	1.00	0.191	0.633	Liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60cs}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	6.00	SM	18	20.00	120.60	60.00	60.60	0.95	0.296	1.28	25.69	3.23	1.07	30.63	0.52	1.00	0.619	2.090	Non-liquefiable
	7.00	SM	15	22.00	140.70	70.00	70.70	0.95	0.294	1.19	26.16	2.50	1.05	29.92	0.46	1.00	0.551	1.876	Non-liquefiable
	9.00	CL	84	14.00	180.90	90.00	90.90	0.93	0.289	1.05	14.68	5.00	1.20	22.62	0.25	1.00	-	-	Non-liquefiable
	10.00	CL	84	21.00	201.00	100.00	101.00	0.91	0.282	1.00	20.90	5.00	1.20	30.07	0.47	1.00	-	-	Non-liquefiable
	11.00	CL-ML	75	21.00	220.00	110.00	110.00	0.88	0.275	0.95	20.02	5.00	1.20	29.03	0.41	1.00	-	-	Non-liquefiable
	12.50	CL-ML	75	18.00	250.00	125.00	125.00	0.84	0.262	0.89	16.10	5.00	1.20	24.32	0.28	1.00	-	-	Non-liquefiable
	14.00	CL	82	18.00	289.80	140.00	149.80	0.80	0.241	0.82	14.71	5.00	1.20	22.65	0.25	1.00	-	-	Non-liquefiable
	15.50	CL	82	25.00	320.85	155.00	165.85	0.76	0.229	0.78	19.41	5.00	1.20	28.30	0.38	0.87	-	-	Non-liquefiable
	18.50	ML	55	27.00	381.10	185.00	196.10	0.68	0.206	0.71	19.28	5.00	1.20	28.14	0.37	0.78	0.348	1.690	Non-liquefiable
	20.00	SM	15	27.00	412.00	200.00	212.00	0.64	0.194	0.69	18.54	2.50	1.05	21.93	0.24	0.75	0.216	1.111	Non-liquefiable
	21.50	CL	84	36.00	442.90	215.00	227.90	0.60	0.182	0.66	23.85	5.00	1.20	33.62	0.52	0.73	-	-	Non-liquefiable
	24.50	CL	81	51.00	509.60	245.00	264.60	0.56	0.168	0.61	31.35	5.00	1.20	42.62	0.52	0.70	-	-	Non-liquefiable
	27.50	ML	96	57.00	572.00	275.00	297.00	0.56	0.168	0.58	33.07	5.00	1.20	44.69	0.52	0.66	0.409	2.433	Non-liquefiable
	29.00	CL	66	57.00	614.80	290.00	324.80	0.56	0.165	0.55	31.63	5.00	1.20	42.95	0.52	0.64	-	-	Non-liquefiable
	30.50	CL-ML	79	65.00	646.60	305.00	341.60	0.56	0.165	0.54	35.17	5.00	1.20	47.20	0.52	0.63	-	-	Non-liquefiable
	32.00	SM	25	65.00	678.40	320.00	358.40	0.56	0.165	0.53	34.33	4.29	1.12	42.57	0.52	0.62	0.385	2.326	Non-liquefiable
	33.50	SM	25	73.00	710.20	335.00	375.20	0.56	0.165	0.52	37.69	4.29	1.12	46.31	0.52	0.60	0.372	2.251	Non-liquefiable
	35.00	CL	63	79.00	742.00	350.00	392.00	0.56	0.165	0.51	39.90	5.00	1.20	52.88	0.52	0.59	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60cs}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	36.50	SM	32	86.00	773.80	365.00	408.80	0.56	0.165	0.49	42.53	4.83	1.17	54.64	0.52	0.58	0.360	2.176	Non-liquefiable
	38.00	SM	32	88.00	805.60	380.00	425.60	0.56	0.165	0.48	42.66	4.83	1.17	54.78	0.52	0.57	0.354	2.138	Non-liquefiable
	40.00	SM	32	92.00	848.00	400.00	448.00	0.56	0.165	0.47	43.47	4.83	1.17	55.73	0.52	0.55	0.341	2.063	Non-liquefiable
P68	0.50	SM	39	5	9.80	5.00	4.80	1.00	0.317	1.70	8.50	5.00	1.20	15.20	0.16	1.00	0.193	0.609	Liquefiable
	1.00	CL-ML	52	5	19.60	10.00	9.60	0.99	0.316	1.70	8.50	5.00	1.20	15.20	0.16	1.00	-	-	Non-liquefiable
	2.00	SM-SC	47	5	39.20	20.00	19.20	0.98	0.314	1.70	8.50	5.00	1.20	15.20	0.16	1.00	0.193	0.616	Liquefiable
	3.00	SM	39	12	58.80	30.00	28.80	0.98	0.311	1.70	20.40	5.00	1.20	29.48	0.44	1.00	0.519	1.667	Non-liquefiable
	4.00	SM	39	16	78.40	40.00	38.40	0.97	0.309	1.61	25.82	5.00	1.20	35.98	0.52	1.00	0.620	2.009	Non-liquefiable
	6.00	SM	24	20	117.60	60.00	57.60	0.95	0.304	1.32	26.35	4.18	1.11	33.37	0.52	1.00	0.620	2.041	Non-liquefiable
	7.00	SM	24	18	137.20	70.00	67.20	0.95	0.301	1.22	21.96	4.18	1.11	28.50	0.39	1.00	0.463	1.537	Non-liquefiable
	9.00	SM	24	20	176.40	90.00	86.40	0.93	0.297	1.08	21.52	4.18	1.11	28.01	0.37	1.00	0.441	1.488	Non-liquefiable
	10.00	SM	24	16	193.00	100.00	93.00	0.91	0.294	1.04	16.59	4.18	1.11	22.56	0.25	1.00	0.298	1.016	Non-liquefiable
	11.00	CL	84	16	212.30	110.00	102.30	0.88	0.285	0.99	15.82	5.00	1.20	23.98	0.27	1.00	-	-	Non-liquefiable
	12.50	CL	84	27	252.50	125.00	127.50	0.84	0.260	0.89	23.91	5.00	1.20	33.69	0.52	1.00	-	-	Non-liquefiable
	15.50	CL	94	28	313.10	155.00	158.10	0.76	0.235	0.80	22.27	5.00	1.20	31.72	0.52	0.86	-	-	Non-liquefiable
	18.50	CL	84	37	377.40	185.00	192.40	0.68	0.208	0.72	26.67	5.00	1.20	37.01	0.52	0.80	-	-	Non-liquefiable
	21.50	CL	91	32	434.30	215.00	219.30	0.60	0.185	0.68	21.61	5.00	1.20	30.93	0.52	0.78	-	-	Non-liquefiable

APPENDIX-H

TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60cs}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	24.50	CL	89	39	497.35	245.00	252.35	0.56	0.172	0.63	24.55	5.00	1.20	34.46	0.52	0.76	-	-	Non-liquefiable
	27.50	CL	91	52	566.50	275.00	291.50	0.56	0.170	0.59	30.46	5.00	1.20	41.55	0.52	0.77	-	-	Non-liquefiable
	29.00	CL	92	54	588.70	290.00	298.70	0.56	0.172	0.58	31.24	5.00	1.20	42.49	0.52	0.76	-	-	Non-liquefiable
	30.50	CL	92	61	619.15	305.00	314.15	0.56	0.172	0.56	34.42	5.00	1.20	46.30	0.52	0.76	-	-	Non-liquefiable
	32.00	CL	92	67	649.60	320.00	329.60	0.56	0.172	0.55	36.90	5.00	1.20	49.29	0.52	0.75	-	-	Non-liquefiable
	33.50	SM-SC	43	72	680.05	335.00	345.05	0.56	0.172	0.54	38.76	5.00	1.20	51.51	0.52	0.74	0.458	2.660	Non-liquefiable
	35.00	SM-SC	43	77	710.50	350.00	360.50	0.56	0.172	0.53	40.55	5.00	1.20	53.67	0.52	0.73	0.453	2.632	Non-liquefiable
	36.50	CL	77	52	740.95	365.00	375.95	0.56	0.172	0.52	26.82	5.00	1.20	37.18	0.52	0.72	-	-	Non-liquefiable
	38.00	CL	77	64	771.40	380.00	391.40	0.56	0.172	0.51	32.35	5.00	1.20	43.82	0.52	0.72	-	-	Non-liquefiable
	40.00	CL	79	101	812.00	400.00	412.00	0.56	0.172	0.49	49.76	5.00	1.20	64.71	0.52	0.71	-	-	Non-liquefiable
P69	0.50	SM	47	4	9.70	5.00	4.70	1.00	0.321	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.528	Liquefiable
	1.00	CL-ML	57	4	19.40	10.00	9.40	0.99	0.319	1.70	6.80	5.00	1.20	13.16	0.14	1.00	-	-	Non-liquefiable
	2.00	SM	46	4	38.80	20.00	18.80	0.98	0.317	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.534	Liquefiable
	3.00	CL-ML	64	10	58.20	30.00	28.20	0.98	0.315	1.70	17.00	5.00	1.20	25.40	0.30	1.00	-	-	Non-liquefiable
	4.00	CL-ML	64	12	77.60	40.00	37.60	0.97	0.312	1.63	19.57	5.00	1.20	28.48	0.39	1.00	-	-	Non-liquefiable
	5.00	SM	31	12	97.00	50.00	47.00	0.96	0.310	1.46	17.50	4.77	1.16	25.12	0.29	1.00	0.351	1.133	Non-liquefiable
	6.00	SM	28	15	115.80	60.00	55.80	0.95	0.309	1.34	20.08	4.56	1.14	27.42	0.35	1.00	0.418	1.353	Non-liquefiable

APPENDIX-H

TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60cs}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	7.00	SM	28	17	135.10	70.00	65.10	0.95	0.306	1.24	21.07	4.56	1.14	28.54	0.39	1.00	0.465	1.519	Non-liquefiable
	9.00	CL-ML	84	15	173.70	90.00	83.70	0.93	0.301	1.09	16.40	5.00	1.20	24.67	0.29	1.00	-	-	Non-liquefiable
	10.00	CL-ML	84	12	196.00	100.00	96.00	0.91	0.289	1.02	12.25	5.00	1.20	19.70	0.21	1.00	-	-	Non-liquefiable
	11.00	CL	87	12	215.60	110.00	105.60	0.88	0.280	0.97	11.68	5.00	1.20	19.01	0.20	1.00	-	-	Non-liquefiable
	12.50	CL	87	18	252.50	125.00	127.50	0.84	0.260	0.89	15.94	5.00	1.20	24.13	0.28	1.00	-	-	Non-liquefiable
	15.50	CL	85	27	313.10	155.00	158.10	0.76	0.235	0.80	21.47	5.00	1.20	30.77	0.52	0.87	-	-	Non-liquefiable
	17.00	CL-ML	64	27	346.80	170.00	176.80	0.72	0.220	0.75	20.31	5.00	1.20	29.37	0.43	0.87	-	-	Non-liquefiable
	18.50	CL	81	44	362.60	185.00	177.60	0.68	0.217	0.75	33.02	5.00	1.20	44.62	0.52	0.87	-	-	Non-liquefiable
	21.50	CL	84	35	421.40	215.00	206.40	0.60	0.191	0.70	24.36	5.00	1.20	34.23	0.52	0.77	-	-	Non-liquefiable
	23.00	CL-ML	72	35	462.30	230.00	232.30	0.56	0.174	0.66	22.96	5.00	1.20	32.56	0.52	0.76	-	-	Non-liquefiable
	24.50	CL	86	43	497.35	245.00	252.35	0.56	0.172	0.63	27.07	5.00	1.20	37.48	0.52	0.74	-	-	Non-liquefiable
	26.00	MI	91	43	527.80	260.00	267.80	0.56	0.172	0.61	26.28	5.00	1.20	36.53	0.52	0.81	-	-	Non-liquefiable
	27.50	MI	91	51	561.00	275.00	286.00	0.56	0.171	0.59	30.16	5.00	1.20	41.19	0.52	0.80	-	-	Non-liquefiable
	29.00	CL-ML	72	60	591.60	290.00	301.60	0.56	0.171	0.58	34.55	5.00	1.20	46.46	0.52	0.79	-	-	Non-liquefiable
	30.50	CL	84	73	622.20	305.00	317.20	0.56	0.171	0.56	40.99	5.00	1.20	54.19	0.52	0.78	-	-	Non-liquefiable
	32.00	CI	94	64	652.80	320.00	332.80	0.56	0.171	0.55	35.08	5.00	1.20	47.10	0.52	0.77	-	-	Non-liquefiable
	33.50	CL	84	67	683.40	335.00	348.40	0.56	0.171	0.54	35.90	5.00	1.20	48.07	0.52	0.77	-	-	Non-liquefiable
	35.00	CL	84	75	714.00	350.00	364.00	0.56	0.171	0.52	39.31	5.00	1.20	52.17	0.52	0.76	-	-	Non-liquefiable

APPENDIX-H

TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60cs}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	36.50	CL	84	92	744.60	365.00	379.60	0.56	0.171	0.51	47.22	5.00	1.20	61.66	0.52	0.75	-	-	Non-liquefiable
	38.00	CL	91	84	775.20	380.00	395.20	0.56	0.171	0.50	42.25	5.00	1.20	55.71	0.52	0.75	-	-	Non-liquefiable
	40.00	CL	91	113	816.00	400.00	416.00	0.56	0.171	0.49	55.40	5.00	1.20	71.48	0.52	0.74	-	-	Non-liquefiable
P70	0.50	ML	69	3.00	10.20	5.00	5.20	1.00	0.305	1.70	5.10	5.00	1.20	11.12	0.12	1.00	0.147	0.48	Liquefiable
	1.00	CL	61	3.00	20.40	10.00	10.40	0.99	0.304	1.70	5.10	5.00	1.20	11.12	0.12	1.00	-	-	Non-liquefiable
	2.00	CL	64	3.00	40.80	20.00	20.80	0.98	0.301	1.70	5.10	5.00	1.20	11.12	0.12	1.00	-	-	Non-liquefiable
	3.00	CL-ML	60	7.00	61.20	30.00	31.20	0.98	0.299	1.70	11.90	5.00	1.20	19.28	0.21	1.00	-	-	Non-liquefiable
	4.00	SM	39	7.00	74.40	40.00	34.40	0.97	0.327	1.70	11.90	5.00	1.20	19.28	0.21	1.00	0.246	0.75	Liquefiable
	5.00	SM	33	10.00	93.00	50.00	43.00	0.96	0.324	1.52	15.25	4.88	1.18	22.87	0.25	1.00	0.304	0.94	Liquefiable
	6.00	SM	33	8.00	111.60	60.00	51.60	0.95	0.322	1.39	11.14	4.88	1.18	18.02	0.19	1.00	0.229	0.71	Liquefiable
	8.00	SM	26	14.00	148.80	80.00	68.80	0.94	0.317	1.21	16.88	4.39	1.12	23.34	0.26	1.00	0.313	0.99	Liquefiable
	9.00	SM	26	17.00	167.40	90.00	77.40	0.93	0.314	1.14	19.32	4.39	1.12	26.08	0.31	1.00	0.376	1.20	Non-liquefiable
	10.00	ML	72	17.00	204.00	100.00	104.00	0.91	0.278	0.98	16.67	5.00	1.20	25.00	0.29	1.00	0.348	1.25	Non-liquefiable
	11.00	ML	72	18.00	224.40	110.00	114.40	0.88	0.269	0.93	16.83	5.00	1.20	25.19	0.30	1.00	0.353	1.31	Non-liquefiable
	12.00	ML	72	15.00	244.80	120.00	124.80	0.85	0.261	0.90	13.43	5.00	1.20	21.11	0.23	1.00	0.274	1.05	Non-liquefiable
	13.00	CL	86	15.00	267.80	130.00	137.80	0.83	0.251	0.85	12.78	5.00	1.20	20.33	0.22	1.00	-	-	Non-liquefiable
	14.50	ML	89	15.00	298.70	145.00	153.70	0.79	0.239	0.81	12.10	5.00	1.20	19.52	0.21	1.00	0.250	1.05	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60cs}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	16.00	CL	51	15.00	329.60	160.00	169.60	0.75	0.226	0.77	11.52	5.00	1.20	18.82	0.20	0.86	-	-	Non-liquefiable
	17.50	CL	67	18.00	360.50	175.00	185.50	0.71	0.214	0.73	13.22	5.00	1.20	20.86	0.23	0.83	-	-	Non-liquefiable
	19.00	SC	50	18.00	393.30	190.00	203.30	0.67	0.201	0.70	12.62	5.00	1.20	20.15	0.22	0.79	0.205	1.02	Non-liquefiable
	20.50	CL	59	20.00	424.35	205.00	219.35	0.63	0.189	0.68	13.50	5.00	1.20	21.20	0.23	0.77	-	-	Non-liquefiable
	23.50	CL	83	27.00	467.65	235.00	232.65	0.56	0.176	0.66	17.70	5.00	1.20	26.24	0.32	0.80	-	-	Non-liquefiable
	26.50	MI	97	31.00	537.95	265.00	272.95	0.56	0.172	0.61	18.76	5.00	1.20	27.52	0.35	0.72	-	-	Non-liquefiable
	28.00	CI	84	31.00	571.20	280.00	291.20	0.56	0.171	0.59	18.17	5.00	1.20	26.80	0.33	0.72	-	-	Non-liquefiable
	29.50	CI	84	28.00	601.80	295.00	306.80	0.56	0.171	0.57	15.99	5.00	1.20	24.18	0.28	0.71	-	-	Non-liquefiable
	31.00	CL	74	28.00	632.40	310.00	322.40	0.56	0.171	0.56	15.59	5.00	1.20	23.71	0.27	0.69	-	-	Non-liquefiable
	32.50	CL	73	36.00	663.00	325.00	338.00	0.56	0.171	0.54	19.58	5.00	1.20	28.50	0.39	0.68	-	-	Non-liquefiable
	34.00	SM	49	36.00	666.40	340.00	326.40	0.56	0.178	0.55	19.93	5.00	1.20	28.91	0.41	0.71	0.344	1.93	Non-liquefiable
	35.50	SM	49	55.00	695.80	355.00	340.80	0.56	0.178	0.54	29.79	5.00	1.20	40.75	0.52	0.70	0.434	2.43	Non-liquefiable
	37.00	ML	62	55.00	725.20	370.00	355.20	0.56	0.178	0.53	29.18	5.00	1.20	40.02	0.52	0.69	0.428	2.40	Non-liquefiable
	38.50	ML	58	65.00	754.60	385.00	369.60	0.56	0.178	0.52	33.81	5.00	1.20	45.57	0.52	0.69	0.428	2.40	Non-liquefiable
	40.00	ML	58	72.00	784.00	400.00	384.00	0.56	0.178	0.51	36.74	5.00	1.20	49.09	0.52	0.68	0.422	2.37	Non-liquefiable
P71	0.50	ML	55	3	9.30	5.00	4.30	1.00	0.336	1.70	5.10	5.00	1.20	11.12	0.12	1.00	0.147	0.437	Liquefiable
	1.00	ML	51	3	18.60	10.00	8.60	0.99	0.335	1.70	5.10	5.00	1.20	11.12	0.12	1.00	0.147	0.439	Liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60cs}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	2.00	CL-ML	80	3	37.20	20.00	17.20	0.98	0.332	1.70	5.10	5.00	1.20	11.12	0.12	1.00	-	-	Non-liquefiable
	3.00	CL	80	5	55.80	30.00	25.80	0.98	0.330	1.70	8.50	5.00	1.20	15.20	0.16	1.00	-	-	Non-liquefiable
	4.00	CL	80	9	74.40	40.00	34.40	0.97	0.327	1.70	15.30	5.00	1.20	23.36	0.26	1.00	-	-	Non-liquefiable
	5.00	SM	36	9	93.00	50.00	43.00	0.96	0.324	1.52	13.72	5.00	1.20	21.47	0.23	1.00	0.280	0.862	Liquefiable
	6.00	SM	36	7	120.60	60.00	60.60	0.95	0.296	1.28	8.99	5.00	1.20	15.79	0.17	1.00	0.200	0.677	Liquefiable
	7.00	SM	36	10	140.70	70.00	70.70	0.95	0.294	1.19	11.89	5.00	1.20	19.27	0.21	1.00	0.246	0.838	Liquefiable
	9.00	CL	86	19	180.90	90.00	90.90	0.93	0.289	1.05	19.93	5.00	1.20	28.91	0.41	1.00	-	-	Non-liquefiable
	10.00	CL	86	22	194.00	100.00	94.00	0.91	0.292	1.03	22.69	5.00	1.20	32.23	0.52	1.00	-	-	Non-liquefiable
	11.00	ML	78	22	213.40	110.00	103.40	0.88	0.283	0.98	21.64	5.00	1.20	30.96	0.52	1.00	0.620	2.188	Non-liquefiable
	12.50	ML	78	27	248.75	125.00	123.75	0.84	0.263	0.90	24.27	5.00	1.20	34.13	0.52	1.00	0.620	2.354	Non-liquefiable
	14.00	CL	86	27	278.60	140.00	138.60	0.80	0.251	0.85	22.93	5.00	1.20	32.52	0.52	1.00	-	-	Non-liquefiable
	15.50	CL	86	31	325.50	155.00	170.50	0.76	0.226	0.77	23.74	5.00	1.20	33.49	0.52	0.87	-	-	Non-liquefiable
	17.00	ML	53	31	357.00	170.00	187.00	0.72	0.214	0.73	22.67	5.00	1.20	32.20	0.52	0.79	0.491	2.291	Non-liquefiable
	18.50	CL-ML	66	38	362.60	185.00	177.60	0.68	0.217	0.75	28.51	5.00	1.20	39.22	0.52	0.81	-	-	Non-liquefiable
	20.00	CL	85	38	392.00	200.00	192.00	0.64	0.204	0.72	27.42	5.00	1.20	37.91	0.52	0.80	-	-	Non-liquefiable
	21.50	CL	85	39	442.90	215.00	227.90	0.60	0.182	0.66	25.83	5.00	1.20	36.00	0.52	0.76	-	-	Non-liquefiable
	23.00	ML	59	39	473.80	230.00	243.80	0.56	0.170	0.64	24.98	5.00	1.20	34.97	0.52	0.74	0.460	2.708	Non-liquefiable
	24.50	CL-ML	82	42	504.70	245.00	259.70	0.56	0.170	0.62	26.06	5.00	1.20	36.27	0.52	0.73	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60cs}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	27.50	MI	92	54	566.50	275.00	291.50	0.56	0.170	0.59	31.63	5.00	1.20	42.95	0.52	0.73	-	-	Non-liquefiable
	29.00	MI	92	56	571.30	290.00	281.30	0.56	0.177	0.60	33.39	5.00	1.20	45.07	0.52	0.74	-	-	Non-liquefiable
	30.50	CL	83	55	600.85	305.00	295.85	0.56	0.177	0.58	31.98	5.00	1.20	43.37	0.52	0.73	-	-	Non-liquefiable
	32.00	CL	83	59	630.40	320.00	310.40	0.56	0.177	0.57	33.49	5.00	1.20	45.19	0.52	0.72	-	-	Non-liquefiable
	33.50	CI	91	58	659.95	335.00	324.95	0.56	0.177	0.55	32.18	5.00	1.20	43.61	0.52	0.71	-	-	Non-liquefiable
	35.00	CL	86	61	689.50	350.00	339.50	0.56	0.177	0.54	33.11	5.00	1.20	44.73	0.52	0.70	-	-	Non-liquefiable
	36.50	CL	86	62	719.05	365.00	354.05	0.56	0.177	0.53	32.95	5.00	1.20	44.54	0.52	0.69	-	-	Non-liquefiable
	38.00	CL	84	61	748.60	380.00	368.60	0.56	0.177	0.52	31.77	5.00	1.20	43.13	0.52	0.68	-	-	Non-liquefiable
	40.00	CL	84	66	788.00	400.00	388.00	0.56	0.177	0.51	33.51	5.00	1.20	45.21	0.52	0.67	-	-	Non-liquefiable
P72	0.50	CL-ML	63	4	10.00	5.00	5.00	1.00	0.311	1.70	6.80	5.00	1.20	13.16	0.14	1.00	-	-	Non-liquefiable
	1.00	CL-ML	63	4	20.00	10.00	10.00	0.99	0.310	1.70	6.80	5.00	1.20	13.16	0.14	1.00	-	-	Non-liquefiable
	2.00	SM-SC	49	4	40.00	20.00	20.00	0.98	0.307	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.552	Liquefiable
	3.00	SM	40	7	60.00	30.00	30.00	0.98	0.305	1.70	11.90	5.00	1.20	19.28	0.21	1.00	0.246	0.808	Liquefiable
	4.00	SM	40	13	80.00	40.00	40.00	0.97	0.302	1.58	20.55	5.00	1.20	29.67	0.45	1.00	0.532	1.758	Non-liquefiable
	6.00	SM	30	15	120.00	60.00	60.00	0.95	0.298	1.29	19.36	4.71	1.15	27.06	0.34	1.00	0.406	1.362	Non-liquefiable
	7.00	SM	30	17	135.80	70.00	65.80	0.95	0.305	1.23	20.96	4.71	1.15	28.90	0.41	1.00	0.484	1.587	Non-liquefiable
	9.00	SM	24	6	174.60	90.00	84.60	0.93	0.300	1.09	6.52	4.18	1.11	11.40	0.13	1.00	0.150	0.500	Liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60cs}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	10.00	ML	74	15	194.00	100.00	94.00	0.91	0.292	1.03	15.47	5.00	1.20	23.57	0.27	1.00	0.317	1.087	Non-liquefiable
	11.00	CL-ML	83	15	213.40	110.00	103.40	0.88	0.283	0.98	14.75	5.00	1.20	22.70	0.25	1.00	-	-	Non-liquefiable
	12.50	CL-ML	83	12	252.50	125.00	127.50	0.84	0.260	0.89	10.63	5.00	1.20	17.75	0.19	1.00	-	-	Non-liquefiable
	15.50	CL-ML	82	16	313.10	155.00	158.10	0.76	0.235	0.80	12.72	5.00	1.20	20.27	0.22	0.87	-	-	Non-liquefiable
	17.00	CL	76	16	343.40	170.00	173.40	0.72	0.222	0.76	12.15	5.00	1.20	19.58	0.21	0.85	-	-	Non-liquefiable
	18.50	ML	53	20	377.40	185.00	192.40	0.68	0.208	0.72	14.42	5.00	1.20	22.30	0.25	0.82	0.241	1.160	Non-liquefiable
	20.00	CL	81	20	408.00	200.00	208.00	0.64	0.196	0.69	13.87	5.00	1.20	21.64	0.24	0.81	-	-	Non-liquefiable
	21.50	CL	63	33	436.45	215.00	221.45	0.60	0.184	0.67	22.18	5.00	1.20	31.61	0.52	0.79	-	-	Non-liquefiable
	23.00	SM	46	33	466.90	230.00	236.90	0.56	0.172	0.65	21.44	5.00	1.20	30.73	0.52	0.78	0.481	2.797	Non-liquefiable
	24.50	CL-ML	60	52	497.35	245.00	252.35	0.56	0.172	0.63	32.73	5.00	1.20	44.28	0.52	0.76	-	-	Non-liquefiable
	26.00	CL	78	52	527.80	260.00	267.80	0.56	0.172	0.61	31.78	5.00	1.20	43.13	0.52	0.81	-	-	Non-liquefiable
	27.50	CL	78	34	552.75	275.00	277.75	0.56	0.174	0.60	20.40	5.00	1.20	29.48	0.44	0.80	-	-	Non-liquefiable
	29.00	ML	54	34	582.90	290.00	292.90	0.56	0.174	0.58	19.87	5.00	1.20	28.84	0.40	0.69	0.330	1.898	Non-liquefiable
	30.50	ML	57	50	616.10	305.00	311.10	0.56	0.173	0.57	28.35	5.00	1.20	39.02	0.52	0.67	0.417	2.410	Non-liquefiable
	33.50	CL-ML	65	56	676.70	335.00	341.70	0.56	0.173	0.54	30.29	5.00	1.20	41.35	0.52	0.65	-	-	Non-liquefiable
	35.00	CL	70	59	707.00	350.00	357.00	0.56	0.173	0.53	31.23	5.00	1.20	42.47	0.52	0.64	-	-	Non-liquefiable
	36.50	CL	70	46	737.30	365.00	372.30	0.56	0.173	0.52	23.84	5.00	1.20	33.61	0.52	0.63	-	-	Non-liquefiable
	38.00	CL-ML	64	46	767.60	380.00	387.60	0.56	0.173	0.51	23.37	5.00	1.20	33.04	0.52	0.61	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60cs}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	40.00	CL-ML	64	60	816.00	400.00	416.00	0.56	0.171	0.49	29.42	5.00	1.20	40.30	0.52	0.59	-	-	Non-liquefiable
P73	0.50	ML	62	9.00	8.35	5.00	3.35	1.00	0.387	1.70	15.30	5.00	1.20	23.36	0.26	1.00	0.313	0.809	Liquefiable
	1.00	CL	81	9.00	16.70	10.00	6.70	0.99	0.386	1.70	15.30	5.00	1.20	23.36	0.26	1.00	-	-	Non-liquefiable
	3.00	CL	66	13.00	50.10	30.00	20.10	0.98	0.380	1.70	22.10	5.00	1.20	31.52	0.52	1.00	-	-	Non-liquefiable
	4.00	CL	66	16.00	66.80	40.00	26.80	0.97	0.377	1.70	27.20	5.00	1.20	37.64	0.52	1.00	-	-	Non-liquefiable
	6.00	CL	93	14.00	118.20	60.00	58.20	0.95	0.302	1.31	18.35	5.00	1.20	27.02	0.34	1.00	-	-	Non-liquefiable
	7.00	CL	94	18.00	137.90	70.00	67.90	0.95	0.300	1.21	21.84	5.00	1.20	31.21	0.52	1.00	-	-	Non-liquefiable
	8.00	SM	20	18.00	155.20	80.00	75.20	0.94	0.302	1.15	20.76	3.61	1.08	26.02	0.31	1.00	0.374	1.238	Non-liquefiable
	9.00	SM	37	12.00	174.60	90.00	84.60	0.93	0.300	1.09	13.05	5.00	1.20	20.66	0.22	1.00	0.267	0.890	Liquefiable
	10.00	CL	80	19.00	194.00	100.00	94.00	0.91	0.292	1.03	19.60	5.00	1.20	28.52	0.39	1.00	-	-	Non-liquefiable
	12.50	CL	94	14.00	247.50	125.00	122.50	0.84	0.265	0.90	12.65	5.00	1.20	20.18	0.22	1.00	-	-	Non-liquefiable
	15.50	CL	87	26.00	310.00	155.00	155.00	0.76	0.237	0.80	20.88	5.00	1.20	30.06	0.47	0.91	-	-	Non-liquefiable
	17.00	ML	60	26.00	314.50	170.00	144.50	0.72	0.244	0.83	21.63	5.00	1.20	30.95	0.52	0.85	0.527	2.156	Non-liquefiable
	18.50	ML	60	33.00	342.25	185.00	157.25	0.68	0.231	0.80	26.32	5.00	1.20	36.58	0.52	0.84	0.521	2.256	Non-liquefiable
	21.50	ML	86	54.00	389.15	215.00	174.15	0.60	0.209	0.76	40.92	5.00	1.20	54.10	0.52	0.87	0.540	2.580	Non-liquefiable
	23.00	CL	84	61.00	416.30	230.00	186.30	0.56	0.195	0.73	44.69	5.00	1.20	58.63	0.52	0.86	-	-	Non-liquefiable
	24.50	SM	47	64.00	443.45	245.00	198.45	0.56	0.195	0.71	45.43	5.00	1.20	59.52	0.52	0.85	0.527	2.701	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60cs}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	26.00	CL-ML	89	58.00	470.60	260.00	210.60	0.56	0.195	0.69	39.97	5.00	1.20	52.96	0.52	0.84	-	-	Non-liquefiable
	27.50	CL-ML	89	52.00	497.75	275.00	222.75	0.56	0.195	0.67	34.84	5.00	1.20	46.81	0.52	0.84	-	-	Non-liquefiable
	29.00	SM	29	51.00	562.60	290.00	272.60	0.56	0.180	0.61	30.89	4.64	1.15	40.04	0.52	0.82	0.509	2.821	Non-liquefiable
	30.50	CL	93	55.00	591.70	305.00	286.70	0.56	0.180	0.59	32.48	5.00	1.20	43.98	0.52	0.81	-	-	Non-liquefiable
	32.00	SM	44	58.00	620.80	320.00	300.80	0.56	0.180	0.58	33.44	5.00	1.20	45.13	0.52	0.80	0.496	2.753	Non-liquefiable
	33.50	CL	85	62.00	649.90	335.00	314.90	0.56	0.180	0.56	34.94	5.00	1.20	46.93	0.52	0.79	-	-	Non-liquefiable
	35.00	CL	85	59.00	703.50	350.00	353.50	0.56	0.174	0.53	31.38	5.00	1.20	42.66	0.52	0.65	-	-	Non-liquefiable
	36.50	CL	79	64.00	733.65	365.00	368.65	0.56	0.174	0.52	33.33	5.00	1.20	45.00	0.52	0.64	-	-	Non-liquefiable
	38.00	CL	79	72.00	763.80	380.00	383.80	0.56	0.174	0.51	36.75	5.00	1.20	49.10	0.52	0.63	-	-	Non-liquefiable
	40.00	CL	79	102.00	804.00	400.00	404.00	0.56	0.174	0.50	50.75	5.00	1.20	65.90	0.52	0.62	-	-	Non-liquefiable
P74	0.50	SM	45	6	9.80	5.00	4.80	1.00	0.317	1.70	10.20	5.00	1.20	17.24	0.18	1.00	0.219	0.690	Liquefiable
	1.00	CL	55	6	19.60	10.00	9.60	0.99	0.316	1.70	10.20	5.00	1.20	17.24	0.18	1.00	-	-	Non-liquefiable
	2.00	SM	46	6	39.20	20.00	19.20	0.98	0.314	1.70	10.20	5.00	1.20	17.24	0.18	1.00	0.219	0.698	Liquefiable
	3.00	CL-ML	70	5	58.80	30.00	28.80	0.98	0.311	1.70	8.50	5.00	1.20	15.20	0.16	1.00	-	-	Non-liquefiable
	4.00	ML	67	11	78.40	40.00	38.40	0.97	0.309	1.61	17.75	5.00	1.20	26.30	0.32	1.00	0.382	1.237	Non-liquefiable
	5.00	SM	44	11	98.00	50.00	48.00	0.96	0.306	1.44	15.88	5.00	1.20	24.05	0.27	1.00	0.327	1.068	Non-liquefiable
	6.00	SM	32	18	117.00	60.00	57.00	0.95	0.306	1.32	23.84	4.83	1.17	32.75	0.52	1.00	0.620	2.030	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60cs}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	7.00	SM	32	19	136.50	70.00	66.50	0.95	0.303	1.23	23.30	4.83	1.17	32.11	0.52	1.00	0.620	2.047	Non-liquefiable
	9.00	SM	24	23	175.50	90.00	85.50	0.93	0.298	1.08	24.87	4.18	1.11	31.73	0.52	1.00	0.620	2.080	Non-liquefiable
	10.00	CL-ML	76	17	194.00	100.00	94.00	0.91	0.292	1.03	17.53	5.00	1.20	26.04	0.31	1.00	-	-	Non-liquefiable
	11.00	ML	51	17	213.40	110.00	103.40	0.88	0.283	0.98	16.72	5.00	1.20	25.06	0.29	1.00	0.350	1.233	Non-liquefiable
	12.50	CL-ML	68	14	246.25	125.00	121.25	0.84	0.266	0.91	12.71	5.00	1.20	20.26	0.22	1.00	-	-	Non-liquefiable
	14.00	SM	39	14	275.80	140.00	135.80	0.80	0.254	0.86	12.01	5.00	1.20	19.42	0.21	1.00	0.248	0.980	Liquefiable
	15.50	CL	79	21	306.90	155.00	151.90	0.76	0.240	0.81	17.04	5.00	1.20	25.45	0.30	0.86	-	-	Non-liquefiable
	18.50	SM	45	29	366.30	185.00	181.30	0.68	0.214	0.74	21.54	5.00	1.20	30.85	0.52	0.80	0.498	2.322	Non-liquefiable
	20.00	CL	82	29	406.00	200.00	206.00	0.64	0.197	0.70	20.21	5.00	1.20	29.25	0.42	0.77	-	-	Non-liquefiable
	21.50	CL	92	55	436.45	215.00	221.45	0.60	0.184	0.67	36.96	5.00	1.20	49.35	0.52	0.75	-	-	Non-liquefiable
	23.00	CL	92	50	466.90	230.00	236.90	0.56	0.172	0.65	32.49	5.00	1.20	43.98	0.52	0.73	-	-	Non-liquefiable
	24.50	MI	94	59	497.35	245.00	252.35	0.56	0.172	0.63	37.14	5.00	1.20	49.57	0.52	0.71	-	-	Non-liquefiable
	26.00	MI	94	50	527.80	260.00	267.80	0.56	0.172	0.61	30.55	5.00	1.20	41.66	0.52	0.69	-	-	Non-liquefiable
	27.50	MI	94	45	558.25	275.00	283.25	0.56	0.172	0.59	26.74	5.00	1.20	37.09	0.52	0.68	-	-	Non-liquefiable
	29.00	CL-ML	64	55	588.70	290.00	298.70	0.56	0.172	0.58	31.82	5.00	1.20	43.19	0.52	0.67	-	-	Non-liquefiable
	30.50	CL-ML	64	51	619.15	305.00	314.15	0.56	0.172	0.56	28.77	5.00	1.20	39.53	0.52	0.65	-	-	Non-liquefiable
	32.00	CL	91	53	649.60	320.00	329.60	0.56	0.172	0.55	29.19	5.00	1.20	40.03	0.52	0.64	-	-	Non-liquefiable
	33.50	CL	91	58	680.05	335.00	345.05	0.56	0.172	0.54	31.22	5.00	1.20	42.47	0.52	0.63	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60cs}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	35.00	CL-ML	76	60	710.50	350.00	360.50	0.56	0.172	0.53	31.60	5.00	1.20	42.92	0.52	0.62	-	-	Non-liquefiable
	36.50	CL	86	57	740.95	365.00	375.95	0.56	0.172	0.52	29.40	5.00	1.20	40.28	0.52	0.61	-	-	Non-liquefiable
	38.00	CL	86	69	771.40	380.00	391.40	0.56	0.172	0.51	34.88	5.00	1.20	46.85	0.52	0.60	-	-	Non-liquefiable
	40.00	CL	86	75	812.00	400.00	412.00	0.56	0.172	0.49	36.95	5.00	1.20	49.34	0.52	0.59	-	-	Non-liquefiable
P75	0.50	SM	44	3	9.85	5.00	4.85	1.00	0.316	1.70	5.10	5.00	1.20	11.12	0.12	1.00	0.147	0.465	Liquefiable
	1.00	CL-ML	51	3	19.70	10.00	9.70	0.99	0.314	1.70	5.10	5.00	1.20	11.12	0.12	1.00	-	-	Non-liquefiable
	2.00	SM-SC	49	3	39.40	20.00	19.40	0.98	0.312	1.70	5.10	5.00	1.20	11.12	0.12	1.00	0.147	0.471	Liquefiable
	3.00	CL-ML	80	7	59.10	30.00	29.10	0.98	0.310	1.70	11.90	5.00	1.20	19.28	0.21	1.00	-	-	Non-liquefiable
	4.00	CL-ML	71	12	78.80	40.00	38.80	0.97	0.307	1.61	19.26	5.00	1.20	28.12	0.37	1.00	-	-	Non-liquefiable
	5.00	ML	64	12	98.50	50.00	48.50	0.96	0.305	1.44	17.23	5.00	1.20	25.68	0.31	1.00	0.365	1.197	Non-liquefiable
	6.00	ML	64	14	118.80	60.00	58.80	0.95	0.301	1.30	18.26	5.00	1.20	26.91	0.34	1.00	0.401	1.332	Non-liquefiable
	7.00	SM	44	17	138.60	70.00	68.60	0.95	0.298	1.21	20.53	5.00	1.20	29.63	0.44	1.00	0.529	1.774	Non-liquefiable
	9.00	CL-ML	80	21	178.20	90.00	88.20	0.93	0.293	1.06	22.36	5.00	1.20	31.83	0.52	1.00	-	-	Non-liquefiable
	10.00	CL-ML	80	23	209.00	100.00	109.00	0.91	0.271	0.96	22.03	5.00	1.20	31.44	0.52	1.00	-	-	Non-liquefiable
	12.50	CL-ML	64	18	261.25	125.00	136.25	0.84	0.251	0.86	15.42	5.00	1.20	23.50	0.27	1.00	-	-	Non-liquefiable
	14.00	CL	88	18	277.20	140.00	137.20	0.80	0.252	0.85	15.37	5.00	1.20	23.44	0.26	1.00	-	-	Non-liquefiable
	15.50	CL	88	25	314.65	155.00	159.65	0.76	0.234	0.79	19.79	5.00	1.20	28.74	0.40	0.90	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60cs}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	17.00	SM	46	25	345.10	170.00	175.10	0.72	0.221	0.76	18.89	5.00	1.20	27.67	0.36	0.83	0.354	1.597	Non-liquefiable
	18.50	SM	39	30	360.75	185.00	175.75	0.68	0.218	0.75	22.63	5.00	1.20	32.16	0.52	0.83	0.512	2.353	Non-liquefiable
	21.50	CL	87	38	419.25	215.00	204.25	0.60	0.192	0.70	26.59	5.00	1.20	36.91	0.52	0.79	-	-	Non-liquefiable
	24.50	SM	47	36	477.75	245.00	232.75	0.56	0.179	0.66	23.60	5.00	1.20	33.32	0.52	0.75	0.465	2.596	Non-liquefiable
	26.00	ML	55	36	530.40	260.00	270.40	0.56	0.171	0.61	21.89	5.00	1.20	31.27	0.52	0.71	0.442	2.581	Non-liquefiable
	27.50	CL-ML	78	42	561.00	275.00	286.00	0.56	0.171	0.59	24.84	5.00	1.20	34.80	0.52	0.70	-	-	Non-liquefiable
	29.00	SM	44	42	591.60	290.00	301.60	0.56	0.171	0.58	24.18	5.00	1.20	34.02	0.52	0.74	0.458	2.672	Non-liquefiable
	30.50	MI	94	44	597.80	305.00	292.80	0.56	0.178	0.58	25.71	5.00	1.20	35.86	0.52	0.74	-	-	Non-liquefiable
	32.00	SM	43	44	627.20	320.00	307.20	0.56	0.178	0.57	25.10	5.00	1.20	35.12	0.52	0.73	0.456	2.554	Non-liquefiable
	33.50	CL	90	52	666.65	335.00	331.65	0.56	0.176	0.55	28.55	5.00	1.20	39.26	0.52	0.72	-	-	Non-liquefiable
	35.00	CL-ML	64	56	696.50	350.00	346.50	0.56	0.176	0.54	30.08	5.00	1.20	41.10	0.52	0.71	-	-	Non-liquefiable
	36.50	SM	46	52	726.35	365.00	361.35	0.56	0.176	0.53	27.36	5.00	1.20	37.83	0.52	0.70	0.436	2.481	Non-liquefiable
	38.00	SM	46	58	756.20	380.00	376.20	0.56	0.176	0.52	29.90	5.00	1.20	40.88	0.52	0.69	0.431	2.454	Non-liquefiable
	40.00	SM	49	64	796.00	400.00	396.00	0.56	0.176	0.50	32.16	5.00	1.20	43.59	0.52	0.68	0.425	2.420	Non-liquefiable
P76	0.50	ML	53	5.00	8.05	5.00	3.05	1.00	0.410	1.70	8.50	5.00	1.20	15.20	0.16	1.00	0.193	0.471	Liquefiable
	1.00	SM	50	5.00	16.10	10.00	6.10	0.99	0.409	1.70	8.50	5.00	1.20	15.20	0.16	1.00	0.193	0.473	Liquefiable
	2.00	CL	60	5.00	32.20	20.00	12.20	0.98	0.405	1.70	8.50	5.00	1.20	15.20	0.16	1.00	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60cs}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	3.00	CL	60	10.00	48.30	30.00	18.30	0.98	0.402	1.70	17.00	5.00	1.20	25.40	0.30	1.00	-	-	Non-liquefiable
	5.00	CL	79	9.00	96.00	50.00	46.00	0.96	0.313	1.47	13.27	5.00	1.20	20.92	0.23	1.00	-	-	Non-liquefiable
	6.00	CL-ML	82	13.00	115.20	60.00	55.20	0.95	0.311	1.35	17.50	5.00	1.20	26.00	0.31	1.00	-	-	Non-liquefiable
	7.00	CL	81	13.00	142.10	70.00	72.10	0.95	0.291	1.18	15.31	5.00	1.20	23.37	0.26	1.00	-	-	Non-liquefiable
	8.00	CL	81	8.00	162.40	80.00	82.40	0.94	0.289	1.10	8.81	5.00	1.20	15.58	0.17	1.00	-	-	Non-liquefiable
	9.00	CL	75	10.00	182.70	90.00	92.70	0.93	0.286	1.04	10.39	5.00	1.20	17.46	0.19	1.00	-	-	Non-liquefiable
	10.00	CL-ML	90	10.00	196.00	100.00	96.00	0.91	0.289	1.02	10.21	5.00	1.20	17.25	0.18	1.00	-	-	Non-liquefiable
	11.00	CL	74	22.00	215.60	110.00	105.60	0.88	0.280	0.97	21.41	5.00	1.20	30.69	0.52	1.00	-	-	Non-liquefiable
	12.00	CL	74	25.00	235.20	120.00	115.20	0.85	0.272	0.93	23.29	5.00	1.20	32.95	0.52	1.00	-	-	Non-liquefiable
	14.50	CL	56	22.00	294.35	145.00	149.35	0.79	0.242	0.82	18.00	5.00	1.20	26.60	0.33	1.00	-	-	Non-liquefiable
	17.50	ML	58	27.00	357.00	175.00	182.00	0.71	0.216	0.74	20.01	5.00	1.20	29.02	0.41	0.82	0.402	1.859	Non-liquefiable
	19.00	CL-ML	84	27.00	387.60	190.00	197.60	0.67	0.204	0.71	19.21	5.00	1.20	28.05	0.37	0.79	-	-	Non-liquefiable
	20.50	CL-ML	84	32.00	418.20	205.00	213.20	0.63	0.192	0.68	21.92	5.00	1.20	31.30	0.52	0.76	-	-	Non-liquefiable
	23.50	CL-ML	66	42.00	479.40	235.00	244.40	0.56	0.171	0.64	26.87	5.00	1.20	37.24	0.52	0.71	-	-	Non-liquefiable
	25.00	SM	50	42.00	495.00	250.00	245.00	0.56	0.176	0.64	26.83	5.00	1.20	37.20	0.52	0.74	0.459	2.601	Non-liquefiable
	26.50	CL	70	61.00	524.70	265.00	259.70	0.56	0.176	0.62	37.85	5.00	1.20	50.42	0.52	0.72	-	-	Non-liquefiable
	29.50	MI	92	51.00	613.60	295.00	318.60	0.56	0.168	0.56	28.57	5.00	1.20	39.29	0.52	0.71	-	-	Non-liquefiable
	31.00	ML	60	53.00	644.80	310.00	334.80	0.56	0.168	0.55	28.97	5.00	1.20	39.76	0.52	0.70	0.434	2.581	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60cs}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	32.50	ML	60	51.00	676.00	325.00	351.00	0.56	0.168	0.53	27.22	5.00	1.20	37.67	0.52	0.68	0.422	2.507	Non-liquefiable
	34.00	ML	57	63.00	663.00	340.00	323.00	0.56	0.179	0.56	35.05	5.00	1.20	47.06	0.52	0.70	0.434	2.422	Non-liquefiable
	35.50	ML	57	73.00	692.25	355.00	337.25	0.56	0.179	0.54	39.75	5.00	1.20	52.70	0.52	0.69	0.428	2.387	Non-liquefiable
	37.00	CL	59	74.00	721.50	370.00	351.50	0.56	0.179	0.53	39.47	5.00	1.20	52.36	0.52	0.68	-	-	Non-liquefiable
	38.50	CL	59	83.00	750.75	385.00	365.75	0.56	0.179	0.52	43.40	5.00	1.20	57.08	0.52	0.68	-	-	Non-liquefiable
	40.00	CL	84	87.00	780.00	400.00	380.00	0.56	0.179	0.51	44.63	5.00	1.20	58.56	0.52	0.67	-	-	Non-liquefiable
P77	0.50	ML	57	5.00	9.10	5.00	4.10	1.00	0.345	1.70	8.50	5.00	1.20	15.20	0.16	1.00	0.193	0.560	Liquefiable
	2.00	CL	53	5.00	36.40	20.00	16.40	0.98	0.341	1.70	8.50	5.00	1.20	15.20	0.16	1.00	-	-	Non-liquefiable
	3.00	CL	75	9.00	54.60	30.00	24.60	0.98	0.338	1.70	15.30	5.00	1.20	23.36	0.26	1.00	-	-	Non-liquefiable
	4.00	MI	94	9.00	80.00	40.00	40.00	0.97	0.302	1.58	14.23	5.00	1.20	22.08	0.24	1.00	-	-	Non-liquefiable
	5.00	ML	70	18.00	100.00	50.00	50.00	0.96	0.300	1.41	25.46	5.00	1.20	35.55	0.52	1.00	0.620	2.067	Non-liquefiable
	6.00	CL	86	28.00	120.00	60.00	60.00	0.95	0.298	1.29	36.15	5.00	1.20	48.38	0.52	1.00	-	-	Non-liquefiable
	8.00	CL	82	26.00	158.40	80.00	78.40	0.94	0.296	1.13	29.36	5.00	1.20	40.24	0.52	1.00	-	-	Non-liquefiable
	9.00	CL	91	30.00	178.20	90.00	88.20	0.93	0.293	1.06	31.94	5.00	1.20	43.33	0.52	1.00	-	-	Non-liquefiable
	10.00	CL-ML	81	30.00	212.00	100.00	112.00	0.91	0.268	0.94	28.35	5.00	1.20	39.02	0.52	1.00	-	-	Non-liquefiable
	11.00	CL	90	22.00	233.20	110.00	123.20	0.88	0.260	0.90	19.82	5.00	1.20	28.78	0.40	1.00	-	-	Non-liquefiable
	12.00	CL	90	27.00	254.40	120.00	134.40	0.85	0.252	0.86	23.29	5.00	1.20	32.95	0.52	1.00	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60cs}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	14.50	SM	41	31.00	295.80	145.00	150.80	0.79	0.241	0.81	25.24	5.00	1.20	35.29	0.52	1.00	0.620	2.576	Non-liquefiable
	16.00	ML	67	31.00	326.40	160.00	166.40	0.75	0.229	0.78	24.03	5.00	1.20	33.84	0.52	0.87	0.540	2.361	Non-liquefiable
	17.50	ML	55	35.00	357.00	175.00	182.00	0.71	0.216	0.74	25.94	5.00	1.20	36.13	0.52	0.84	0.521	2.409	Non-liquefiable
	19.00	CL	85	35.00	380.00	190.00	190.00	0.67	0.208	0.73	25.39	5.00	1.20	35.47	0.52	0.83	-	-	Non-liquefiable
	20.50	ML	61	41.00	410.00	205.00	205.00	0.63	0.196	0.70	28.64	5.00	1.20	39.36	0.52	0.81	0.502	2.570	Non-liquefiable
	22.00	CL	59	41.00	453.20	220.00	233.20	0.59	0.178	0.65	26.85	5.00	1.20	37.22	0.52	0.76	-	-	Non-liquefiable
	23.50	CL	59	45.00	484.10	235.00	249.10	0.56	0.170	0.63	28.51	5.00	1.20	39.21	0.52	0.74	-	-	Non-liquefiable
	25.00	SM	45	45.00	482.50	250.00	232.50	0.56	0.181	0.66	29.51	5.00	1.20	40.41	0.52	0.69	0.428	2.361	Non-liquefiable
	26.50	SM	45	44.00	511.45	265.00	246.45	0.56	0.181	0.64	28.03	5.00	1.20	38.63	0.52	0.68	0.422	2.327	Non-liquefiable
	28.00	MI	86	44.00	576.80	280.00	296.80	0.56	0.170	0.58	25.54	5.00	1.20	35.65	0.52	0.83	-	-	Non-liquefiable
	29.50	CL	54	100.00	607.70	295.00	312.70	0.56	0.170	0.57	56.55	5.00	1.20	72.86	0.52	0.82	-	-	Non-liquefiable
	31.00	ML	55	97.00	638.60	310.00	328.60	0.56	0.170	0.55	53.51	5.00	1.20	69.21	0.52	0.81	0.502	2.960	Non-liquefiable
	32.50	CL	69	86.00	669.50	325.00	344.50	0.56	0.170	0.54	46.33	5.00	1.20	60.60	0.52	0.80	-	-	Non-liquefiable
	34.00	ML	61	95.00	690.20	340.00	350.20	0.56	0.172	0.53	50.77	5.00	1.20	65.92	0.52	0.64	0.397	2.306	Non-liquefiable
	35.50	ML	61	63.00	720.65	355.00	365.65	0.56	0.172	0.52	32.95	5.00	1.20	44.54	0.52	0.63	0.391	2.270	Non-liquefiable
	37.00	ML	71	45.00	751.10	370.00	381.10	0.56	0.172	0.51	23.05	5.00	1.20	32.66	0.52	0.62	0.385	2.234	Non-liquefiable
	38.50	ML	71	64.00	781.55	385.00	396.55	0.56	0.172	0.50	32.14	5.00	1.20	43.57	0.52	0.61	0.378	2.198	Non-liquefiable
	40.00	CL	84	93.00	812.00	400.00	412.00	0.56	0.172	0.49	45.82	5.00	1.20	59.98	0.52	0.60	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60cs}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
P78	0.50	ML	61	8.00	9.85	5.00	4.85	1.00	0.316	1.70	13.60	5.00	1.20	21.32	0.23	1.00	0.277	0.879	Liquefiable
	1.00	ML	61	8.00	19.70	10.00	9.70	0.99	0.314	1.70	13.60	5.00	1.20	21.32	0.23	1.00	0.277	0.882	Liquefiable
	3.00	ML	67	10.00	59.10	30.00	29.10	0.98	0.310	1.70	17.00	5.00	1.20	25.40	0.30	1.00	0.358	1.156	Non-liquefiable
	4.00	ML	67	9.00	78.80	40.00	38.80	0.97	0.307	1.61	14.45	5.00	1.20	22.34	0.25	1.00	0.295	0.959	Liquefiable
	5.00	SM-SC	49	9.00	99.50	50.00	49.50	0.96	0.302	1.42	12.79	5.00	1.20	20.35	0.22	1.00	0.262	0.869	Liquefiable
	6.00	SM-SC	49	14.00	119.40	60.00	59.40	0.95	0.299	1.30	18.16	5.00	1.20	26.80	0.33	1.00	0.397	1.327	Non-liquefiable
	7.00	CL	77	12.00	139.30	70.00	69.30	0.95	0.297	1.20	14.41	5.00	1.20	22.30	0.25	1.00	-	-	Non-liquefiable
	9.00	CL-ML	91	31.00	184.50	90.00	94.50	0.93	0.284	1.03	31.89	5.00	1.20	43.27	0.52	1.00	-	-	Non-liquefiable
	10.00	CL	86	16.00	205.00	100.00	105.00	0.91	0.276	0.98	15.61	5.00	1.20	23.74	0.27	1.00	-	-	Non-liquefiable
	11.00	CL-ML	82	16.00	222.20	110.00	112.20	0.88	0.272	0.94	15.11	5.00	1.20	23.13	0.26	1.00	-	-	Non-liquefiable
	12.50	CL	86	18.00	252.50	125.00	127.50	0.84	0.260	0.89	15.94	5.00	1.20	24.13	0.28	1.00	-	-	Non-liquefiable
	14.00	CL-ML	81	18.00	278.60	140.00	138.60	0.80	0.251	0.85	15.29	5.00	1.20	23.35	0.26	1.00	-	-	Non-liquefiable
	15.50	CL-ML	81	28.00	308.45	155.00	153.45	0.76	0.238	0.81	22.60	5.00	1.20	32.12	0.52	0.90	-	-	Non-liquefiable
	18.50	CL-ML	78	27.00	377.40	185.00	192.40	0.68	0.208	0.72	19.47	5.00	1.20	28.36	0.38	0.84	-	-	Non-liquefiable
	20.00	CL	77	27.00	392.00	200.00	192.00	0.64	0.204	0.72	19.49	5.00	1.20	28.38	0.38	0.88	-	-	Non-liquefiable
	21.50	CL	84	33.00	421.40	215.00	206.40	0.60	0.191	0.70	22.97	5.00	1.20	32.56	0.52	0.87	-	-	Non-liquefiable
	23.00	ML	70	33.00	450.80	230.00	220.80	0.56	0.178	0.67	22.21	5.00	1.20	31.65	0.52	0.86	0.533	2.991	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60cs}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	24.50	ML	70	37.00	480.20	245.00	235.20	0.56	0.178	0.65	24.13	5.00	1.20	33.95	0.52	0.86	0.533	2.991	Non-liquefiable
	26.00	CL-ML	53	37.00	514.80	260.00	254.80	0.56	0.176	0.63	23.18	5.00	1.20	32.82	0.52	0.76	-	-	Non-liquefiable
	27.50	CL-ML	53	55.00	544.50	275.00	269.50	0.56	0.176	0.61	33.50	5.00	1.20	45.20	0.52	0.75	-	-	Non-liquefiable
	29.00	SM	43	59.00	574.20	290.00	284.20	0.56	0.176	0.59	35.00	5.00	1.20	47.00	0.52	0.74	0.459	2.601	Non-liquefiable
	30.50	CL-ML	62	69.00	603.90	305.00	298.90	0.56	0.176	0.58	39.91	5.00	1.20	52.89	0.52	0.73	-	-	Non-liquefiable
	32.00	ML	51	75.00	643.20	320.00	323.20	0.56	0.174	0.56	41.72	5.00	1.20	55.06	0.52	0.69	0.428	2.462	Non-liquefiable
	33.50	ML	51	68.00	673.35	335.00	338.35	0.56	0.174	0.54	36.97	5.00	1.20	49.36	0.52	0.68	0.422	2.426	Non-liquefiable
	35.00	CL-ML	62	64.00	703.50	350.00	353.50	0.56	0.174	0.53	34.04	5.00	1.20	45.85	0.52	0.67	-	-	Non-liquefiable
	36.50	CL-ML	62	72.00	733.65	365.00	368.65	0.56	0.174	0.52	37.50	5.00	1.20	50.00	0.52	0.66	-	-	Non-liquefiable
	38.00	CL-ML	62	78.00	763.80	380.00	383.80	0.56	0.174	0.51	39.81	5.00	1.20	52.78	0.52	0.65	-	-	Non-liquefiable
	40.00	CL	70	88.00	804.00	400.00	404.00	0.56	0.174	0.50	43.78	5.00	1.20	57.54	0.52	0.64	-	-	Non-liquefiable
P79	0.50	SM	39	4.00	9.20	5.00	4.20	1.00	0.340	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.498	Liquefiable
	1.00	CL	59	4.00	18.40	10.00	8.40	0.99	0.339	1.70	6.80	5.00	1.20	13.16	0.14	1.00	-	-	Non-liquefiable
	2.00	CL	59	4.00	36.80	20.00	16.80	0.98	0.336	1.70	6.80	5.00	1.20	13.16	0.14	1.00	-	-	Non-liquefiable
	3.00	CL	78	8.00	55.20	30.00	25.20	0.98	0.334	1.70	13.60	5.00	1.20	21.32	0.23	1.00	-	-	Non-liquefiable
	5.00	CL	87	9.00	98.00	50.00	48.00	0.96	0.306	1.44	12.99	5.00	1.20	20.59	0.22	1.00	-	-	Non-liquefiable
	6.00	CL	87	12.00	117.60	60.00	57.60	0.95	0.304	1.32	15.81	5.00	1.20	23.97	0.27	1.00	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60cs}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	7.00	CL-ML	65	12.00	140.70	70.00	70.70	0.95	0.294	1.19	14.27	5.00	1.20	22.13	0.24	1.00	-	-	Non-liquefiable
	8.00	CL	87	26.00	160.80	80.00	80.80	0.94	0.291	1.11	28.92	5.00	1.20	39.71	0.52	1.00	-	-	Non-liquefiable
	9.00	CL	87	23.00	180.90	90.00	90.90	0.93	0.289	1.05	24.12	5.00	1.20	33.95	0.52	1.00	-	-	Non-liquefiable
	11.00	CL	77	16.00	206.80	110.00	96.80	0.88	0.293	1.02	16.26	5.00	1.20	24.51	0.28	1.00	-	-	Non-liquefiable
	12.00	CL	77	19.00	225.60	120.00	105.60	0.85	0.284	0.97	18.49	5.00	1.20	27.19	0.34	1.00	-	-	Non-liquefiable
	13.00	CL-ML	90	19.00	247.00	130.00	117.00	0.83	0.272	0.92	17.57	5.00	1.20	26.08	0.31	1.00	-	-	Non-liquefiable
	14.50	CL	83	22.00	275.50	145.00	130.50	0.79	0.259	0.88	19.26	5.00	1.20	28.11	0.37	1.00	-	-	Non-liquefiable
	16.00	ML	75	22.00	323.20	160.00	163.20	0.75	0.231	0.78	17.22	5.00	1.20	25.67	0.31	0.89	0.324	1.406	Non-liquefiable
	17.50	ML	55	36.00	353.50	175.00	178.50	0.71	0.218	0.75	26.95	5.00	1.20	37.33	0.52	0.86	0.533	2.443	Non-liquefiable
	19.00	SM	43	36.00	343.90	190.00	153.90	0.67	0.232	0.81	29.02	5.00	1.20	39.82	0.52	0.87	0.540	2.322	Non-liquefiable
	20.50	CL	83	51.00	371.05	205.00	166.05	0.63	0.218	0.78	39.58	5.00	1.20	52.49	0.52	0.86	-	-	Non-liquefiable
	23.50	CL	81	40.00	465.30	235.00	230.30	0.56	0.176	0.66	26.36	5.00	1.20	36.63	0.52	0.81	-	-	Non-liquefiable
	26.50	CL	84	38.00	524.70	265.00	259.70	0.56	0.176	0.62	23.58	5.00	1.20	33.30	0.52	0.72	-	-	Non-liquefiable
	29.50	SM	41	38.00	584.10	295.00	289.10	0.56	0.176	0.59	22.35	5.00	1.20	31.82	0.52	0.69	0.428	2.425	Non-liquefiable
	31.00	ML	63	38.00	613.80	310.00	303.80	0.56	0.176	0.57	21.80	5.00	1.20	31.16	0.52	0.68	0.422	2.390	Non-liquefiable
	32.50	CL-ML	74	43.00	643.50	325.00	318.50	0.56	0.176	0.56	24.09	5.00	1.20	33.91	0.52	0.67	-	-	Non-liquefiable
	35.50	CL	77	53.00	702.90	355.00	347.90	0.56	0.176	0.54	28.42	5.00	1.20	39.10	0.52	0.63	-	-	Non-liquefiable
	38.50	CL	85	58.00	762.30	385.00	377.30	0.56	0.176	0.51	29.86	5.00	1.20	40.83	0.52	0.61	-	-	Non-liquefiable

APPENDIX-H

TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60cs}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	40.00	CL	85	64.00	792.00	400.00	392.00	0.56	0.176	0.51	32.32	5.00	1.20	43.79	0.52	0.61	-	-	Non-liquefiable
P80	0.50	CL-ML	61	5	10.40	5.00	5.40	1.00	0.299	1.70	8.50	5.00	1.20	15.20	0.16	1.00	-	-	Non-liquefiable
	2.00	CL	65	5	41.60	20.00	21.60	0.98	0.296	1.70	8.50	5.00	1.20	15.20	0.16	1.00	-	-	Non-liquefiable
	3.00	SM	42	8	62.40	30.00	32.40	0.98	0.294	1.70	13.60	5.00	1.20	21.32	0.23	1.00	0.277	0.945	Liquefiable
	5.00	CL	84	14	104.00	50.00	54.00	0.96	0.289	1.36	19.05	5.00	1.20	27.86	0.36	1.00	-	-	Non-liquefiable
	6.00	ML	72	13	117.60	60.00	57.60	0.95	0.304	1.32	17.13	5.00	1.20	25.55	0.30	1.00	0.362	1.190	Non-liquefiable
	7.00	SM	49	13	137.20	70.00	67.20	0.95	0.301	1.22	15.86	5.00	1.20	24.03	0.27	1.00	0.327	1.084	Non-liquefiable
	8.00	CL-ML	86	24	156.80	80.00	76.80	0.94	0.299	1.14	27.39	5.00	1.20	37.86	0.52	1.00	-	-	Non-liquefiable
	9.00	CL-ML	86	35	176.40	90.00	86.40	0.93	0.297	1.08	37.65	5.00	1.20	50.18	0.52	1.00	-	-	Non-liquefiable
	10.00	CL	93	35	196.00	100.00	96.00	0.91	0.289	1.02	35.72	5.00	1.20	47.87	0.52	1.00	-	-	Non-liquefiable
	11.00	ML	84	37	220.00	110.00	110.00	0.88	0.275	0.95	35.28	5.00	1.20	47.33	0.52	1.00	0.620	2.258	Non-liquefiable
	12.00	CL	89	23	240.00	120.00	120.00	0.85	0.266	0.91	21.00	5.00	1.20	30.20	0.48	1.00	-	-	Non-liquefiable
	14.50	CL	87	30	290.00	145.00	145.00	0.79	0.245	0.83	24.91	5.00	1.20	34.90	0.52	1.00	-	-	Non-liquefiable
	16.00	SC	47	30	326.40	160.00	166.40	0.75	0.229	0.78	23.26	5.00	1.20	32.91	0.52	0.83	0.517	2.261	Non-liquefiable
	17.50	SC	47	46	351.75	175.00	176.75	0.71	0.219	0.75	34.60	5.00	1.20	46.52	0.52	0.82	0.506	2.304	Non-liquefiable
	19.00	SM	40	46	381.90	190.00	191.90	0.67	0.207	0.72	33.21	5.00	1.20	44.85	0.52	0.84	0.522	2.521	Non-liquefiable
	20.50	SM-SC	50	49	401.80	205.00	196.80	0.63	0.200	0.71	34.93	5.00	1.20	46.91	0.52	0.84	0.518	2.597	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60cs}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	22.00	CL	51	49	431.20	220.00	211.20	0.59	0.187	0.69	33.72	5.00	1.20	45.46	0.52	0.82	-	-	Non-liquefiable
	23.50	CL	51	65	467.65	235.00	232.65	0.56	0.176	0.66	42.61	5.00	1.20	56.14	0.52	0.80	-	-	Non-liquefiable
	25.00	CL-ML	81	77	497.50	250.00	247.50	0.56	0.176	0.64	48.94	5.00	1.20	63.73	0.52	0.79	-	-	Non-liquefiable
	26.50	CL-ML	69	85	527.35	265.00	262.35	0.56	0.176	0.62	52.48	5.00	1.20	67.97	0.52	0.77	-	-	Non-liquefiable
	28.00	ML	51	101	557.20	280.00	277.20	0.56	0.176	0.60	60.66	5.00	1.20	77.80	0.52	0.76	0.473	2.693	Non-liquefiable
	29.50	ML	51	51	587.05	295.00	292.05	0.56	0.176	0.59	29.84	5.00	1.20	40.81	0.52	0.75	0.466	2.656	Non-liquefiable
	31.00	CL-ML	61	63	616.90	310.00	306.90	0.56	0.176	0.57	35.96	5.00	1.20	48.15	0.52	0.74	-	-	Non-liquefiable
	32.50	CL	85	72	646.75	325.00	321.75	0.56	0.176	0.56	40.14	5.00	1.20	53.17	0.52	0.73	-	-	Non-liquefiable
	34.00	ML	64	77	676.60	340.00	336.60	0.56	0.176	0.55	41.97	5.00	1.20	55.36	0.52	0.72	0.449	2.557	Non-liquefiable
	35.50	CL-ML	55	80	706.45	355.00	351.45	0.56	0.176	0.53	42.67	5.00	1.20	56.21	0.52	0.72	-	-	Non-liquefiable
	37.00	CL-ML	55	88	736.30	370.00	366.30	0.56	0.176	0.52	45.98	5.00	1.20	60.18	0.52	0.71	-	-	Non-liquefiable
	38.50	CL-ML	55	85	766.15	385.00	381.15	0.56	0.176	0.51	43.54	5.00	1.20	57.25	0.52	0.70	-	-	Non-liquefiable
	40.00	CL-ML	64	91	796.00	400.00	396.00	0.56	0.176	0.50	45.73	5.00	1.20	59.88	0.52	0.69	-	-	Non-liquefiable

APPENDIX-I
SITE PHOTOGRAPHS

SPT sample at depth 9.00 m

UDS at depth 28.00 m

SPT at depth 15.50 m

SPT sample at depth 33.50 m

APPENDIX-I
SITE PHOTOGRAPHS

UDS at depth 19.00 m

SPT at depth 32.50 m

SPT at depth 12.50 m

SPT sample at depth 33.00 m

APPENDIX-I
SITE PHOTOGRAPHS

SPT sample at depth 12.00 m

SPT at depth 23.50 m

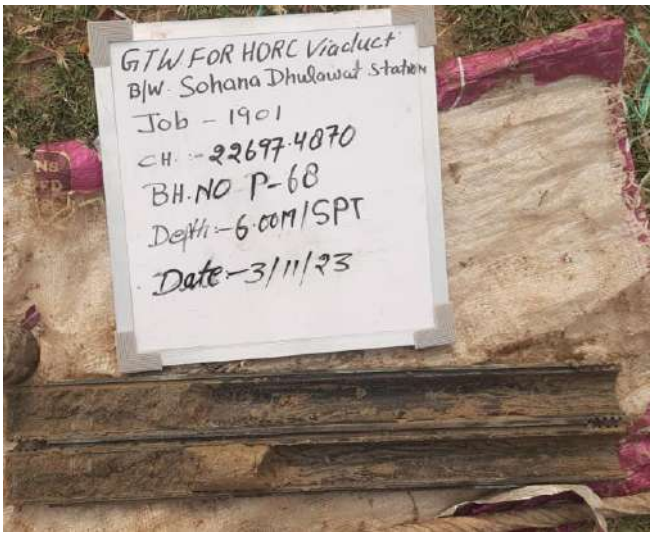
SPT at depth 8.00 m

UDS at depth 28.00 m

APPENDIX-I
SITE PHOTOGRAPHS

SPT at depth 6.00 m

SPT sample at depth 30.50 m



SPT sample at depth 6.00 m

SPT at depth 12.50 m

APPENDIX-I
SITE PHOTOGRAPHS

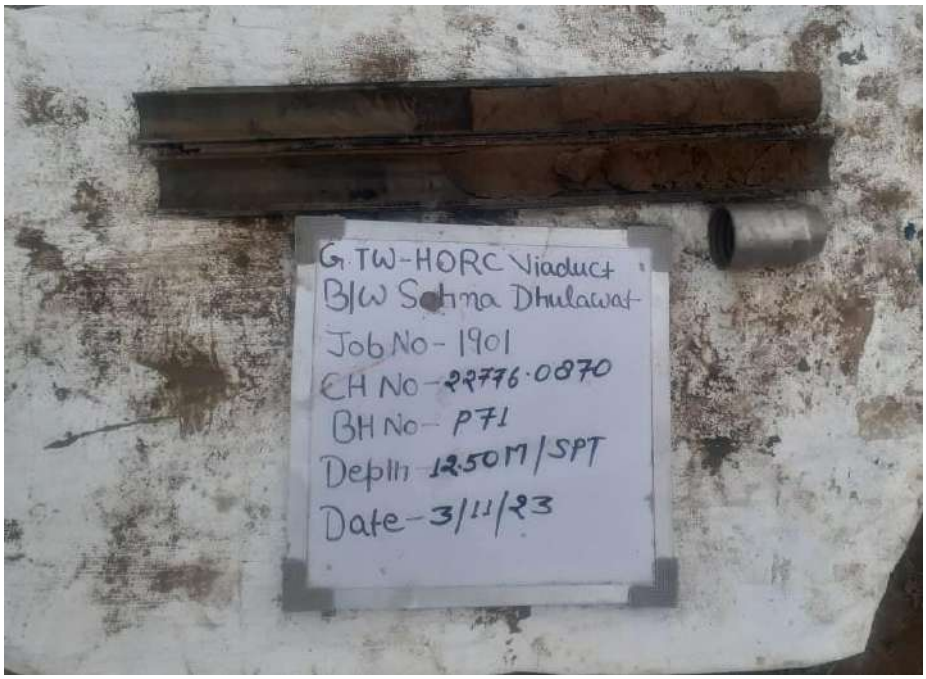
UDS at depth 23.00 m

SPT sample at depth 33.50 m

SPT sample at depth 12.00 m

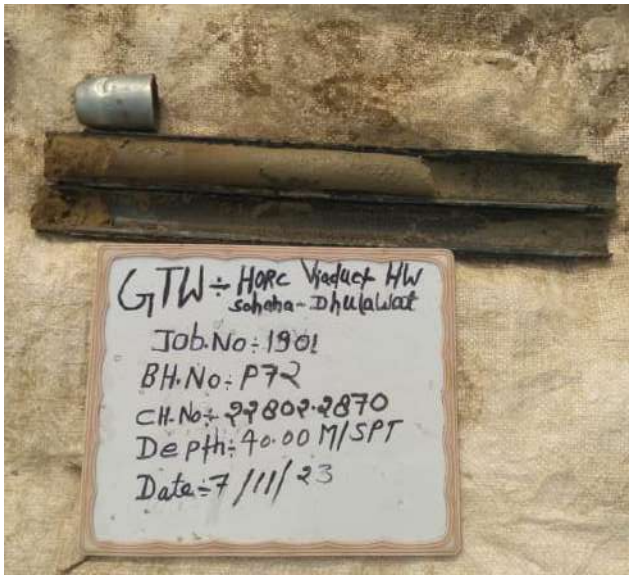
SPT at depth 8.00 m

APPENDIX-I
SITE PHOTOGRAPHS



SPT sample at depth 12.50 m

SPT at depth 12.50 m

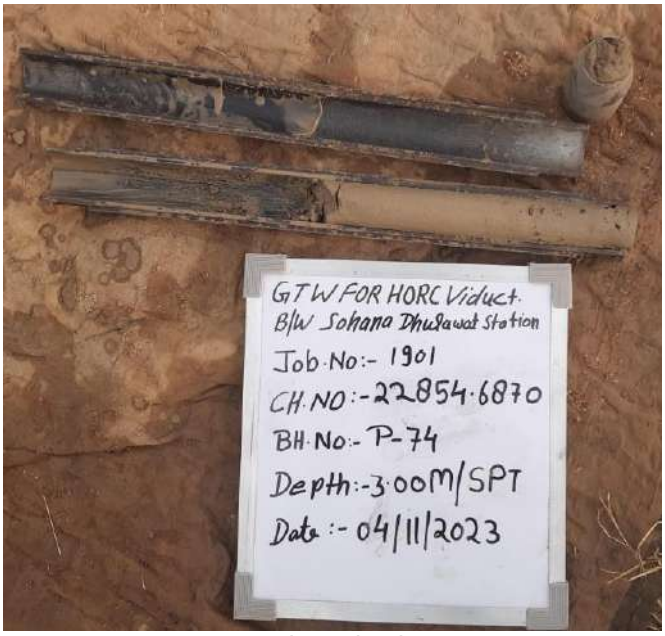


SPT sample at depth 40.00 m

APPENDIX-I
SITE PHOTOGRAPHS

SPT at depth 6.00 m

SPT sample at depth 27.50 m



SPT sample at depth 3.00 m

SPT sample at depth 21.50 m

APPENDIX-I
SITE PHOTOGRAPHS

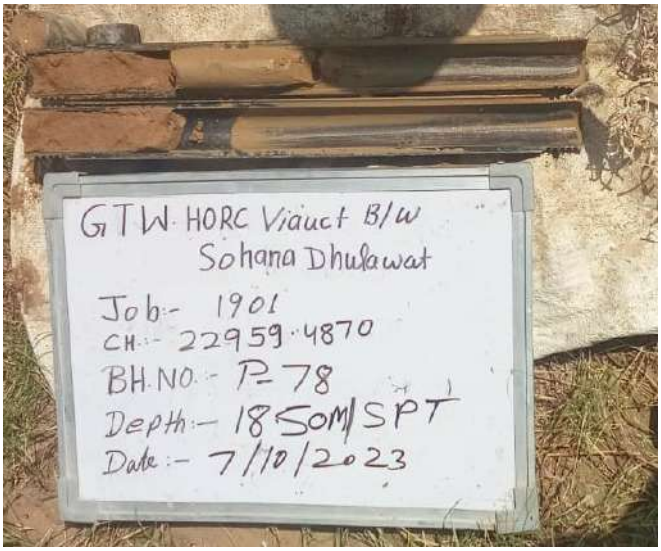
SPT sample at depth 32.00 m

UDS at depth 10.00 m

SPT sample at depth 29.50 m

SPT at depth 12.50 m

APPENDIX-I
SITE PHOTOGRAPHS



SPT sample at depth 18.50 m

SPT at depth 23.50 m

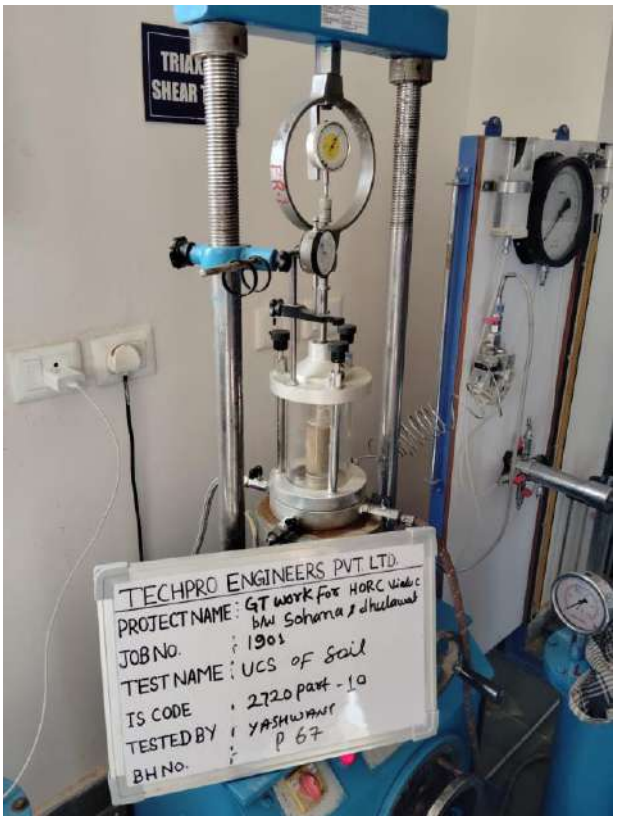
SPT sample at depth 29.50 m

SPT sample at depth 31.00 m

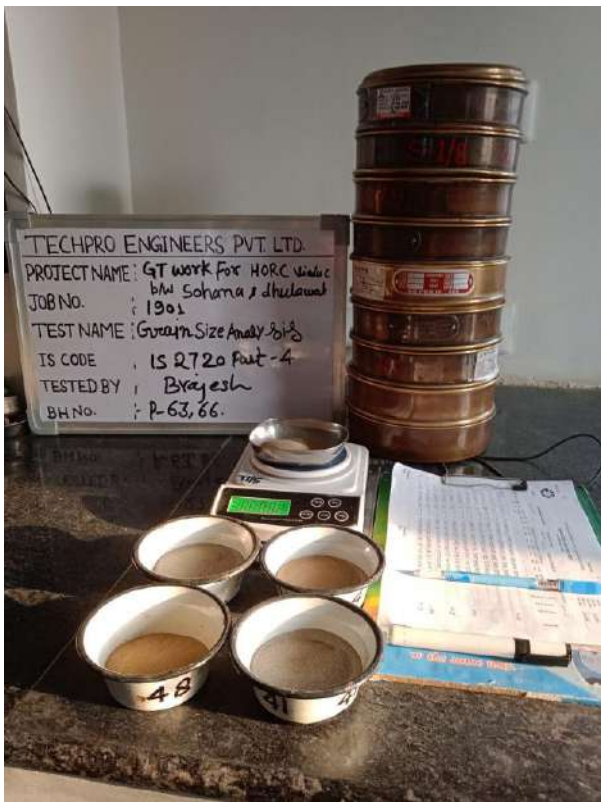
APPENDIX-J
LABORATORY PHOTOGRAPHS

Water content test

Atterbergs' limit test



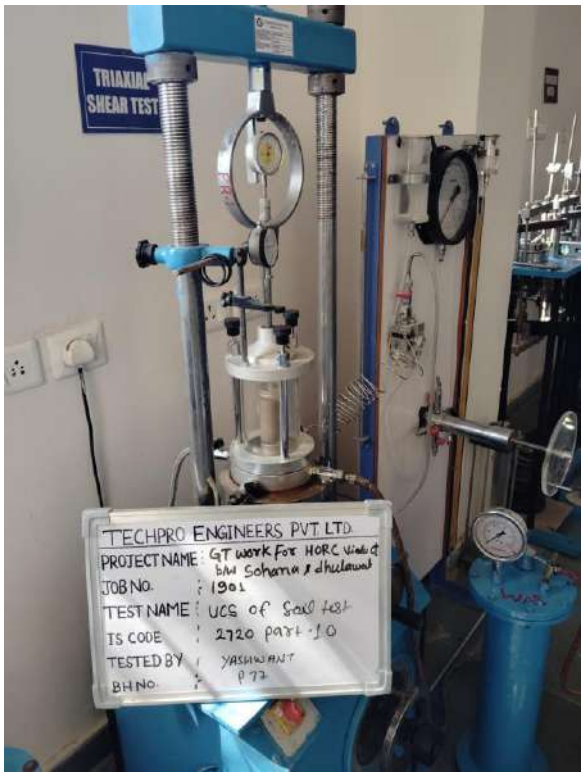
Triaxial test



Grain size analysis

APPENDIX-J
LABORATORY PHOTOGRAPHS

Direct shear test



UCS test soil

Moisture content test

Grain size analysis

APPENDIX-K
CHART 1: FIELD BORELOG CHARTS (P61)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GT for HORC Viaduct Between Sohana & Dhulawat Stations			Project Code:	1901
Coordinate:	N: 3119493.892	E: 701210.312		Location/ Chainage:	22514.0870
Method of Drilling:	Percussion	Drilling Equipment:	Powermech	Bore No.:	P61
Casing Lowered (M):	28.00	Bentonite Used: X	Standard Sampler:	Yes	Barrel Type:	NA
Ground Elevation:	R.L-191.635	Date: From 27/9/23 to 30/09/2023			Water Table (M):	1.52 m

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	CR (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
27/9/23	0.00	0.50	0.50	DS	SX	collected										Non cohesive soil
"	1.00	1.45	0.45	U	—	Received										— do —
"	2.00	2.45	0.45	D/P	—	3	3	2	5	-						Non cohesive soil with
"	3.00	3.45	0.45	D/P	—	3	3	3	6	-						cohesive soil (Interbed)
"	4.00	4.45	0.45	U	—	Received										— do —
"	5.00	5.45	0.45	D/P	—	5	7	8	15	-	-	-	-	-	-	Non cohesive soil
28/9/23	6.00	6.45	0.45	DP	SX	6	8	13	21							Non cohesive soil.
"	7.00	7.45	0.45	U	"	Received										do
"	8.00	8.45	0.45	DP	"	5	6	9	15							Non cohesive soil.
"	9.00	9.45	0.45	DP	"	9	11	14	25							cohesive soil.
"	10.00	10.45	0.45	U	"	Received										do
"	11.00	11.45	0.45	DP	"	7	11	13	24							cohesive soil
"	12.00	12.45	0.45	DP	"	8	13	15	28							do
"	13.00	13.45	0.45	U	"	Received										do
"	14.50	14.95	0.45	DP	"	9	15	17	32							cohesive soil.
"	16.00	16.45	0.45	U	"	Received										do
"	17.50	17.95	0.45	DP	"	7	11	14	25							Cohesive soil
"	19.00	19.45	0.45	U	"	Received										do
"	20.50	20.95	0.45	DP	"	11	20	24	52							do
"	22.00	22.45	0.45	U	"	Received										Non cohesive soil.
"	23.50	23.95	0.45	DP	"	12	23	35	58							cohesive soil.
"	25.00	25.45	0.45	U	"	Received										do
29/9/23	26.50	26.95	0.45	DP	SX	12	23	27	50							cohesive soil
	28.00	28.45	0.45	U	"	Received										"

Supervisor

S.I. - E-in-C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 2: FIELD BORELOG CHARTS (P61)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	G.T. For Horc Viaduct between Sohana Dhulawat Stations			Project Code:	1901
Coordinate:	N: 31194.93892	E: 7012106312		Location/ Chainage:	22514.0870
Method of Drilling:	Percussion	Drilling Equipment:	Powerwinch	Bore No.:	P-61
Casing Lowered (M):	28.00	Bentonite Used: X	Standard Sampler:	yes	Barrel Type:	NA
Ground Elevation:	R.L-191.635	Date: From 27/09/23 to 30/09/2023			Water Table (M):	1.52

Day/Date	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
29/9/23	29.50	29.95	0.45	DP	SX	18	32	36	68							Non cohesive soil
"	31.00	31.45	0.45	DP	"	17	35	39	74							Non cohesive soil with Gravel
"	32.50	32.95	0.45	DP	"	15	28	33	61							Non coherive soil.
"	34.00	34.45	0.45	DP	"	17	35	50	85							do
30/9/23	35.50	35.95	0.45	DP	"	12	27	37	64							do
"	37.00	37.45	0.45	DP	"	15	31	52	83							cohesive soil with Gravel
"	38.50	38.95	0.45	DP	"	17	34	55	89							do
	40.00	40.35	0.35	DP	"	25	65	36	101							cohesive soil with Gravel

Jitender Parashar

Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 3: FIELD BORELOG CHARTS (P62)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc. No:	GT/053
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date:	28.12.2021

Project Name: GT work for HORC Viaduct B/w Sohana & Dhaulpuwat Station				Project Code:	1901
Coordinate:	N: 3119515.583	E: 701195.421		Location/ Chainage:	22540-2870
Method of Drilling:	Percussion	Drilling Equipment:	Power with	Bore No.:	P62
Casing Lowered (M):	9.00	Bentonite Used:	NO	Standard Sampler:	Yes	Barrel Type:	N/A
Ground Elevation:	R.L-191.61	Date: From 28/9/2023 to 1/10/2023				Water Table (M):	1.50

Day/Date	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
28/9/23	0.00	0.50	0.50	D	SX	collected				—	—	—	—	—	—	Brownish cohesive soil
"	1.00	1.45	0.45	DP	—	1	2	3	5	—	—	—	—	—	—	do
"	2.00	2.45	0.45	U	—	Received				—	—	—	—	—	—	Brownish cohesive soil with gravels
"	3.00	3.45	0.45	DP	—	4	6	10	16	—	—	—	—	—	—	do
"	4.00	4.45	0.45	DP	—	7	11	14	25	—	—	—	—	—	—	do
"	5.00	5.45	0.45	U	—	Received				—	—	—	—	—	—	do
"	6.00	6.45	0.45	DP	—	9	14	16	30	—	—	—	—	—	—	do
"	7.00	7.45	0.45	DP	—	8	17	19	36	—	—	—	—	—	—	do
"	8.00	8.45	0.45	U	—	Slipped				—	—	—	—	—	—	do/ps collected
"	9.00	9.45	0.45	DP	—	5	8	11	19	—	—	—	—	—	—	Brownish yellow non cohesive soil
"	10.00	10.45	0.45	DP	—	7	10	15	25	—	—	—	—	—	—	do
29/9/23	11.00	11.45	0.45	U	—	Received				—	—	—	—	—	—	do
"	12.50	12.95	0.45	DP	—	6	11	17	28	—	—	—	—	—	—	do
"	14.00	14.45	0.45	U	—	Received				—	—	—	—	—	—	do
"	15.50	15.95	0.45	DP	—	8	15	18	33	—	—	—	—	—	—	do
"	17.00	17.45	0.45	U	—	Received				—	—	—	—	—	—	do
"	18.50	18.95	0.45	DP	—	9	17	19	36	—	—	—	—	—	—	Brownish yellow non cohesive soil with gravels
"	20.00	20.45	0.45	U	—	Received				—	—	—	—	—	—	do
"	21.50	21.95	0.45	DP	—	9	18	21	39	—	—	—	—	—	—	do
"	23.00	23.45	0.45	U	—	Received				—	—	—	—	—	—	Brownish cohesive soil with gravels
"	24.50	24.95	0.45	DP	—	11	29	33	62	—	—	—	—	—	—	do
30/9/23	26.00	26.45	0.45	U	—	Received				—	—	—	—	—	—	Cohesive Soil
"	27.50	27.95	0.45	DP	—	10	23	27	50	—	—	—	—	—	—	do
"	29.00	29.45	0.45	U	—	Slipped				—	—	—	—	—	—	do/ps collected

Supervisor

Site - Civil E - In - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 4: FIELD BORELOG CHARTS (P62)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name: GT WORK for HORC Viaduct B/w Sohana & Dhulat station		Project Code:	1901
Coordinate: N: 3119515.583	E: 701195.421	Location/ Chainage:	22540-2870
Method of Drilling: Percussion	Drilling Equipment: Powerwin	Bore No.: P62	
Casing Lowered (M): 21.00	Bentonite Used: NO	Standard Sampler: YES	Barrel Type: N/A
Ground Elevation: R.L-191.61	Date: From 28/9/2023 to 1/10/2023	Water Table (M):	1.50

Day/Date	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
30/9/23	30.50	30.95	045	DP	SX	13	25	31	56	–	–	–	–	–	–	cohesive soil
11/10/23	32.00	32.45	045	U	–	Slipped				–	–	–	–	–	–	— do/DS collected
"	33.50	33.95	045	DP	–	15	28	34	62	–	–	–	–	–	–	Cohesive soil with gravel
"	35.00	35.45	045	U	–	Slipped				–	–	–	–	–	–	— do/DS collected
"	36.50	36.95	045	DP	–	19	32	37	69	–	–	–				— do —
"	38.00	38.45	045	U	–	Slipped				–	–	–	–	–	–	— do —
"	40.00	40.45	045	DP		20	29	33	62	–	–	–	–	–	–	Non cohesive soil with Gravel.

Jitender Bhardwaj

Supervisor

E-in-C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 5: FIELD BORELOG CHARTS (P63)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GT work for HORC viaduct B/w Sohana & Dhulawat section			Project Code:	1901
Coordinate:	N: 3119537.582	E: 701180.991		Location/ Chainage:	22566.4870
Method of Drilling:	Percussion	Drilling Equipment:	Power rinch	Bore No.:	P-63
Casing Lowered (M):	22.00 Bentonite Used: No	Standard Sampler:	YES	Barrel Type:	N/A
Ground Elevation:	R.L-191.645	Date: From 2/10/2023 to 3/10/2023		Water Table (M):	1.50

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
2/10/23	00	0.50	0.50	D	SX	Collected				—	—	—	—	—	—	Cohesive soil
11	1.00	1.45	045	U	—	Received				—	—	—	—	—	—	— do —
11	2.00	2.45	045	DP	—	1	1	2	3	—	—	—	—	—	—	— do —
11	3.00	3.45	045	DP	—	2	2	4	6	—	—	—	—	—	—	— do —
11	4.00	4.45	045	U	—	Received				—	—	—	—	—	—	— do —
11	5.00	5.45	045	DP	—	3	5	7	12	—	—	—	—	—	—	Non cohesive soil
11	6.00	6.45	0.45	DP	—	3	7	11	18	—	—	—	—	—	—	— do —
11	7.00	7.45	045	U	—	Slipped				—	—	—	—	—	—	— do/ not collected
11	8.00	8.45	045	DP	—	5	10	16	26	—	—	—	—	—	—	Non cohesive soil with gravels
11	9.00	9.45	045	DP	—	7	12	19	31	—	—	—	—	—	—	— do —
11	10.00	10.45	045	U	—	Received				—	—	—	—	—	—	cohesive soil
11	11.00	11.45	645	DP	—	8	15	22	37	—	—	—	—	—	—	— do —
11	12.00	12.45	045	DP	—	7	18	23	41	—	—	—	—	—	—	— do —
11	13.00	13.45	045	U	—	Received				—	—	—	—	—	—	cohesive soil with gravels
11	14.00	14.45	045	DP	—	9	15	17	32	—	—	—	—	—	—	— do —
11	16.00	16.45	045	U	—	Received				—	—	—	—	—	—	cohesive soil
11	17.50	17.95	045	DP	—	8	20	24	44	—	—	—	—	—	—	— do —
11	19.00	19.45	045	U	—	Received				—	—	—	—	—	—	Non cohesive soil
11	20.50	20.95	045	DP	—	11	19	30	49	—	—	—	—	—	—	— do —
11	22.00	22.45	045	U	—	Received				—	—	—	—	—	—	cohesive soil with gravel
11	23.50	23.95	045	DP	—	9	17	25	42	—	—	—	—	—	—	— do —
11	25.00	25.45	045	U	—	Received				—	—	—	—	—	—	— do —
3/10/23	26.50	26.95	045	DP	—	11	20	26	46	—	—	—	—	—	—	— do —
11	28.00	28.45	045	U	—	Received				—	—	—	—	—	—	— do —

Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 6: FIELD BORELOG CHARTS (P63)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	Network for HORC viaduct B/w Sohana Dhulawat station			Project Code:	1901
Coordinate:	N: 3119537.582	E: 701180.991		Location/ Chainage:	22568-4870
Method of Drilling:	Percussion	Drilling Equipment:	Powerwinch	Bore No.:	P-63
Casing Lowered (M):	22.0m Bentonite Used: NO	Standard Sampler:	Yes	Barrel Type:	N/A
Ground Elevation:	R.L - 191.645	Date: From 2/10/2023 to 3/10/2023		Water Table (M):	1.50

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
3/10/23	29.50	29.95	045	DP	SX	10	21	28	49	—	—	—	—	—	—	cohesive soil with gravel
11	31.00	31.45	045	DP	—	13	22	30	52	—	—	—	—	—	—	— do —
11	32.50	32.95	045	DP	—	15	25	32	57	—	—	—	—	—	—	— do —
11	34.00	34.45	045	U	—	Slipped				—	—	—	—	—	—	Non cohesive soil
11	35.50	35.95	045	DP	—	12	28	30	58	—	—	—	—	—	—	— do —
11	37.00	37.45	045	U	—	Slipped				—	—	—	—	—	—	— do —
11	38.50	38.95	045	DP	—	10	27	33	60	—	—	—	—	—	—	— do —
11	40.00	40.45	045	DP	—	12	28	37	65	—	—	—	—	—	—	Non cohesive soil

03/10/2023
Geotechnical Engineer

3/10/2023
Supervisor

Abbreviation Used : U- Undisturbed Sample, C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

E - in - C

APPENDIX-K
CHART 7: FIELD BORELOG CHARTS (P64)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GT- for HORC viaduct b/w Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 3119559.818	E: 701167.064		Location/ Chainage:	22592.6870
Method of Drilling:	Percussion	Drilling Equipment	Powerwinch	Bore No.:	P64
Casing Lowered (M):	22.00	Bentonite Used: NO	Standard Sampler : Yes	Barrel Type :	N/A
Ground Elevation:	R.L - 191.728	Date: From 28/9/23 to 30/9/23		Water Table (M):	1.60

Day / Date	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
28/9/23	0.0	0.50	0.50	DS	SX	-	Recevid									NON cohesive soil
"	1.00	1.45	0.45	DP	"	2	2	2	4							cohesiv soil
"	2.00	2.45	0.45	U	"	-	Recevid									- do -
"	3.00	3.45	0.45	DP	"	6	6	7	13							NON cohesive soil
"	4.00	4.45	0.45	DP	"	7	9	11	20							- do -
"	5.00	5.45	0.45	U	"	Slipped			-							- do -
"	6.00	6.45	0.45	DP	"	3	5	8	13							- do -
"	7.00	7.45	0.45	DP	"	4	6	9	15							- do -
"	8.00	8.45	0.45	U	"	-	Recevid									- do -
29/9/23	9.00	9.45	0.45	DP	"	9	10	14	24							Cohesive soil
"	10.00	10.45	0.45	DP	"	10	14	17	31							- do -
"	11.00	11.45	0.45	U	"	-	Recevid									- do -
"	12.50	12.95	0.45	DP	"	6	12	15	27							- do -
"	14.00	14.45	0.45	U	"	-	Recevid									NON cohesive soil with Gravel
"	15.50	15.95	0.45	DP	"	8	14	18	32							
"	17.00	17.45	0.45	U	"	Recevid -										- do -
"	18.50	18.95	0.45	DP	"	6	13	16	29							- do -
"	20.00	20.45	0.45	U	"	Recevid										- do
"	21.50	21.95	0.45	DP	"	9	14	19	33							cohesive soil with Gravel
"	23.00	23.45	0.45	U	"	Recevid -										- do
"	24.50	24.95	0.45	DP	"	10	24	42	66							NON cohesive soil with Gravel
"	26.00	26.45	0.45	U	"	Slipped -										
"	27.50	27.95	0.45	DP	"	12	26	30	56							- do -
"	29.00	29.45	0.45	U	"	Recevid -										- do -

Supervisor

S.E. E-in-C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 8: FIELD BORELOG CHARTS (P64)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue	01 04 2018
		Rev No.:	R03
		Rev. Date:	28 12 2021

Project Name:	GT. For HORC Viaduct b/w Sohana Dhulawat station			Project Code:	1901
Coordinate:	N: 3119559.818	E: 701167.064		Location/ Chainage:	22592.6870
Method of Drilling:	Percussion	Drilling Equipment	Power winch	Bore No.:	P64
Casing Lowered (M):	22.00	Bentonite Used: NO	Standard Sampler: Yes	Barrel Type:	N/A
Ground Elevation:	RL-191.728	Date: From 28/9/23 to 30/9/23		Water Table (M):	1.60

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
"	30.50	30.95	0.45	DP	SX	10	26	33	59							Non cohesive soil
30/9	32.00	32.45	0.45	U	"	Slipped			-							with Gravel
23	33.50	33.95	0.45	DP	"	12	28	35	63							— do
"	35.00	35.45	0.45	U	"	Slipped			-							Non cohesive soil
"	36.50	36.95	0.45	DP	"	10	29	38	67							— do
"	38.00	38.45	0.45	U	"	Slipped										— do
"	40.00	40.45	0.45	DP	"	14	32	51	83							Non cohesive soil

Jitender Parashar

S.E.-civil

Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 9: FIELD BORELOG CHARTS (P65)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date:	28.12.2021

Project Name:	GT. for HORC viaduct b/w Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 3119582.405	E: 701153.57		Location/ Chainage:	22618.2870
Method of Drilling:	Percussion	Drilling Equipment:	Power winch	Bore No.:	P65
Casing Lowered (M):	20.00	Bentonite Used: NO	Standard Sampler: Yes	Barrel Type:	N/A
Ground Elevation:	R.L-191.825	Date: From 01/10/23 to 2/10/23		Water Table (M):	1.60

Day Date	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
1/10/23	0.0	0.50	0.50	DS	SX	-	Recevid									NON cohesive soil
"	1.00	1.45	0.45	U	"	-	Recevid									— do —
"	2.00	2.45	0.45	DP	"	2	2	3	5							cohesive soil
"	3.00	3.45	0.45	DP	"	2	5	5	10							— do —
"	4.00	4.45	0.45	U	"	-	Recevid									NON cohesive soil
"	5.00	5.45	0.45	DP	"	3	7	8	15							— do —
"	6.00	6.45	0.45	DP	"	4	9	11	20							— do —
"	7.00	7.45	0.45	U	"	-	Recevid									— do —
"	8.00	8.45	0.45	DP	"	6	10	15	25							— do —
"	9.00	9.45	0.45	DP	"	4	7	9	16							— do —
"	10.00	10.45	0.45	U	"	-	Recevid									— do —
"	11.00	11.45	0.45	DP	"	5	6	10	16							NON cohesive soil
"	12.00	12.45	0.45	DP	"	5	6	11	17							with Gravel
"	13.00	13.45	0.45	U	"	-	Recevid									— do —
"	14.50	14.95	0.45	DP	"	6	12	18	30							— do —
"	16.00	16.45	0.45	U	"	Slipped -										— do —
"	17.50	17.95	0.45	DP	"	6	10	13	23							— do —
"	19.00	19.45	0.45	U	"	- Slipped -										— do —
"	20.50	20.95	0.45	DP	"	6	11	16	27							— do —
"	22.00	22.45	0.45	U	"	Recevid -										— do —
2/10/23	23.50	23.95	0.45	DP	"	10	22	30	52							— do —
"	25.00	25.45	0.45	U	"	-	Recevid									— do —
"	26.50	26.95	0.45	DP	"	11	17	24	41							— do —
"	28.00	28.45	0.45	U	"	-	Recevid -									— do —

Supervisor

S.P. E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 10: FIELD BORELOG CHARTS (P65)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GT. for HORC viaduct b/w Sohana Dhulawat Station					Project Code:	1901
Coordinate:	N: 3119582.405	E: 701153.57			Location/ Chainage:	22618.8870	
Method of Drilling:	Percussion		Drilling Equipment	Powerwinch		Bore No.:	P65
Casing Lowered (M):	20.00	Bentonite Used: NO	Standard Sampler :	Yes		Barrel Type :	N/A
Ground Elevation:	R.L-191.82.5	Date: From 1/10/23 to 2/10/23				Water Table (M):	1.60

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
4	29.50	29.95	0.45	DP	SX	6	10	12	22							Cohesive Soil
4	31.00	31.45	0.45	U	11	-	Recevid									— do —
11	32.50	32.95	0.45	DP	11	10	21	29	50							NON cohesive Soil
11	34.00	34.45	0.45	U	11	Slipped	—									with Gravel Soil
11	35.50	35.95	0.45	DP	11	13	26	33	59							— do —
11	37.00	37.45	0.45	U	11	—	Slipped									— do —
11	38.50	38.95	0.45	DP	11	9	16	28	44							NONCohesive Soil
11	40.00	40.45	0.45	DP	11	10	21	35	56							— do —

Supervisor

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

E - in - C

APPENDIX-K
CHART 11: FIELD BORELOG CHARTS (P66)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name: GT for HORC Viaduct B/w Sohana Dhulawat Station				Project Code:	1901
Coordinate:	N: 3119605.336	E: 761140.518		Location/ Chainage:	22645.087C
Method of Drilling:	Percussion	Drilling Equipment:	Pano rock inch	Bore No.:	P66
Casing Lowered (M):	19.50	Bentonite Used:	NO	Standard Sampler:	Yes	Barrel Type:	N/A
Ground Elevation:	R.L-191.818	Date: From 28/09/23 to 30/9/23				Water Table (M):	17.50M

Day/Date	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
28/9/23	0.00	0.50	0.50	DS	SX	collected										Non-cohesive soil
"	1.00	1.45	0.45	U	"	Received										— do —
"	2.00	2.45	0.45	DP	"	1	2	4	6							Non-cohesive soil with gravel
"	3.00	3.45	0.45	DP	"	1	2	2	4							— do —
"	4.00	4.45	0.45	U	"	Received										— do —
"	5.00	5.45	0.45	DP	"	2	6	8	14							Non-cohesive soil
"	6.00	6.45	0.45	DP	"	3	2	6	8							— do —
"	7.00	7.45	0.45	U	"	Skipped										— do collected DS
"	8.00	8.45	0.45	DP	"	10	10	28	46							Cohesive soil with gravel
"	9.00	9.45	0.45	DP	"	3	7	8	15							— do —
"	10.00	10.45	0.45	U	"	Received										— do —
"	11.00	11.45	0.45	DP	"	8	10	12	22							— do —
"	12.00	12.45	0.45	DP	"	7	8	14	22							— do —
"	13.00	13.45	0.45	U	"	Received										Non-cohesive soil with gravel
29/9/23	14.00	14.45	0.45	DP	"	4	6	8	14							— do —
"	16.00	16.45	0.45	U	"	Received										— do —
"	17.50	17.95	0.45	DP	"	11	25	32	57							— do —
"	19.00	19.45	0.45	U	"	Received										— do —
"	20.50	20.95	0.45	DP	"	12	30	34	64							— do —
"	22.00	22.45	0.45	U	"	10	21	31	50							— do —
"	23.50	23.95	0.45	DP	"	15	20	33	53							— do —
"	25.00	25.45	0.45	U	"	Received										Cohesive soil with gravel
"	26.50	26.95	0.45	DP	"	16	12	10	22							— do —
"	28.00	28.45	0.45	U	"	Skipped										— do collected DS

Jitender Parashar

Techpro Engineers Pvt. Ltd. Kanpur

Supervisor

S.E.-Civil

E - in - C

Abbreviation Used: U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 12: FIELD BORELOG CHARTS (P66)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	001/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GT for HORC Viaduct B/w Sohana Dhulawat (Mod-III)			Project Code:	1901
Coordinate:	N: 3119605.336	E: 701140.518		Location/ Chainage:	23645.080
Method of Drilling:	Percussion	Drilling Equipment:	Rossenrich	Bore No.:	P66
Casing Lowered (M):	19.50	Bentonite Used: NO	Standard Sampler:	YES	Barrel Type:	N/A
Ground Elevation:	R-L-191.818	Date: From 23/09/22 to 30/09/23			Water Table (M):	1.50

Day/Date	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
30/9/23	32.50	32.95	0.45	DP	SK	9	13	20	33							Extremely dense silty clay with pebbles & cobbles
11	34.00	34.45	0.45	U	11	Recovered										Medium dense silty sand with kankar
11	32.00	32.95	0.45	DP	11	18	29	30	59							do.
11	34.00	34.45	0.45	U	11	Pushed										do. collected DS
11	35.50	35.95	0.45	DP	11	14	26	31	57							do.
11	37.00	37.45	0.45	U	11	Pushed										do. collected DS
11	38.00	38.45	0.45	DP	11	21	37	33	70							do.
11	40.00	40.45	0.45	DP	11	17	33	40	73							do.

Techpro Engineers Pvt. Ltd.

Supervisor

C.E. Civil

E - In - C

Abbreviation Used :- U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 13: FIELD BORELOG CHARTS (P67)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date:	28.12.2021

Project Name:	GT for HORC Viaduct blw Sohana Station & Dhulawat			Project Code:	1901
Coordinate:	N: 3119608.472	E: 701127.908		Location/ Chainage:	22571.237
Method of Drilling:	Percussion		Drilling Equipment	Rotary rig	Bore No.: P67
Casing Lowered (M):	17.00	Bentonite Used: Yes	Standard Sampler:	Yes	Barrel Type: SLA
Ground Elevation:	R.L-191.985	Date: From 30/09/23 to 2/9/23			Water Table (M): 1.00

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
30/9/23	0.00	0.50	0.50	DS	SX	collected										Non cohesive soil
"	1.00	1.45	0.45	DP	"	2	3	5	8							— do —
"	2.00	2.45	0.45	U	"	Received										Non cohesive soil with gravel
"	3.00	3.45	0.45	DP	"	1	2	3	5							— do —
"	4.00	4.45	0.45	DP	"	2	3	4	7							Non-cohesive soil
"	5.00	5.45	0.45	U	"	slipped										— do — DS collected
"	6.00	6.45	0.45	DP	"	5	9	11	20							Non cohesive soil
1/10/23	7.00	7.45	0.45	DP	"	6	10	12	22							— do —
"	8.00	8.45	0.45	U	"	slipped										— do — DS collected
"	9.00	9.45	0.45	DP	"	5	6	8	14							Cohesive soil with gravel
"	10.00	10.45	0.45	DP	"	7	9	12	21							— do —
"	11.00	11.45	0.45	U	"	Received										— do —
"	12.00	12.45	0.45	DP	"	5	7	11	18							— do —
"	14.00	14.45	0.45	U	"	Received										Cohesive soil
"	15.00	15.45	0.45	DP	"	8	10	15	25							— do —
"	17.00	17.45	0.45	U	"	Received										— do —
"	18.00	18.45	0.45	DP	"	7	10	17	27							Non-cohesive soil
"	20.00	20.45	0.45	U	"	slipped										-do- DS collected
2/10/23	21.00	21.45	0.45	DP	"	8	16	20	36							— do —
"	23.00	23.45	0.45	U	"	Received										Non cohesive soil with gravel
"	24.00	24.45	0.45	DP	"	8	18	33	51							— do —
"	26.00	26.45	0.45	U	"	slipped										-do- DS collected
"	27.00	27.45	0.45	DP	"	10	21	36	57							Cohesive soil with gravel
"	29.00	29.45	0.45	U	"	Received										Non cohesive soil with gravel

Supervisor

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

E-in-C

APPENDIX-K
CHART 14: FIELD BORELOG CHARTS (P67)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01 04 2018
		Rev. No.:	R03
		Rev. Date:	28 12 2021

Project Name:	GTR for HORC Viaduct b/w Sohana Dhulawat station			Project Code:	1901
Coordinate:	N: 3119628.473	E: 701127.988		Location/ Chainage:	22671.2270
Method of Drilling:	Percussion	Drilling Equipment	Powerwinch	Bore No.:	P67
Casing Lowered (M):	17.00	Bentonite Used: Yes	Standard Sampler: Yes	Barrel Type:	N/A
Ground Elevation:	R.L-191.985	Date: From 30/9/23 to 2/9/23		Water Table (M):	1.80

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
8/10/23	30.50	30.95	0.45	DP	SX	12	27	38	65							Non-cohesive soil with gravel
"	32.00	32.45	0.45	U	"	Slipped										— do —
"	33.50	33.95	0.45	DP	"	21	33	40	73							— do —
"	35.00	35.45	0.45	U	"	23	36	43	79							— do —
"	36.50	36.95	0.45	DP	"	27	39	47	86							— do —
"	38.00	38.45	0.45	U	"	23	37	51	88							— do —
"	40.00	40.45	0.45	DP	"	27	38	54	92							— do —

Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 15: FIELD BORELOG CHARTS (P68)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name: GT WORK FOR HORC Viaduct B/w Sohana Dhulawat Stretch				Project Code:	1901
Coordinate: N: 3119657866		E: 701115.947		Location/ Chainage:	72677.4870
Method of Drilling: Rotary		Drilling Equipment: Manual/ Hydraulic		Bore No.:	P-68
Casing Lowered (M): —	Bentonite Used: NA	Standard Sampler: Yes		Barrel Type:	NA
Ground Elevation: R.L-191.917		Date: From 03/11/23 to 06/11/2023		Water Table (M):	1.60m

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
3 10/23	0.00	0.50	0.50	D	SX	collected				—	—	—	—	—	—	Non cohesive soil
"	1.00	1.45	0.45	DP	"	2	2	3	5	—	—	—	—	—	—	do
"	2.00	2.45	0.45	U	"	Received				—	—	—	—	—	—	do
"	3.00	3.45	0.45	DP	"	3	5	7	12	—	—	—	—	—	—	do
"	4.00	4.45	0.41	DP	"	5	8	8	16	—	—	—	—	—	—	do
"	5.00	5.45	0.45	U/D	"	skipped				—	—	—	—	—	—	Non cohesive soil with Gravel
"	6.00	6.45	0.45	DP	"	4	9	11	20	—	—	—	—	—	—	do
"	7.00	7.45	0.45	DP	"	5	8	10	18	—	—	—	—	—	—	do
"	8.00	8.45	0.45	U	"	Received				—	—	—	—	—	—	do
"	9.00	9.45	0.45	DP	"	6	9	11	20	—	—	—	—	—	—	do
"	10.00	10.45	0.45	DP	SX	6	7	9	16	—	—	—	—	—	—	do
"	11.00	11.45	0.45	U	"	Received				—	—	—	—	—	—	Cohesive soil with Gravel
"	12.50	12.95	0.45	DP	"	8	10	17	27	—	—	—	—	—	—	do
4 10/23	14.00	14.45	0.45	U	"	Received				—	—	—	—	—	—	Cohesive soil with Gravel
"	15.50	15.95	0.45	DP	"	9	12	16	28	—	—	—	—	—	—	Cohesive soil
"	17.00	17.45	0.45	U	"	Received				—	—	—	—	—	—	Cohesive soil with Gravel
"	18.50	18.95	0.45	DP	"	11	17	20	37	—	—	—	—	—	—	do
"	20.00	20.45	0.45	U	"	Received				—	—	—	—	—	—	do
"	21.50	21.95	0.45	DP	SX	8	15	17	32	—	—	—	—	—	—	do
"	23.00	23.45	0.45	U	"	Received				—	—	—	—	—	—	Non cohesive soil
"	24.50	24.95	0.45	DP	"	9	19	20	39	—	—	—	—	—	—	Cohesive soil
"	26.00	26.45	0.45	U	"	Received				—	—	—	—	—	—	do
5 10/23	27.50	27.95	0.45	DP	"	11	25	27	52	—	—	—	—	—	—	do
"	29.00	29.45	0.45	DP	"	13	24	30	54	—	—	—	—	—	—	do

Techpro Engineers Pvt. Ltd.

Supervisor

Sr Engr - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 16: FIELD BORELOG CHARTS (P68)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW FOR HORC Viaduct B/W Sohana Dhulawat station			Project Code:	1901
Coordinate:	N: 3119651.866	E: 701115.947		Location/ Chainage:	22697.4870
Method of Drilling:	Rotary	Drilling Equipment:	Mounted Trip Hydraulic	Bore No.:	P-68
Casing Lowered (M):	X	Bentonite Used: NA	Standard Sampler: Yes.	Barrel Type:	NA
Ground Elevation:	R.L-191.917	Date: From 3/11/23 to 6/11/23		Water Table (M):	1.60

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
5/10/23	30.50	30.95	0.45	DP	SX	14	26	35	61	—	—	—	—	—	-	cohesive soil.
"	32.00	32.45	0.45	DP	"	17	30	37	67	—	—	—	—	—	-	do
"	33.50	33.95	0.45	DP	"	19	32	40	72	—	—	—	—	—	-	Non cohesive soil.
"	35.00	35.45	0.45	DP	"	21	35	42	77	—	—	—	—	—	-	do
"	36.50	36.95	0.45	DP	"	17	25	27	52	—	—	—	—	—	-	cohesive soil.
6/10/23	38.00	38.45	0.45	DP	"	23	29	35	64	—	—	—	—	—	-	do
"	40.00	40.30	0.30	DP	"	29	101	—	101	—	—	—	—	-	-	cohesive soil with Gravel

Supervisor

Techpro Engineers Pvt. Ltd. Jaipur

SE-C.Coil

E-in-C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 17: FIELD BORELOG CHARTS (P69)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW FOR HORC Viaduct B/w Sohana Dhulawat stations			Project Code:	1901
Coordinate:	N: 3119675.469	E: 701104.421		Location/ Chainage:	22723.6870
Method of Drilling:	Rotary	Drilling Equipment:	Hydraulic	Bore No.:	P-69
Casing Lowered (M):	— Bentonite Used: NA	Standard Sampler :	Yes	Barrel Type :	NA
Ground Elevation:	R.L -191.999	Date: From 3/11/23 to 8/11/23		Water Table (M):	1.70

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
3/11/23	0.00	0.50	0.50	D	SX	collected				—	—	—	—	—	—	Non Cohesive soil
"	1.00	1.45	0.45	DP	"	1	2	2	4	—	—	—	—	—	—	do
"	2.00	2.45	0.45	U	"	Received				—	—	—	—	—	—	do
4/11/23	3.00	3.45	0.45	DP	"	3	4	6	10	—	—	—	—	—	—	Cohesive soil with Gravel
"	4.00	4.45	0.45	DP	"	4	5	7	12	—	—	—	—	—	—	do
"	5.00	5.45	0.45	U	"	Received				—	—	—	—	—	—	Non cohesive soil
"	6.00	6.45	0.45	DP	"	3	6	9	15	—	—	—	—	—	—	do
"	7.00	7.45	0.45	DP	"	4	8	9	17	—	—	—	—	—	—	do
5/11/23	8.00	8.45	0.45	U	SX	Received				—	—	—	—	—	—	do
"	9.00	9.45	0.45	DP	"	4	6	9	15	—	—	—	—	—	—	Cohesive soil
"	10.00	10.45	0.45	DP	"	4	5	7	12	—	—	—	—	—	—	do
"	11.00	11.45	0.45	U	"	Received				—	—	—	—	—	—	do
"	12.00	12.95	0.45	DP	"	5	7	11	18	—	—	—	—	—	—	do
"	14.00	14.45	0.45	U	"	Received				—	—	—	—	—	—	do
"	15.50	15.95	0.45	DP	"	7	12	15	27	—	—	—	—	—	—	do
"	17.00	17.45	0.45	U	SX	Received				—	—	—	—	—	—	Cohesive soil.
"	18.50	18.95	0.45	DP	"	11	20	24	44	—	—	—	—	—	—	Cohesive soil with Gravel
"	20.00	20.45	0.45	U	"	Received				—	—	—	—			Cohesive soil
"	21.50	21.95	0.45	DP	"	7	14	21	35	—	—	—	—			do
"	23.00	23.45	0.45	U	"	Received				—	—	—	—			Non cohesive soil.
"	24.50	24.95	0.45	DP	"	14	20	23	43	—	—	—	—			do
"	26.00	26.45	0.45	U	"	Received				—	—	—	—			Cohesive soil
"	27.50	27.95	0.45	DP	"	17	23	28	51	—	—	—	—			do
"	29.00	29.45	0.45	DP	"	19	25	35	60	—	—	—	—			Non cohesive soil

Supervisor

Techpro Engineers Pvt. Ltd. Jaipur

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 18: FIELD BORELOG CHARTS (P69)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW FOR HORC Viaduct B/w Sohana Dhulawat station			Project Code:	1901
Coordinate:	N: 3119675.469	E: 701104.421	Location/ Chainage:	22723.6870	
Method of Drilling:	Rotary	Drilling Equipment:	Auto Trip Hydraulic	Bore No.:	P-69
Casing Lowered (M):	— Bentonite Used: NA	Standard Sampler:	YES	Barrel Type:	NA
Ground Elevation:	R.L-191.999	Date: From 3/11/23 to 6/11/23		Water Table (M):	1.70

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
6/11/23	30.00	30.45	0.45	DP	SX	25	35	38	73	—	—	—	—	—	-	Non cohesive soil
"	32.00	32.45	0.45	DP	"	15	25	39	64	—	—	—	—	—	-	cohesive soil with Gravel
"	33.50	33.95	0.45	DP	"	19	29	38	67	—	—	—	—	—	—	do
"	35.00	35.45	0.45	DP	"	21	32	43	75	—	—	—	—	—	—	do
"	36.50	36.95	0.45	DP	"	37	42	50	92	—	—	—	—	—	—	Non cohesive soil with Gravel
"	38.00	38.45	0.45	DP	"	24	34	45	84	—	—	—	—	—	—	Cohesive Soil with Gravel
"	40.00	40.45	0.45	DP	"	20	39	74	113	—	—	—	—	—	—	—do—

Supervisor

Techpro Engineers Pvt. Ltd. Gurgaon

S.E. (101)

E - In - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 19: FIELD BORELOG CHARTS (P70)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GT work for HORC Viaduct btw. Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 2119699.349	E: 761093.375	Location/ Chainage:	29749.0870	
Method of Drilling:	Percussion	Drilling Equipment:	Power winch	Bore No.:	P70
Casing Lowered (M):	26.00	Bentonite Used: N/O	Standard Sampler:	Yes	Barrel Type:	N/A
Ground Elevation:	RL - 192.161	Date: From 3/10/23 to 5/10/23			Water Table (M):	1.60 m

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
3/10/23	0.00	0.45	0.45	DS	SX	Collected										Non-cohesive soil
"	1.00	1.45	0.45	U		Received										—do—
"	3.00	3.45	0.45	DP		1	1	2	3							—do—
"	2.00	2.45	0.45	DP		2	3	4	7							—do—
"	4.00	4.45	0.45	U		Received										—do—
"	5.00	5.45	0.45	DP		2	4	6	10							—do—
"	6.00	6.45	0.45	DP		3	3	5	8							—do—
"	7.00	7.45	0.45	U		Slipped										—do—DS collected
"	8.00	8.45	0.45	DP		5	6	8	14							—do—
"	9.00	9.45	0.45	DP		5	7	10	17							—do—
"	10.00	10.45	0.45	U		Received										Cohesive soil with gravel
"	11.00	11.45	0.45	DP		4	7	11	18							—do—
"	12.00	12.45	0.45	DP		3	6	9	15							—do—
"	13.00	13.45	0.45	U		Received										—do—
"	14.00	14.45	0.45	DP		3	5	10	15							—do—
4/10/23	15.00	15.45	0.45	U		Received										—do—
"	16.00	16.45	0.45	DP		5	8	10	18							—do—
"	17.00	17.45	0.45	U		Received										—do—
"	18.00	18.45	0.45	DP		7	9	11	20							—do—
"	19.00	19.45	0.45	U		Received										—do—
"	20.00	20.45	0.45	DP		8	12	15	27							—do—
"	21.00	21.45	0.45	U		Received										—do—
"	22.00	22.45	0.45	DP		16	14	17	31							—do—
"	23.00	23.45	0.45	U		Received										—do—

Supervisor

E - In - C

Abbreviation Used: U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 20: FIELD BORELOG CHARTS (P70)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date:	28.12.2021

Project Name:	GT work for HORC Viaduct blw Sohana & Dhulawat Section			Project Code:	1901
Coordinate:	N: 3119699.349	E: 76[illegible]93.375		Location/ Chainage:	29749.0070
Method of Drilling:	Percussion		Drilling Equipment:	Rigmaster	Bore No.: P70
Casing Lowered (M):	3.0M	Bentonite Used: NIL	Standard Sampler:	V.S	Barrel Type: NA
Ground Elevation:	R.L-192.161	Date: From 3/10/23 to 5/10/23			Water Table (M): 1.60 M

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
11	20.0	20.45	0.45	DP	SX	9	12	16	28							— do —
11	21.0	21.45	0.45	U		Shipped										Non-cohesive soil with [illegible]
11	22.0	22.45	0.45	DP		11	15	21	36							— do —
11	24.0	24.45	0.45	U		Shipped										— do — N.S
11	25.0	25.45	0.45	DP		19	23	32	55							— do —
11	27.0	27.45	0.45	U		Shipped										— do —
5/10/23	28.0	28.45	0.45	DP		15	30	35	65							— do —
11	30.0	30.45	0.45	DP		17	32	40	72							— do —

Tirath Parashar

Supervisor

E - In - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 21: FIELD BORELOG CHARTS (P71)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW-HORC Viaduct btw Sohana Dhulawat (Haryana)			Project Code:	1901
Coordinate:	N: 3119723.456	E: 701082.834		Location/ Chainage:	22776.0870
Method of Drilling:	Percussion	Drilling Equipment:	Manual Powerswinch	Bore No.:	P 71
Casing Lowered (M):	12.00	Bentonite Used: NO	Standard Sampler:	Yes	Barrel Type:	N/A
Ground Elevation:	R.L-192.387	Date: From 3/11/23 to 5/11/23			Water Table (M):	1.70

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
3/11/23	0.00	0.50	0.50	DS	SX	collected										Non-cohesive soil
"	0.00	1.45	0.45	DP	"	1	1	2	3							— do —
"	2.00	2.45	0.45	U	"	slipped										-do- DS collected
"	3.00	3.45	0.45	DP	"	2	2	3	5							Non-cohesive soil
"	4.00	4.45	0.45	DP	"	3	4	5	9							— do —
"	5.00	5.45	0.45	U	"	slipped										-do- DS collected
"	6.00	6.45	0.45	DP	"	3	3	4	7							Non-cohesive soil
"	7.00	7.45	0.45	DP	"	4	4	6	10							— do —
"	8.00	8.45	0.45	U	"	Received										— do —
"	9.00	9.45	0.45	DP	"	6	9	10	19							— do —
"	10.00	10.45	0.45	DP	"	7	10	12	22							— do —
"	11.00	11.45	0.45	U	"	Received										Cohesive soil with gravel
"	12.50	12.95	0.45	DP	"	10	12	15	27							— do —
4/11/23	14.00	14.45	0.45	U	"	Received										— do —
"	15.50	15.95	0.45	DP	"	10	14	17	31							— do —
"	17.00	17.45	0.45	U	"	Received										— do —
"	18.50	18.95	0.45	DP	"	19	17	21	38							— do —
"	20.00	20.45	0.45	U	"	slipped										-do- DS collected
"	21.50	21.95	0.45	DP	"	12	16	23	39							Non-cohesive soil
"	23.00	23.45	0.45	U	"	slipped										-do- DS collected
"	24.50	24.95	0.45	DP	"	16	22	20	42							Non-cohesive soil
"	26.00	26.45	0.45	U	"	Received										— do —
"	27.50	27.95	0.45	DP	"	19	23	31	54							— do —
"	29.00	29.45	0.45	DP	"	20	24	32	56							— do —

Nitesh
Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 22: FIELD BORELOG CHARTS (P71)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW-HORC Viaduct blw Sohana Dhulawat station			Project Code:	1901
Coordinate:	N: 3119723.456	E: 701082.834		Location/ Chainage:	22776.0870
Method of Drilling:	Percussion	Drilling Equipment:	Manual Power winch	Bore No.:	P71
Casing Lowered (M):	12.50 Bentonite Used: NO	Standard Sampler :	Yes	Barrel Type :	N/A
Ground Elevation:	R.L-192.287	Date: From 3/11/23 to 5/11/23		Water Table (M):	1.70

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
4/11/23	30.50	30.95	0.45	DP	SX	20	25	30	55							Non-cohesive soil
11	32.00	32.45	0.45	DP	11	23	26	33	59							— do —
11	33.50	33.95	0.45	DP	11	22	25	33	58							— do —
11	35.00	35.45	0.45	DP	11	24	29	32	61							— do —
5/11/23	36.50	36.95	0.45	DP	11	23	27	35	62							— do —
11	38.00	38.45	0.45	DP	11	25	28	33	61							— do —
11	40.00	40.45	0.45	DP	11	25	29	37	66							— do —

Supervisor

Abbreviation Used :- U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

E - in - C

APPENDIX-K
CHART 23: FIELD BORELOG CHARTS (P72)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTL-HORC Viaduct btw Sohana Dhulawat			Project Code:	1901
Coordinate:	N: 3119747.802	E: 701872.794		Location/ Chainage:	28802.2870
Method of Drilling:	Percussion	Drilling Equipment:	Rotary with Tricone bit	Bore No.:	P72
Casing Lowered (M):	20.00 Bentonite Used:	NC	Standard Sampler :	Yes	Barrel Type :	N/A
Ground Elevation:	R.L- 192.289	Date: From 5/11/23	to 7/11/23	Water Table (M):	1.60

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
5/11/23	0.00	0.50	0.50	DS	SX	collected										Non-cohesive soil
"	1.00	1.45	0.45	DP	"	1	2	2	4							— do —
"	2.00	2.45	0.45	U	"	Received										Non-cohesive soil with gravel
"	3.00	3.45	0.45	DP	"	2	3	4	7							— do —
"	4.00	4.45	0.45	DP	"	4	6	7	13							— do —
"	5.00	5.45	0.45	U	"	Received										— do —
"	6.00	6.45	0.45	DP	"	5	6	9	15							Non-cohesive soil
"	7.00	7.45	0.45	DP	"	4	6	11	17							— do —
"	8.00	8.45	0.45	U	"	slipped										— do —
"	9.00	9.45	0.45	DP	"	2	3	3	6							— do —
"	10.00	10.45	0.45	DP	"	4	7	8	15							— do —
"	11.00	11.45	0.45	U	"	Received										cohesive soil
"	12.50	12.95	0.45	DP	"	4	6	6	12							— do —
"	14.00	14.45	0.45	U	"	Received										— do —
"	15.50	15.95	0.45	DP	"	6	7	9	16							— do —
"	17.00	17.45	0.45	U	"	Received										— do —
"	18.50	18.95	0.45	DP	"	7	9	11	20							— do —
"	20.00	20.45	0.45	U	"	Received										Cohesive soil with gravel
6/11/23	21.50	21.95	0.45	DP	"	8	15	18	33							— do —
"	23.00	23.45	0.45	U	"	slipped										— do —
"	24.50	24.95	0.45	DP	"	14	24	28	52							Non-cohesive soil
"	26.00	26.45	0.45	U	"	Received										cohesive soil
"	27.50	27.95	0.45	DP	"	10	16	18	34							— do —
"	29.00	29.45	0.45	U	"	slipped										Non-cohesive soil

Supervisor

Techpro Engineers Pvt. Ltd.

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N > 100). Sampler means SPT sampler

APPENDIX-K
CHART 24: FIELD BORELOG CHARTS (P72)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	6-Th) HORC Viaduct blw Sohana Dhulawat station			Project Code:	1901
Coordinate:	N: 3119747.802	E: 701072.794	Location/ Chainage:	22802-23870	
Method of Drilling:	Percussion	Drilling Equipment:	Powerwinch	Bore No.:	P72
Casing Lowered (M):	30.00	Bentonite Used: NO	Standard Sampler :	Yes	Barrel Type : N/A
Ground Elevation:	R.L- 192.289	Date: From 5/11/23 to 7/11/23			Water Table (M): 1.60

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
6/11/23	30.50	30.95	0.45	DP	SX	13	23	27	50							Non-cohesive soil
11	32.00	32.45	0.45	DP	11	slipped										— do —
11	33.50	33.95	0.45	DP	11	15	26	30	56							— do —
11	35.00	35.45	0.45	DP	11	17	27	32	59							— do —
7/11/23	36.50	36.95	0.45	DP	11	14	20	26	46							— do —
11	38.00	38.45	0.45	DP	11	slipped										— do —
11	40.00	40.45	0.45	DP	11	20	26	34	60							— do —

Techpro Engineers Pvt. Ltd.

Supervisor

E.E-in-C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 25: FIELD BORELOG CHARTS (P73)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GT FOR HORC Viaduct Between Sohana Dhulawat stations			Project Code:	1901
Coordinate:	N: 3119772.31	E: 701063.285		Location/ Chainage:	22828.4870
Method of Drilling:	Percussion	Drilling Equipment:	Power winch	Bore No.:	P-73
Casing Lowered (M):	29.00	Bentonite Used: NA	Standard Sampler:	Yes.	Barrel Type: NA
Ground Elevation:	R.L-192.387	Date: From 02/10/23 to 04/10/23		Water Table (M):	1.85

Day/Date	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
2/10/23	0.00	0.50	0.50	DS	SX	Collected										Non cohesive soil
"	1.00	1.45	0.45	DP	"	3	4	5	9							do
"	2.00	2.45	0.45	U	"	Received										do
3/10/23	3.00	3.45	0.45	DP	"	4	5	8	13							cohesive soil with Gravel
"	4.00	4.45	0.45	DP	"	5	7	9	16							do
"	5.00	5.45	0.45	U	"	Received										do
"	6.00	6.45	0.45	DP	"	4	5	9	14							Cohesive soil
"	7.00	7.45	0.45	DP	"	3	6	12	18							do
"	8.00	8.45	0.45	U	"	Received										Gray Non cohesive soil
"	9.00	9.45	0.45	DP	"	4	5	7	12							do
"	10.00	10.45	0.45	DP	"	5	9	10	19							cohesive soil
"	11.00	11.45	0.45	U	"	Received										do
"	12.30	12.95	0.45	DP	"	3	5	9	14							do
"	14.00	14.45	0.45	U	"	Received										do
"	15.50	15.95	0.45	DP	"	7	11	15	26							do
"	17.00	17.45	0.45	U	"	Received										do
"	18.50	18.95	0.45	DP	"	9	14	19	33							Non cohesive soil
"	20.00	20.45	0.45	U	"	Received										cohesive soil with Gravel
"	21.50	21.95	0.45	DP	"	11	22	32	54							do
"	23.00	23.45	0.45	DP	"	13	24	37	61							Non cohesive soil
4/10/23	24.50	24.95	0.45	DP	SX	15	27	37	64							do
"	26.00	26.45	0.45	DP	"	14	28	30	58							do
"	27.50	27.95	0.45	DP	"	13	25	27	52							do
"	29.00	29.45	0.45	DP	"	10	23	28	51							do

Supervisor

E-in-C

04/10/23

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 26: FIELD BORELOG CHARTS (P73)

TECHPRO ENGINEERS PVT. LTD.

BORE/ DRILL LOG

Doc No:	GT/ 003
Date of Issue:	01.04.2018
Rev. No.:	R03
Rev. Date.:	28.12.2021
Project Code:	1901

Project Name:	GT FOR HORC Viaduct Between Sohana Dhulawat station		
Coordinate:	N: 3119772.31	E: 701063.285	Location/ Chainage: 22828.4870
Method of Drilling:	Percussion	Drilling Equipment: Powerminen	Bore No.: P.73
Casing Lowered (M):	29.00	Bentonite Used: NA	Standard Sampler: Yes	Barrel Type: NA
Ground Elevation:	R.L-192.387	Date: From 03/10/23 to 04/10/23	Water Table (M): 1.85

Day/Date	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
4/10/23	30.50	30.95	0.45	DP	SX	4	25	30	55							Non cohesive soil
"	32.00	32.45	0.45	DP	"	11	27	31	58							cohesive soil.
"	33.50	33.95	0.45	DP	"	12	29	33	62							do
"	35.00	35.45	0.45	DP	"	10	24	35	59							do
"	36.50	36.95	0.45	DP	"	14	29	35	64							do
"	38.00	38.45	0.45	DP	"	17	32	40	72							cohesive soil.
"	40.00	40.40	0.40	DP	"	24	60	42	102							do

Shameem Ahmed

Supervisor

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

Techpro Engineers Pvt. Ltd.

SPE/Hrvid 04/10/23

APPENDIX-K
CHART 27: FIELD BORELOG CHARTS (P74)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW HORC Viaduct b/w Sohna & Dhulawat Station			Project Code:	1901
Coordinate:	N: 3119797.076	E: 7010594.272		Location/ Chainage:	22854.6870
Method of Drilling:	Rotary.	Drilling Equipment:	Autorigt Hydraulic	Bore No.:	P74
Casing Lowered (M):	20.00 Bentonite Used: Not	Standard Sampler:	Yes	Barrel Type:	NA
Ground Elevation:	R.L-192.472	Date: From 04/11/2023 to 06/11/2023		Water Table (M):	2.45

Day / Date	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
04/11/23	0.00	0.50	0.50	DS	Sx	Collected.										Non-Cohesive Soil.
11	1.00	1.45	0.45	DP	11	2	3	3	6							—do—
11	2.00	2.45	0.45	U	11	Received.										—do—
11	3.00	3.45	0.45	DP	11	2	2	3	5							—do—
11	4.00	4.45	0.45	DP	11	3	5	6	11							—do—
11	5.00	5.45	0.45	U	11	Received.										—do—
11	6.00	6.45	0.45	DP	11	5	8	10	18							—do—
11	7.00	7.45	0.45	DP	11	4	7	12	19							—do—
11	8.00	8.45	0.45	U	11	Received.										—do—
11	9.00	9.45	0.45	DP	11	6	10	13	23							—do—
11	10.00	10.45	0.45	DP	11	5	7	10	17							Non-Cohesive Soil+Gravel
05/11/23	11.00	11.45	0.45	U	11	Received.										—do—
11	12.50	12.95	0.45	DP	11	4	6	8	14							Cohesive Soil.
11	14.00	14.45	0.45	U	11	Slipped.										—do— + DS Collected
11	15.50	15.95	0.45	DP	11	7	8	13	21							Cohesive Soil+Gravel.
11	17.00	17.45	0.45	U	11	Received.										—do—
11	18.50	18.95	0.45	DP	11	10	13	16	29							Non-Cohesive Soil.
11	20.00	20.45	0.45	U	11	Slipped.										—do— + DS Collected
11	21.50	21.95	0.45	DP	11	12	23	32	55							Cohesive Soil with gravel
11	23.00	23.45	0.45	DP	11	11	20	30	50							—do—
11	24.50	24.95	0.45	DP	11	13	24	35	59							Cohesive Soil
11	26.00	26.45	0.45	DP	11	9	22	28	50							—do—
11	27.50	27.95	0.45	DP	11	10	20	25	45							—do—
11	29.00	29.45	0.45	DP	11	9	25	30	55							Non-Cohesive Soil.

Techpro Engineers Pvt. Ltd. Gurgaon

Supervisor

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 28: FIELD BORELOG CHARTS (P74)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW HORC Viaduct b/w Sohna & Dhulawat Station			Project Code:	1901
Coordinate:	N: 3119797.076	E: 701054.272		Location/ Chainage:	22854.6870
Method of Drilling:	Rotary		Drilling Equipment:	Auto N P Hydraulic	Bore No.: P-74
Casing Lowered (M):	20.00	Bentonite Used: Not	Standard Sampler:	Yes	Barrel Type: N.A
Ground Elevation:	R.L-192.472	Date: From 04/11/2023 to 06/11/2023			Water Table (M): 3.45

Day / Date	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
1/	30.50	30.95	0.45	DP	9"	10	22	29	51							Non-Cohesive Soil
06/11/23	32.00	32.45	0.45	DP	11"	12	25	28	53							Cohesive Soil with gravel
1/	33.50	33.95	0.45	DP	11"	11	22	31	58							—do—
1/	35.00	35.45	0.45	DP	11"	13	26	34	60							—do—
1/	36.50	36.95	0.45	DP	11"	12	25	32	57							—do—
1/	38.00	38.45	0.45	DP	11"	15	30	39	69							—do—
1/	40.00	40.45	0.45	DP	11"	20	35	40	75							—do—

Supervisor

Techpro Engineers Pvt. Ltd. Rohtak

Sr. Engineer

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 29: FIELD BORELOG CHARTS (P75)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GTI/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date:	28.12.2021

Project Name:	(DFC)-HORC Viaduct blw Sohana Dhulawat stations			Project Code:	1901
Coordinate:	N: 3119821.943	E: 701045.81		Location/ Chainage:	22880.8870
Method of Drilling:	Percussion	Drilling Equipment:	Manual Rope winch	Bore No.:	P-75
Casing Lowered (M):	18.00	Bentonite Used: NO	Standard Sampler: Yes	Barrel Type:	N/A
Ground Elevation:	R.L-192.565	Date: From 5/11/23 to 7/11/23		Water Table (M):	1.80

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
6/11/23	1.00	1.50	0.50	DS	SX	collected										Non-cohesive soil
"	1.50	1.95	0.45	DP	"	1	1	2	3							— do —
"	2.00	2.45	0.45	U	"	Received										Non-cohesive soil with gravel
"	3.00	3.45	0.45	DP	"	2	3	4	7							— do —
"	4.00	4.45	0.45	DP	"	4	5	7	12							— do —
"	5.00	5.45	0.45	U	"	Received										— do —
"	6.00	6.45	0.45	DP	"	4	6	8	14							Non-cohesive soil
"	7.00	7.45	0.45	DP	"	6	8	9	17							— do —
"	8.00	8.45	0.45	U	"	slipped										do-DS collected
"	9.00	9.45	0.45	DP	"	5	10	11	21							Non-cohesive soil
"	10.00	10.45	0.45	DP	"	5	11	12	23							— do —
"	11.00	11.45	0.45	U	"	Received										— do —
6/11/23	12.50	12.95	0.45	DP	"	6	8	10	18							cohesive soil with gravel
"	14.00	14.45	0.45	U	"	slipped										do-DS collected
"	15.50	15.95	0.45	DP	"	7	11	14	25							cohesive soil with gravel
"	17.00	17.45	0.45	U	"	slipped										Non-cohesive soil with gravel-DS
"	18.50	18.95	0.45	DP	"	11	14	16	30							Non-cohesive soil with gravel
"	20.00	20.45	0.45	U	"	slipped										— do DS collected
"	21.50	21.95	0.45	DP	"	12	17	21	38							Non-cohesive soil with gravel
"	23.00	23.45	0.45	U	"	Received										— do —
"	24.50	24.95	0.45	DP	"	13	16	20	36							Non-cohesive soil
"	26.00	26.45	0.45	U	"	slipped										-do- DS collected
"	27.50	27.95	0.45	DP	"	14	19	23	42							Non-cohesive soil
"	29.00	29.45	0.45	U	"	Received										— do —

Techpro Engineers Pvt. Ltd.

Supervisor

E - In - C

Abbreviation Used: U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 30: FIELD BORELOG CHARTS (P75)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No: GT/003
		Date of Issue: 01.04.2018
		Rev. No.: R03
		Rev. Date.: 28.12.2021

Project Name:	GTW-HORC Viaduct b/w Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 3119821.943	E: 701045.81		Location/ Chainage:	22880.8870
Method of Drilling:	Percussion	Drilling Equipment:	Manual Powerwinch	Bore No.:	P.75
Casing Lowered (M):	18.00	Bentonite Used: NO	Standard Sampler: Yes	Barrel Type:	N/A
Ground Elevation:	R.L-192.565	Date: From 5/11/23 to 7/11/23		Water Table (M):	1.80

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
6/11/23	30.50	30.95	0.45	DP	SX	16	20	24	44							Non-coherive soil
"	32.00	32.45	0.45	U	"	Received										— do —
"	33.50	33.95	0.45	DP	"	20	25	27	52							— do —
7/11/23	35.00	35.45	0.45	DP	"	22	26	30	56							— do —
"	36.50	36.95	0.45	DP	"	20	24	28	52							— do —
"	38.00	38.45	0.45	DP	"	25	27	31	58							— do —
"	40.00	40.45	0.45	DP	"	24	29	35	64							— do —

Nitesh
Supervisor

Techpro Engineers Pvt. Ltd. Kanpur

E 2 in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 31: FIELD BORELOG CHARTS (P76)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GT. For HORC Between Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 3119847.024	E: 701037.86		Location/ Chainage:	22907.0870
Method of Drilling:	Percussion	Drilling Equipment:	Power winch	Bore No.:	P-76
Casing Lowered (M):	30.00 Bentonite Used: NA	Standard Sampler:	Yes.	Barrel Type:	NA
Ground Elevation:	R.L-193.717	Date: From 4/10/23 to 6/10/23		Water Table (M):	2.55

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
4/10/23	0.00	0.50	0.50	D	SX	collected										Non cohesive soil
"	1.00	1.45	0.45	U	"	Received										do
"	2.00	2.45	0.45	DP	"	1	2	3	5							cohesive soil
"	3.00	3.45	0.45	DP	"	3	4	6	10							do
"	4.00	4.45	0.45	U	"	Received										do
"	5.00	5.45	0.45	DP	"	2	4	5	9							Cohesive soil
"	6.00	6.45	0.45	DP	"	3	5	8	13							do
5/10/23	7.00	7.45	0.45	U	SX	Received										do
"	8.00	8.45	0.45	DP	"	2	3	5	8							cohesive soil with Gravel
"	9.00	9.45	0.45	DP	"	3	3	7	10							do
"	10.00	10.45	0.45	U	"	Received										Cohesive soil
"	11.00	11.45	0.45	DP	"	6	10	12	22							do
"	12.00	12.45	0.45	DP	"	6	12	13	25							do
"	13.00	13.45	0.45	U	"	Received										do
"	14.50	14.95	0.45	DP	"	5	8	14	22							Cohesive soil
"	16.00	16.45	0.45	U	"	Received										do
"	17.50	17.95	0.45	DP	"	6	11	16	27							Non cohesive soil
"	19.00	19.45	0.45	U	"	slipped										do
"	20.50	20.95	0.45	DP	"	8	15	17	32							Non cohesive soil with Gravel
"	22.00	22.45	0.45	U	"	slipped										
"	23.50	23.95	0.45	DP	"	11	20	22	42							Cohesive soil with Gravel
"	25.00	25.45	0.45	U	"	Received										Cohesive soil.
"	26.50	26.95	0.45	DP	"	12	22	39	61							Non cohesive soil
6/10/23	28.00	28.45	0.45	U	"	Received										do

Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 32: FIELD BORELOG CHARTS (P76)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GT FOR HORC Between Sohana Dhulawat station			Project Code:	1901
Coordinate:	N: 3119847.024	E: 701037.86		Location/ Chainage:	22907.0870
Method of Drilling:	Percussion		Drilling Equipment:	Power Wagon	Bore No.: P-76
Casing Lowered (M):	30.00	Bentonite Used: NA	Standard Sampler:	Yes	Barrel Type: NA
Ground Elevation:	R.L-192.717	Date: From 4/10/23	to 6/10/23		Water Table (M): 2.55

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
6/10/23	29.50	29.95	0.45	DP	SX	10	22	29	51							Cohesive soil.
11	31.00	31.45	0.45	DP	"	15	23	30	53							Non cohesive soil
11	32.50	32.95	0.45	DP	"	13	25	26	51							do
11	34.00	34.45	0.45	DP	"	15	28	35	63							Non cohesive soil.
11	35.50	35.95	0.45	DP	"	16	33	40	73							do
11	37.00	37.45	0.45	DP	"	18	35	39	74							Non cohesive soil.
11	38.50	38.95	0.45	DP	"	20	38	45	83							Cohesive soil with Gravel
11	40.00	40.45	0.45	DP		25	32	55	87							Non cohesive soil.

Supervisor

Techpro Engineers Pvt. Ltd. Gurgaon

E - In - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 33: FIELD BORELOG CHARTS (P77)

TECHPRO ENGINEERS PVT. LTD. — **BORE/ DRILL LOG**

Doc No:	GT/003
Date of Issue:	01.04.2018
Rev. No.:	R03
Rev. Date.:	28.12.2021

Project Name: GT FOR HORC Viaduct between Sohana Dhulawat stations — Project Code: 1901

Coordinate: N: 3119872.31 — E: 701030.427 — Location/ Chainage: 22933.2870

Method of Drilling: Percussion — Drilling Equipment: Powerwinch — Bore No.: P-77

Casing Lowered (M): 29.00 — Bentonite Used: NA — Standard Sampler: Yes — Barrel Type: NA

Ground Elevation: R.L-192.676 — Date: From 07/10/23 to 09/10/2023 — Water Table (M): 2.62

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
7/10/23	0.00	0.50	0.50	D	SX	Collected										Non cohesive soil
"	1.00	1.45	0.45	U	"	Received										do
"	2.00	2.45	0.45	DP	"	1	2	3	5							Cohesive soil
"	3.00	3.45	0.45	DP	"	3	4	5	9							cohesive soil with Gravel
"	4.00	4.45	0.45	U	"	Received										cohesive soil.
"	5.00	5.45	0.45	DP	"	5	8	10	18							cohesive soil with Gravel
8/10/23	6.00	6.45	0.45	DP	"	8	12	16	28							cohesive soil
"	7.00	7.45	0.45	U	"	Received										cohesive soil
"	8.00	8.45	0.45	DP	"	7	9	17	26							do
"	9.00	9.45	0.45	DP	"	8	13	17	30							cohesive soil with Gravel
"	10.00	10.45	0.45	U	"	Received										do
"	11.00	11.45	0.45	DP	"	7	10	12	22							cohesive soil
"	12.00	12.45	0.45	DP	"	8	12	15	27							do
"	13.00	13.45	0.45	U	"	Received										cohesive soil.
"	14.50	14.95	0.45	DP	"	7	13	18	31							Non Cohesive soil.
"	16.00	16.45	0.45	U	"	slipped										DS-Non cohesive soil.
"	17.50	17.95	0.45	DP	"	9	15	20	35							Non cohesive soil
"	19.00	19.45	0.45	U	"	Received										do
"	20.50	20.95	0.45	DP	"	9	16	25	41							Non cohesive soil with Gravel
"	22.00	22.45	0.45	U	"	Received										do
"	23.50	23.95	0.45	DP	"	12	18	27	45							do
"	25.00	25.45	0.45	U	"	Received										Non cohesive soil
"	26.50	26.95	0.45	DP	"	11	18	26	44							Non cohesive soil
9/10/23	28.00	28.45	0.45	U	"	Received										do

Supervisor — E In - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 34: FIELD BORELOG CHARTS (P77)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GT. For HORC Viaduct between Sohana Dhulawat station			Project Code:	1901
Coordinate:	N: 3119872.31	E: 701030.427		Location/ Chainage:	22933.2876
Method of Drilling:	Percussion		Drilling Equipment:	Power winch	Bore No.: P-77
Casing Lowered (M):	29.00	Bentonite Used: NA	Standard Sampler:	Yes	Barrel Type: NA
Ground Elevation:	R.L-192.676	Date: From 07/10/23 to 9/10/23			Water Table (M): 2.62

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	CR (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
9-10-23	29.50	29.95	0.45	DP	SX	19	90	60	100							cohesive soil with Gravel
〃	31.00	31.45	0.45	DP	〃	17	42	55	97							Non cohesive soil.
〃	32.50	32.95	0.45	DP	〃	19	40	46	86							cohesive soil with Gravel
〃	34.00	34.45	0.45	DP	〃	21	43	52	95							Non cohesive soil
〃	35.50	35.95	0.45	DP	〃	11	22	41	63							do
〃	37.00	37.45	0.45	DP	〃	7	14	31	45							do
〃	38.50	38.95	0.45	DP	〃	14	29	35	64							Non cohesive soil.
〃	40.00	40.45	0.45	DP	〃	19	35	58	93							cohesive soil with Gravel

Techpro Engineers Pvt. Ltd.

Supervisor

E - In - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 35: FIELD BORELOG CHARTS (P78)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GT FOR HORC Viaduct between Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 3119847.704	E: 701023.541		Location/ Chainage:	229549.4870
Method of Drilling:	Percussion	Drilling Equipment:	Rotary wash	Bore No.:	P-78
Casing Lowered (M):	24.50	Bentonite Used: NA	Standard Sampler:	Yes	Barrel Type: NA
Ground Elevation:	R.L - 192.731	Date: From 6/10/23 to 8/10/23			Water Table (M): 2.60

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
6/10/23	0.00	0.50	0.50	D	SX	collected										Non cohesive soil
"	1.00	1.45	0.45	DP	"	2	3	5	8							do
"	2.00	2.45	0.45	U	"	Received										do
"	3.00	3.45	0.45	DP	"	3	4	6	10							do
"	4.00	4.45	0.45	DP	"	2	3	6	9							cohesive soil
"	5.00	5.45	0.45	U	"	Received										do
"	6.00	6.45	0.45	DP	"	4	6	8	14							Non cohesive soil
"	7.00	7.45	0.45	DP	"	3	5	7	12							cohesive soil with Gravel
"	8.00	8.45	0.45	U	"	Received										do
7/10/23	9.00	9.45	0.45	DP	"	12	14	17	31							Non cohesive soil
"	10.00	10.45	0.45	DP	"	4	6	10	16							cohesive soil with Gravel
"	11.00	11.45	0.45	U	"	Received										do
"	12.50	12.95	0.45	DP	"	5	7	11	18							Cohesive soil with Gravel
"	14.00	14.45	0.45	U	"	Received										Cohesive soil
"	15.50	15.95	0.45	DP	"	9	13	15	28							do
"	17.00	17.45	0.45	U	"	Received										do
"	18.50	18.95	0.45	DP	"	11	12	15	27							Non cohesive soil
"	20.00	20.45	0.45	U	"	Received										cohesive soil
"	21.50	21.95	0.45	DP	"	9	15	18	33							do
"	23.00	23.45	0.45	U	"	Slipped										Dis. None cohesive soil.
8/10/23	24.50	24.95	0.45	DP	"	12	17	20	37							do
"	26.00	26.45	0.45	U	"	Received										Non cohesive soil
"	27.50	27.95	0.45	DP	"	13	26	29	55							do
"	29.00	29.45	0.45	DP	"		27	32	59							do

Supervisor

E - In - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration [blows] > 100), Sampler means SPT sampler

APPENDIX-K
CHART 36: FIELD BORELOG CHARTS (P78)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GT FOR HORC Viaduct Bitween Sohana Dhulawat station			Project Code:	1901
Coordinate:	N: 3119897.704	E: 701023.541		Location/ Chainage:	229594.4870
Method of Drilling:	Percussion	Drilling Equipment:	Power winch	Bore No.:	R78
Casing Lowered (M):	29.50 m	Bentonite Used: NA	Standard Sampler:	Yes	Barrel Type: NA
Ground Elevation:	R.L-192.731	Date: From 6/10/23	to 8/10/23	Water Table (M):	2.60

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
10/8/23	30.00	30.45	0.45	DP	SX	11	31	38	69							Non cohesive soil
"	32.00	32.45	0.45	DP	"	13	33	42	75							do
"	33.50	33.95	0.45	DP	"	9	31	37	68							do
"	35.00	35.45	0.45	DP	"	12	29	35	64							cohesive soil
"	36.50	36.95	0.45	DP	"	14	33	39	72							do
"	38.00	38.45	0.45	DP	"	17	35	43	78							do
"	40.00	40.45	0.45	DP	"	19	38	50	88							cohesive soil

Supervisor

E - In - C

Abbreviation Used : U- Undisturbed Sample, C- Core Sample, D- Disturbed Sample, P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 37: FIELD BORELOG CHARTS (P79)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	C/o. for HORC viaduct b/w sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 3199923.237	E: 701017.19		Location/ Chainage:	22985.6870
Method of Drilling:	Percussion		Drilling Equipment:	Powerwinch	Bore No.: P 79
Casing Lowered (M):	20.00	Bentonite Used: NO	Standard Sampler:	Yes	Barrel Type: N/A
Ground Elevation:	R.L-192.898	Date: From 3/10/23 to 4/10/23			Water Table (M): 2.20

Day / Date	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
3/10	0.0	0.50	0.50	DS	SX	Recovid			-							Non cohesvie soil
"	1.00	1.45	0.45	U	"	Recovid			-							- do -
"	2.00	2.45	0.45	DP	"	1	2	2	4							- do -
"	3.00	3.45	0.45	DP	"	2	3	5	8							- do -
"	4.00	4.45	0.45	U	"	Recovid			-							- do -
"	5.00	5.45	0.45	DP	"	2	3	6	9							Non cohesvie soil
"	6.00	6.45	0.45	DP	"	3	4	8	12							- do -
"	7.00	7.45	0.45	U	"	Recovid										- do -
"	8.00	8.45	0.45	DP	"	7	11	12	36							- do -
"	9.00	9.45	0.45	DP	"	8	10	13	23							- do -
"	10.00	10.45	0.45	U	"	Recovid										- do -
"	11.00	11.45	0.45	DP	"	5	7	9	16							- do -
4/10	12.00	12.45	0.45	DP	"	6	8	11	19							Non Cohesvie Soil
"	13.00	13.45	0.45	U	"	Recovid										- do -
"	14.00	14.45	0.45	DP	"	4	9	13	22							- do -
"	15.00	15.45	0.45	U	"	-	Recovid									- do -
"	16.00	16.45	0.45	DP	"	8	12	24	36							- do -
"	17.00	17.45	0.45	U	"	Recovid										Cohesvie soil
"	18.00	18.45	0.45	DP	"	7	23	28	51							- do -
"	19.00	19.45	0.45	U	"	Recovid										- do -
"	20.00	20.45	0.45	DP	"	8	15	25	40							Cohesvie soil with gravel
"	21.00	21.45	0.45	U	"	Recovid										Cohesvie soil
"	22.00	22.45	0.45	DP	"	9	18	20	38							- do -
"	23.00	23.45	0.45	U	"	Shifted										- do -

Supervisor

E In - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 38: FIELD BORELOG CHARTS (P79)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	G.T. For HORC Viaduct b/w Sohana Dhulawat station			Project Code:	1901
Coordinate:	N: 3119923.237	E: 701017.19		Location/ Chainage:	22985.6870
Method of Drilling:	Percussion	Drilling Equipment	Powerwinch	Bore No.:	P79
Casing Lowered (M):	20.00	Bentonite Used:	No	Standard Sampler :	Yes
Barrel Type :	N/A				
Ground Elevation:	R.L-192.898	Date: From 3/10/23 to 4/10/23		Water Table (M):	2.20

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
1/10/23	29.50	29.95	0.45	DP	2x	8	15	23	38							Non-cohesive soil
"	31.00	31.45	0.45	U	"	slipped										— do —
"	32.50	32.95	0.45	DP	"	15	17	26	43							— do —
"	34.00	34.45	0.45	U	"	slipped										Non-cohesive soil with Gravel
"	35.50	35.95	0.45	DP	"	19	23	30	53							— do —
"	37.00	37.45	0.45	U	"	slipped										Non cohesive soil
"	38.50	38.95	0.45	DP	"	16	26	32	58							— do —
"	40.00	40.45	0.45	DP	"	18	28	36	64							— do —

Supervisor

E - In - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 39: FIELD BORELOG CHARTS (P80)

Manual

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW FOR HORC Viaduct between sohana Dhulawat stations			Project Code:	1901
Coordinate:	N: 3119948.898	E: 761011.378		Location/ Chainage:	23011.8870
Method of Drilling:	Rotary	Drilling Equipment:	Hydraulic	Bore No.:	P-80
Casing Lowered (M):	20.5	Bentonite Used:	NA	Standard Sampler:	Yes	Barrel Type:	NA
Ground Elevation:	R.L - 193.042	Date: From	21/10/23 to 24/10/23	Water Table (M):	2.35 m

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
21/10/23	0.00	0.50	0.50	D	SX	collected				—	—	—	—	—	—	Non cohesive soil
"	1.00	1.45	0.45	U	"	Received				—	—	—	—	—	—	do
"	2.00	2.45	0.45	DP	"	2	2	3	5	—	—	—	—	—	—	do
"	3.00	3.45	0.45	DP	"	3	3	5	8	—	—	—	—	—	—	do
"	4.00	4.45	0.45	U	"	Received				—	—	—	—	—	—	cohesive soil with Gravel
"	5.00	5.45	0.45	DP	"	4	5	9	14	—	—	—	—	—	—	cohesive soil
"	6.00	6.45	0.45	DP	"	3	5	8	13	—	—	—	—	—	—	do
"	7.00	7.45	0.45	U	"	Received				—	—	—	—	—	—	do
"	8.00	8.45	0.45	DP	"	7	10	14	24	—	—	—	—	—	—	do
"	9.00	9.45	0.45	DP	"	6	11	24	35	—	—	—	—	—	—	do
"	10.00	10.45	0.45	U	"	Received				—	—	—	—	—	—	cohesive soil.
"	11.00	11.45	0.45	DP	"	7	12	25	37	—	—	—	—	—	—	Non cohesive soil.
"	12.00	12.45	0.45	DP	"	8	11	12	23	—	—	—	—	—	—	cohesive soil
22/10/23	13.00	13.45	0.45	U	"	Received				—	—	—	—	—	—	cohesive soil
"	14.50	14.95	0.45	DP	"	8	12	18	30	—	—	—	—	—	—	do
"	16.00	16.45	0.45	U	"	Received				—	—	—	—	—	—	do
"	17.50	17.95	0.45	DP	"	12	20	26	46	—	—	—	—	—	—	do
"	19.00	19.45	0.45	U	"	Received				—	—	—	—	—	—	Non cohesive soil
"	20.50	20.95	0.45	DP	"	15	22	27	49	—	—	—	—	—	—	do
"	22.00	22.45	0.45	U	"	Received				—	—	—	—	—	—	cohesive soil with Gravel
"	23.50	23.95	0.45	DP	"	20	30	35	65	—	—	—	—	—	—	do
"	25.00	25.45	0.45	U/DP	"	17	35	42	77	—	—	—	—	—	—	Non cohesive soil
"	26.50	26.95	0.45	DP	"	19	38	47	85	—	—	—	—	—	—	do
"	28.00	28.45	0.45	U	"	28	45	56	101	—	—	—	—	—	—	do

Supervisor

C E - In - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 40: FIELD BORELOG CHARTS (P80)

Manual.

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW FOR HORC Viaduct between Sohana Dhulawat (Haryana)			Project Code:	1901
Coordinate:	N: 3119948.898	E: 701011.378		Location/ Chainage:	23011.8870
Method of Drilling:	Rotary		Drilling Equipment:	Rotary	Bore No.: P80
Casing Lowered (M):	2.00	Bentonite Used: NA	Standard Sampler:	Yes.	Barrel Type: NA
Ground Elevation:	R.L-193.042	Date: From 21/10/23	to	24/10/23	Water Table (M): 2.35m

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
23/10/23	29.50	29.95	0.45	DP	5x	16	24	27	51	–	–	–	–	–	–	Non Cohesive soil
"	31.00	31.45	0.45	DP	"	15	28	35	63	–	–	–	–	–	–	do
"	32.50	32.95	0.45	DP	"	12	32	40	72	–	–	–	–	–	–	do
"	34.00	34.45	0.45	DP	4	22	34	43	77	–	–	–	–	–	–	do
24/10/23	35.50	35.95	0.45	DP	4	20	36	44	80	–	–	–	–	–	–	do
"	37.00	37.45	0.45	DP	"	23	38	50	88	–	–	–	–	–	–	Cohesive soil
"	38.50	38.95	0.45	DP	"	25	37	48	85	–	–	–	–	–	–	do
"	40.00	40.45	0.45	DP	"	28	39	52	91	–	–	–	–	–	–	do

Supervisor

Techpro Engineers Pvt. Ltd.

E-in-C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

End of Report

Report No: 1901-HORC-V

Report No.: 1901-HORC-V

Date: Nov 2nd; 2023

GEOTECHNICAL INVESTIGATION REPORT

ULR No.: TC916923000000032P
REVISION-R1

AT THE SITE FOR

HORC VIADUCT BETWEEN SOHANA & DHULAWAT STATIONS OF HARYANA ORBITAL RAIL CORRIDOR (HORC) PROJECT, HARYANA

FROM BOREHOLES P81 TO P100

CLIENT

HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LTD.

Plot No. 143, 5th floor RailTel tower, Sector-44,
Gurugram, Haryana 122003

GENERAL CONSULTANTS

RITES-SMEC JV

Gurugram, Haryana

GEOTECHNICAL CONSULTANTS

TECHPRO ENGINEERS PVT. LTD.

114, RAM GANGA HOUSING SOCIETY, NARAMAU, G T ROAD, KANPUR-209 217, Phone: 9793209918

e-mail: info@techproindia.com

TC-9169

REVISION NOTES

REVISION NO.	DATE	DESCRIPTION
R1	09.12.23	• Vertical and Lateral pile load capacity in Table 1 to 4 of Appendix-H and recommendations revised. • Lithological profile added in Appendix-C. • Field bore log charts added in Appendix-K.

TECHPRO ENGINEERS PVT.LTD.
114, Ram Ganga Housing Society, Naramau, G T Road, Kanpur-209 217
Tel.: 9793209918, e-mail: info@techproindia.com
Web site: www.techproindia.com

REPORT FORMAT

Report No.	Bore included	Total Number of Bores
1901-HORC-I	A1 to P20	21
1901-HORC-II	P21 to P40	20
1901-HORC-III	P41 to P60	20
1901-HORC-IV	P61 to P80	20
1901-HORC-V	P81 to P100	20
1901-HORC-VI	P101 to P113	13
1901-HORC-VII	P114A to P133A	20
1901-HORC-VIII	P134A to A2A	16
1901-HORC-IX	P114B to P133B	20
1901-HORC-X	P134B to A2B	16

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National Accreditation Board for Testing and Calibration Laboratories

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TECHPRO ENGINEERS PVT. LTD. (LABORATORY DIVISION)

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in the field of

TESTING

Certificate Number: TC-9169

Issue Date: 23/12/2022 **Valid Until:** 22/12/2024

This certificate remains valid for the Scope of Accreditation as specified in the annexure subject to continued satisfactory compliance to the above standard & the relevant requirements of NABL.
(To see the scope of accreditation of this laboratory, you may also visit NABL website www.nabl-india.org)

Name of Legal Identity : Techpro Engineers Private Limited

Signed for and on behalf of NABL

N. Venkateswaran
Chief Executive Officer

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Nov 2nd; 2023

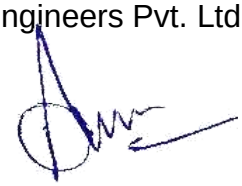
ACKNOWLEDGEMENTS

We are pleased to submit the part-5 of the report of Geotechnical investigation, conducted for the boreholes P81 to P100 for the design of foundations for HORC Viaduct between Sohana & Dhulawat stations of Haryana Orbital Rail Corridor (HORC) project in the state of Haryana, India.

We hereby, convey our sincere thanks to Mr. Neeraj Bhandari (CPM/South) and Mr. Raju Solanki (DGM/C/South), HRIDCL for trust and support during the investigation. We also acknowledge our thanks to Mr. Uma Maheshwara Rao B, DGM/C/West, HRIDCL for awarding the said work to us. We are also grateful Mr. Ravindra Dutta Upadhyay (Geotech Expert), Mr. PS Gautam & Mr. Jitender Parashar, Site Engineer from the RITES- SMEC JV and Mohd. Ishak (Executive/Civil) from HRIDCL, for their help rendered during and prior to the investigation work.

We are also thankful to our staff members for conducting field and laboratory test, preparing sketches, and typing the report.

for Techpro Engineers Pvt. Ltd.



(Arvind K. Garg)
B.Tech. (Civil), M.Tech.
Principal Consultant &
Managing Director

1. INTRODUCTION:

Haryana Rail Infrastructure Development Corporation Ltd. (HRIDC) and Ministry of Railways, Govt. of India has come together to form a new company namely Haryana Orbital Rail Corporation Limited (HORCL), to design and construction of new BG line from Palwal to Sonipat named Haryana Orbital Rail Corridor (HORC), in the state of Haryana, India. In this connection, a Geotechnical investigation has been planned for the design of foundations of Viaduct between Sohana & Dhulawat stations of Haryana Orbital Rail Corridor (HORC) Project in the state of Haryana. The work of conducting the detailed Geotechnical Investigation has been awarded to us by HRIDC, through work order No. HRIDC/HORC/GTI/211/2023-2024/Vol-0 dated 02-09-2023, which includes investigation in field, laboratory testing of disturbed and undisturbed samples, collected from the field, and submission of the geotechnical **investigation** test report.

A geotechnical investigation was carried out, with the locations, planned by the client. Purpose of the investigation is to determine the nature and properties of soil and rock strata across the bore holes and representing them through log sections showing the levels, nature, and properties of various strata up to a sufficient depth below the founding level, proneness of site to artesian conditions, seismic disturbance and other engineering properties of soil and rock strata.

This part -5 of the report includes the detailed methodology of investigation, collection of samples, field and laboratory test result including their interpretation/ analysis, recommendations on the properties of soils and rock required for design of foundation and suggesting suitable type and depth of foundation with allowable bearing capacity for safe and strong foundations for the Bore Hole numbers P81 to P100.

2. SCOPE OF WORK:

For the design of foundation of viaduct, it is required to determine the allowable bearing capacity together with necessary engineering characteristics of underlying soil & rock strata. In general, the geotechnical investigation has been planned as per IS:1892-2021 and further extended to IS: 1904, IS:2911 (part-1/Sec 2) & IRC 78:2014 for planning the laboratory testing and computing the allowable bearing capacity, hence the scope of work is as follows:

2.1. Mobilisation of all tools & plants along with accessories, materials, labours etc. at site of work for drilling and testing work, including setting up boring and shifting to different bore holes point etc.

2.2. Exploratory drilling of 150 mm diameter bore holes through soil deposits and 75 mm in rock within the proposed alignment upto the required depth.

2.3. Collection of disturbed soil samples at an interval of 3.00 meter in all the bore holes.

2.4. Collection of undisturbed soil samples at every 3.00 m interval or at change of stratum from all the boreholes.

2.5. To conduct Standard Penetration Test (SPT) at an interval of 3.00 m or noticeable change of stratum in soil deposits in all bore holes.

2.6. Collection of rock core samples and preserving them in core boxes.

2.7. To collect ground water sample on completion of bore holes.

2.8. To record the ground water table in all the bore holes.

2.9. Transporting all the disturbed, undisturbed soil and rock core samples collected during the field investigation to our NABL accredited Geotech Engineering laboratory at Kanpur.

2.10. To conduct the laboratory tests on all the soil and rock core samples collected during field investigation for determination of their engineering characteristics.

2.11. To compile of field and laboratory test results, working out the allowable bearing capacity and preparing the report including detailed recommendations and necessary precautions.

3. GEOLOGICAL INFORMATION OF THE REGION:

3.1. Geography:

The project location is in the bordering area of Gurugram and Nuh (recent old name-Mewat), districts in the Indian state of Haryana. The stretch of the alignment of the proposed corridor starts from southmost part of Gurugram in the town of Sohna and ends at Dhulawat, which is a village lying at the north of Nuh district.

Haryana is a state located in the northern part of India. Gurugram is among one

of the districts in Haryana which is also the part of National Capital Region (30km south of New Delhi). It lies at an elevation of 217 m above msl. Sohna is a small town located 25km in the south of Gurugram. Sohna is well known for its hot water springs and famous Shiva temple. Sohna is located in between 28°15' N latitude and 77°40' E longitude at the elevation of 212.14m above msl. Mewat district is located at 28 °12′ N latitude, 77 °3′ E longitude, at the south of Gurugram at an elevation of 199 m above msl. The location is bordered by Rewari district on west and Faridabad & Palwal district on the east.

3.2. Geology:

The Gurugram district is having of almost flat topography, however, in the north-eastern part small isolated hillocks of Precambrian rocks are exposed. Small hill ranges which are part of the Aravali and Mangar Bani ranges exists in the district. The major part of district is underlain by Quaternary alluvium consisting of sand, clay and silt. The alluvial plain is formed by the Sahibi river which is a tributary of River Yamuna. Soils of the Gurgaon district is classified as tropical and brown soils, existing in the north western extreme, northern and north eastern parts of the district and water logged and salt affected soils in the southern parts of the district. The soils are medium textured loamy sand is the average texture in Gurgaon and Sohna blocks.

3.3. Rainfall and Climate:

The area has hot semi-arid type of climate characterising extreme dryness of the air except in the monsoon season. Intense hot summer and cold winters. The total annual rainfall in the region is about 596 mm, of which 75 to 80% is because of the south-west monsoon.

3.4. Seismicity:

The site under consideration exists in the district of Gurugram and Mewat which lies in the Seismic Zone IV (high damage risk zone), as per the current seismic zonation map of India (IS 1893-2016): RA 2021 and have a zone factor of 0.24 for design basis earthquake. The region is surrounded by many in-homogeneities in the form of faults and ridges like Sohna Fault, Moradabad Fault, Delhi-Moradabad Fault, Delhi-Haridwar ridge, junction of Aravalli and Alluvium near Delhi. The Sohna fault line lies between the Delhi ridge and Sohna town and falls between the Arjangarh and

Manesar outcrops. All the developed area in Gurugram comes within 200 km of the fault line. The Sohna fault line is located at the junction between the hard rock terrain of the Aravalli hills and the sandy formation of the Yamuna River and is currently inactive from several years and is capable of a disastrous earthquake.

The project location has been marked in Fig.1 Seismic zone map of India.

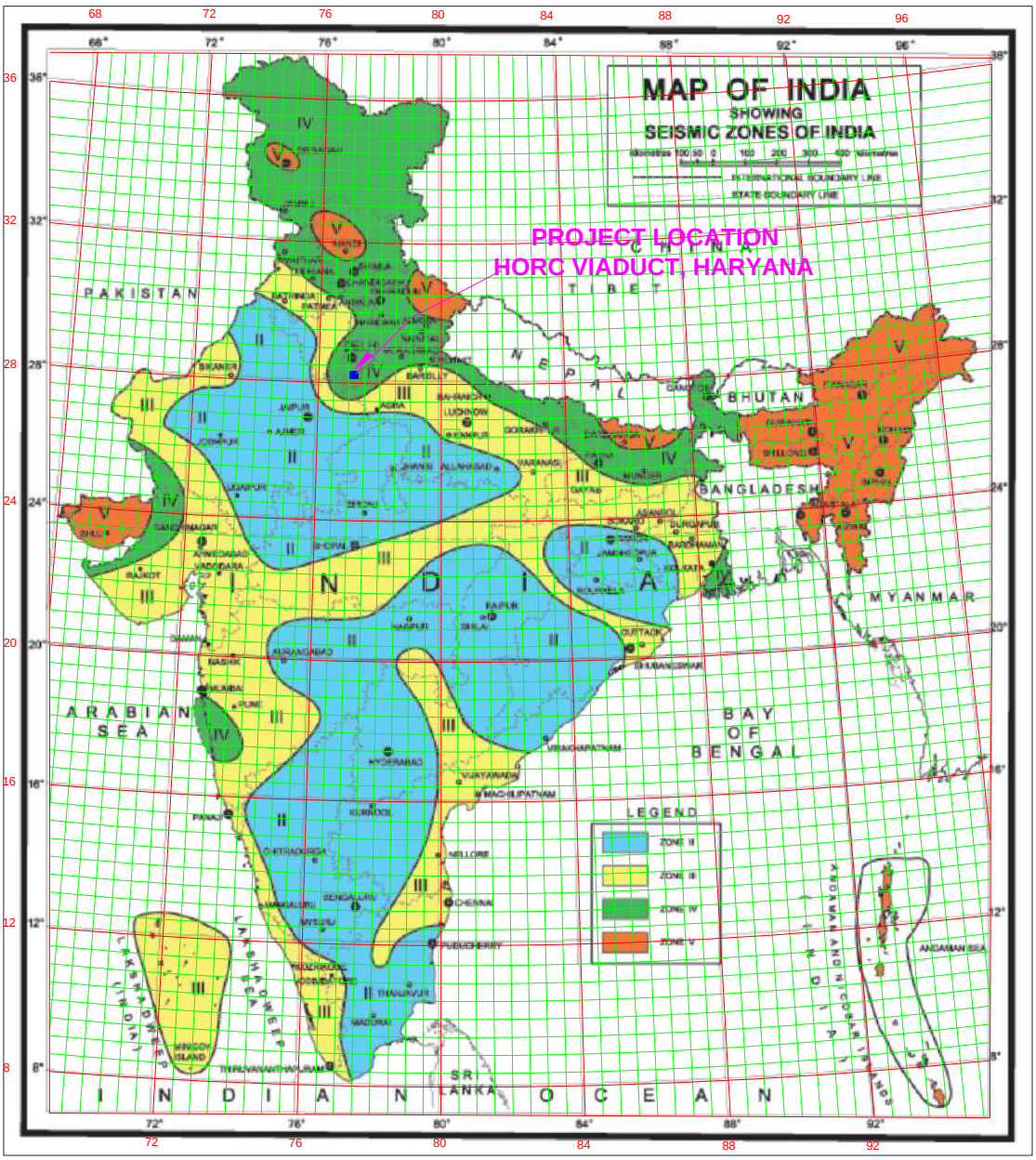


Fig.1: Seismic Zone Map of India

4. FIELD INVES TIGATION:

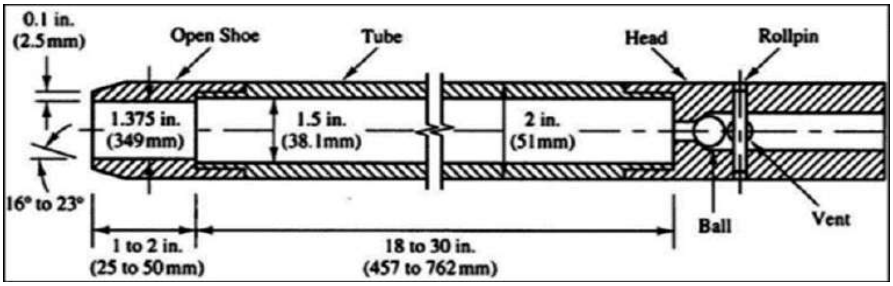
The field investigation work at this site was carried out from Oct 5th; 2023 to Oct 12th; 2023 and Oct 21st; 2023 to Oct 30th; 2023. The following investigation

work was carried out:

4.1. **Twenty number** of **boreholes** (marked as P81 to P100) of diameter 150 mm in soil were made within the proposed alignment for conducting Standard Penetration Test and collection of disturbed and undisturbed samples. The boreholes were progressed using power operated winch machine under **percussion** method of drilling. Casing was used to keep the borehole stable. The records of achieved depth of bore holes have been given in Para No. 6, the details of drilled bores along with depth of casing used have been reported in Appendix B. Locations of boreholes have been reported in "TEST LOCATION PLAN" in Appendix A.

4.2. **Standard Penetration Tests** were conducted at 1.00 to 2.00 metre interval upto the depth of 12.00 meter and 3.00 metre interval, beyond 12.00 metre depth, as per the procedure in IS: 2131-1981-(RA: 2021) in all the bore holes. The **standard SPT sampler** (without liner and with no space for liner) and **auto-trip hammer** of standard weight of 63.50 kg have been used to perform the test.

For conducting the test, the bottom of the borehole was properly cleaned, and split spoon sampler was properly seated in position in the borehole. The split spoon sampler resting on the bottom of borehole was allowed to sink under its own weight; then the sampler was allowed to penetrate 15 cm with the blows of the hammer 63.50 kg weight falling free through 75cm, thereafter the split spoon sampler was further driven by another 15 cm. For the 3rd and final drive, the sampler was further allowed to penetrate 15 cm. The number of blows required to get each 15 cm of penetration, was recorded. The first 15 cm of drive is seating drive.



Structure of SPT Sampler

The total blows of penetration for the second and third 15 cm of penetration is termed the penetration resistance N. The N' values are indicative of the compactness/ relative density of cohesion less soils and consistency of cohesive soils.

In case the blows count of SPT in soil (including the number of blows of seating) exceeds 100, the corresponding penetration was recorded and this particular test at that depth stopped. If the total penetration is more than the seating penetration of 15 cm, then breakup of blow counts for 15 cm seating penetration and for remaining portion of penetration is also given.

SPT 'N' values are correlated with non-cohesive stratum as per BS: 5930 (1999) – for sandy strata and with consistency of cohesive stratum.

Correlation For Clay/Plastic Silt		**Correlation For Sand/Non-Plastic Silt**	
Consistency of clays	**Penetration Value**	**Relative Density of sand**	**Penetration Value**
Very Soft	0 to 2 Blows	Very loose	0 to 4 Blows
Soft	3 to 4 Blows	Loose	5 to 10 Blows
Medium Stiff	5 to 8 Blows	Medium	11 to 30 Blows
Stiff	9 to 16 Blows	Dense	31 to 50 Blows
Very Stiff	17 to 32 Blows	Very Dense	Above 50
Hard	Above 32		

In this method, the sampler acts as a probe and the driving energy is supplied by the fall of the drop weight. The values of 'N' depend on the compactness or relative density of the material. In hard formations, the testing is discontinued if 'N' value is found to be more than 100. It is termed as 'Refusal'. Refusal is also recorded when SPT blow count records 50 or more for any of the single drive of 15 cm.

'N' value depends upon degree of saturation and over burden pressure of the formation. Silty fine sand and fine sand below the water table develop pore water pressure depending on the in-situ void ratio which in turn affects the effective stress. This change in effective stress influences the 'N' value considerably.

Depth of overburden affects the SPT values in none to low cohesive soils and hence need correction. The SPT value after the overburden correction, N' is as follows:

$$N' = 0.77x \log (2000/q) \times N$$

Where, q= Overburden Pressure (kN/m^2) and N = observed SPT value

N' is corrected further for dilatancy in case of saturated fine sands and silts for the values of N' greater than 15.

Modified value after dilatancy correction N" = 15+ (N'-15)/2

Soil samples obtained from split spoon sampler were collected in the polythene bags of suitable size. These samples were property sealed, labelled, and carefully transported to the laboratory for testing. The results have been reported in Table 1 to 20 of Appendix B under the title "SUMMARY OF TEST RESULTS".

4.3. **Disturbed soil samples** were collected at 0.50 metre, then at 1.00 to 2.00 metre interval upto the depth of 12.00 meter and 3.00 metre interval, beyond 12.00 metre depth and at significant change of stratum. Soil from cutting edge of SPT samplers and retained in split spoon, used for Standard Penetration Tests was taken as disturbed samples. These samples were placed without delay in adequately sealed polythene bags. Where the collection of disturbed soil samples could not be collected from SPT samples, Shelby tubes were driven and retained soil samples were obtained. The laboratory tests were conducted on the collected soil samples and reported in Table 1 to 20 of Appendix-B under the title "SUMMARY OF TEST RESULTS".

4.4. **Undisturbed soil samples** were collected in accordance with IS: 2132-1986-(RA: 2021) at an interval of 3.00 metre or at change of stratum, starting from the depth of 1.00 or 2.00 m, by using 100 mm dia. and 450 mm long MS tubes provided with sampler head with ball check arrangement. However, the some of the samples could not be extracted due to the partial penetration or slippage during the evacuation.

Moreover, collection of Undisturbed samples in very hard cohesive soils/ dense granular soils/gravels/ cobbles/ pebbles/ boulders, refusal strata is practically not possible and such collected samples will not truly represent the undisturbed conditions.

Immediately after taking undisturbed sample in the tube, the adopter head was removed along with the disturbed material. The visible ends of the samples shall then be trimmed off any wet disturbed soil. The ends will then be coated alternately with four layers of molten wax. More molten wax will then be added to give a total thickness of not less than 25 mm. The laboratory test results have been reported in Table 1 to 20 of Appendix-B.

4.5. The **ground water table** in the borehole was allowed to stabilize and measured after 8, 16, 24 and 48 hours after completion of the bore hole. It was ensured that last two reading were identical. The records of ground water table have been given in Para No.6.

4.6. **Ground water samples** were collected from borehole as per IS: 6935-1973-(RA:2019) for chemical analysis to determine aggressiveness in relation to attack on concrete / reinforcement including determination of pH value.

5. LABORATORY TESTS:

The following laboratory tests were conducted to determine the engineering characteristics of sub-soils:

5.1. **Field moisture contents** were determined by oven drying method as per IS: 2720 (part II)-1973-(RA: 2020). The results have been reported in Table 1 to 20: "SUMMARY OF TEST RESULTS" of Appendix B.

5.2. **Bulk density** of soil strata was obtained using Shelby tubes in accordance with IS 2720 (part XXIX)-1975-(RA: 2020). The results have been reported in Table 1 to 20: "SUMMARY OF TEST RESULTS" of Appendix B.

5.3. **Mechanical sieve analysis** test was performed in accordance with IS: 2720 (Part IV) – 1985-(RA: 2020), for the purpose of identification by grain size analysis, on coarse part of the soil samples and the results have been reported in Table 1 to 20: "SUMMARY OF TEST RESULTS" of Appendix B.

5.4. **Particle size analysis** test by **Hydrometer method** were performed in accordance with IS: 2720 (Part IV) -1985-(RA: 2020) on the part of soil samples obtained after the sieve analysis. The results have been reported in Table 1 to 20: "SUMMARY OF TEST RESULTS" of Appendix B.

5.5. **Atterbergs' limits tests** were performed in accordance with IS: 2720 (part V)-1985-(RA: 2020) and results have been reported in Table 1 to 20: "SUMMARY OF TEST RESULTS" of Appendix B.

5.6. **Specific gravity tests** were performed in accordance with IS 2720 (part III-sec. 1) -1980-(RA: 2021) and the results have been reported in Table 1 to 20: "SUMMARY OF TEST RESULTS" of Appendix B.

5.7. **Consolidation tests** were performed on cohesive soil samples in accordance with IS: 2720 (part XV)-1965-(RA: 2021). The results have been reported in Table 1 to 20: "SUMMARY OF TEST RESULTS" of Appendix B.

5.8. **Direct shear tests** were performed as per IS: 2720 (part XIII)-1986-(RA: 2021), on the undisturbed soil samples obtained during the field investigation. The results and the density of samples have been reported in Table 1 to 20: "SUMMARY OF TEST RESULTS" of Appendix B.

5.9. **Tri-axial Compression Test** under Unconsolidated Un-drained (UU) condition as per IS: 2720 (Part-XI)-1993-(RA: 2021) were performed on the selected undisturbed soil samples, obtained during the field investigation. The results have been reported in Table 1 to 20: "SUMMARY OF TEST RESULTS" of Appendix B.

5.10. **Unconfined Compressive strength tests** were performed in accordance with IS 2720 (Part-X) -1991-(RA:2020) on selected undisturbed soil samples and the results have been reported in Table 21 of Appendix B

5.11. **Shrinkage Limit tests** were performed in accordance with IS 2720 (part-VI) -1972-(RA: 2021) and the results have been reported in Table 1 to 20: "SUMMARY OF TEST RESULTS" of Appendix B.

5.12. **Free Swell Index** were performed in accordance with IS 2720 (part-XL) -1977-(RA: 2021) and the results have been reported in Table 1 to 20: "SUMMARY OF TEST RESULTS" of Appendix B.

6. GROUND WATER TABLE:

The water table at this site was encountered during the drilling operation up to the depth of investigation.

Borehole No.	Chainage	Global Co-ordinates (UTM format)		Reduced Level (m)	Depth of Borehole (m)	Water table (m)
		Easting	Northing			
P81	23038.087	701006.108	3119974.676	193.105	40.00	2.40
P82	23064.287	701001.381	3120000.559	193.262	40.00	2.30
P83	23090.487	700997.207	3120026.492	193.307	40.00	1.20
P84	23116.687	700993.573	3120052.551	193.358	40.00	1.70

Borehole No.	Chainage	Global Co-ordinates (UTM format)		Reduced Level (m)	Depth of Borehole (m)	Water table (m)
		Easting	Northing			
P85	23142.887	700990.491	3120078.652	193.345	40.00	2.20
P86	23169.087	700987.956	3120104.840	193.548	40.00	1.20
P87	23195.287	700985.969	3120131.106	193.452	40.00	1.20
P88	23221.487	700984.542	3120157.378	193.536	40.00	1.70
P89	23247.687	700983.655	3120183.668	193.530	40.00	1.90
P90	23273.887	700983.219	3120209.933	193.532	40.00	1.60
P91	23300.087	700983.157	3120236.169	193.954	40.00	1.80
P92	23326.287	700983.302	3120262.393	193.930	40.00	1.90
P93	23352.487	700983.613	3120288.593	193.956	40.00	1.40
P94	23378.687	700983.967	3120314.829	193.960	40.00	1.60
P95	23404.887	700984.323	3120341.027	193.924	40.00	1.20
P96	23431.087	700984.677	3120367.185	193.961	40.00	1.20
P97	23457.287	700985.033	3120393.383	193.010	40.00	1.80
P98	23483.487	700985.388	3120419.581	193.030	40.00	1.05
P99	23509.687	700985.744	3120445.778	193.271	40.00	1.00
P100	23535.887	700986.099	3120471.976	193.996	40.00	1.30

7. DESCRIPTION OF STRATA:

The classification of soil stratum has been done with the help of soil characteristics obtained in laboratory tests as per IS 1498-1970-(RA:2021). The classification of rock masses has been done based on RMR as per IS: 4464-1985, IS: 13365-1. The detailed nature of the strata has been reported in Table 1 to 20: “SUMMARY OF TEST RESULTS” of Appendix-B and represented through Lithological plots in Appendix-C.

The strata exhibited in all the bore hole, is predominantly comprising of inorganic silty clays of low plasticity and inorganic silts of non to low plastic category. Silty sands were encountered at variable depth and thickness in most of the boreholes. Inorganic silts of intermediate plasticity were also found at some depths and thickness in some of the boreholes.

8. SAFE BEARING CAPACITY COMPUTATIONS:

For the construction of viaducts, deep foundation **(Bored Cast-In-Situ RCC piles)** have been considered for computation of load bearing capacity of the underlying soil strata. The computation of load bearing capacity of bored cast-in-situ RCC piles have been done as per IS 2911 (part-1, section-2)-2010-(RA: 2020) with due consideration of effects of liquefaction.

8.1. Design Parameters:

Factor of safety in compression	=	2.50
Factor of safety in tension	=	3.00
Depth of critical water table	=	0.00 m
Diameter of pile	=	1.00 & 1.20 m
Cut off length	=	2.50 m
Type of pile head consider	=	Fixed

8.2. Computation of friction along pile stem:

$$Q_{uf} = \sum K_i . P_{di} . \tan\delta_i . A_{si}$$

where,

Q_{uf} = Ultimate shaft friction (kN/m^2)

K_i = Coefficient of earth pressure at mid-depth of ith layer

P_{di} = Effective overburden pressure at mid-depth of ith layer (kN/m^2)

A_{si} = Surface area of pile stem in i^{th} layer (m^2)

δ_i = Angle of wall friction between pile and soil of ith layer (= ϕ) (degree)

ϕ_i = Angle of internal friction of soil in i^{th} layer (degree)

$\sum$ = Sum of all layers up to i^{th} layer

8.3. Computation of Cohesion along the stem of pile:

$$Q_{uc} = \sum \alpha_i . c_i . A_{si}$$

Where,

c_i = Cohesion in i^{th} layer

A_{si} = Surface area of pile stem in i^{th} layer (m^2)

α_i = Adhesion factor for i^{th} layer of soil depending of consistency of soils

$\sum$ = Sum of cohesion of all layers considered

8.4. Computation of end bearing resistance:

$$Q_{ub} = A_p (c.Nc + q.Nq + 0.5.\ \gamma.B.N\gamma)$$

Where,

A_p = Area of the pile toe (m^2)

c = cohesion of soils at pile toe (kN/m^2)

γ = Effective Unit weight of soils at pile toe (kN/m^3)

B = Diameter of pile (m)

q = Effective overburden pressure at pile toe (kN/m^2)

N_c = Bearing Capacity Factor (Recommended equal to 9)

$Nq, N\gamma$ = Bearing Capacity Factor

8.5. Lateral load capacity of piles in soils:

$$Q_u = 12.E.I.\delta/(L_1+L_f)^3$$

where,

Q_u = Ultimate lateral load capacity of pile (kN)

δ = Permissible deflection (m) = 5 mm

E = Young Modulus of pile material (kN/m^2)

I = Moment of Inertia of the pile cross section (m^4)

L_1 = Cantilever Length of pile (m)

L_f = Length of fixity (m)

Detailed calculations of pile load carrying capacity in compression & uplift in soil have been reported in **Table-1 to 2** of **Appendix-H.**

Pile lateral Load capacity has been given in **Table-3 to 4** of **Appendix-H**.

9. LIQUEFACTION ANALYSIS:

Liquefaction is the sudden loss of shear strength of the

loose fine sands due to earthquake-induced vibration under saturated conditions. Liquefaction generally takes place in loose fine sands (fines < 10 %, D_{60}= 0.20 mm to 1.0 mm and C_u between 2 to 5) with N value less than 15. In case of soil strata having N>15, liquefaction of soil will not take place normally.

The present site falls in **seismic zone – IV.** Considering the history of past earthquakes and available seismic data, an earthquake of **magnitude 7.0** having peak ground acceleration **a_{max}= 0.24 g** is considered in the present analysis.

Preliminary assessment of liquefaction potential of foundation strata is made by simplified approach proposed by IS: 1893 (part-1)-2016-(RA: 2021) from the data obtained in Standard Penetration Test.

In this method, cyclic shear stress likely to be induced in the foundation strata by Design Basis Earthquake is first evaluated. Next threshold cyclic shear stress, which is good enough to cause liquefaction, is determined from SPT data and the empirical relations. Finally, comparison of these two stresses is used in the estimation of liquefaction susceptibility of the foundation strata.

Cyclic Stress Ratio (CSR):

The equivalent average of shear stress likely to be induced in the foundation material due to an earthquake is calculated by using the equations

Cyclic Resistance Ratio (CRR):

It expresses capacity of soil to resist liquefaction. CRR is determined using correlation between corrected blow count $(N_1)_{60}$ and CRR for earthquake of magnitude 7.5. $(N_1)_{60}$ is the SPT blow count corrected to an effective overburden pressure of 100 kPa and to hammer energy efficiency of 60 %.

Following variable have been adopted in calculation of N_{60} (SPT value for 60% efficiency)

Energy correction to SPT values:

C_{60} = 1.00 (energy efficiency factor)

Design Earthquake Base:

Earthquake zone = IV

Magnitude of earthquake = 7

Seismic Zone factor = 0.24

Status of Liquefaction:

The value of CSR and CRR are computed at different depth and then the ratio of CRR to CSR to get the factor of safety towards the susceptibility of the stratum towards liquefaction potential.

If factor of safety:

< 1.00 : Stratum is to be considered as liquefiable

> 1.20 : Non-Liquefiable

The detailed calculations of liquefaction, have been reported in **Table-5** of **Appendix-H.**

10. RECOMMENDATIONS:

Keeping in mind, the field test results, laboratory test results and IS codes of practice the following recommendations are hereby made:

10.1. **Bored Cast-In-Situ RCC Piles** of diameter 1000 and 1200 mm have been adopted for SBC computations of foundation for Viaduct.

10.2. **Cut off length** of piles have been considered as 2.50 m from the existing ground level for the purpose of computation of SBC.

10.3. **Pile length** recommended in the table below, shall be measured **after the cut-off depth.**

10.4. **Allowable load carrying capacity** of pile corresponding to the length and diameter of pile shall be read from the tables below:

10.4.1. For Pile diameter = 1000 mm

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
P81	25.00	2200	1700	65
	27.50	2550	1900	
	30.00	2650	2100	
	32.50	2900	2300	
	35.00	3350	2550	

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
P82	25.00	2100	1600	45
	27.50	2350	1800	
	30.00	2600	2050	
	32.50	2850	2250	
	35.00	3100	2500	
P83	25.00	2100	1600	40
	27.50	2350	1850	
	30.00	2650	2100	
	32.50	2900	2300	
	35.00	3100	2550	
P84	25.00	2800	1800	155
	27.50	3050	2000	
	30.00	3300	2200	
	32.50	3500	2400	
	35.00	3750	2650	
P85	25.00	2100	1550	40
	27.50	2250	1750	
	30.00	2400	1950	
	32.50	2600	2100	
	35.00	2850	2300	
P86	25.00	2200	1650	70
	27.50	2350	1800	
	30.00	2600	2000	
	32.50	2850	2250	
	35.00	3100	2500	
P87	25.00	2400	1650	40
	27.50	2950	1800	
	30.00	3200	2050	
	32.50	3400	2250	
	35.00	3600	2450	
P88	25.00	2500	1950	100
	27.50	2700	2150	
	30.00	2950	2350	
	32.50	3600	2550	
	35.00	3950	2750	

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
P89	25.00	2400	1450	35
	27.50	2200	1650	
	30.00	2350	1900	
	32.50	2600	2050	
	35.00	2850	2300	
P90	25.00	2500	1700	75
	27.50	2350	1850	
	30.00	2550	2050	
	32.50	2800	2250	
	35.00	3650	2400	
P91	25.00	2200	1650	55
	27.50	2500	1900	
	30.00	2700	2100	
	32.50	2900	2350	
	35.00	3300	2550	
P92	25.00	2150	1650	45
	27.50	2400	1900	
	30.00	2600	2100	
	32.50	2800	2250	
	35.00	3150	2500	
P93	25.00	3000	1700	105
	27.50	2400	1900	
	30.00	2650	2100	
	32.50	2950	2300	
	35.00	3200	2550	
P94	25.00	2350	1800	55
	27.50	2550	2050	
	30.00	3100	2250	
	32.50	3300	2500	
	35.00	3450	2750	
P95	25.00	1900	1550	45
	27.50	2450	1650	
	30.00	2400	1850	
	32.50	2900	2100	
	35.00	2900	2300	

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
P96	25.00	2700	1550	40
	27.50	2250	1750	
	30.00	2950	1950	
	32.50	3400	2200	
	35.00	3050	2450	
P97	25.00	2000	1500	40
	27.50	2600	1750	
	30.00	2600	1900	
	32.50	2850	2100	
	35.00	3250	2300	
P98	25.00	2000	1500	50
	27.50	3050	1700	
	30.00	3800	1950	
	32.50	3950	2200	
	35.00	4000	2450	
P99	25.00	2700	1750	160
	27.50	2750	1950	
	30.00	3000	2150	
	32.50	3200	2350	
	35.00	3650	2550	
P100	25.00	2700	1650	65
	27.50	2900	1850	
	30.00	3100	2050	
	32.50	3350	2250	
	35.00	3600	2450	

***** *Indicates Grade of Concrete*

10.4.2. For Pile diameter = 1200 mm

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
P81	25.00	2950	2200	100
	27.50	3400	2500	
	30.00	3550	2750	
	32.50	3800	3050	

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
	35.00	4550	3350	
P82	25.00	2700	2050	75
	27.50	3050	2350	
	30.00	3400	2600	
	32.50	3700	2900	
	35.00	4050	3200	
P83	25.00	2650	2050	65
	27.50	3000	2300	
	30.00	3400	2600	
	32.50	3700	2900	
	35.00	4000	3200	
P84	25.00	4100	2300	215
	27.50	4500	2650	
	30.00	4800	2950	
	32.50	5200	3300	
	35.00	5550	3600	
P85	25.00	2800	2000	65
	27.50	2950	2300	
	30.00	3200	2500	
	32.50	3450	2750	
	35.00	3800	3000	
P86	25.00	3050	2200	105
	27.50	3300	2400	
	30.00	3550	2700	
	32.50	3850	3000	
	35.00	4200	3350	
P87	25.00	3350	2100	70
	27.50	4200	2400	
	30.00	4550	2700	
	32.50	4850	3000	
	35.00	5200	3300	
P88	25.00	3300	2550	140
	27.50	3600	2800	
	30.00	3900	3100	
	32.50	5100	3350	

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
	35.00	5550	3650	
P89	25.00	3500	1950	60
	27.50	3000	2200	
	30.00	3200	2500	
	32.50	3500	2750	
	35.00	3800	3050	
P90	25.00	3550	2200	115
	27.50	3150	2450	
	30.00	3450	2700	
	32.50	3750	2950	
	35.00	5200	3200	
P91	25.00	2950	2100	85
	27.50	3300	2400	
	30.00	3500	2700	
	32.50	3850	3000	
	35.00	4400	3300	
P92	25.00	2800	2100	75
	27.50	3100	2400	
	30.00	3350	2650	
	32.50	3650	2900	
	35.00	4050	3200	
P93	25.00	4300	2150	150
	27.50	3200	2450	
	30.00	3500	2750	
	32.50	3900	3000	
	35.00	4250	3300	
P94	25.00	3000	2250	85
	27.50	3300	2550	
	30.00	4100	2850	
	32.50	4300	3200	
	35.00	4450	3500	
P95	25.00	2400	1950	70
	27.50	3350	2100	
	30.00	3100	2400	
	32.50	3900	2700	

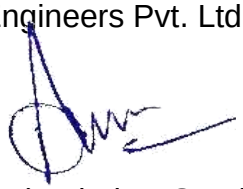
Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
	35.00	3800	3000	
P96	25.00	3950	2050	65
	27.50	3050	2350	
	30.00	4200	2600	
	32.50	4900	2950	
	35.00	4100	3250	
P97	25.00	2700	1950	60
	27.50	3650	2200	
	30.00	3600	2500	
	32.50	3900	2750	
	35.00	4550	3000	
P98	25.00	2650	1950	75
	27.50	4450	2250	
	30.00	5750	2600	
	32.50	5900	3000	
	35.00	5950	3300	
P99	25.00	3800	2300	220
	27.50	3900	2600	
	30.00	4200	2900	
	32.50	4500	3150	
	35.00	5200	3450	
P100	25.00	3900	2200	100
	27.50	4250	2500	
	30.00	4450	2800	
	32.50	4900	3100	
	35.00	5300	3350	

***** *Indicates Grade of Concrete*

10.5. Liquefaction Potential: All the bore holes have been analysed for Liquefaction potential as per IS: 1893 (part-1)-2016-(RA: 2021) with Seismic Zone IV, earthquake intensity of 7.0 on Richter scale and critical ground water table at existing ground level. Out of which several boreholes show the potential at various depths mentioned in the table below:

Bore No.	Liquefiable depth zone (meter)
P81	Top 4.00 & 5.00 to 6.00
P82	Top 1.00 & 7.00 to 8.00
P83	Top 6.00 & 7.00 to 9.00
P84	Top 1.00
P85	1.00 to 2.00 & 6.00 to 8.00
P86	3.00 to 6.00
P87	3.00 to 8.00
P88	Top 1.00 & 3.00 to 4.00
P89	Top 1.00 ,3.00 to 7.00 & 8.00 to 9.00
P90	Top 1.00 & 3.00 to 5.00
P91	Top 1.00 & 3.00 to 7.00
P92	Top 1.00 & 3.00 to 7.00
P93	Top 4.00
P94	Top 1.00 & 5.00 to 6.00
P95	2.00 to 5.00 & 7.00 to 8.00
P96	Top 1.00, 2.00 to 4.00 & 6.00 to 8.00
P97	3.00 to 6.00 & 7.00 to 8.00
P98	Top 5.00 & 6.00 to 7.00
P99	1.00 to 3.00
P100	1.00 to 3.00 & 5.00 to 6.00

for Techpro Engineers Pvt. Ltd.



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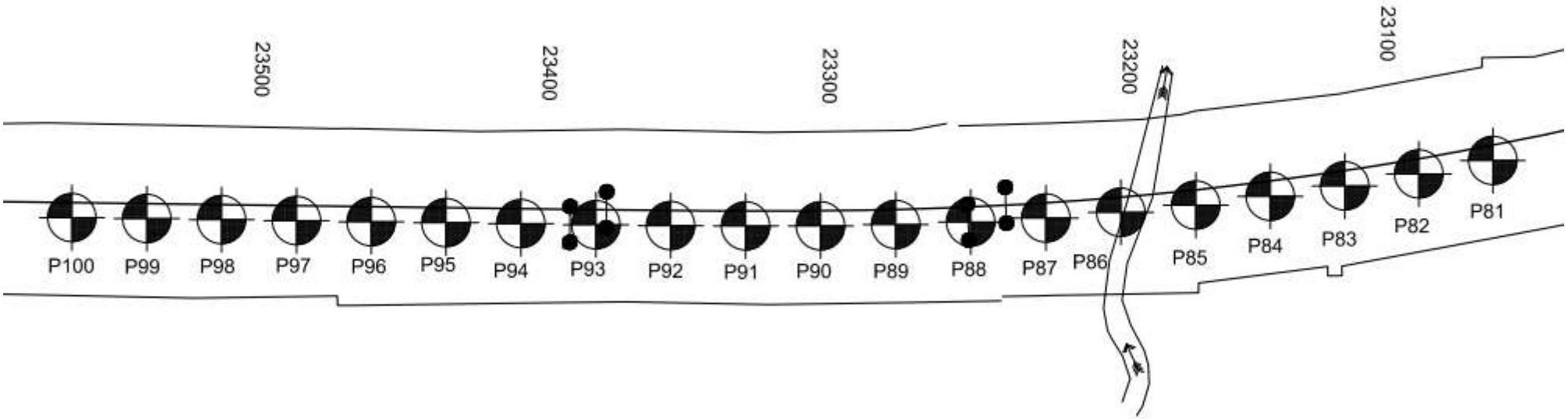
APPENDIX-A
TEST LOCATION PLAN



APPENDIX "B"
TABLE 1: SUMMARY OF TEST RESULTS

Bore No : P81	**Ground Elevation : RL 193.105 m**	**Method of drilling: Percussion**	**Depth of Water-table: 2.40 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 21/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23038.087	**Casing Lowered : 22.00 m**	**Ending Date : 23/10/2023**	**Hammer type : Rope-pulley**

FIELD TEST RESULT										LABORATORY TEST RESULT					
				SPT Test Result						Grain Size Analysis					
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)
Classification of ROCK															
	0.50	D	1	-	-	-	-	-	SM	0	0	0	54	46	0
	1.00	U	2	-	-	-	-	-	SM-SC	0	0	1	52	42	5
	2.00	D	3	1	1	1	2	2.66	-	-	-	-	-	-	-
	3.00	D	4	2	3	4	7	8.61	ML	0	0	1	44	55	0
	4.00	U	5	-	-	-	-	-	CL-ML	1	1	3	28	59	8
	5.00	D	6	2	3	5	8	8.93	ML	0	0	1	34	60	5
	6.00	D	7	3	6	8	14	15.00	ML	0	0	1	48	51	0
	7.00	U	8	-	-	-	-	-	CL-ML	7	5	4	16	60	8
	8.00	D	9	5	7	9	16	16.00	CL	3	1	1	10	77	8
	9.00	D	10	6	9	10	19	19.00	-	-	-	-	-	-	-
	10.00	U	11	-	-	-	-	-	ML	2	1	2	7	81	7
	11.00	D	12	6	10	11	21	17.04	-	-	-	-	-	-	-
	12.00	D	13	7	11	13	24	24.00	CL	1	1	0	8	79	11
	13.00	U	14	-	-	-	-	-	-	-	-	-	-	-	-
	14.50	D	15	8	12	17	29	29.00	CL	1	0	1	24	66	8
	16.00	U	16	-	-	-	-	-	SC	5	0	1	46	41	7
	17.50	D	17	7	13	15	28	28.00	CL	3	2	1	18	66	10

Depth Below NGL (Meter)	Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage		
	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure
0.50	6.62	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-
1.00	14.23	1.88	1.65	26.0	21.0	5.0	2.65	DST	3.0	26.3	-	0.606	-	-	-	-
2.00	19.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3.00	17.19	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-
4.00	17.28	2.02	1.72	26.0	19.5	6.5	2.67	UU	44.0	11.5	-	0.552	-	8	17	-
5.00	18.95	-	-	25.0	21.0	4.0	-	-	-	-	-	-	-	-	-	-
6.00	16.11	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-
7.00	19.93	2.03	1.69	27.5	21.5	6.0	2.66	UU	48.0	12.7	0.114	0.574	-	-	20	-
8.00	22.37	-	-	28.0	20.5	7.5	-	-	-	-	-	-	-	-	-	-
9.00	20.65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10.00	19.47	2.02	1.69	29.5	23.5	6.0	2.66	UU	45.0	11.0	-	0.574	-	8	21	-
11.00	19.32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12.00	23.20	-	-	31.0	21.0	10.0	-	-	-	-	-	-	-	-	-	-
13.00	21.18	2.04	1.68	-	-	-	2.67	UU	53.0	9.5	-	0.589	-	-	-	-
14.50	19.77	-	-	27.0	19.0	8.0	-	-	-	-	-	-	-	-	-	-
16.00	17.25	1.98	1.69	26.5	19.0	7.5	2.66	DST	5.0	27.5	-	0.574	-	-	-	-
17.50	21.79	-	-	29.0	20.0	9.0	-	-	-	-	-	-	-	-	-	-

Depth Below NGL (Meter)	Test on Rock Specimen											
	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
	Classification of SOIL											
0.50	Silty Sands											
1.00	Silty Sands with clay binder											
2.00												
3.00	Inorganic Silts of low plasticity											
4.00	Inorganic Silty Clays of low plasticity											
5.00	Inorganic Silts of low plasticity											
6.00												
7.00	Inorganic Silty Clays of low plasticity											
8.00	Inorganic clays of low plasticity											
9.00												
10.00	Inorganic Silts of low plasticity											
11.00												
12.00	Inorganic clays of low plasticity											
13.00												
14.50												
16.00	Clayey Sands											
17.50	Inorganic clays of low plasticity											

APPENDIX "B"
TABLE 1: SUMMARY OF TEST RESULTS

Bore No : P81	**Ground Elevation : RL 193.105 m**	**Method of drilling: Percussion**	**Depth of Water-table: 2.40 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 21/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23038.087	**Casing Lowered : 22.00 m**	**Ending Date : 23/10/2023**	**Hammer type : Rope-pulley**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
Classification of ROCK																																Classification of SOIL											
	19.00	U	18	-	-	-	-	-	CL-ML	7	2	2	25	56	8	14.60	2.04	1.78	26.5	20.0	6.5	2.66	UU	44.0	12.2	-	0.494	-	-	-	-	Inorganic Silty Clays of low plasticity											
	20.50	D	19	15	24	54	78	35.77	-	-	-	-	-	-	-	19.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	22.00	D	20	-	-	-	-	-	-	-	-	-	-	-	-	17.28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	23.50	D	21	20	40	62	R	-	CL-ML	7	1	2	10	73	7	21.87	-	-	27.0	21.0	6.0	-	-	-	-	-	-	-	-	-	-												
	25.00	D	22	7	32	40	72	31.51	ML	2	0	0	8	85	5	24.21	-	-	27.0	22.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	26.50	D	23	15	23	32	55	25.40	CL-ML	1	1	2	22	67	7	17.69	-	-	26.0	19.5	6.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	28.00	D	24	17	32	35	67	28.74	ML	0	0	1	26	73	0	23.67	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	29.50	D	25	21	45	50	95	36.93	ML	0	1	1	34	64	0	18.69	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	31.00	D	26	15	22	30	52	23.22	CL-ML	2	2	2	20	68	6	21.29	-	-	27.0	21.0	6.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	32.50	D	27	17	25	35	60	25.22	-	-	-	-	-	-	-	20.77	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	34.00	D	28	16	27	36	63	63.00	CL	2	1	0	14	74	9	15.35	-	-	29.0	20.0	9.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	35.50	D	29	18	30	34	64	25.67	CL-ML	3	2	2	38	50	5	11.35	-	-	25.0	20.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	37.00	D	30	21	35	42	77	28.93	-	-	-	-	-	-	-	14.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	38.50	D	31	23	37	48	85	30.64	CL-ML	1	2	2	32	57	6	21.02	-	-	26.0	19.5	6.5	-	-	-	-	-	-	-	-	-	-												
	40.00	D	32	27	42	50	92	32.09	-	-	-	-	-	-	-	11.14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"

TABLE 2: SUMMARY OF TEST RESULTS

Bore No : P82	**Ground Elevation : RL 193.262 m**	**Method of drilling: Percussion**	**Depth of Water-table: 2.30 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 05/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23064.287	**Casing Lowered : 18.00 m**	**Ending Date : 07/10/2023**	**Hammer type : Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	ML	0	0	1	42	57	0	12.48	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	1.00	U	2	-	-	-	-	-	CL-ML	2	1	1	32	58	6	14.53	1.82	1.59	26.0	19.5	6.5	2.66	UU	35.0	12.2	-	0.673	-	-	-	-	Inorganic Silty Clays of low plasticity											
	2.00	D	3	1	1	2	3	4.02	-	-	-	-	-	-	-	17.33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	3.00	D	4	1	2	3	5	6.25	-	-	-	-	-	-	-	18.82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	4.00	U	5	-	-	-	-	-	CL-ML	2	2	1	22	67	6	18.93	2.04	1.72	27.0	21.0	6.0	2.66	UU	44.0	10.8	0.132	0.551	-	8	17	-												
	5.00	D	6	2	3	5	8	9.03	-	-	-	-	-	-	-	16.83	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	6.00	D	7	3	4	7	11	11.89	-	-	-	-	-	-	-	22.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	7.00	U	8	-	-	-	-	-	ML	0	0	1	48	51	0	18.25	1.86	1.57	Non-Plastic			2.63	DST	3.0	27.5	-	0.672	-	-	-	-	Inorganic Silts of low plasticity											
	8.00	D	9	5	7	10	17	16.13	-	-	-	-	-	-	-	19.09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	9.00	D	10	6	7	11	18	16.38	-	-	-	-	-	-	-	18.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	10.00	D	11	-	-	-	-	-	CL-ML	2	1	1	32	60	4	17.31	-	-	24.5	19.0	5.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	11.00	D	12	8	10	14	24	24.00	CL	0	0	1	22	70	7	23.37	-	-	26.5	19.0	7.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	12.00	D	13	9	12	17	29	29.00	CL	1	1	1	14	73	10	19.22	-	-	28.0	19.5	8.5	-	-	-	-	-	-	-	-	-	-												
	13.00	U	14	-	-	-	-	-	-	-	-	-	-	-	-	17.70	2.10	1.78	-	-	-	2.68	UU	55.0	9.0	-	0.502	-	-	-	-												
	14.50	D	15	12	15	18	33	33.00	CL	7	4	5	11	60	13	18.60	-	-	31.5	19.0	12.5	-	-	-	-	-	-	-	-	-	-												
	16.00	U	16	-	-	-	-	-	CL	2	1	2	18	67	10	18.24	2.05	1.73	28.5	18.5	10.0	2.68	UU	52.0	10.5	-	0.546	-	8	13	-												
	17.50	D	17	11	17	20	37	37.00	-	-	-	-	-	-	-	15.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

APPENDIX "B"

TABLE 2: SUMMARY OF TEST RESULTS

Bore No : P82	**Ground Elevation : RL 193.262 m**	**Method of drilling: Percussion**	**Depth of Water-table: 2.30 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 05/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23064.287	**Casing Lowered : 18.00 m**	**Ending Date : 07/10/2023**	**Hammer type : Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	19.00	U	18	-	-	-	-	-	CL	2	1	2	16	69	10	20.09	2.08	1.73	27.5	18.5	9.0	2.67	UU	51.0	10.6	-	0.542	-	-	-	-												
	20.50	D	19	13	20	21	41	41.00	-	-	-	-	-	-	-	17.78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	22.00	U	20	-	-	-	-	-	CL-ML	4	2	2	29	58	5	18.76	2.07	1.74	24.0	19.5	4.5	2.65	DST	12.0	24.5	-	0.520	-	-	-	-	Inorganic Silty Clays of low plasticity											
	23.50	D	21	15	23	25	48	48.00	CL	2	1	2	10	71	14	18.27	-	-	32.0	19.0	13.0	-	-	-	-	-	-	-	-	-	-												
	25.00	D	22	-	-	-	-	-	CL	1	1	2	25	63	8	19.33	-	-	27.5	19.5	8.0	-	-	-	-	-	-	-	-	-	-												
	26.50	D	23	15	24	27	51	51.00	CL	0	0	1	14	73	12	17.81	-	-	29.0	19.0	10.0	-	-	-	-	-	-	-	-	-	-												
	28.00	U	24	-	-	-	-	-	-	-	-	-	-	-	-	17.40	2.08	1.77	-	-	-	2.68	UU	55.0	9.5	-	0.513	-	-	-	-	Inorganic clays of low plasticity											
	29.50	D	25	14	25	30	55	55.00	-	-	-	-	-	-	-	14.88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	31.00	U	26	-	-	-	-	-	CL	3	1	2	22	60	12	17.46	2.05	1.75	29.5	18.5	11.0	2.68	UU	56.0	10.5	-	-	-	-	-	-												
	32.50	D	27	17	28	32	60	60.00	-	-	-	-	-	-	-	17.14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	34.00	D	28	19	31	36	67	67.00	MI	1	1	1	5	75	17	30.71	-	-	40.0	28.5	11.5	-	-	-	-	-	-	-	-	-	-												
	35.50	D	29	22	34	37	71	71.00	MI	1	1	1	4	75	18	29.23	-	-	42.0	28.0	14.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of Intermediate plasticity											
	37.00	D	30	-	-	-	-	-	-	-	-	-	-	-	-	27.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	38.50	D	31	25	36	39	75	75.00	MI	1	1	2	5	72	19	25.75	-	-	44.0	28.5	15.5	-	-	-	-	-	-	-	-	-	-												
	40.00	D	32	28	39	42	81	28.32	CL	2	1	1	32	57	7	15.97	-	-	26.5	19.5	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 3: SUMMARY OF TEST RESULTS

Bore No : P83	Ground Elevation : RL 193.307 m	Method of drilling :Percussion	Depth of Water-table: 1.20 m
Diameter of Bore Hole : 150 mm	Bore Retained using : Casing	Starting Date : 23/10/2023	SPT Sampler: Standard
Location / Chainage : 23090.487	Casing Lowered : 21.00 m	Ending Date : 27/10/2023	Hammer type : Rope-pulley

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	SM	0	0	1	52	47	0	6.26	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	1.00	D	2	1	2	3	5	7.71	-	-	-	-	-	-	-	16.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	2.00	U	3	-	-	-	-	-	SM	0	0	1	53	46	0	16.27	1.99	1.71	Non-Plastic			2.65	DST	6.0	26.8	-	0.550	-	-	-	-												
	3.00	D	4	1	2	4	6	7.77	-	-	-	-	-	-	-	16.93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	4.00	D	5	2	3	4	7	8.56	ML	1	0	1	40	58	0	20.70	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	5.00	U	6	-	-	-	-	-	ML	0	1	0	29	64	6	17.81	2.01	1.71	25.0	21.0	4.0	2.66	DST	10.0	24.8	-	0.556	-	-	-	-												
	6.00	D	7	6	9	30	39	29.19	SM	0	0	0	56	44	0	17.94	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	7.00	D	8	2	2	6	8	8.55	-	-	-	-	-	-	-	17.49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	8.00	U	9	-	-	-	-	-	ML	0	0	1	48	51	0	19.28	1.98	1.66	Non-Plastic			2.64	DST	0.0	28.6	-	0.590	-	-	-	-	Inorganic Silts of low plasticity											
	9.00	D	10	9	14	18	32	23.45	-	-	-	-	-	-	-	18.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	10.00	D	11	10	15	19	34	23.92	CL	1	0	1	8	83	7	20.20	-	-	29.0	22.0	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	11.00	U	12	-	-	-	-	-	CL	2	0	2	5	80	11	20.90	2.03	1.68	31.0	21.5	9.5	2.68	UU	58.0	8.9	0.106	0.595	-	0	22	-												
	12.50	D	13	9	14	18	32	21.84	CL-ML	1	1	0	24	69	5	19.81	-	-	26.0	21.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	14.00	U	14	-	-	-	-	-	CL	2	1	2	28	56	11	19.13	2.01	1.69	26.5	17.5	9.0	2.67	UU	52.0	9.5	-	0.580	-	0	15	-	Inorganic clays of low plasticity											
	15.50	D	15	9	17	21	38	38.00	-	-	-	-	-	-	-	13.28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	17.00	D	16	-	-	-	-	-	CL	1	1	2	23	63	10	20.45	-	-	27.0	17.0	10.0	-	-	-	-	-	-	-	-	-	-												

APPENDIX "B"
TABLE 3: SUMMARY OF TEST RESULTS

Bore No : P83	**Ground Elevation : RL 193.307 m**	**Method of drilling :Percussion**	**Depth of Water-table: 1.20 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 23/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23090.487	**Casing Lowered : 21.00 m**	**Ending Date : 27/10/2023**	**Hammer type : Rope-pulley**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	18.50	D	17	8	18	23	41	41.00	-	-	-	-	-	-	-	18.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	20.00	U	18	-	-	-	-	-	CL	0	1	1	6	82	10	20.33	1.98	1.65	31.0	22.5	8.5	2.67	UU	48.0	10.2	-	0.623	-	-	21	-	Inorganic clays of low plasticity											
	21.50	D	19	14	24	25	49	49.00	-	-	-	-	-	-	-	15.59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	23.00	U	20	-	-	-	-	-	ML	8	3	2	14	62	11	16.87	1.84	1.57	32.0	24.0	8.0	2.68	UU	55.0	9.6	-	0.703	-	-	-	-	Inorganic Silts of low plasticity											
	24.50	D	21	15	20	30	50	24.83	CL-ML	1	1	1	24	68	5	23.08	-	-	26.0	21.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	26.00	D	22	-	-	-	-	-	CL-ML	1	1	0	14	76	8	24.65	-	-	27.0	20.5	6.5	-	-	-	-	-	-	-	-	-	-												
	27.50	D	23	17	19	28	47	47.00	MI	2	1	0	5	80	12	24.98	-	-	37.0	27.0	10.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of Intermediate plasticity											
	29.00	D	24	-	-	-	-	-	-	-	-	-	-	-	-	27.09	2.14	1.68	-	-	-	2.68	RUU	62.0	8.1	-	0.595	-	-	-	-												
	30.50	D	25	18	21	26	47	21.91	CL-ML	3	2	2	27	60	6	14.82	-	-	27.0	20.5	6.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	32.00	D	26	-	-	-	-	-	CL	2	1	2	24	64	7	17.21	-	-	28.0	21.0	7.0	-	-	-	-	-	-	-	-	-	-												
	33.50	D	27	16	22	28	50	22.04	-	-	-	-	-	-	-	17.39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	35.00	D	28	-	-	-	-	-	CL	1	1	1	21	68	8	19.10	2.06	1.73	28.0	20.5	7.5	2.67	RUU	47.0	12.8	-	0.543	-	-	-	-	Inorganic clays of low plasticity											
	36.50	D	29	18	26	29	55	55.00	-	-	-	-	-	-	-	19.29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	38.00	D	30	20	28	30	58	23.13	CL-ML	2	1	0	20	71	6	20.65	-	-	26.0	20.0	6.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	40.00	D	31	18	30	31	61	23.48	-	-	-	-	-	-	-	20.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"

TABLE 4: SUMMARY OF TEST RESULTS

Bore No : P84	**Ground Elevation : RL 193.358**	**Method of drilling :Percussion**	**Depth of Water-table: 1.70 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 23/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23116.687	**Casing Lowered : 18.00 m**	**Ending Date : 26/10/2023**	**Hammer type : Rope-pulley**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	ML	0	0	1	47	52	0	7.39	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	1.00	D	2	3	3	4	7	10.78	CL	0	0	1	38	54	7	19.61	-	-	26.0	19.0	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	2.00	U	3	-	-	-	-	-	CL-ML	2	1	1	45	44	7	18.26	2.00	1.69	25.5	19.5	6.0	2.66	DST	8.0	26.5	-	0.574	-	6	18	-	Inorganic Silty Clays of low plasticity											
	3.00	D	4	2	4	5	9	11.29	ML	0	0	0	48	52	0	17.62	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	4.00	D	5	3	6	8	14	15.83	-	-	-	-	-	-	-	20.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	5.00	U	6	-	-	-	-	-	CL-ML	0	1	1	34	58	6	17.12	1.99	1.70	25.0	19.5	5.5	2.66	DST	10.0	25.0	-	0.565	-	0	18	-	Inorganic Silty Clays of low plasticity											
	6.00	D	7	3	10	12	22	19.49	-	-	-	-	-	-	-	17.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	7.00	D	8	4	11	13	24	20.10	ML	0	0	1	46	53	0	17.75	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	8.00	U	9	-	-	-	-	-	ML	1	0	1	10	80	8	21.25	2.01	1.66	29.0	22.5	6.5	2.67	UU	45.0	10.2	0.108	0.608	-	0	20	-												
	9.00	D	10	5	8	11	19	16.80	-	-	-	-	-	-	-	20.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	10.00	D	11	8	13	15	28	20.79	-	-	-	-	-	-	-	19.22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	11.00	U	12	-	-	-	-	-	CL-ML	1	0	1	38	55	5	19.49	1.99	1.67	26.0	21.0	5.0	2.66	DST	6.0	27.0	-	0.598	-	-	-	-	Inorganic Silty Clays of low plasticity											
	12.50	D	13	7	10	17	27	19.45	CL-ML	3	0	2	22	66	7	21.13	-	-	28.0	22.0	6.0	-	-	-	-	-	-	-	-	-	-												
	14.00	U	14	-	-	-	-	-	CL-ML	4	1	2	23	61	9	17.51	2.01	1.71	27.5	21.5	6.0	2.67	UU	48.0	11.2	-	0.561	-	-	-	-												
	15.50	D	15	9	14	16	30	30.00	CL	0	0	1	16	72	11	17.65	-	-	30.0	20.0	10.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	17.00	U	16	-	-	-	-	-	CL-ML	3	1	1	24	64	7	20.72	1.81	1.50	27.0	20.5	6.5	2.66	DST	7.0	26.7	-	0.773	-	-	-	-	Inorganic Silty Clays of low plasticity											

APPENDIX "B"
TABLE 4: SUMMARY OF TEST RESULTS

Bore No : P84	**Ground Elevation : RL 193.358**	**Method of drilling :Percussion**	**Depth of Water-table: 1.70 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 23/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23116.687	**Casing Lowered : 18.00 m**	**Ending Date : 26/10/2023**	**Hammer type : Rope-pulley**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	18.50	D	17	11	15	16	31	19.53	-	-	-	-	-	-	-	20.59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	20.00	D	18	-	-	-	-	-	CL	1	1	2	18	70	8	17.64	-	-	27.0	20.0	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	21.50	D	19	12	17	20	37	20.96	-	-	-	-	-	-	-	22.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	23.00	U	20	-	-	-	-	-	CL	3	6	6	9	64	12	18.38	2.02	1.71	32.0	22.0	10.0	2.68	UU	56.0	9.5	-	0.567	-	-	-	-												
	24.50	D	21	9	18	22	40	21.20	ML	1	1	0	34	60	4	22.63	-	-	24.0	20.0	4.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	26.00	D	22	-	-	-	-	-	CL	0	0	1	14	77	8	21.59	-	-	28.0	21.0	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	27.50	D	23	13	21	27	48	23.00	SM	0	0	0	55	45	0	19.55	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	29.00	D	24	-	-	-	-	-	ML	0	0	1	48	51	0	19.28	2.06	1.73	Non-Plastic			2.65	RDST	4.0	29.1	-	0.532	-	-	-	-	Inorganic Silts of low plasticity											
	30.50	D	25	10	18	24	42	20.33	SM	4	3	5	39	49	0	17.59	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	32.00	D	26	-	-	-	-	-	ML	0	0	1	48	51	0	20.34	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	33.50	D	27	12	19	23	42	19.68	-	-	-	-	-	-	-	19.58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	35.00	D	28	-	-	-	-	-	-	-	-	-	-	-	-	18.80	2.04	1.72	-	-	-	-	RDST	2.0	28.7	-	-	-	-	-	-												
	36.50	D	29	14	20	26	46	20.19	ML	1	0	1	45	53	0	20.01	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	38.00	D	30	-	-	-	-	-	-	-	-	-	-	-	-	19.10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	40.00	D	31	17	24	28	52	21.14	-	-	-	-	-	-	-	19.86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed samples.

APPENDIX "B"

TABLE 5: SUMMARY OF TEST RESULTS

Bore No : P85	**Ground Elevation : RL 193.345 m**	**Method of drilling :Percussion**	**Depth of Water-table: 2.20 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 05/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23142.887	**Casing Lowered : 21.00 m**	**Ending Date : 07/10/2023**	**Hammer type : Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m²)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm²)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	CL	2	1	1	18	69	9	13.98	-	-	27.5	19.0	8.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	1.00	U	2	-	-	-	-	-	ML	0	0	1	32	62	5	14.41	1.94	1.70	24.0	20.0	4.0	2.65	DST	17	24.6	-	0.559	-	-	-	-	Inorganic Silts of low plasticity											
	2.00	D	3	1	2	2	4	5.27	CL-ML	0	0	1	37	55	7	18.07	-	-	25.0	19.0	6.0	-	-	-	-	-	-	-	0	15	-	Inorganic Silty Clays of low plasticity											
	3.00	D	4	2	3	3	6	7.39	-	-	-	-	-	-	-	18.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	4.00	D	5	-	-	-	-	-	CL	0	0	1	32	59	8	20.54	-	-	27.5	20.0	7.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	5.00	D	6	3	4	7	11	12.49	ML	0	0	0	38	62	0	18.36	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	6.00	D	7	2	4	7	11	12.03	-	-	-	-	-	-	-	17.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	7.00	U	8	-	-	-	-	-	SM	0	0	0	72	28	0	20.29	1.90	1.58	Non-Plastic			2.63	DST	3	28.5	-	0.665	-	-	-	-	Silty Sands											
	8.00	D	9	4	6	8	14	14.31	ML	1	0	1	17	73	8	20.24	-	-	29.0	23.5	5.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	9.00	D	10	5	7	10	17	15.93	-	-	-	-	-	-	-	21.84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	10.00	U	11	-	-	-	-	-	CL-ML	0	1	0	7	86	6	19.25	1.99	1.67	24.0	19.0	5.0	2.66	DST	13	24.5	-	0.594	-	-	-	-	Inorganic Silty Clays of low plasticity											
	11.00	D	12	7	13	15	28	20.56	-	-	-	-	-	-	-	19.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	12.00	D	13	6	9	11	20	16.57	-	-	-	-	-	-	-	22.19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	13.00	U	14	-	-	-	-	-	CL-ML	3	1	2	30	56	8	18.42	1.97	1.66	27.0	20.5	6.5	2.66	DST	15	26.5	-	0.599	-	17	18	-												
	14.50	D	15	8	8	14	22	16.86	-	-	-	-	-	-	-	20.78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	16.00	U	16	-	-	-	-	-	CL	1	1	1	10	76	11	22.07	2.09	1.71	29.5	19.0	10.5	2.67	UU	46	10.2	-	0.560	-	-	-	-	Inorganic clays of low plasticity											
	17.50	D	17	6	13	24	37	37.00	-	-	-	-	-	-	-	23.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

APPENDIX "B"
TABLE 5: SUMMARY OF TEST RESULTS

Bore No : P85	**Ground Elevation : RL 193.345 m**	**Method of drilling :Percussion**	**Depth of Water-table: 2.20 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 05/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23142.887	**Casing Lowered : 21.00 m**	**Ending Date : 07/10/2023**	**Hammer type : Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	19.00	U	18	-	-	-	-	-	CL	5	2	2	11	71	9	18.11	2.04	1.73	28.0	19.0	9.0	2.67	UU	48	11.5	-	0.546	-	-	-	-												
	20.50	D	19	8	11	32	43	43.00	-	-	-	-	-	-	-	16.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	22.00	U	20	-	-	-	-	-	CL	16	7	6	9	51	11	16.41	2.07	1.78	31.0	21.0	10.0	2.68	UU	54	10.6	-	0.507	-	-	-	-	Inorganic clays of low plasticity											
	23.50	D	21	6	10	17	27	27.00	CL	4	3	4	11	65	13	21.19	-	-	32.0	20.0	12.0	-	-	-	-	-	-	-	-	-	-												
	25.00	U	22	-	-	-	-	-	CL	10	2	1	29	51	7	16.01	1.98	1.71	26.0	19.0	7.0	2.66	DST	13	25.0	-	0.559	-	-	-	-												
	26.50	D	23	7	18	29	47	22.88	ML	0	1	1	38	60	0	18.33	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	28.00	U	24	-	-	-	-	-	MI	0	0	0	10	77	13	33.06	2.10	1.58	42.0	30.5	11.5	2.70	UU	60	8.5	-	0.709	-	-	-	-	Inorganic Silts of Intermediate plasticity											
	29.50	D	25	10	30	36	66	66.00	-	-	-	-	-	-	-	32.09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	31.00	D	26	-	-	-	-	-	CL-ML	1	1	0	34	59	5	21.82	-	-	25.0	19.0	6.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	32.50	D	27	14	27	33	60	25.13	CL	0	1	0	12	80	7	27.96	-	-	26.0	19.0	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	34.00	D	28	-	-	-	-	-	-	-	-	-	-	-	-	14.38	1.99	1.74	-	-	-	2.67	RUU	44	9.1	-	0.534	-	-	-	-												
	35.50	D	29	16	28	36	64	25.42	ML	2	1	2	37	58	0	16.28	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	37.00	D	30	-	-	-	-	-	CL	0	0	1	22	71	6	21.06	-	-	26.0	19.0	7.0	-	-	-	-	-	-	-	-	-	-												
	38.50	D	31	18	30	38	68	68.00	CL	4	3	3	9	70	11	21.42	-	-	29.5	19.0	10.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	40.00	D	32	18	32	40	72	72.00	-	-	-	-	-	-	-	24.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed samples.

APPENDIX "B"
TABLE 6: SUMMARY OF TEST RESULTS

Bore No : P86	**Ground Elevation : RL 193.548 m**	**Method of drilling :Percussion**	**Depth of Water-table: 1.20 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 23/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23169.087	**Casing Lowered : 18.00 m**	**Ending Date : 26/10/2023**	**Hammer type : Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																													
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen									
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL									
	0.50	D	1	-	-	-	-	-	CL-ML	0	0	1	38	55	6	11.64	-	-	26.0	20.5	5.5	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity									
	1.00	D	2	2	3	4	7	7.00	CL	0	0	1	42	49	8	16.06	-	-	28.0	20.5	7.5	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity									
	2.00	D	3	-	-	-	-	-	-	-	-	-	-	-	-	18.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	3.00	D	4	2	2	4	6	8.01	ML	0	0	1	46	53	0	18.89	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity									
	4.00	D	5	2	3	5	8	10.06	-	-	-	-	-	-	-	17.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	5.00	U	6	-	-	-	-	-	ML	0	0	0	41	59	0	19.01	1.96	1.65	Non-Plastic			2.64	DST	8.0	25.7	-	0.600	-	-	-	-									
	6.00	D	7	3	5	8	13	14.85	-	-	-	-	-	-	-	16.81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	7.00	D	8	8	15	21	36	27.23	CL	0	0	1	18	74	7	19.65	-	-	28.0	21.0	7.0	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity									
	8.00	U	9	-	-	-	-	-	CL-ML	0	0	1	27	67	5	19.29	1.97	1.65	26.0	21.0	5.0	2.66	DST	10.0	25.5	-	0.612	-	-	-	-									
	9.00	D	10	7	13	18	31	23.31	-	-	-	-	-	-	-	20.39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity									
	10.00	D	11	9	12	15	27	20.83	-	-	-	-	-	-	-	20.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	11.00	U	12	-	-	-	-	-	ML	2	0	1	7	84	6	19.14	1.90	1.59	27.0	22.0	5.0	2.66	DST	11.0	25.2	0.102	0.669	-	0	21	-	Inorganic Silts of low plasticity									
	12.50	D	13	8	8	15	23	23.00	CL	2	1	1	12	72	12	18.00	-	-	31.0	21.5	9.5	-	-	-	-	-	-	-	-	-	-									
	14.00	U	14	-	-	-	-	-	CL	4	3	2	14	67	10	16.70	2.02	1.73	29.0	20.5	8.5	2.67	UU	51.0	10.5	-	0.543	-	8	20	-	Inorganic clays of low plasticity									
	15.50	D	15	6	7	12	19	19.00	-	-	-	-	-	-	-	20.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	17.00	U	16	-	-	-	-	-	ML	6	3	3	28	54	6	17.67	1.97	1.67	25.0	21.0	4.0	2.65	DST	5.0	27.0	-	0.587	-	-	-	-	Inorganic Silts of low plasticity									

APPENDIX "B"
TABLE 6: SUMMARY OF TEST RESULTS

Bore No : P86	**Ground Elevation : RL 193.548 m**	**Method of drilling :Percussion**	**Depth of Water-table: 1.20 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 23/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23169.087	**Casing Lowered : 18.00 m**	**Ending Date : 26/10/2023**	**Hammer type : Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																													
				SPT Test Result							Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen									
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL									
	18.50	D	17	6	12	18	30	30.00	CL	8	4	5	20	56	7	15.78	-	-	28.0	20.5	7.5	-	-	-	-	-	-	-	-	-										
	20.00	D	18	-	-	-	-	-	-	-	-	-	-	-	-	15.84	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	21.50	D	19	10	19	30	49	49.00	CL	2	1	0	24	65	8	18.96	-	-	28.0	20.0	8.0	-	-	-	-	-	-	-	-	-										Inorganic clays of low plasticity
	23.00	U	20	-	-	-	-	-	CL	3	2	1	14	69	11	15.20	2.01	1.74	31.0	21.0	10.0	2.68	UU	53.0	9.4	-	0.537	-	-	-	-										
	24.50	D	21	13	18	26	44	44.00	-	-	-	-	-	-	-	18.78	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	26.00	U	22	-	-	-	-	-	CL-ML	4	1	2	29	58	6	13.12	1.89	1.67	26.0	21.0	5.0	2.65	DST	4.0	27.1	-	0.587	-	-	-	-										Inorganic Silty Clays of low plasticity
	27.50	D	23	11	21	28	49	23.80	ML	0	0	0	10	84	6	20.75	-	-	27.0	23.0	4.0	-	-	-	-	-	-	-	-	-										Inorganic Silts of low plasticity
	29.00	D	24	-	-	-	-	-	ML	0	0	1	42	57	0	17.75	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-										
	30.50	D	25	12	22	30	52	24.00	SM	2	1	2	47	48	0	17.28	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-										Silty Sands
	32.00	D	26	15	25	26	51	23.31	CL	4	2	1	22	63	8	17.96	-	-	28.0	21.0	7.0	-	-	-	-	-	-	-	-	-										
	33.50	D	27	18	23	25	48	48.00	CL	2	1	2	8	75	12	14.78	-	-	32.0	21.0	11.0	-	-	-	-	-	-	-	-	-										
	35.00	D	28	-	-	-	-	-	-	-	-	-	-	-	-	18.80	2.06	1.73	-	-	-	2.67	RUU	67.0	9.3	-	0.543	-	-	-	-										Inorganic clays of low plasticity
	36.50	D	29	17	20	27	47	47.00	CL	6	3	4	22	58	7	20.10	-	-	28.0	20.0	8.0	-	-	-	-	-	-	-	-	-										
	38.00	D	30	-	-	-	-	-	-	-	-	-	-	-	-	19.62	2.08	1.74	-	-	-	-	RUU	49.0	13.1	-	-	-	-	-	-										
	40.00	D	31	20	24	30	54	54.00	-	-	-	-	-	-	-	19.67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 7: SUMMARY OF TEST RESULTS

Bore No : P87	**Ground Elevation : RL 193.452 m**	**Method of drilling :Percussion**	**Depth of Water-table: 1.26 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using : Casing**	**Starting Date : 25/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23195.287	**Casing Lowered : 20.00 m**	**Ending Date : 27/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (KN/m²)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm²)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	CL-ML	0	0	1	27	67	5	19.73	-	-	26.0	21.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	1.00	U	2	-	-	-	-	-	CL	1	0	1	40	48	10	18.65	2.01	1.69	27.0	18.5	8.5	2.68	UU	51.0	12.5	-	0.586	-	8	17	-	Inorganic clays of low plasticity											
	2.00	D	3	2	3	3	6	6.00	-	-	-	-	-	-	-	21.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	3.00	D	4	2	2	4	6	7.72	ML	0	1	1	47	51	0	17.78	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	4.00	U	5	-	-	-	-	-	SM	1	1	1	48	49	0	16.97	1.96	1.68	Non-Plastic			2.64	DST	4.0	27.5	-	0.576	-	-	-	-	Silty Sands											
	5.00	D	6	3	4	5	9	10.46	-	-	-	-	-	-	-	18.10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	6.00	D	7	3	5	4	9	10.02	-	-	-	-	-	-	-	17.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	7.00	U	8	-	-	-	-	-	SM	1	0	1	58	40	0	18.36	1.99	1.68	Non-Plastic			2.63	DST	0.0	29.0	-	0.565	-	-	-	-												
	8.00	D	9	4	4	6	10	10.00	CL	7	6	5	17	53	12	15.57	-	-	31.0	21.0	10.0	-	-	-	-	-	-	-	19	17	-	Inorganic clays of low plasticity											
	9.00	D	10	6	12	19	31	22.97	CL-ML	2	1	0	27	64	6	22.13	-	-	26.0	20.5	5.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	10.00	D	11	-	-	-	-	-	SM	0	0	1	52	47	0	18.44	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	11.00	D	12	6	8	12	20	16.93	CL-ML	0	0	1	18	76	5	18.32	-	-	26.0	20.0	6.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	12.00	D	13	8	11	15	26	19.42	-	-	-	-	-	-	-	22.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	13.00	U	14	-	-	-	-	-	CL	7	6	8	7	61	11	18.50	1.98	1.67	30.0	21.0	9.0	2.67	UU	53.0	11.5	0.112	0.599	-	-	-	-	Inorganic clays of low plasticity											
	14.50	D	15	8	15	18	33	33.00	-	-	-	-	-	-	-	17.26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	16.00	U	16	-	-	-	-	-	CL-ML	1	1	0	42	50	6	17.91	1.95	1.65	25.0	20.0	5.0	2.66	DST	6.0	26.8	-	0.612	-	-	-	-	Inorganic Silty Clays of low plasticity											
	17.50	D	17	6	12	16	28	28.00	CL	0	0	1	14	76	9	15.87	-	-	29.0	21.5	7.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											

APPENDIX "B"
TABLE 7: SUMMARY OF TEST RESULTS

Bore No : P87	**Ground Elevation : RL 193.452 m**	**Method of drilling :Percussion**	**Depth of Water-table: 1.26 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using : Casing**	**Starting Date : 25/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23195.287	**Casing Lowered : 20.00 m**	**Ending Date : 27/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	19.00	U	18	-	-	-	-	-	CL	3	2	1	12	69	13	19.63	2.11	1.76	31.0	21.5	9.5	2.67	UU	56.0	9.5	-	0.517	-	-	-	-	Inorganic clays of low plasticity											
	20.50	D	19	6	16	22	38	38.00	-	-	-	-	-	-	-	15.61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	22.00	U	20	-	-	-	-	-	ML	8	2	2	14	66	8	18.32	2.00	1.69	30.5	23.0	7.5	2.66	UU	42.0	11.5	-	0.574	-	-	-	-	Inorganic Silts of low plasticity											
	23.50	D	21	12	18	15	33	33.00	CL	4	2	2	14	66	12	16.29	-	-	31.0	21.0	10.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	25.00	U	22	-	-	-	-	-	ML	2	0	0	35	59	4	18.06	1.95	1.65	24.0	20.0	4.0	2.63	DST	7.0	26.5	-	0.594	-	-	-	-	Inorganic Silts of low plasticity											
	26.50	D	23	8	15	27	42	21.48	ML	2	0	0	47	51	0	19.93	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	28.00	D	24	-	-	-	-	-	-	-	-	-	-	-	-	18.39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	29.50	D	25	12	21	28	49	22.91	ML	0	0	1	24	70	5	21.71	-	-	23.0	19.0	4.0	-	-	-	-	-	-	-	-	-	-												
	31.00	D	26	-	-	-	-	-	ML	0	0	1	42	57	0	18.48	2.05	1.73	Non-Plastic			2.65	RDST	0.0	29.3	-	0.532	-	-	-	-												
	32.50	D	27	15	20	25	45	20.92	-	-	-	-	-	-	-	18.65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	34.00	D	28	-	-	-	-	-	ML	0	0	2	45	53	0	17.24	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	35.50	D	29	16	21	27	48	21.08	-	-	-	-	-	-	-	17.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	37.00	D	30	-	-	-	-	-	-	-	-	-	-	-	-	19.24	2.07	1.74	-	-	-	-	RDST	0.0	28.7	-	-	-	-	-	-												
	38.50	D	31	18	24	29	53	21.75	ML	0	1	1	46	52	0	19.27	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	40.00	D	32	20	26	31	57	22.45	-	-	-	-	-	-	-	20.44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 8: SUMMARY OF TEST RESULTS

Bore No : P88	**Ground Elevation : RL 193.536 m**	**Method of drilling :Percussion**	**Depth of Water-table: 1.70 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 05/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23211.487	**Casing Lowered : 18.00 m**	**Ending Date : 07/10/2023**	**Hammer type : Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	ML	0	0	0	36	60	4	10.84	-	-	24.0	20.0	4.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	1.00	D	2	1	2	3	5	5.00	CL	0	0	2	22	63	13	20.02	-	-	32.0	19.0	13.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	2.00	U	3	-	-	-	-	-	CL	0	0	1	47	44	8	21.19	1.99	1.64	27.5	20.0	7.5	2.66	DST	18.0	24.2	0.165	0.620	-	8	14	-												
	3.00	D	4	1	2	5	7	8.80	SM	1	1	3	62	33	0	18.04	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	4.00	D	5	2	3	6	9	10.73	CL-ML	0	1	2	32	59	6	18.91	-	-	25.5	19.5	6.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	5.00	U	6	-	-	-	-	-	-	-	-	-	-	-	-	12.23	1.89	1.68	-	-	-	2.66	DST	16.0	23.6	-	0.583	-	-	-	-												
	6.00	D	7	5	6	7	13	14.31	CL-ML	7	6	3	24	55	5	19.37	-	-	25.0	20.0	5.0	-	-	-	-	-	-	-	-	-	-												
	7.00	D	8	6	8	9	17	16.54	CL	2	2	1	18	70	7	21.03	-	-	27.0	20.0	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	8.00	D	9	-	-	-	-	-	-	-	-	-	-	-	-	22.90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	9.00	D	10	6	8	10	18	16.50	SM	0	0	1	63	36	0	16.64	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	10.00	D	11	7	10	11	21	17.65	-	-	-	-	-	-	-	16.98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	11.00	U	12	-	-	-	-	-	CL	1	1	1	19	71	7	23.97	2.07	1.67	26.5	19.5	7.0	2.66	DST	16.0	25.3	-	0.593	-	9	16	-	Inorganic clays of low plasticity											
	12.50	D	13	8	11	13	24	24.00	CL	0	0	1	12	78	9	22.71	-	-	27.0	19.0	8.0	-	-	-	-	-	-	-	-	-	-												
	14.00	U	14	-	-	-	-	-	CL	2	5	4	16	62	11	18.00	2.08	1.76	29.5	18.5	11.0	2.67	UU	54.0	10.6	-	0.515	-	-	15	-												
	15.50	D	15	5	10	16	26	26.00	-	-	-	-	-	-	-	18.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	17.00	D	16	-	-	-	-	-	CL	0	1	2	22	68	7	19.89	-	-	26.0	19.0	7.0	-	-	-	-	-	-	-	-	-	-												

APPENDIX "B"
TABLE 8: SUMMARY OF TEST RESULTS

Bore No : P88	**Ground Elevation : RL 193.536 m**	**Method of drilling :Percussion**	**Depth of Water-table: 1.70 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 05/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23211.487	**Casing Lowered : 18.00 m**	**Ending Date : 07/10/2023**	**Hammer type : Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (KN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	18.50	D	17	4	8	10	18	18.00	CL	0	1	1	34	55	9	18.05	-	-	28.5	20.0	8.5	-	-	-	-	-	-	-	-	-	-												
	20.00	D	18	-	-	-	-	-	-	-	-	-	-	-	-	25.60	2.08	1.66	-	-	-	2.67	RDST	15.0	25.9	-	0.608	-	-	-	-												
	21.50	D	19	7	10	12	22	22.00	-	-	-	-	-	-	-	25.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	23.00	D	20	-	-	-	-	-	CL	0	1	2	16	70	11	18.07	-	-	29.5	18.5	11.0	-	-	-	-	-	-	-	-	-	-												
	24.50	D	21	10	15	20	35	19.37	CL	4	8	9	14	56	9	20.46	-	-	27.5	20.5	7.0	-	-	-	-	-	-	-	-	-	-												
	26.00	U	22	-	-	-	-	-	SM	0	1	2	57	40	0	21.94	1.93	1.58		Non-Plastic		2.65	DST	8.0	24.5	-	0.677	-	-	-	-	Silty Sands											
	27.50	D	23	11	16	21	37	19.42	CL	0	1	1	22	68	8	20.87	-	-	27.0	20.0	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	29.00	U	24	-	-	-	-	-	ML	1	0	2	29	63	5	18.90	2.04	1.72	23.0	19.0	4.0	2.66	UU	38.0	13.8	-	0.550	-	-	-	-	Inorganic Silts of low plasticity											
	30.50	D	25	15	20	28	48	22.15	-	-	-	-	-	-	-	20.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	32.00	U	26	-	-	-	-	-	CL	1	2	3	27	60	7	18.90	2.05	1.72	27.0	20.0	7.0	2.66	UU	40.0	13.4	-	0.547	-	-	-	-	Inorganic clays of low plasticity											
	33.50	D	27	16	21	29	50	21.99	ML	0	0	2	35	59	4	20.73	-	-	24.0	20.0	4.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	35.00	D	28	-	-	-	-	-	SM	0	1	2	54	43	0	18.78	-	-		Non-Plastic		-	-	-	-	-	-	-	-	-	-												
	36.50	D	29	18	25	30	55	22.76	SM	0	1	3	56	40	0	18.29	-	-		Non-Plastic		-	-	-	-	-	-	-	-	-	-	Silty Sands											
	38.00	D	30	-	-	-	-	-	-	-	-	-	-	-	-	18.68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	40.00	D	31	20	29	33	62	23.80	CL-ML	0	0	1	25	68	6	24.46	-	-	26.0	19.5	6.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 9: SUMMARY OF TEST RESULTS

Bore No : P89	Ground Elevation : RL 193.530 m	Method of drilling :Percussion	Depth of Water-table: 1.90 m
Diameter of Bore Hole: 150 mm	Bore Retained using : Casing	Starting Date : 25/10/2023	SPT Sampler: Standard
Location / Chainage : 23247.687	Casing Lowered : 20.00 m	Ending Date : 27/10/2023	Hammer type: Auto-trip

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	ML	0	0	1	46	48	5	7.35	-	-	26.0	22.0	4.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	1.00	U	2	-	-	-	-	-	CL	0	1	2	43	43	11	17.30	2.02	1.72	28.0	18.5	9.5	2.66	UU	47.0	11.5	-	0.547	-	-	16	-	Inorganic clays of low plasticity											
	2.00	D	3	1	2	2	4	4.00	-	-	-	-	-	-	-	21.10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	3.00	D	4	1	2	3	5	6.18	SM	3	2	1	53	41	0	17.80	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	4.00	U	5	-	-	-	-	-	SM	1	1	1	56	41	0	19.02	1.95	1.64	Non-Plastic			2.63	DST	2.0	27.5	-	0.604	-	-	-	-												
	5.00	D	6	2	2	3	5	5.64	-	-	-	-	-	-	-	17.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	6.00	D	7	2	3	4	7	7.59	-	-	-	-	-	-	-	18.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	7.00	D	8	-	-	-	-	-	CL-ML	1	1	0	34	57	7	20.40	1.94	1.61	27.0	20.5	6.5	-	RDST	4.0	23.9	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	8.00	D	9	3	4	5	9	9.11	ML	7	6	4	29	50	4	14.16	-	-	24.0	20.0	4.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	9.00	D	10	9	13	14	27	20.75	CL	2	1	0	22	68	7	21.26	-	-	28.0	21.0	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	10.00	U	11	-	-	-	-	-	-	-	-	-	-	-	-	20.81	1.94	1.60	-	-	-	2.65	DST	5.0	27.4	-	0.652	-	-	-	-												
	11.00	D	12	5	9	10	19	19.00	CL	1	1	0	20	70	8	23.24	-	-	29.0	20.5	8.5	-	-	-	-	-	-	-	-	-	-												
	12.00	D	13	5	9	12	21	21.00	-	-	-	-	-	-	-	22.56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	13.00	D	14	-	-	-	-	-	CL	1	1	0	17	70	11	23.48	-	-	30.0	20.5	9.5	-	-	-	-	-	-	-	-	-	-												
	14.50	D	15	4	8	11	19	19.00	-	-	-	-	-	-	-	19.80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	16.00	U	16	-	-	-	-	-	SM	3	2	2	51	42	0	19.19	1.93	1.62	Non-Plastic			2.64	DST	3.0	28.2	-	0.630	-	-	-	-	Silty Sands											
	17.50	D	17	6	10	13	23	16.64	CL-ML	2	1	1	44	47	5	19.65	-	-	27.0	21.0	6.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											

APPENDIX "B"
TABLE 9: SUMMARY OF TEST RESULTS

Bore No : P89	**Ground Elevation : RL 193.530 m**	**Method of drilling :Percussion**	**Depth of Water-table: 1.90 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using : Casing**	**Starting Date : 25/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23247.687	**Casing Lowered : 20.00 m**	**Ending Date : 27/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	19.00	U	18	-	-	-	-	-	CL	7	2	2	7	72	10	17.36	2.01	1.71	31.5	21.5	10.0	2.68	UU	58.0	8.2	-	0.567	-	7	20	-												
	20.50	D	19	13	19	21	40	40.00	-	-	-	-	-	-	-	18.10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	22.00	U	20	-	-	-	-	-	CL	11	5	3	11	59	11	19.65	2.03	1.70	30.0	21.0	9.0	2.68	UU	59.0	9.5	-	0.576	-	-	19	-												
	23.50	D	21	12	19	20	39	39.00	-	-	-	-	-	-	-	16.62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	25.00	U	22	-	-	-	-	-	SM	0	1	0	54	45	0	19.80	1.96	1.64	Non-Plastic			2.63	DST	2.0	28.1	-	0.604	-	-	-	-	Silty Sands											
	26.50	D	23	12	20	22	42	21.41	-	-	-	-	-	-	-	17.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	28.00	D	24	-	-	-	-	-	CL-ML	0	0	1	32	62	5	21.47	-	-	27.0	21.0	6.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	29.50	D	25	12	25	27	52	23.82	-	-	-	-	-	-	-	18.62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	31.00	U	26	-	-	-	-	-	SM-SC	10	6	6	28	41	9	14.72	2.02	1.76	25.5	19.5	6.0	2.67	UU	46.0	11.1	-	0.520	-	-	-	-												
	32.50	D	27	1	15	21	36	18.23	-	-	-	-	-	-	-	15.34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Silty Sands with clay binder											
	34.00	D	28	-	-	-	-	-	SM-SC	5	4	4	38	44	5	18.77	-	-	24.0	19.0	5.0	-	-	-	-	-	-	-	-	-	-												
	35.50	D	29	14	17	24	41	19.09	CL	6	2	2	22	60	8	17.74	-	-	28.0	21.0	7.0	-	-	-	-	-	-	-	-	-	-												
	37.00	D	30	-	-	-	-	-	-	-	-	-	-	-	-	19.54	2.07	1.73	-	-	-	2.67	RUU	50.0	10.3	-	0.543	-	-	-	-	Inorganic clays of low plasticity											
	38.50	D	31	17	24	29	53	21.75	-	-	-	-	-	-	-	17.29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	40.00	D	32	20	28	31	59	22.97	CL-ML	1	1	2	32	58	6	19.40	-	-	27.0	21.5	5.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"

TABLE 10: SUMMARY OF TEST RESULTS

Bore No : P90	Ground Elevation : RL 193.532 m	Method of drilling :Percussion	Depth of Water-table: 1.60 m
Diameter of Bore Hole: 150 mm	Bore Retained using: Casing	Starting Date : 25/10/2023	SPT Sampler: Standard
Location / Chainage : 23273.887	Casing Lowered: 23.00 m	Ending Date: 27/10/2023	Hammer type: Auto-trip

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	ML	0	0	1	40	59	0	9.10	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	1.00	U	2	-	-	-	-	-	CL-ML	0	0	0	31	62	7	14.95	1.99	1.73	28.0	21.5	6.5	2.66	UU	38.0	11.2	0.102	0.538	-	-	-	-	Inorganic Silty Clays of low plasticity											
	2.00	D	3	1	2	2	4	4.00	CL	2	1	1	7	77	12	20.71	-	-	32.0	21.0	11.0	-	-	-	-	-	-	-	8	18	-	Inorganic clays of low plasticity											
	3.00	D	4	2	3	3	6	7.58	ML	0	0	1	44	55	0	17.73	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	4.00	U	5	-	-	-	-	-	SM	1	1	1	59	38	0	18.43	1.96	1.66	Non-Plastic			2.64	DST	0.0	29.2	-	0.595	-	-	-	-	Silty Sands											
	5.00	D	6	4	7	8	15	16.10	-	-	-	-	-	-	-	19.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	6.00	D	7	3	8	10	18	17.40	-	-	-	-	-	-	-	18.49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	7.00	U	8	-	-	-	-	-	ML	0	1	1	8	85	5	21.66	1.94	1.59	24.0	20.0	4.0	2.65	DST	7.0	26.0	-	0.662	-	-	-	-	Inorganic Silts of low plasticity											
	8.00	D	9	3	5	7	12	12.30	CL-ML	4	2	2	11	74	7	19.82	-	-	28.0	21.5	6.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	9.00	D	10	4	6	9	15	14.90	-	-	-	-	-	-	-	20.26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	10.00	U	11	-	-	-	-	-	CL	6	2	3	6	75	8	17.89	2.01	1.70	28.0	21.0	7.0	2.66	UU	44.0	9.5	-	0.561	-	0	19	-	Inorganic clays of low plasticity											
	11.00	D	12	5	7	10	17	15.43	CL-ML	0	0	1	10	84	5	22.83	-	-	26.0	21.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	12.00	D	13	4	8	11	19	16.11	-	-	-	-	-	-	-	22.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	13.00	U	14	-	-	-	-	-	CL-ML	1	0	2	6	84	7	23.76	2.03	1.64	27.0	20.5	6.5	2.66	UU	42.0	10.5	-	0.622	-	-	-	-												
	14.50	D	15	6	8	13	21	21.00	CL	4	2	3	8	72	11	18.37	-	-	30.0	20.5	9.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	16.00	U	16	-	-	-	-	-	ML	0	0	1	40	53	6	18.98	1.94	1.63	27.0	22.0	5.0	2.65	DST	7.0	27.3	-	0.626	-	-	-	-	Inorganic Silts of low plasticity											
	17.50	D	17	8	10	15	25	25.00	CL	3	2	2	24	60	9	18.66	-	-	28.0	20.5	7.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											

APPENDIX "B"

TABLE 10: SUMMARY OF TEST RESULTS

Bore No : P90	**Ground Elevation : RL 193.532 m**	**Method of drilling :Percussion**	**Depth of Water-table: 1.60 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date : 25/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23273.887	**Casing Lowered: 23.00 m**	**Ending Date: 27/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	19.00	U	18	-	-	-	-	-	CL-ML	2	1	2	18	69	8	19.23	2.03	1.70	27.0	20.5	6.5	2.66	UU	42.0	11.0	-	0.565	-	-	-	-	Inorganic Silty Clays of low plasticity											
	20.50	D	19	7	13	19	32	19.37	-	-	-	-	-	-	-	19.90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	22.00	U	20	-	-	-	-	-	CL	5	1	2	18	63	11	20.47	2.04	1.69	31.0	21.0	10.0	2.67	UU	55.0	9.2	-	0.580	-	-	20	-	Inorganic clays of low plasticity											
	23.50	D	21	9	15	21	36	36.00	-	-	-	-	-	-	-	17.24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	25.00	U	22	-	-	-	-	-	SM	2	1	1	58	38	0	18.75	1.91	1.61	Non-Plastic			2.64	DST	0.0	29.7	-	0.640	-	-	-	-	Silty Sands											
	26.50	D	23	10	18	23	41	21.07	-	-	-	-	-	-	-	19.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	28.00	D	24	-	-	-	-	-	ML	2	1	1	42	49	5	19.92	-	-	27.0	22.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	29.50	D	25	15	20	35	55	24.82	ML	0	0	0	18	82	0	20.68	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	31.00	D	26	17	22	37	59	25.62	ML	3	0	0	3	88	6	23.68	-	-	27.0	22.0	5.0	-	-	-	-	-	-	-	-	-	-												
	32.50	D	27	20	27	39	66	27.24	CL-ML	2	2	1	24	64	7	16.26	-	-	28.0	22.0	6.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	34.00	D	28	-	-	-	-	-	-	-	-	-	-	-	-	15.73	2.05	1.77	-	-	-	2.66	RUU	40.0	12.1	-	0.503	-	-	-	-												
	35.50	D	29	18	25	37	62	25.11	CL-ML	9	1	2	32	50	6	21.04	-	-	27.5	21.0	6.5	-	-	-	-	-	-	-	-	-	-												
	37.00	D	30	-	-	-	-	-	-	-	-	-	-	-	-	16.81	2.03	1.74	-	-	-	-	RDST	5.0	29.1	-	-	-	-	-	-												
	38.50	D	31	15	22	31	53	21.83	CL	2	1	1	34	54	8	15.04	-	-	28.0	21.0	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	40.00	D	32	16	24	32	56	22.28	-	-	-	-	-	-	-	20.62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 11: SUMMARY OF TEST RESULTS

Bore No : P91	**Ground Elevation : RL 193.953 m**	**Method of drilling :Percussion**	**Depth of Water-table: 1.80 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 07/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23300.087	**Casing Lowered : 22.00 m**	**Ending Date : 09/10/2023**	**Hammer type : Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	ML	0	0	1	44	55	0	13.32	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	1.00	U	2	-	-	-	-	-	CL-ML	0	0	1	36	57	6	17.32	1.95	1.66	25.0	19.5	5.5	2.66	DST	14.0	23.4	-	0.602	-	0	15	-	Inorganic Silty Clays of low plasticity											
	2.00	D	3	1	2	2	4	5.34	CL-ML	0	0	1	32	60	7	18.18	-	-	26.0	20.0	6.0	-	-	-	-	-	-	-	-	-	-												
	3.00	D	4	2	3	4	7	8.81	ML	2	1	1	40	56	0	16.87	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	4.00	U	5	-	-	-	-	-	ML	0	1	1	37	61	0	17.84	1.97	1.67	Non-Plastic			2.63	DST	3.0	26.6	-	0.575	-	-	-	-												
	5.00	D	6	3	4	5	9	10.28	-	-	-	-	-	-	-	18.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	6.00	D	7	4	5	6	11	12.06	-	-	-	-	-	-	-	17.61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	7.00	D	8	-	-	-	-	-	CL	2	1	2	28	60	7	17.09	-	-	27.0	19.5	7.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	8.00	D	9	3	6	6	12	12.00	-	-	-	-	-	-	-	20.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	9.00	D	10	3	10	17	27	27.00	CL	2	1	2	27	61	7	19.42	-	-	27.5	19.5	8.0	-	-	-	-	-	-	-	-	-	-												
	10.00	U	11	-	-	-	-	-	CL	2	1	1	15	73	8	22.94	2.06	1.68	29.0	21.0	8.0	2.66	UU	44.0	11.5	0.142	0.587	-	8	18	-												
	11.00	D	12	6	9	12	21	21.00	CL	1	1	2	13	75	8	22.52	-	-	29.5	21.5	8.0	-	-	-	-	-	-	-	-	-	-												
	12.00	D	13	5	10	14	24	24.00	-	-	-	-	-	-	-	23.57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	13.00	U	14	-	-	-	-	-	CL	6	2	2	11	66	13	18.99	2.10	1.76	32.0	21.5	10.5	2.67	UU	53.0	9.5	-	0.513	-	-	-	-												
	14.50	D	15	5	9	10	19	19.00	CL	4	2	2	10	68	14	19.48	-	-	32.0	21.0	11.0	-	-	-	-	-	-	-	-	-	-												
	16.00	U	16	-	-	-	-	-	CL	3	1	2	16	67	11	14.82	2.08	1.81	29.5	19.5	10.0	2.67	UU	57.0	10.5	-	0.474	-	-	-	-												
	17.50	D	17	8	25	33	58	58.00	CL	4	2	2	15	65	12	18.94	-	-	30.0	19.0	11.0	-	-	-	-	-	-	-	-	-	-												

APPENDIX "B"
TABLE 11: SUMMARY OF TEST RESULTS

Bore No : P91	**Ground Elevation : RL 193.953 m**	**Method of drilling :Percussion**	**Depth of Water-table: 1.80 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 07/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23300.087	**Casing Lowered : 22.00 m**	**Ending Date : 09/10/2023**	**Hammer type : Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen													
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	19.00	U	18	-	-	-	-	-	CL	7	3	3	11	63	13	14.33	2.19	1.92	32.0	19.5	12.5	2.68	UU	55.0	9.5	-	0.399	-	17	18	-												
	20.50	D	19	6	24	41	65	65.00	-	-	-	-	-	-	-	18.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	22.00	U	20	-	-	-	-	-	CL	2	3	3	18	64	10	14.40	1.98	1.73	29.0	21.0	8.0	2.66	DST	16.0	23.5	-	0.538	-	-	-	-	Inorganic clays of low plasticity										
	23.50	D	21	9	25	43	68	68.00	CL	3	2	2	21	63	9	19.69	-	-	29.0	21.5	7.5	-	-	-	-	-	-	-	-	-												
	25.00	D	22	-	-	-	-	-	-	-	-	-	-	-	-	20.95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	26.50	D	23	9	14	26	40	20.40	CL-ML	0	2	2	40	51	5	20.60	-	-	24.0	19.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	28.00	U	24	-	-	-	-	-	MI	1	1	1	6	74	17	22.73	2.02	1.65	42.0	27.5	14.5	2.69	UU	61.0	8.5	-	0.634	-	-	-	-	Inorganic Silts of Intermediate plasticity										
	29.50	D	25	6	11	29	40	19.73	ML	1	1	1	42	55	0	20.02	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity										
	31.00	D	26	-	-	-	-	-	CL	0	1	1	35	57	6	17.82	-	-	26.5	19.0	7.5	-	-	-	-	-	-	-	-	-	-												
	32.50	D	27	10	18	24	42	42.00	CL	2	2	2	11	71	12	14.19	-	-	31.0	18.5	12.5	-	-	-	-	-	-	-	-	-	-												
	34.00	D	28	-	-	-	-	-	-	-	-	-	-	-	-	17.46	2.02	1.72	-	-	-	2.68	RUU	58.0	10.2	-	0.558	-	-	-	-												
	35.50	D	29	12	19	26	45	45.00	-	-	-	-	-	-	-	17.39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	37.00	D	30	-	-	-	-	-	CL	4	2	1	27	55	11	18.45	-	-	29.0	19.0	10.0	-	-	-	-	-	-	-	-	-	-												
	38.50	D	31	16	26	30	56	56.00	-	-	-	-	-	-	-	17.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	40.00	D	32	20	28	33	61	61.00	CL	2	1	1	24	63	9	18.30	-	-	30.0	21.5	8.5	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 12: SUMMARY OF TEST RESULTS

Bore No : P92	**Ground Elevation : RL 193.93 m**	**Method of drilling :Percussion**	**Depth of Water-table: 1.90 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 09/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23326.287	**Casing Lowered : 22.00 m**	**Ending Date : 11/10/2023**	**Hammer type : Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																													
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen									
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK																			Classification of SOIL
	0.50	D	1	-	-	-	-	-	ML	0	0	0	46	54	0	7.41	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-										Inorganic Silts of low plasticity
	1.00	D	2	-	-	-	-	-	CL-ML	0	0	1	38	55	6	19.35	-	-	26.5	20.5	6.0	-	-	-	-	-	-	-	-	-	-										Inorganic Silty Clays of low plasticity
	2.00	D	3	1	1	2	3	4.03	CL-ML	0	0	1	44	49	6	18.85	-	-	27.0	21.0	6.0	-	-	-	-	-	-	-	-	-	-										
	3.00	D	4	2	2	3	5	6.33	SM-SC	4	2	2	42	45	5	17.54	-	-	25.5	20.5	5.0	-	-	-	-	-	-	-	-	-	-										Silty Sands with clay binder
	4.00	U	5	-	-	-	-	-	ML	0	0	0	34	66	0	14.10	1.96	1.72	Non-Plastic			2.65	DST	9.0	26.5	-	0.543	-	-	-	-										Inorganic Silts of low plasticity
	5.00	D	6	2	3	5	8	9.18	-	-	-	-	-	-	-	16.54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	6.00	D	7	2	4	7	11	12.12	ML	0	0	1	48	51	0	19.20	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-										
	7.00	U	8	-	-	-	-	-	CL	6	2	2	12	71	7	17.21	1.96	1.67	27.5	19.5	8.0	2.66	DST	13.0	25.5	-	0.593	-	-	-	-										Inorganic clays of low plasticity
	8.00	D	9	5	6	11	17	17.00	-	-	-	-	-	-	-	21.15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	9.00	D	10	6	6	12	18	18.00	-	-	-	-	-	-	-	20.89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	10.00	U	11	-	-	-	-	-	CL	1	0	0	8	83	8	20.71	2.07	1.71	28.0	20.0	8.0	2.66	UU	42.0	12.2	0.142	0.551	-	9	15	-										
	11.00	D	12	4	8	8	16	16.00	-	-	-	-	-	-	-	21.32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	12.00	D	13	3	4	4	8	8.00	CL	6	2	3	12	63	14	20.13	-	-	34.0	22.0	12.0	-	-	-	-	-	-	-	-	-	-										
	13.00	U	14	-	-	-	-	-	CL	8	6	5	8	60	13	19.29	2.04	1.71	31.5	21.5	10.0	2.67	UU	53.0	9.5	-	0.561	-	19	18	-										
	14.50	D	15	5	5	7	12	12.00	-	-	-	-	-	-	-	19.67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	16.00	U	16	-	-	-	-	-	CL	3	2	3	15	67	10	16.77	2.06	1.76	28.0	19.5	8.5	2.66	UU	50.0	10.2	-	0.511	-	-	-	-										
	17.50	D	17	6	10	15	25	17.28	CL-ML	6	2	4	15	66	7	18.55	-	-	26.5	20.5	6.0	-	-	-	-	-	-	-	-	-	-										Inorganic Silty Clays of low plasticity

APPENDIX "B"
TABLE 12: SUMMARY OF TEST RESULTS

Bore No : P92	**Ground Elevation : RL 193.93 m**	**Method of drilling :Percussion**	**Depth of Water-table: 1.90 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 09/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23326.287	**Casing Lowered : 22.00 m**	**Ending Date : 11/10/2023**	**Hammer type : Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																													
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen									
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL									
	19.00	U	18	-	-	-	-	-	CL	8	6	7	16	54	9	17.05	2.03	1.73	28.0	19.0	9.0	2.67	UU	55.0	11.0	-	0.539	-	-	-	-											
	20.50	D	19	7	12	18	30	30.00	-	-	-	-	-	-	-	19.69	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	22.00	U	20	-	-	-	-	-	CL	7	3	4	19	54	13	15.89	2.01	1.73	31.0	19.5	11.5	2.68	UU	59.0	11.5	-	0.545	-	-	14	-											
	23.50	D	21	8	21	27	48	48.00	-	-	-	-	-	-	-	22.58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	25.00	U	22	-	-	-	-	-	CL	5	5	6	11	60	13	16.21	2.04	1.76	32.0	21.0	11.0	2.67	UU	53.0	10.3	-	0.520	-	16	18	-											
	26.50	D	23	9	19	29	48	48.00	-	-	-	-	-	-	-	17.51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	28.00	D	24	-	-	-	-	-	CL	3	2	2	14	68	11	18.79	-	-	31.0	21.0	10.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	29.50	D	25	6	12	27	39	39.00	-	-	-	-	-	-	-	16.82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	31.00	D	26	-	-	-	-	-	CL	0	1	1	12	77	9	18.89	-	-	29.0	21.5	7.5	-	-	-	-	-	-	-	-	-	-											
	32.50	D	27	12	26	28	54	23.42	CL	0	1	3	14	74	8	17.61	-	-	28.0	21.0	7.0	-	-	-	-	-	-	-	-	-	-											
	34.00	D	28	-	-	-	-	-	-	-	-	-	-	-	-	17.26	2.05	1.75	-	-	-	2.67	RUU	45.0	10.8	-	0.526	-	-	-	-											
	35.50	D	29	12	19	29	48	48.00	CL	2	1	1	16	70	10	18.81	-	-	31.0	20.5	10.5	-	-	-	-	-	-	-	-	-	-											
	37.00	D	30	-	-	-	-	-	-	-	-	-	-	-	-	17.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	38.50	D	31	14	20	30	50	50.00	-	-	-	-	-	-	-	17.15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	40.00	D	32	17	28	36	64	24.34	SM	0	0	1	52	47	0	21.35	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample

APPENDIX "B"
TABLE 13: SUMMARY OF TEST RESULTS

Bore No : P93	**Ground Elevation : RL 193.956 m**	**Method of drilling :Percussion**	**Depth of Water-table: 1.40 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using : Casing**	**Starting Date : 26/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23352.487	**Casing Lowered : 20.00 m**	**Ending Date : 29/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																						
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m²)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm²)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery % / R.Q.D % / Density (gm /cc) / Specific gravity / Moisture content (%) / Water absorption (%) / Point load Index / U.C.S (MPa) / Porosity / Hardness / Modulus of Elasticity / Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL
	0.50	D	1	-	-	-	-	-	ML	0	0	1	48	46	5	10.67	-	-	25.0	21.0	4.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity
	1.00	U	2	-	-	-	-	-	SM-SC	0	0	0	51	44	5	9.99	1.94	1.76	26.0	21.5	4.5	2.65	DST	4.0	26.5	-	0.506	-	-	-	-	Silty Sands with clay binder
	2.00	D	3	2	3	3	6	8.25	-	-	-	-	-	-	-	8.97	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	3.00	D	4	2	2	3	5	6.46	SM	3	2	1	47	47	0	17.24	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands
	4.00	U	5	-	-	-	-	-	CL-ML	1	0	1	41	51	6	20.05	1.97	1.64	26.0	21.0	5.0	2.66	DST	6.0	25.8	0.113	0.622	-	-	-	-	Inorganic Silty Clays of low plasticity
	5.00	D	6	4	6	8	14	15.65	CL-ML	1	0	1	35	56	7	16.97	-	-	27.0	21.0	6.0	-	-	-	-	-	-	-	-	-	-	
	6.00	D	7	3	5	7	12	13.39	CL-ML	0	1	1	28	63	7	19.05	-	-	27.5	21.5	6.0	-	-	-	-	-	-	-	0	20	-	
	7.00	D	8	-	-	-	-	-	-	-	-	-	-	-	-	18.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	8.00	D	9	8	11	15	26	21.02	SM	0	0	0	58	42	0	19.01	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands
	9.00	D	10	4	7	12	19	17.03	CL-ML	0	1	1	35	58	5	16.74	-	-	25.5	20.0	5.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity
	10.00	U	11	-	-	-	-	-	CL-ML	0	1	1	38	54	6	18.12	2.04	1.73	25.0	20.0	5.0	2.65	DST	7.0	26.5	-	0.532	-	-	-	-	
	11.00	D	12	7	6	12	18	15.95	CL-ML	0	0	1	22	69	8	23.54	-	-	28.0	21.5	6.5	-	-	-	-	-	-	-	-	-	-	
	12.00	D	13	4	6	10	16	16.00	CL	2	1	1	11	75	10	20.75	-	-	30.0	22.0	8.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity
	13.00	U	14	-	-	-	-	-	CL	3	1	1	9	75	11	23.96	2.01	1.62	30.0	21.5	8.5	2.67	UU	52.0	9.5	-	0.648	-	8	20	-	
	14.50	D	15	9	12	17	29	19.86	CL-ML	4	2	1	15	71	7	16.59	-	-	26.0	20.5	5.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity
	16.00	U	16	-	-	-	-	-	-	-	-	-	-	-	-	15.93	2.02	1.74	-	-	-	2.66	UU	56.0	11.5	-	0.529	-	-	-	-	
	17.50	D	17	8	12	17	29	19.00	-	-	-	-	-	-	-	19.54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

APPENDIX "B"
TABLE 13: SUMMARY OF TEST RESULTS

Bore No : P93	**Ground Elevation : RL 193.956 m**	**Method of drilling :Percussion**	**Depth of Water-table: 1.40 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using : Casing**	**Starting Date : 26/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23352.487	**Casing Lowered : 20.00 m**	**Ending Date : 29/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	19.00	U	18	-	-	-	-	-	CL	5	2	1	13	67	12	19.31	1.86	1.56	31.0	21.5	9.5	2.67	UU	55.0	8.7	-	0.712	-	-	-	-												
	20.50	D	19	8	14	18	32	32.00	-	-	-	-	-	-	-	19.80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	22.00	U	20	-	-	-	-	-	CL	12	3	3	26	45	11	20.88	1.97	1.63	30.0	20.0	10.0	2.67	UU	57.0	8.5	-	0.638	-	-	-	-	Inorganic clays of low plasticity											
	23.50	D	21	10	20	25	45	45.00	CL	6	1	3	18	62	10	18.39	-	-	29.0	20.0	9.0	-	-	-	-	-	-	-	-	-	-												
	25.00	D	22	-	-	-	-	-	SM	0	0	1	52	47	0	18.39	2.08	1.76	Non-Plastic			2.65	RDST	2.0	28.8	-	0.506	-	-	-	-												
	26.50	D	23	14	26	28	54	25.44	-	-	-	-	-	-	-	22.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Silty Sands											
	28.00	D	24	16	30	33	63	27.83	-	-	-	-	-	-	-	21.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	29.50	D	25	15	29	30	59	26.11	CL	3	1	1	28	59	8	16.31	-	-	28.0	21.0	7.0	-	-	-	-	-	-	-	-	-	-												
	31.00	D	26	16	26	29	55	24.46	-	-	-	-	-	-	-	15.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	32.50	D	27	17	28	31	59	25.29	-	-	-	-	-	-	-	17.66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	34.00	D	28	15	30	40	70	70.00	CL	1	1	1	30	57	10	16.43	-	-	29.0	21.0	8.0	-	-	-	-	-	-	-	-	-	-												
	35.50	D	29	18	33	45	78	78.00	-	-	-	-	-	-	-	18.33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	37.00	D	30	20	30	39	69	69.00	-	-	-	-	-	-	-	17.76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	38.50	D	31	21	23	37	60	60.00	CL	3	1	1	32	52	11	18.33	-	-	31.0	21.5	9.5	-	-	-	-	-	-	-	-	-	-												
	40.00	D	32	25	30	40	70	70.00	-	-	-	-	-	-	-	18.89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 14: SUMMARY OF TEST RESULTS

Bore No : P94	**Ground Elevation : RL 193.994 m**	**Method of drilling :Percussion**	**Depth of Water-table: 1.60 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 07/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23378.687	**Casing Lowered : 20.00 m**	**Ending Date : 09/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	0.50	D	1	-	-	-	-	-	ML	0	0	0	35	65	0	12.08	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity									
	1.00	D	2	1	1	1	2	3.07	ML	0	0	0	32	63	5	18.00	-	-	26.0	22.0	4.0	-	-	-	-	-	-	-	-	-	-											
	2.00	U	3	-	-	-	-	-	CL-ML	1	1	1	25	65	7	17.53	2.04	1.74	27.0	20.5	6.5	2.67	DST	16.0	23.6	-	0.538	-	9	18	-	Inorganic Silty Clays of low plasticity										
	3.00	D	4	1	1	2	3	3.76	-	-	-	-	-	-	-	18.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	4.00	D	5	2	2	4	6	7.12	-	-	-	-	-	-	-	18.22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	5.00	U	6	-	-	-	-	-	ML	4	2	1	34	55	4	16.89	1.95	1.67	26.0	22.0	4.0	2.66	DST	13.0	25.0	-	0.593	-	-	-	-	Inorganic Silts of low plasticity										
	6.00	D	7	2	3	5	8	8.73	CL-ML	3	2	2	33	55	5	16.89	-	-	26.0	21.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	7.00	D	8	3	3	6	9	9.46	-	-	-	-	-	-	-	15.72	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	8.00	U	9	-	-	-	-	-	CL-ML	1	2	2	32	56	7	17.49	2.03	1.73	27.0	21.0	6.0	2.66	DST	17.0	23.5	0.140	0.540	-	8	20	-											
	9.00	D	10	4	5	9	14	13.72	CL	5	3	2	22	59	9	17.22	-	-	29.0	22.0	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	10.00	D	11	5	7	10	17	15.57	-	-	-	-	-	-	-	14.59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	11.00	D	12	-	-	-	-	-	CL-ML	6	2	1	18	65	8	20.58	-	-	28.0	21.5	6.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	12.50	D	13	3	8	11	19	15.91	-	-	-	-	-	-	-	21.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	14.00	U	14	-	-	-	-	-	CL	2	1	1	14	73	9	19.95	1.99	1.66	29.0	21.5	7.5	2.67	UU	47.0	11.2	-	0.609	-	-	-	-	Inorganic clays of low plasticity										
	15.50	D	15	5	11	15	26	26.00	-	-	-	-	-	-	-	20.96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	17.00	U	16	-	-	-	-	-	CL	3	1	1	28	58	9	15.32	2.07	1.80	29.0	22.0	7.0	2.67	UU	45.0	13.0	-	0.487	-	-	-	-	Inorganic clays of low plasticity										

APPENDIX "B"
TABLE 14: SUMMARY OF TEST RESULTS

Bore No : P94	**Ground Elevation : RL 193.994 m**	**Method of drilling :Percussion**	**Depth of Water-table: 1.60 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 07/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23378.687	**Casing Lowered : 20.00 m**	**Ending Date : 09/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																													
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen									
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL									
	18.50	D	17	7	10	12	22	15.90	-	-	-	-	-	-	-	16.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	20.00	U	18	-	-	-	-	-	CL-ML	4	2	2	17	69	6	18.63	2.16	1.82	26.0	19.5	6.5	2.66	DST	16.0	24.0	-	0.462	-	-	-	-	Inorganic Silty Clays of low plasticity									
	21.50	D	19	7	11	14	25	25.00	CL	2	1	1	27	59	10	17.10	-	-	31.0	21.5	9.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity									
	23.00	U	20	-	-	-	-	-	CL	2	1	2	18	69	8	16.45	1.98	1.70	30.0	21.0	9.0	2.67	UU	49.0	11.5	-	0.571	-	-	-	-										
	24.50	D	21	10	13	18	31	31.00	CL	0	0	1	14	73	12	16.63	-	-	30.0	19.5	10.5	-	-	-	-	-	-	-	-	-	-										
	26.00	U	22	-	-	-	-	-	CL	4	2	1	22	63	8	15.83	2.06	1.78	27.5	19.5	8.0	2.68	UU	51.0	13.5	-	0.507	-	-	-	-										
	27.50	D	23	12	17	22	39	39.00	-	-	-	-	-	-	-	11.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	29.00	U	24	-	-	-	-	-	CL	4	2	1	14	67	12	17.53	2.07	1.76	31.5	20.0	11.5	2.67	UU	51.0	10.2	-	0.516	-	-	-	-										
	30.50	D	25	13	19	25	44	20.72	ML	0	1	1	45	53	0	17.84	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity									
	32.00	D	26	-	-	-	-	-	-	-	-	-	-	-	-	21.62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	33.50	D	27	16	24	33	57	57.00	CL	4	2	3	11	69	11	18.23	-	-	30.0	21.0	9.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity									
	35.00	D	28	-	-	-	-	-	CL-ML	2	1	2	32	58	5	18.92	2.10	1.77	26.0	21.0	5.0	2.66	RDST	8.0	28.9	-	0.503	-	-	-	-	Inorganic Silty Clays of low plasticity									
	36.50	D	29	21	28	39	67	67.00	MI	1	1	1	9	73	15	24.01	-	-	39.0	26.0	13.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of Intermediate plasticity									
	38.00	D	30	-	-	-	-	-	-	-	-	-	-	-	-	13.41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	40.00	D	31	24	33	46	79	79.00	CL	1	1	2	10	72	14	17.07	-	-	33.5	20.5	13.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity									

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"

TABLE 15: SUMMARY OF TEST RESULTS

Bore No: P95	**Ground Elevation: RL 193.924 m**	**Method of drilling: Percussion**	**Depth of Water-table: 1.20 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 27/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 23404.887	**Casing Lowered: 18.00 m**	**Ending Date: 29/10/2023**	**Hammer type: Rope-pulley**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	CL-ML	0	0	1	46	48	5	10.64	-	-	26.0	21.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	1.00	D	2	1	2	2	4	6.20	-	-	-	-	-	-	-	19.41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	2.00	U	3	-	-	-	-	-	SM-SC	0	0	0	51	44	5	20.67	1.94	1.61	26.5	21.0	5.5	2.64	DST	3.0	28.0	-	0.640	-	-	-	-	Silty Sands with clay binder											
	3.00	D	4	2	3	4	7	9.14	-	-	-	-	-	-	-	19.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	4.00	D	5	3	3	4	7	8.65	SM	0	0	1	55	44	0	17.40	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	5.00	U	6	-	-	-	-	-	CL-ML	3	2	1	40	47	7	20.48	1.96	1.63	27.0	20.5	6.5	2.66	DST	4.0	27.5	-	0.632	-	-	-	-	Inorganic Silty Clays of low plasticity											
	6.00	D	7	4	7	9	16	16.51	SM	0	0	1	54	45	0	17.50	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	7.00	D	8	4	5	6	11	11.90	-	-	-	-	-	-	-	17.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	8.00	U	9	-	-	-	-	-	CL	2	1	1	32	56	8	17.12	2.02	1.72	28.0	21.0	7.0	2.66	UU	45.0	10.7	0.105	0.542	-	8	20	-	Inorganic clays of low plasticity											
	9.00	D	10	8	10	14	24	19.56	-	-	-	-	-	-	-	20.86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	10.00	D	11	9	12	16	28	28.00	CL	0	1	1	10	78	10	20.00	-	-	29.0	21.0	8.0	-	-	-	-	-	-	-	-	-	-												
	11.00	U	12	-	-	-	-	-	CL	1	1	1	8	78	11	23.09	2.03	1.65	30.0	21.0	9.0	2.67	UU	52.0	9.5	-	0.618	-	-	-	-												
	12.50	D	13	5	6	9	15	15.00	-	-	-	-	-	-	-	24.49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	14.00	U	14	-	-	-	-	-	CL	3	1	1	14	70	11	20.68	1.94	1.61	29.0	20.5	8.5	2.67	UU	53.0	9.0	-	0.658	-	0	19	-												
	15.50	D	15	7	11	14	25	25.00	-	-	-	-	-	-	-	18.40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	17.00	D	16	-	-	-	-	-	-	-	-	-	-	-	-	20.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	18.50	D	17	8	15	20	35	21.20	CL-ML	0	0	1	35	59	5	19.00	-	-	26.0	20.5	5.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											

APPENDIX "B"
TABLE 15: SUMMARY OF TEST RESULTS

Bore No: P95	Ground Elevation: RL 193.924 m	Method of drilling: Percussion	Depth of Water-table: 1.20 m
Diameter of Bore Hole: 150 mm	Bore Retained using: Casing	Starting Date: 27/10/2023	SPT Sampler: Standard
Location / Chainage: 23404.887	Casing Lowered: 18.00 m	Ending Date: 29/10/2023	Hammer type: Rope-pulley

FIELD TEST RESULT										LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen												
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index	
																							Classification of ROCK									Classification of SOIL												
	20.00	U	18	-	-	-	-	-	CL	10	5	3	9	63	10	17.91	1.97	1.67	30.0	21.0	9.0	2.67	UU	49.0	10.2	-	0.599	-	-	-	-	Inorganic clays of low plasticity												
	21.50	D	19	14	20	26	46	46.00	-	-	-	-	-	-	-	20.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-													
	23.00	D	20	-	-	-	-	-	CL-ML	2	1	1	14	74	8	20.32	2.08	1.73	27.0	20.5	6.5	-	RUU	40.0	9.4	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity												
	24.50	D	21	16	21	27	48	24.07	-	-	-	-	-	-	-	13.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-													
	26.00	D	22	-	-	-	-	-	CL-ML	0	0	1	32	60	7	19.55	-	-	26.0	21.0	5.0	-	-	-	-	-	-	-	-	-	-													
	27.50	D	23	17	20	25	45	22.18	ML	4	2	1	12	76	5	25.73	-	-	24.0	20.0	4.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity												
	29.00	U	24	-	-	-	-	-	ML	6	1	1	25	62	5	19.63	2.01	1.68	24.5	20.5	4.0	2.65	DST	6.0	26.7	-	0.577	-	-	-	-													
	30.50	D	25	14	23	29	52	23.59	CL-ML	2	1	2	40	49	6	19.99	-	-	27.0	20.5	6.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity												
	32.00	D	26	13	30	37	67	67.00	CL	5	2	1	13	67	12	18.58	-	-	29.0	20.0	9.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity												
	33.50	D	27	15	31	36	67	67.00	-	-	-	-	-	-	-	18.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-													
	35.00	D	28	13	29	35	64	25.94	SM	0	1	1	52	46	0	21.35	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands												
	36.50	D	29	12	25	33	58	58.00	CL	2	1	1	16	70	10	22.32	-	-	29.0	20.5	8.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity												
	38.00	D	30	12	26	30	56	56.00	-	-	-	-	-	-	-	21.94	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-													
	40.00	D	31	14	26	32	58	58.00	CL	1	1	2	12	75	9	24.35	-	-	28.5	20.5	8.0	-	-	-	-	-	-	-	-	-	-													

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 16: SUMMARY OF TEST RESULTS

Bore No : P96	**Ground Elevation : RL 193.961 m**	**Method of drilling: Percussion**	**Depth of Water-table: 1.20 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using : Casing**	**Starting Date : 28/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23431.087	**Casing Lowered : 21.00 m**	**Ending Date : 30/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	ML	0	0	1	42	57	0	14.85	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	1.00	D	2	1	1	2	3	4.61	CL-ML	0	0	1	46	49	4	19.45	-	-	26.0	21.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	2.00	U	3	-	-	-	-	-	SM	9	1	1	54	35	0	14.71	2.02	1.76	Non-Plastic			2.63	DST	3.0	27.5	-	0.494	-	-	-	-	Silty Sands											
	3.00	D	4	2	2	3	5	6.44	-	-	-	-	-	-	-	16.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	4.00	D	5	1	1	3	4	4.86	CL-ML	0	0	1	38	55	6	19.46	-	-	27.0	21.0	6.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	5.00	D	6	-	-	-	-	-	-	-	-	-	-	-	-	19.10	1.94	1.63	-	-	-	2.66	RDST	5.0	24.3	-	0.632	-	-	-	-												
	6.00	D	7	3	4	6	10	11.14	SM	0	1	0	57	42	0	17.17	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	7.00	D	8	3	4	7	11	11.80	-	-	-	-	-	-	-	18.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	8.00	D	9	-	-	-	-	-	CL	0	1	1	13	77	8	20.42	-	-	28.0	21.0	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	9.00	D	10	4	6	8	14	14.11	-	-	-	-	-	-	-	19.86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	10.00	D	11	5	7	9	16	15.30	-	-	-	-	-	-	-	18.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	11.00	U	12	-	-	-	-	-	CL	2	0	1	7	82	8	22.45	2.02	1.65	29.0	21.5	7.5	2.66	UU	42.0	10.5	-	0.612	-	9	20	-												
	12.50	D	13	5	8	10	18	18.00	-	-	-	-	-	-	-	21.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	14.00	U	14	-	-	-	-	-	CL-ML	1	1	0	18	71	9	20.92	2.01	1.66	27.0	20.5	6.5	2.66	UU	40.0	11.2	-	0.602	-	-	-	-	Inorganic Silty Clays of low plasticity											
	15.50	D	15	6	10	14	24	17.53	-	-	-	-	-	-	-	17.58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	17.00	U	16	-	-	-	-	-	SM	2	1	2	55	40	0	17.75	2.03	1.72	Non-Plastic			2.63	DST	2.0	28.0	-	0.529	-	-	-	-	Silty Sands											
	18.50	D	17	10	17	22	39	22.69	-	-	-	-	-	-	-	19.70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

APPENDIX "B"

TABLE 16: SUMMARY OF TEST RESULTS

Bore No : P96	**Ground Elevation : RL 193.961 m**	**Method of drilling: Percussion**	**Depth of Water-table: 1.20 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using : Casing**	**Starting Date : 28/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23431.087	**Casing Lowered : 21.00 m**	**Ending Date : 30/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m²)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm²)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	20.00	D	18	-	-	-	-	-	CL-ML	2	1	1	27	62	7	19.69	-	-	26.0	20.5	5.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	21.50	D	19	12	19	24	43	23.22	-	-	-	-	-	-	-	19.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	23.00	U	20	-	-	-	-	-	CL	4	1	2	22	60	11	23.47	1.99	1.61	30.0	22.0	8.0	2.67	UU	49.0	9.4	-	0.658	-	-	-	-	Inorganic clays of low plasticity											
	24.50	D	21	14	21	24	45	45.00	-	-	-	-	-	-	-	24.91	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	26.00	D	22	-	-	-	-	-	SM	1	1	0	55	43	0	18.06	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	27.50	D	23	12	24	28	52	24.35	-	-	-	-	-	-	-	19.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	29.00	D	24	-	-	-	-	-	CL-ML	2	2	2	34	53	7	23.23	2.13	1.73	27.0	20.5	6.5	2.66	RUU	42.0	12.1	-	0.538	-	-	-	-	Inorganic Silty Clays of low plasticity											
	30.50	D	25	14	25	30	55	24.29	-	-	-	-	-	-	-	18.15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	32.00	D	26	16	26	33	59	25.01	SM	0	0	1	50	49	0	19.36	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	33.50	D	27	15	21	29	50	21.95	CL-ML	1	1	1	37	53	7	22.82	-	-	27.5	21.0	6.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	35.00	D	28	-	-	-	-	-	SM	1	1	1	50	47	0	17.96	2.09	1.77	Non-Plastic			2.65	RDST	5.0	29.3	-	0.497	-	-	-	-	Silty Sands											
	36.50	D	29	17	24	29	53	22.03	CL	1	1	0	18	72	8	11.90	-	-	28.0	21.0	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	38.00	D	30	19	30	32	62	24.07	-	-	-	-	-	-	-	12.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	40.00	D	31	22	33	36	69	25.41	CL-ML	1	1	2	14	75	7	22.31	-	-	27.0	20.5	6.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 17: SUMMARY OF TEST RESULTS

Bore No : P97	**Ground Elevation : RL 194.016 m**	**Method of drilling :Percussion**	**Depth of Water-table: 1.80 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 08/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23457.287	**Casing Lowered : 19.00 m**	**Ending Date : 10/10/2023**	**Hammer type : Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	CL-ML	2	1	1	34	57	5	12.14	-	-	25.5	20.5	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	1.00	D	2	-	-	-	-	-	-	-	-	-	-	-	-	19.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	2.00	D	3	1	1	2	3	3.00	CL	2	1	2	35	52	8	20.38	-	-	27.5	19.5	8.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	3.00	D	4	2	3	4	7	8.87	ML	1	1	1	40	53	4	16.19	-	-	24.0	20.0	4.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	4.00	U	5	-	-	-	-	-	SM	5	1	0	53	41	0	13.75	1.99	1.75	Non-Plastic			2.64	DST	7.0	27.0	-	0.509	-	-	-	-	Silty Sands											
	5.00	D	6	3	4	6	10	11.46	-	-	-	-	-	-	-	19.57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	6.00	D	7	3	5	7	12	13.18	-	-	-	-	-	-	-	18.41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	7.00	U	8	-	-	-	-	-	ML	3	1	1	44	47	4	18.74	2.01	1.69	24.0	20.0	4.0	2.65	DST	10.0	26.0	-	0.568	-	-	-	-	Inorganic Silts of low plasticity											
	8.00	D	9	4	6	8	14	14.26	CL	2	1	1	39	49	8	19.47	-	-	28.0	21.0	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	9.00	D	10	5	9	14	23	18.83	-	-	-	-	-	-	-	23.39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	10.00	U	11	-	-	-	-	-	CL	0	1	1	2	88	8	18.31	2.03	1.72	29.0	22.0	7.0	2.66	UU	44.0	11.5	0.146	0.547	-	0	20	-												
	11.00	D	12	3	5	6	11	10.17	-	-	-	-	-	-	-	21.81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	12.00	D	13	5	6	8	14	14.00	CL	3	2	1	6	77	11	19.52	-	-	29.0	20.0	9.0	-	-	-	-	-	-	-	-	-	-												
	13.00	U	14	-	-	-	-	-	-	-	-	-	-	-	-	20.94	2.06	1.70	-	-	-	2.67	UU	51.0	9.5	-	0.571	-	-	-	-												
	14.50	D	15	6	8	9	17	17.00	CL	6	2	2	11	69	10	19.15	-	-	27.0	19.5	7.5	-	-	-	-	-	-	-	-	-	-												
	16.00	U	16	-	-	-	-	-	CL	0	1	2	46	44	7	17.23	1.98	1.69	28.0	20.0	8.0	2.66	DST	8.0	26.5	-	0.574	-	7	17	-												
	17.50	D	17	7	9	11	20	20.00	CL	3	2	2	15	66	12	21.10	-	-	30.0	21.0	9.0	-	-	-	-	-	-	-	-	-	-												

APPENDIX "B"
TABLE 17: SUMMARY OF TEST RESULTS

Bore No : P97	Ground Elevation : RL 194.016 m	Method of drilling :Percussion	Depth of Water-table: 1.80 m
Diameter of Bore Hole : 150 mm	Bore Retained using : Casing	Starting Date : 08/10/2023	SPT Sampler: Standard
Location / Chainage : 23457.287	Casing Lowered : 19.00 m	Ending Date : 10/10/2023	Hammer type : Auto-trip

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	19.00	D	18	-	-	-	-	-	-	-	-	-	-	-	-	20.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	20.50	D	19	3	10	15	25	25.00	CL	6	3	5	8	66	12	22.98	-	-	31.0	21.0	10.0	-	-	-	-	-	-	-	-	-	-												
	22.00	D	20	-	-	-	-	-	-	-	-	-	-	-	-	21.88	2.10	1.72	-	-	-	-	RUU	44.0	11.3	-	-	-	-	-	-	Inorganic clays of low plasticity											
	23.50	D	21	8	16	27	43	43.00	CL	9	7	6	6	59	13	15.36	-	-	33.0	22.0	11.0	2.67	-	-	-	-	-	-	8	18	-												
	25.00	D	22	-	-	-	-	-	-	-	-	-	-	-	-	20.44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	26.50	D	23	7	14	25	39	20.17	CL-ML	2	1	2	26	61	8	22.81	-	-	28.0	21.5	6.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	28.00	D	24	-	-	-	-	-	-	-	-	-	-	-	-	15.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	29.50	D	25	15	37	40	77	31.19	SM	0	1	1	50	48	0	19.16	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	31.00	U	26	-	-	-	-	-	SM	0	1	1	51	47	0	19.56	2.03	1.70	Non-Plastic			2.63	DST	7.0	26.8	-	0.547	-	-	-	-												
	32.50	D	27	16	33	39	72	28.53	ML	0	1	2	44	53	0	20.29	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	34.00	D	28	-	-	-	-	-	-	-	-	-	-	-	-	17.46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	35.50	D	29	15	35	38	73	27.64	ML	0	0	0	38	58	4	19.00	-	-	25.0	21.0	4.0	-	-	-	-	-	-	-	-	-	-												
	37.00	U	30	-	-	-	-	-	-	-	-	-	-	-	-	19.60	2.18	1.82	-	-	-	2.65	DST	10.0	26.5	-	-	-	-	-	-												
	38.50	D	31	17	34	37	71	26.05	CL-ML	0	0	1	35	59	5	19.50	-	-	25.0	20.5	4.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	40.00	D	32	20	32	39	71	25.56	SM	1	1	1	52	45	0	18.21	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"

TABLE 18: SUMMARY OF TEST RESULTS

Bore No : P98	**Ground Elevation : RL 193.030 m**	**Method of drilling :Percussion**	**Depth of Water-table: 1.09 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using : Casing**	**Starting Date : 28/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23483.487	**Casing Lowered : 21.00 m**	**Ending Date : 30/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	ML	0	0	1	46	53	0	16.54	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	1.00	U	2	-	-	-	-	-	SM	0	1	1	52	46	0	15.67	1.92	1.66	Non-Plastic			2.62	DST	1.0	27.5	-	0.578	-	-	-	-	Silty Sands											
	2.00	D	3	1	1	2	3	4.24	SM	5	2	3	42	48	0	18.82	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	3.00	D	4	1	2	2	4	5.28	-	-	-	-	-	-	-	19.19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	4.00	U	5	-	-	-	-	-	SM	0	1	1	54	44	0	16.65	1.95	1.67	Non-Plastic			2.63	DST	2.0	27.3	-	0.575	-	-	-	-												
	5.00	D	6	2	3	3	6	7.12	CL-ML	3	1	1	36	54	5	17.55	-	-	26.0	21.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	6.00	D	7	2	3	5	8	9.09	ML	0	0	1	47	52	0	17.45	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	7.00	U	8	-	-	-	-	-	CL-ML	7	3	3	34	46	7	18.81	1.98	1.67	28.0	21.5	6.5	2.66	DST	8.0	25.7	-	0.593	-	9	20	-	Inorganic Silty Clays of low plasticity											
	8.00	D	9	4	5	7	12	12.00	CL	2	1	1	18	68	10	19.54	-	-	29.0	21.0	8.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	9.00	D	10	3	6	9	15	15.00	-	-	-	-	-	-	-	17.94	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	10.00	U	11	-	-	-	-	-	CL	2	1	1	14	71	11	23.34	1.96	1.59	30.0	20.5	9.5	2.66	UU	47.0	9.5	0.110	0.673	-	-	-	-												
	11.00	D	12	5	8	10	18	18.00	-	-	-	-	-	-	-	24.29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	12.00	D	13	6	9	12	21	21.00	-	-	-	-	-	-	-	21.40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	13.00	U	14	-	-	-	-	-	CL	8	4	4	11	63	10	17.85	2.02	1.71	30.0	20.5	9.5	2.67	UU	53.0	9.2	-	0.561	-	-	-	-												
	14.50	D	15	6	10	15	25	18.31	CL-ML	2	1	1	24	64	8	20.63	-	-	27.5	21.0	6.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	16.00	U	16	-	-	-	-	-	CL-ML	1	1	0	32	57	9	17.63	2.05	1.74	28.0	22.0	6.0	2.66	UU	43.0	10.3	-	0.529	-	-	-	-												
	17.50	D	17	5	9	12	21	15.91	-	-	-	-	-	-	-	17.64	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

APPENDIX "B"
TABLE 18: SUMMARY OF TEST RESULTS

Bore No : P98	**Ground Elevation : RL 193.030 m**	**Method of drilling :Percussion**	**Depth of Water-table: 1.09 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using : Casing**	**Starting Date : 28/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23483.487	**Casing Lowered : 21.00 m**	**Ending Date : 30/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m²)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm²)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	19.00	U	18	-	-	-	-	-	SM	3	10	25	26	36	0	11.35	1.95	1.75	Non-Plastic			2.60	DST	0.0	36.0	-	0.486	-	-	-	-	Silty Sands											
	20.50	D	19	8	13	17	30	18.79	CL-ML	3	3	2	24	63	5	15.21	-	-	26.0	21.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	22.00	D	20	-	-	-	-	-	ML	0	0	1	45	54	0	14.47	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	23.50	D	21	10	16	21	37	20.64	CL-ML	4	1	0	22	66	7	20.92	-	-	27.0	21.0	6.0	-	-	-	-	-	-	-	-	-	-												
	25.00	U	22	-	-	-	-	-	CL-ML	2	1	1	28	62	6	20.16	1.95	1.62	27.0	21.0	6.0	2.66	UU	40.0	11.5	-	0.642	-	-	-	-	Inorganic Silty Clays of low plasticity											
	26.50	D	23	11	18	24	42	21.63	-	-	-	-	-	-	-	20.13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	28.00	U	24	-	-	-	-	-	SM	0	0	1	57	42	0	19.85	1.98	1.65	Non-Plastic			2.62	DST	4.0	28.5	-	0.588	-	-	-	-												
	29.50	D	25	14	23	31	54	24.73	-	-	-	-	-	-	-	19.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	31.00	D	26	16	25	33	58	25.54	SM	0	0	1	68	31	0	20.71	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	32.50	D	27	15	28	34	62	26.24	-	-	-	-	-	-	-	19.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	34.00	D	28	-	-	-	-	-	-	-	-	-	-	-	-	19.33	2.11	1.77	-	-	-	2.63	RDST	0.0	31.3	-	0.486	-	-	-	-	Silty Sands											
	35.50	D	29	13	26	32	58	24.09	SM	0	1	1	58	40	0	15.37	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	37.00	D	30	-	-	-	-	-	SM	4	2	2	52	40	0	16.37	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	38.50	D	31	15	27	33	60	23.97	-	-	-	-	-	-	-	16.76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	40.00	D	32	15	29	33	62	24.16	-	-	-	-	-	-	-	18.40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 19: SUMMARY OF TEST RESULTS

Bore No : P99	**Ground Elevation : RL 193.271 m**	**Method of drilling :Percussion**	**Depth of Water-table: 1.00 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 09/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23509.687	**Casing Lowered : 19.00 m**	**Ending Date : 12/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	0.50	D	1	-	-	-	-	-	CL	0	0	1	42	50	7	17.93	-	-	27.5	20.5	7.0	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	1.00	U	2	-	-	-	-	-	SM-SC	0	0	0	54	40	6	17.44	2.07	1.76	26.5	21.0	5.5	2.65	DST	10.5	27.5	-	0.506	-	-	-	-	Silty Sands with clay binder										
	2.00	D	3	2	2	3	5	6.95	-	-	-	-	-	-	-	18.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	3.00	D	4	3	5	8	13	15.90	SM	1	1	0	54	44	0	17.66	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	4.00	U	5	-	-	-	-	-	ML	1	1	0	46	45	7	18.05	1.98	1.68	27.0	22.0	5.0	2.66	DST	11.0	26.0	-	0.583	-	-	-	-	Inorganic Silts of low plasticity										
	5.00	D	6	6	8	9	17	17.39	ML	1	2	0	28	64	5	21.30	-	-	24.0	20.0	4.0	-	-	-	-	-	-	-	-	-	-										
	6.00	D	7	5	9	12	21	19.20	SM	0	0	1	52	47	0	18.19	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	7.00	D	8	-	-	-	-	-	CL-ML	0	1	1	44	47	7	20.83	-	-	26.5	20.5	6.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	8.00	D	9	7	10	15	25	25.00	CL	1	1	1	6	83	8	17.19	-	-	27.5	19.5	8.0	2.67	-	-	-	-	-	-	-	13	-	Inorganic clays of low plasticity										
	9.00	D	10	9	13	18	31	31.00	-	-	-	-	-	-	-	20.62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	10.00	D	11	-	-	-	-	-	CL	1	1	2	10	79	7	20.69	2.05	1.70	27.0	19.5	7.5	-	RUU	47.0	9.6	-	-	-	-	-	-										
	11.00	D	12	5	9	11	20	20.00	-	-	-	-	-	-	-	20.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	12.00	D	13	3	5	6	11	11.00	CL	2	1	3	12	73	9	22.29	-	-	28.0	20.0	8.0	-	-	-	-	-	-	-	-	-	-										
	13.00	U	14	-	-	-	-	-	CL	3	2	2	15	66	12	15.94	2.02	1.74	30.0	19.0	11.0	2.67	UU	55.0	11.0	0.167	0.534	-	-	-	-										
	14.50	D	15	6	8	12	20	20.00	CL	2	1	2	13	69	13	20.67	-	-	31.5	19.0	12.5	-	-	-	-	-	-	-	-	-	-										
	16.00	U	16	-	-	-	-	-	CL	1	1	1	45	43	9	16.21	1.98	1.70	26.0	18.0	8.0	2.66	DST	7.0	27.5	-	0.565	-	0	15	-										
	17.50	D	17	3	8	10	18	18.00	CL	2	1	1	32	54	10	19.48	-	-	28.0	19.0	9.0	-	-	-	-	-	-	-	-	-	-										

APPENDIX "B"
TABLE 19: SUMMARY OF TEST RESULTS

Bore No : P99	Ground Elevation : RL 193.271 m	Method of drilling :Percussion	Depth of Water-table: 1.00 m
Diameter of Bore Hole : 150 mm	Bore Retained using : Casing	Starting Date : 09/10/2023	SPT Sampler: Standard
Location / Chainage : 23509.687	Casing Lowered : 19.00 m	Ending Date : 12/10/2023	Hammer type: Auto-trip

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	19.00	U	18	-	-	-	-	-	SM	0	0	1	50	49	0	20.06	1.99	1.66	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	20.50	D	19	4	7	12	19	14.15	-	-	-	-	-	-	-	19.46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	22.00	U	20	-	-	-	-	-	CL	5	3	4	23	58	7	22.95	2.02	1.64	28.0	20.0	8.0	2.66	DST	12.0	26.5	-	0.622	-	-	-	-	Inorganic clays of low plasticity											
	23.50	D	21	7	12	18	30	18.01	CL-ML	3	2	1	34	53	7	15.55	-	-	26.5	20.5	6.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	25.00	D	22	-	-	-	-	-	SM	0	0	1	52	47	0	17.65	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	26.50	D	23	14	20	28	48	23.39	-	-	-	-	-	-	-	18.69	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	28.00	U	24	-	-	-	-	-	CL	5	1	1	35	51	7	20.12	2.01	1.67	26.5	19.5	7.0	2.66	DST	13.0	25.5	-	0.593	-	-	-	-	Inorganic clays of low plasticity											
	29.50	D	25	14	17	22	39	39.00	CL	5	2	2	24	58	9	16.61	-	-	28.0	20.5	7.5	-	-	-	-	-	-	-	-	-	-												
	31.00	D	26	-	-	-	-	-	ML	0	0	1	44	55	0	17.83	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	32.50	D	27	16	19	24	43	20.29	-	-	-	-	-	-	-	19.20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	34.00	D	28	-	-	-	-	-	ML	0	1	1	41	57	0	18.52	2.04	1.72	Non-Plastic			2.65	RDST	5.0	25.4	-	0.541	-	-	-	-												
	35.50	D	29	20	26	30	56	23.33	-	-	-	-	-	-	-	21.44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	37.00	D	30	-	-	-	-	-	SM	0	0	2	51	47	0	18.21	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	38.50	D	31	21	26	32	58	23.22	-	-	-	-	-	-	-	18.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	40.00	D	32	18	30	34	64	24.50	-	-	-	-	-	-	-	16.93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"

TABLE 20: SUMMARY OF TEST RESULTS

Bore No : P100	**Ground Elevation : RL 193.996 m**	**Method of drilling: Percussion**	**Depth of Water-table: 1.30 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using : Casing**	**Starting Date : 28/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23535.887	**Casing Lowered : 24.00 m**	**Ending Date : 30/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	CL-ML	0	0	1	48	47	4	16.94	-	-	24.5	20.0	4.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	1.00	U	2	-	-	-	-	-	ML	0	1	1	47	48	3	18.23	2.01	1.70	24.0	20.0	4.0	2.65	DST	3.0	28.5	-	0.559	-	-	-	-	Inorganic Silts of low plasticity											
	2.00	D	3	1	2	2	4	5.48	-	-	-	-	-	-	-	18.73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	3.00	D	4	2	3	3	6	7.69	CL-ML	0	0	0	42	52	6	18.58	-	-	26.0	20.5	5.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	4.00	D	5	-	-	-	-	-	-	-	-	-	-	-	-	18.55	1.87	1.58	-	-	-	2.65	RDST	6.0	24.5	-	0.677	-	-	-	-												
	5.00	D	6	2	3	5	8	9.35	ML	1	0	1	46	52	0	16.80	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	6.00	D	7	5	7	9	16	16.49	SM	0	0	1	60	39	0	20.22	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	7.00	D	8	-	-	-	-	-	-	-	-	-	-	-	-	20.56	2.00	1.66	-	-	-	-	RDST	0.0	28.9	-	-	-	-	-	-												
	8.00	D	9	6	7	13	20	17.89	CL-ML	0	1	0	16	76	7	20.62	-	-	27.0	21.0	6.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	9.00	D	10	8	10	13	23	19.04	-	-	-	-	-	-	-	23.59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	10.00	U	11	-	-	-	-	-	CL	2	1	0	13	76	8	20.51	1.98	1.64	29.0	21.5	7.5	2.66	UU	43.0	11.5	0.154	0.622	-	-	-	-	Inorganic clays of low plasticity											
	11.00	D	12	7	11	13	24	18.82	ML	1	0	0	10	82	7	19.70	-	-	30.0	23.5	6.5	-	-	-	-	-	-	-	-	19	-	Inorganic Silts of low plasticity											
	12.00	D	13	8	13	18	31	21.72	-	-	-	-	-	-	-	20.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	13.00	D	14	-	-	-	-	-	-	-	-	-	-	-	-	22.19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	14.50	D	15	5	8	10	18	18.00	CL	4	2	1	9	75	9	17.31	-	-	29.0	21.5	7.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	16.00	U	16	-	-	-	-	-	SM-SC	4	3	4	44	40	5	15.52	2.01	1.74	25.0	20.0	5.0	2.66	UU	49.0	15.1	-	0.529	-	-	-	-	Silty Sands with clay binder											
	17.50	D	17	12	20	27	47	26.23	-	-	-	-	-	-	-	17.96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

APPENDIX "B"
TABLE 20: SUMMARY OF TEST RESULTS

Bore No : P100	**Ground Elevation : RL 193.996 m**	**Method of drilling: Percussion**	**Depth of Water-table: 1.30 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using : Casing**	**Starting Date : 28/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23535.887	**Casing Lowered : 24.00 m**	**Ending Date : 30/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	19.00	U	18	-	-	-	-	-	SM	1	1	1	56	41	0	19.79	2.00	1.67	Non-Plastic			2.64	DST	3.0	30.1	-	0.581	-	-	-	-	Silty Sands											
	20.50	D	19	7	15	22	37	21.32	ML	6	3	4	34	48	5	17.34	-	-	27.0	22.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	22.00	U	20	-	-	-	-	-	CL	3	2	3	20	59	13	16.35	1.95	1.68	33.5	22.0	11.5	2.67	UU	57.0	10.5	-	0.589	-	-	18	-	Inorganic clays of low plasticity											
	23.50	D	21	7	12	18	30	30.00	-	-	-	-	-	-	-	20.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	25.00	U	22	-	-	-	-	-	SM	1	0	0	52	47	0	19.63	1.95	1.63	Non-Plastic			2.64	DST	2.0	27.9	-	0.620	-	-	-	-	Silty Sands											
	26.50	D	23	8	15	23	38	20.19	-	-	-	-	-	-	-	18.64	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	28.00	D	24	-	-	-	-	-	SM	0	0	1	56	43	0	19.81	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	29.50	D	25	18	21	23	44	21.37	-	-	-	-	-	-	-	18.62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	31.00	D	26	-	-	-	-	-	ML	1	1	1	46	51	0	18.97	2.07	1.74	Non-Plastic			2.65	RDST	2.0	27.8	-	0.523	-	-	-	-	Inorganic Silts of low plasticity											
	32.50	D	27	15	30	24	54	23.61	-	-	-	-	-	-	-	17.88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	34.00	D	28	14	24	26	50	22.03	SM	1	0	1	48	50	0	18.30	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	35.50	D	29	12	13	16	29	15.71	SM	1	1	0	54	44	0	18.08	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	37.00	D	30	-	-	-	-	-	-	-	-	-	-	-	-	17.84	2.06	1.75	-	-	-	2.65	RDST	0.0	28.8	-	0.514	-	-	-	-												
	38.50	D	31	18	24	23	47	20.16	SM	0	0	1	53	46	0	17.53	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	40.00	D	32	15	28	30	58	22.74	-	-	-	-	-	-	-	17.97	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX-B
TABLE 21: UCS TEST ON SOIL SAMPLES

BH No.	DEPTH (m)	UCS (kg/cm²)
P81	4.00	0.49
	7.00	0.56
	10.00	0.51
	13.00	0.61
	19.00	0.48
P82	1.00	0.64
	4.00	0.59
	13.00	0.76
	16.00	0.69
	19.00	0.72
	28.00	0.74
	31.00	0.71
P83	11.00	0.69
	14.00	0.62
	20.00	0.57
	23.00	0.60
P84	8.00	0.50
	14.00	0.55
	23.00	0.63
P85	16.00	0.76
	19.00	0.68
	22.00	0.74
	28.00	0.62
P86	14.00	0.59
	23.00	0.62
P87	1.00	0.56
	13.00	0.62
	19.00	0.65
	22.00	0.47
P88	14.00	0.59
	29.00	0.50

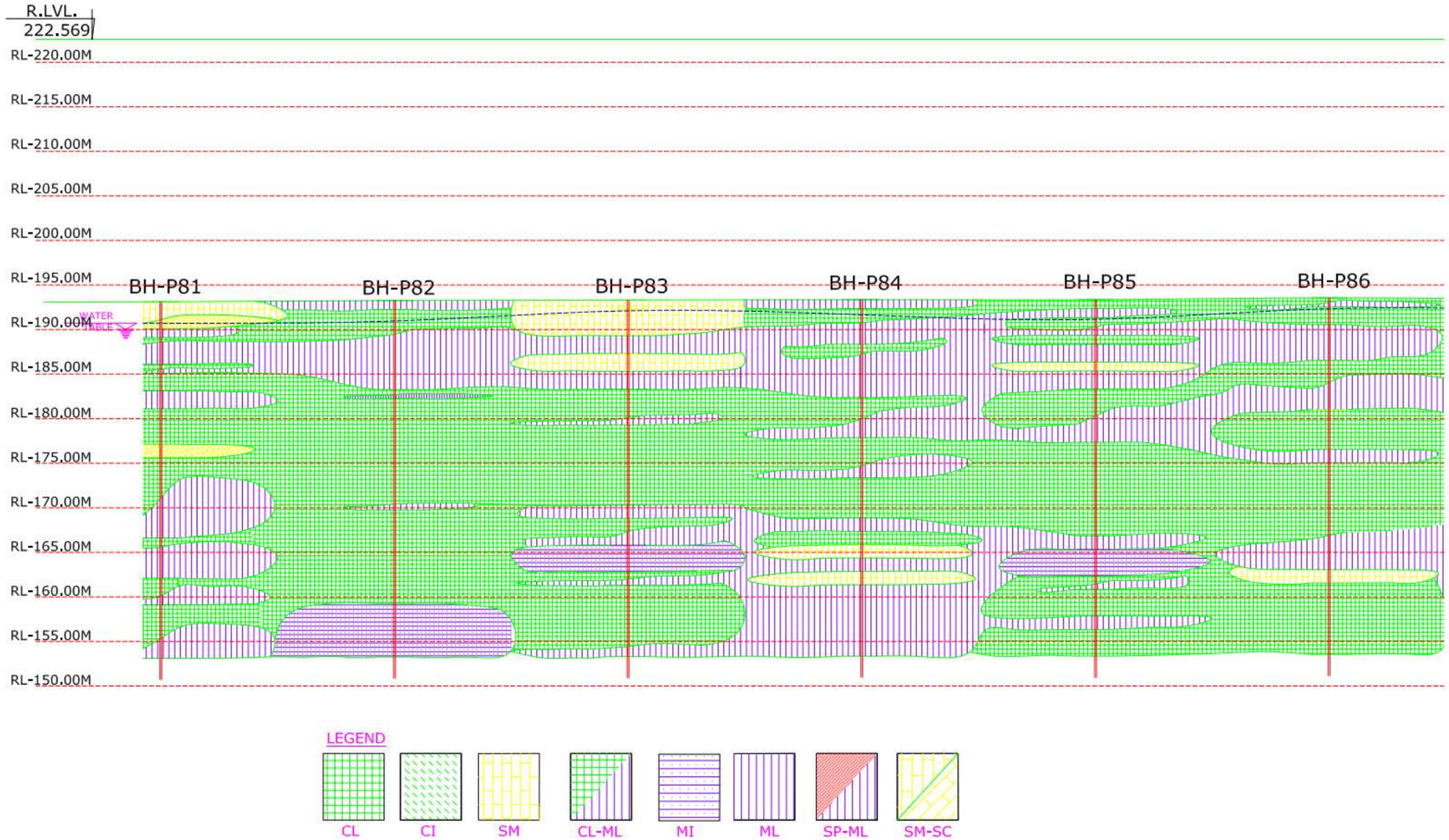
APPENDIX-B
TABLE 21: UCS TEST ON SOIL SAMPLES

BH No.	DEPTH (m)	UCS (kg/cm²)
	32.00	0.53
P89	1.00	0.52
	19.00	0.66
	22.00	0.68
	31.00	0.51
P90	1.00	0.42
	10.00	0.48
	13.00	0.44
	19.00	0.42
	22.00	0.62
P91	10.00	0.71
	13.00	0.82
	16.00	0.78
	19.00	0.86
	28.00	0.69
P92	10.00	0.79
	13.00	0.81
	16.00	0.74
	19.00	0.70
	22.00	0.81
	25.00	0.73
P93	13.00	0.63
	16.00	0.65
	19.00	0.58
	22.00	0.62
P94	14.00	0.57
	17.00	0.64
	23.00	0.55
	26.00	0.66
	29.00	0.66
P95	8.00	0.48

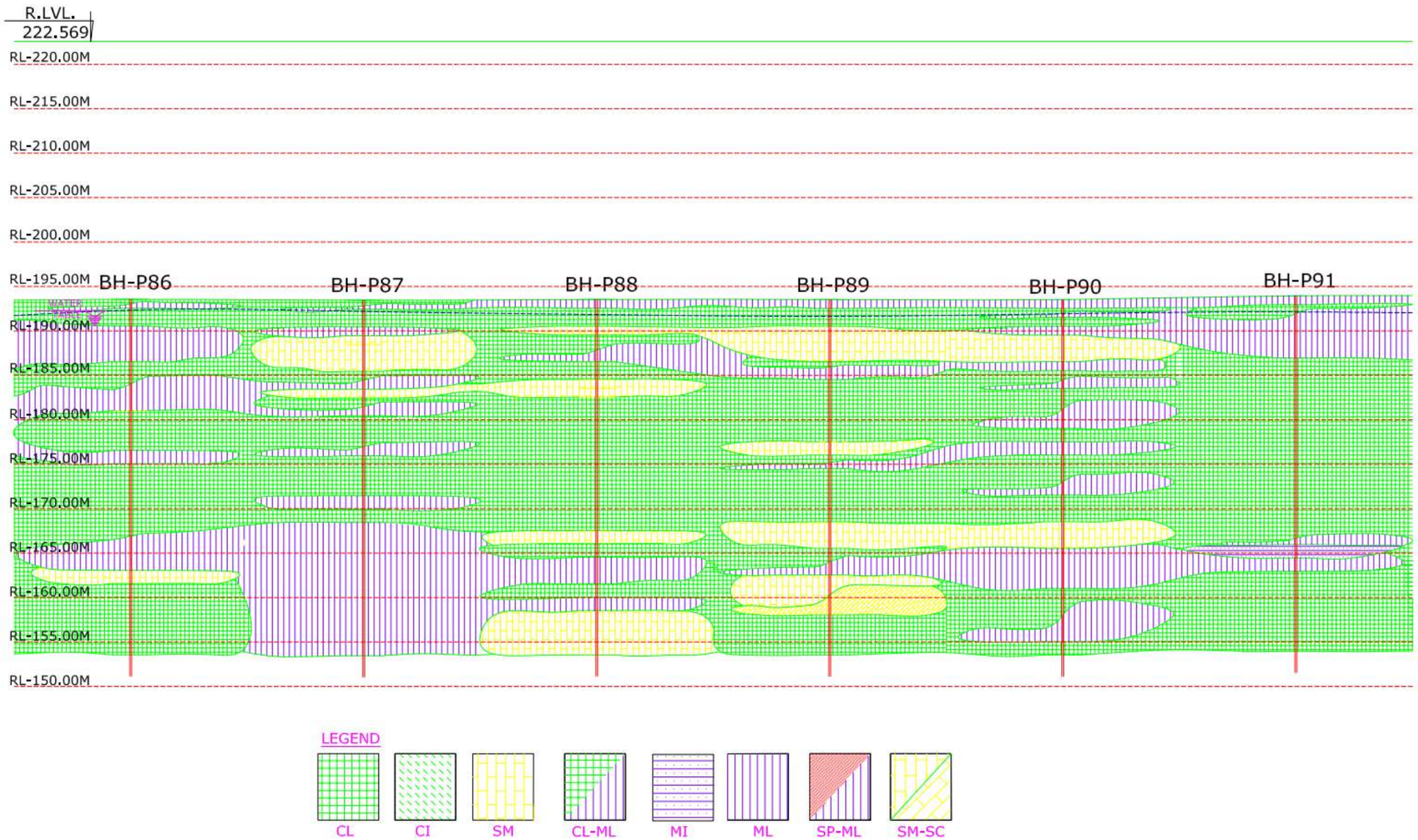
APPENDIX-B
TABLE 21: UCS TEST ON SOIL SAMPLES

BH No.	DEPTH (m)	UCS (kg/cm²)
	11.00	0.59
	14.00	0.61
	20.00	0.56
P96	11.00	0.57
	14.00	0.51
	23.00	0.68
P97	10.00	0.69
	13.00	0.75
P98	10.00	0.53
	13.00	0.68
	16.00	0.59
	25.00	0.51
P99	13.00	0.82
P100	16.00	0.48
	22.00	0.49

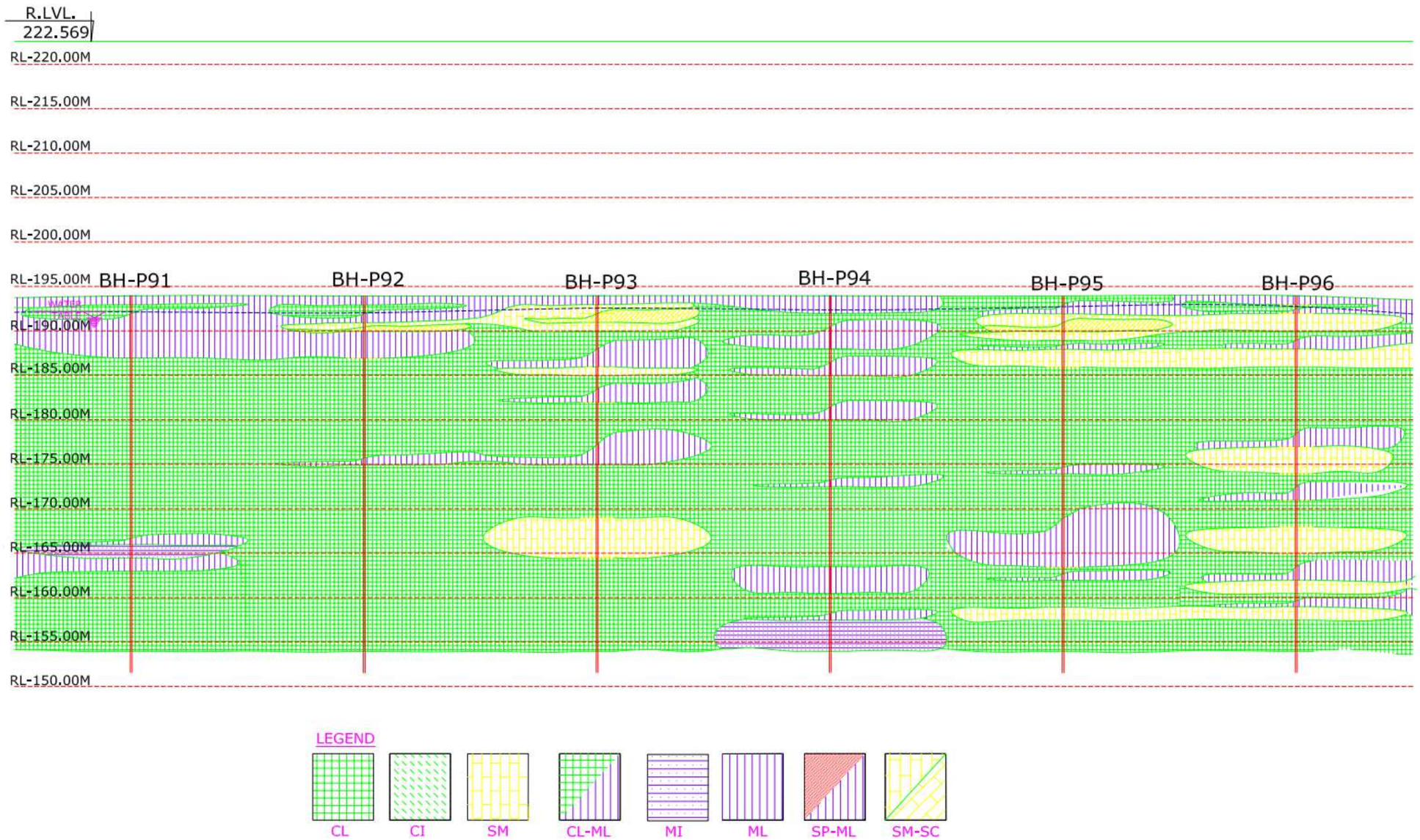
APPENDIX-C
PLOT 1: LITHOLOGICAL PROFILE-1



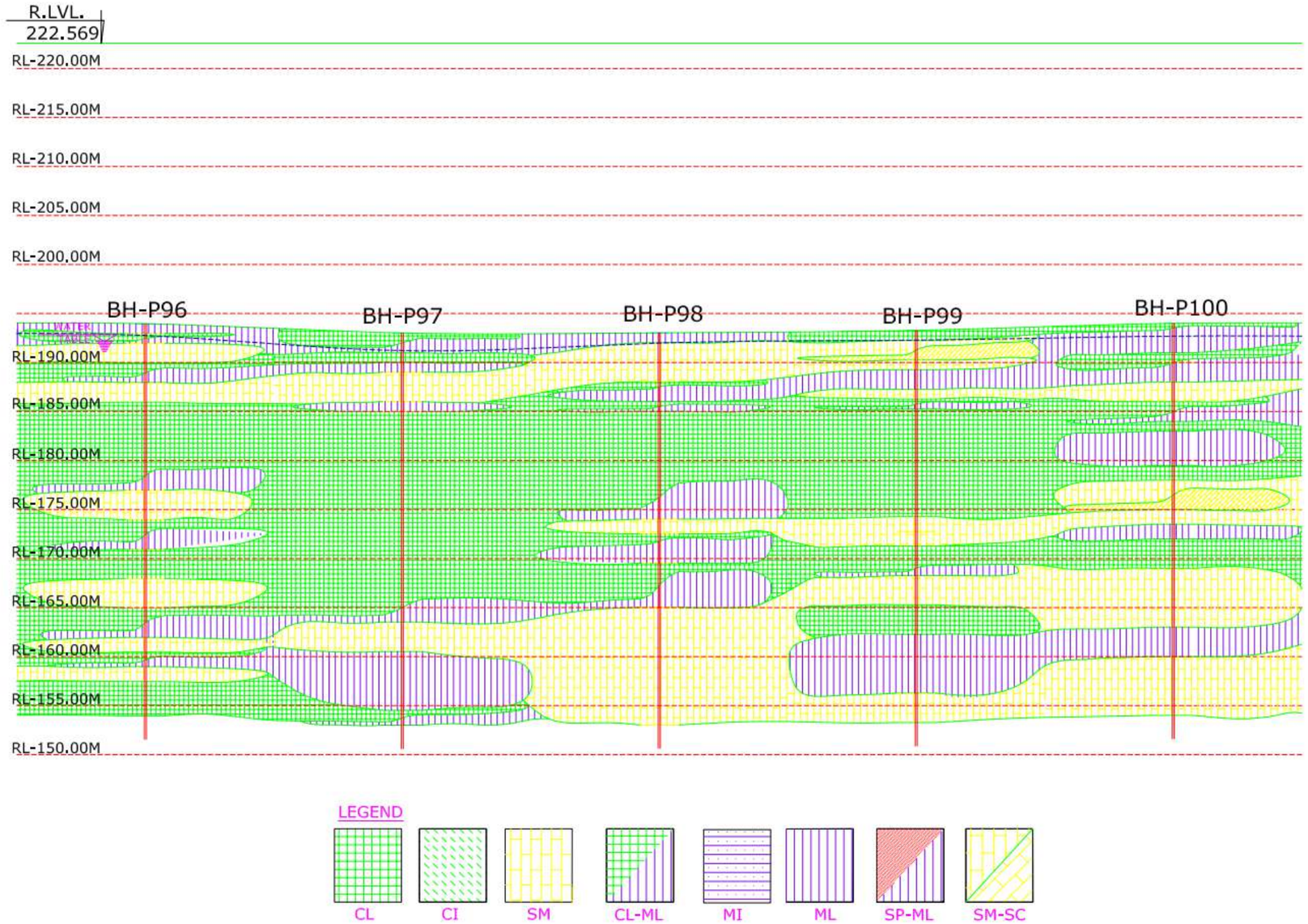
APPENDIX-C
PLOT 2: LITHOLOGICAL PROFILE-2



APPENDIX-C
PLOT 3: LITHOLOGICAL PROFILE-3

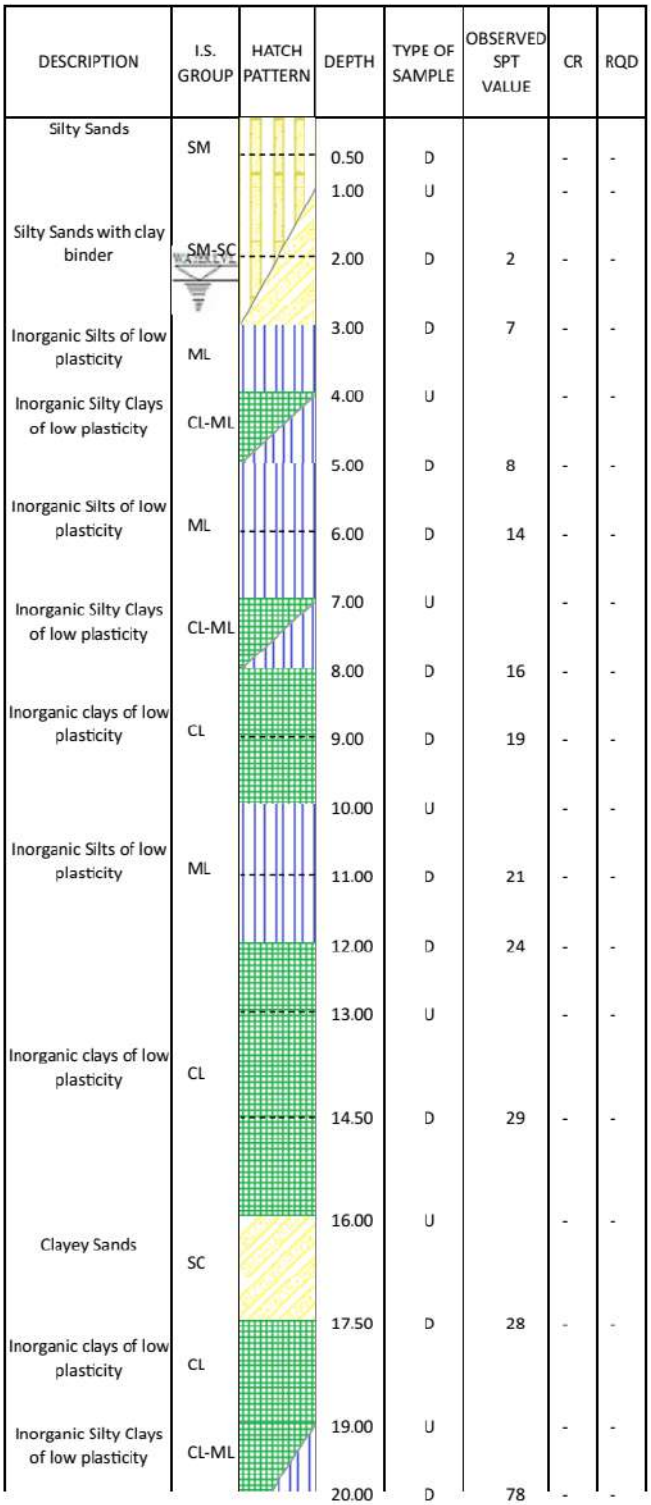


APPENDIX-C
PLOT 4: LITHOLOGICAL PROFILE-4

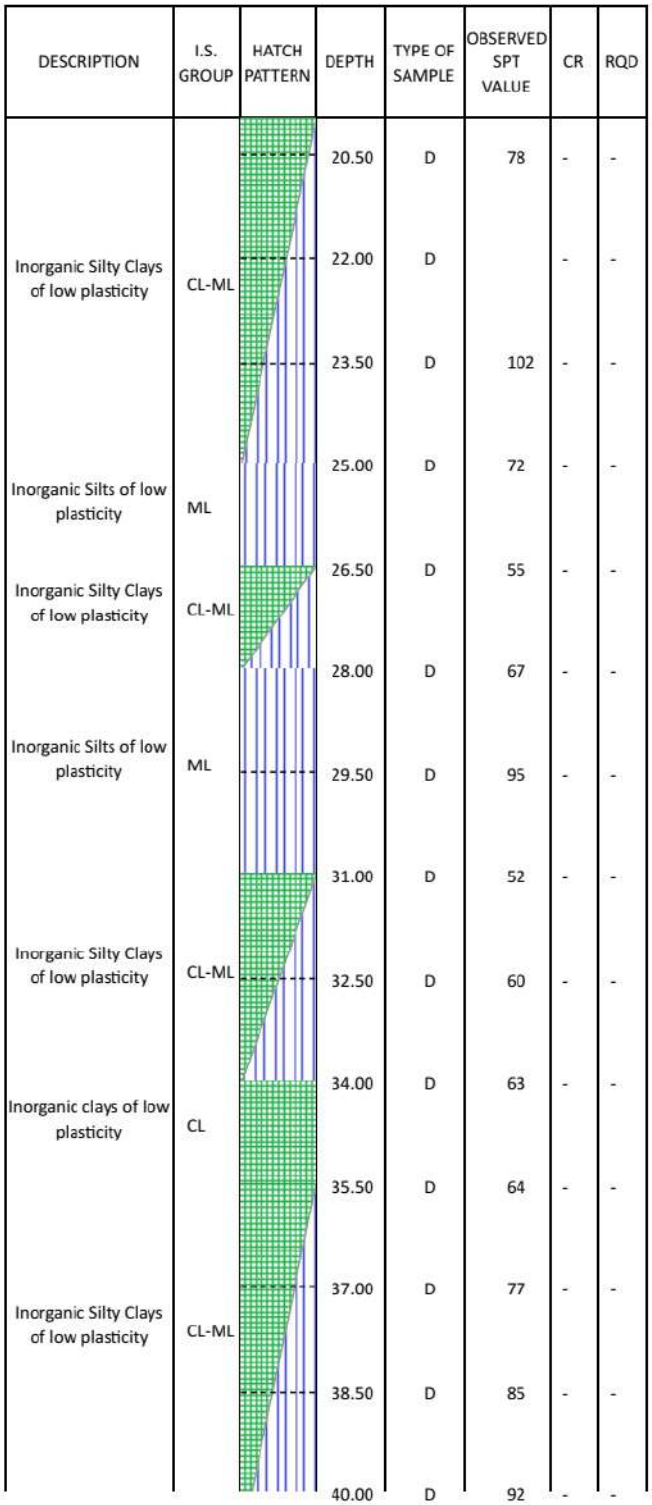


APPENDIX-C
PLOT 5: LITHOLOGICAL PLOTS

BH-P81-23038.087

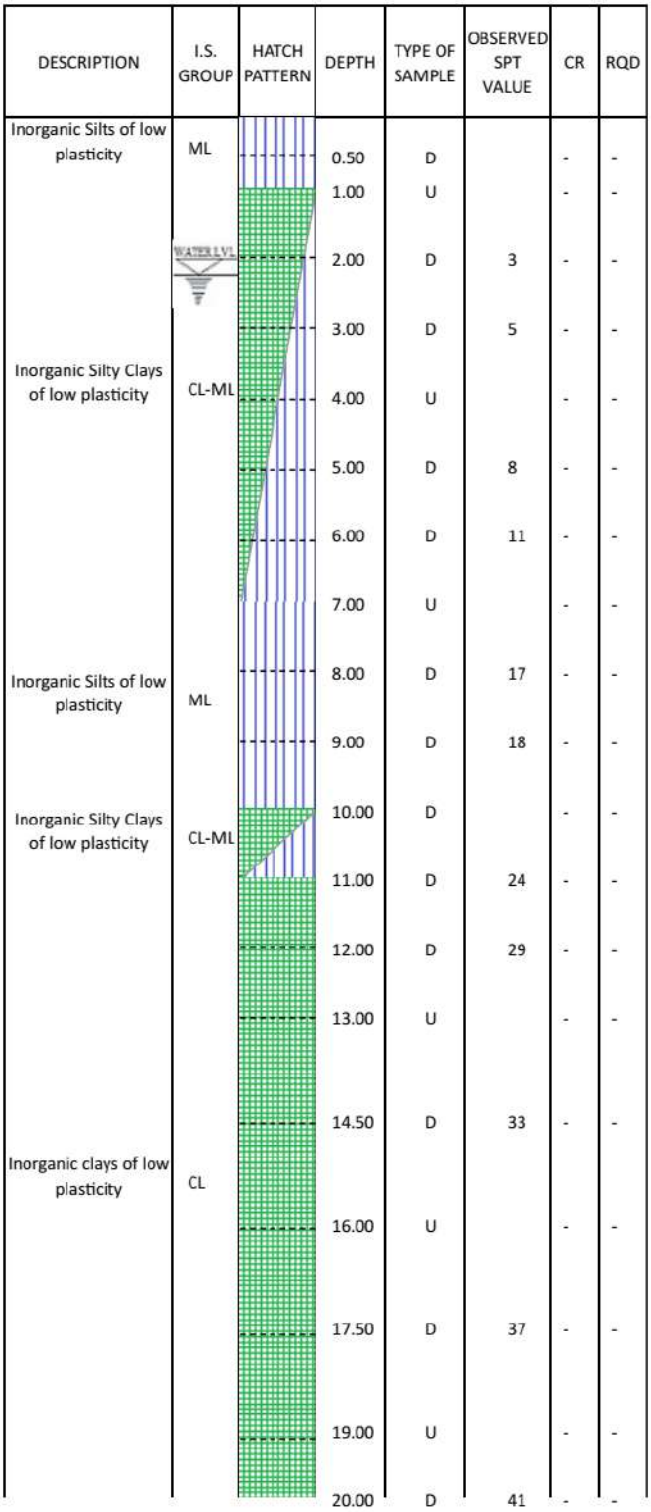


BH-P81-23038.087



APPENDIX-C
PLOT 6: LITHOLOGICAL PLOTS

BH-P82-23064.2870



BH-P82-23064.2870

APPENDIX-C
PLOT 7: LITHOLOGICAL PLOTS

BH-P83-23090.487

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			0.50	D		-	-
			1.00	D	5	-	-
Silty Sands	SM		2.00	U		-	-
			3.00	D	6	-	-
			4.00	D	7	-	-
Inorganic Silts of low plasticity	ML		5.00	U		-	-
			6.00	D	39	-	-
Silty Sands	SM		7.00	D	8	-	-
			8.00	U		-	-
Inorganic Silts of low plasticity	ML		9.00	D	32	-	-
			10.00	D	34	-	-
Inorganic clays of low plasticity	CL		11.00	U		-	-
			12.50	D	32	-	-
Inorganic Silty Clays of low plasticity	CL-ML		14.00	U		-	-
			15.50	D	38	-	-
Inorganic clays of low plasticity	CL		17.00	D		-	-
			18.50	D	41	-	-
			20.00	U		-	-

BH-P83-23090.487

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			20.00	U		-	-
Inorganic clays of low plasticity	CL		21.50	D	49	-	-
Inorganic Silts of low plasticity	ML		23.00	U		-	-
			24.50	D	50	-	-
Inorganic Silty Clays of low plasticity	CL-ML		26.00	D		-	-
			27.50	D	47	-	-
Inorganic Silts of Intermediate plasticity	MI		29.00	D		-	-
			30.50	D	47	-	-
Inorganic Silty Clays of low plasticity	CL-ML		32.00	D		-	-
			33.50	D	50	-	-
Inorganic clays of low plasticity	CL		35.00	D		-	-
			36.50	D	55	-	-
			38.00	D	58	-	-
Inorganic Silty Clays of low plasticity	CL-ML		40.00	D	61	-	-

APPENDIX-C
PLOT 8: LITHOLOGICAL PLOTS

BH-P84-23116.687

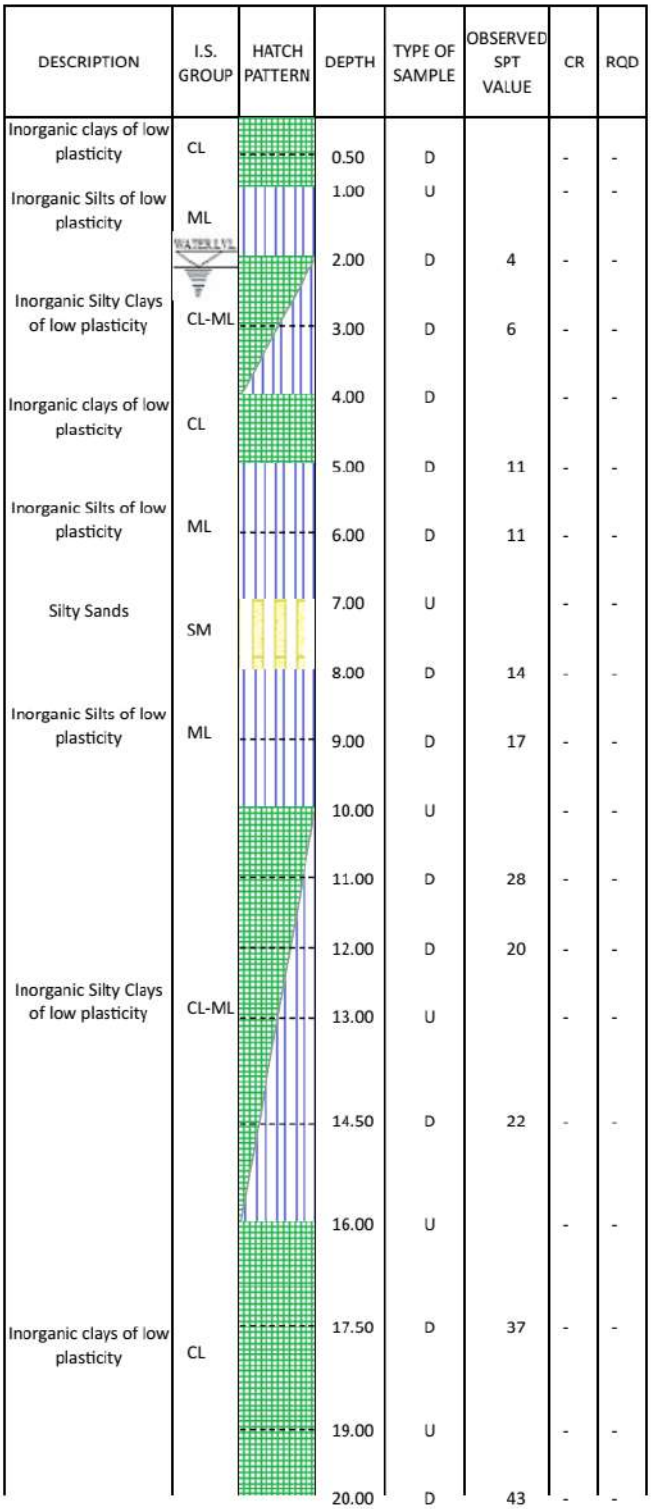
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Inorganic Silts of low plasticity	ML		0.50	D		-	-
Inorganic clays of low plasticity	CL		1.00	D	7	-	-
			2.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML		3.00	D	9	-	-
Inorganic Silts of low plasticity	ML		4.00	D	14	-	-
			5.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML		6.00	D	22	-	-
			7.00	D	24	-	-
			8.00	U		-	-
Inorganic Silts of low plasticity	ML		9.00	D	19	-	-
			10.00	D	28	-	-
			11.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML		12.50	D	27	-	-
			14.00	U		-	-
Inorganic clays of low plasticity	CL		15.50	D	30	-	-
			17.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML		18.50	D	31	-	-
			20.00	D		-	-

BH-P84-23116.687

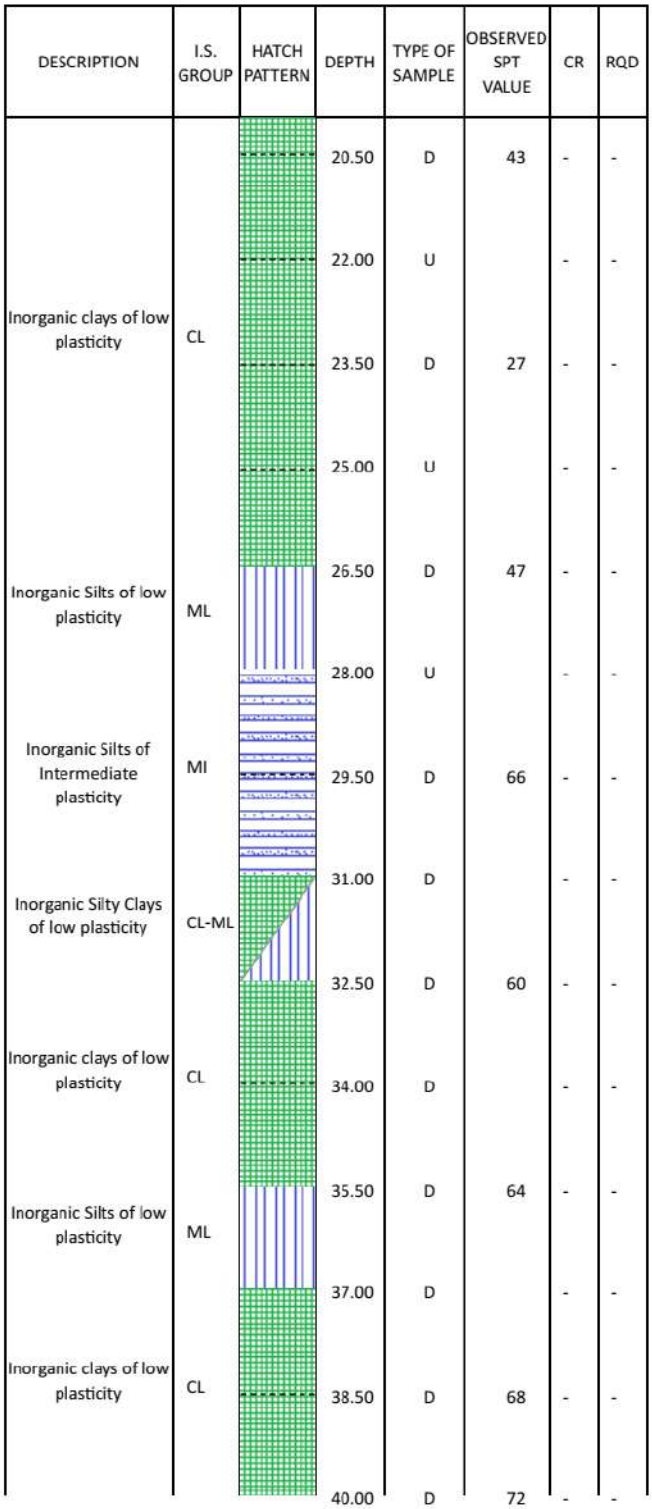
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			20.00	D		-	-
Inorganic clays of low plasticity	CL		21.50	D	37	-	-
			23.00	U		-	-
Inorganic Silts of low plasticity	ML		24.50	D	40	-	-
Inorganic clays of low plasticity	CL		26.00	D		-	-
Silty Sands	SM		27.50	D	48	-	-
Inorganic Silts of low plasticity	ML		29.00	D		-	-
Silty Sands	SM		30.50	D	42	-	-
			32.00	D		-	-
			33.50	D	42	-	-
			35.00	D		-	-
Inorganic Silts of low plasticity	ML		36.50	D	46	-	-
			38.00	D		-	-
			40.00	D	52	-	-

APPENDIX-C
PLOT 9: LITHOLOGICAL PLOTS

BH-P85-23142.8870



BH-P85-23142.8870



APPENDIX-C
PLOT 10: LITHOLOGICAL PLOTS

BH-P86-23169.087

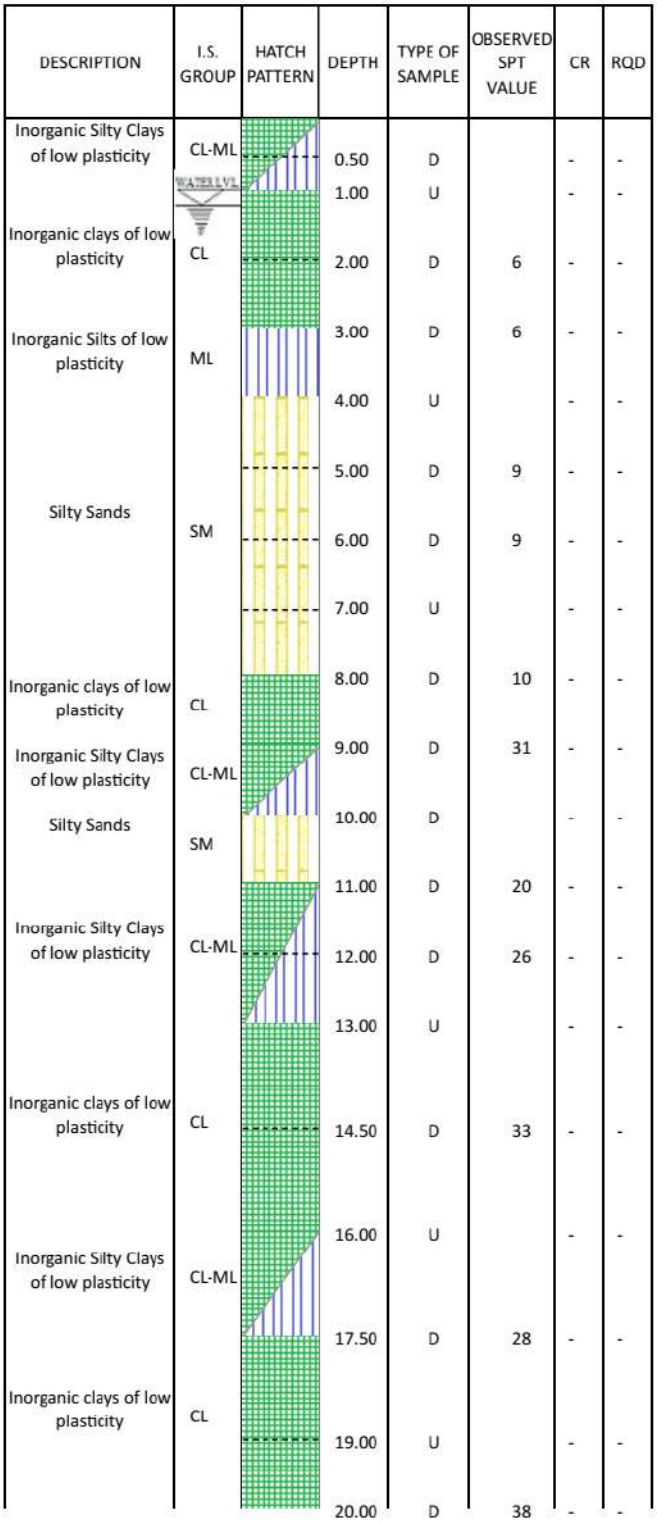
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Inorganic Silty Clays of low plasticity	CL-ML		0.50	D		-	-
			1.00	D	7	-	-
Inorganic clays of low plasticity	CL		2.00	D		-	-
			3.00	D	6	-	-
			4.00	D	8	-	-
Inorganic Silts of low plasticity	ML		5.00	U		-	-
			6.00	D	13	-	-
Inorganic clays of low plasticity	CL		7.00	D	36	-	-
			8.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML		9.00	D	31	-	-
			10.00	D	27	-	-
Inorganic Silts of low plasticity	ML		11.00	U		-	-
			12.50	D	23	-	-
Inorganic clays of low plasticity	CL		14.00	U		-	-
			15.50	D	19	-	-
Inorganic Silts of low plasticity	ML		17.00	U		-	-
Inorganic clays of low plasticity	CL		18.50	D	30	-	-
			20.00	D		-	-

BH-P86-23169.087

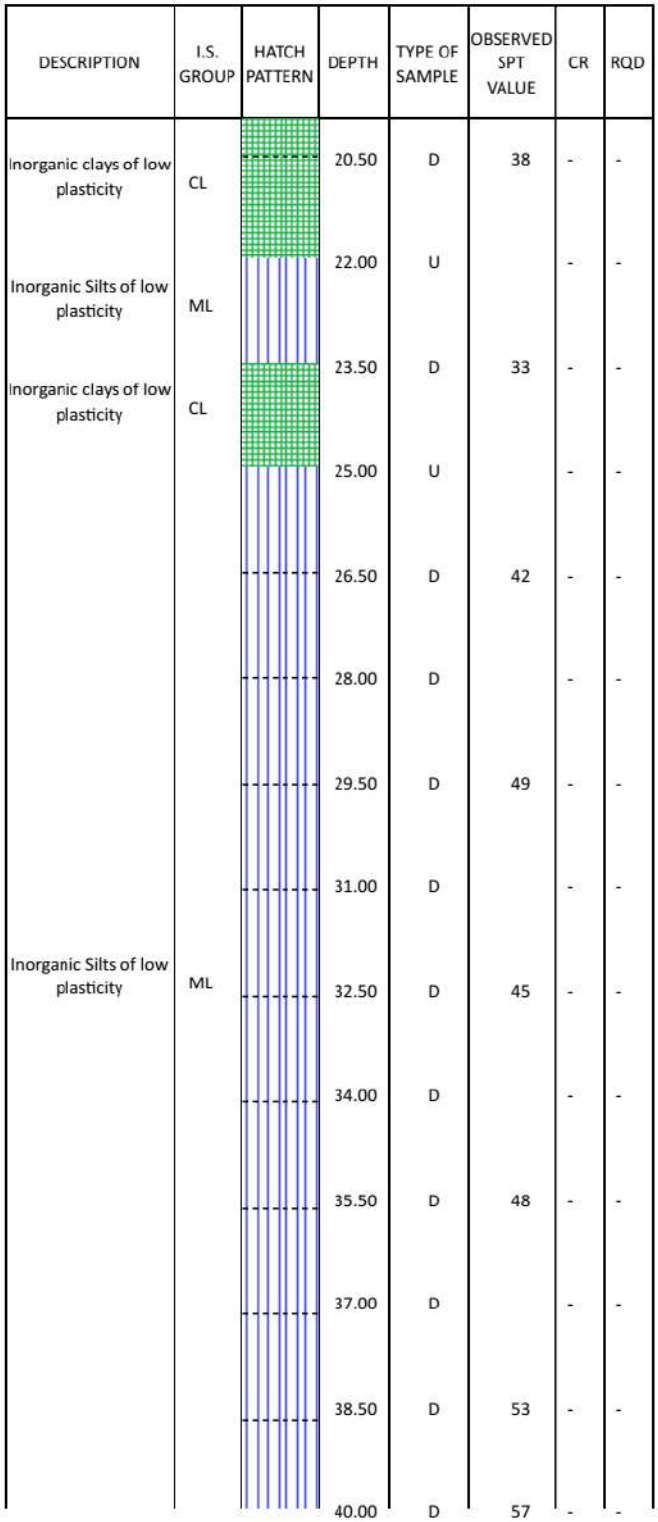
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			20.00	D		-	-
			21.50	D	49	-	-
Inorganic clays of low plasticity	CL		23.00	U		-	-
			24.50	D	44	-	-
			26.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML		27.50	D	49	-	-
Inorganic Silts of low plasticity	ML		29.00	D		-	-
			30.50	D	52	-	-
Silty Sands	SM		32.00	D	51	-	-
			33.50	D	48	-	-
			35.00	D		-	-
Inorganic clays of low plasticity	CL		36.50	D	47	-	-
			38.00	D		-	-
			40.00	D	54	-	-

APPENDIX-C
PLOT 11: LITHOLOGICAL PLOTS

BH-P87-23195.287



BH-P87-23195.287



APPENDIX-C
PLOT 12: LITHOLOGICAL PLOTS

BH-P88-23211.4870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Inorganic Silts of low plasticity	ML		0.50	D		-	-
			1.00	D	5	-	-
Inorganic clays of low plasticity	CL		2.00	U		-	-
Silty Sands	SM		3.00	D	7	-	-
			4.00	D	9	-	-
Inorganic Silty Clays of low plasticity	CL-ML		5.00	U		-	-
			6.00	D	13	-	-
			7.00	D	17	-	-
Inorganic clays of low plasticity	CL		8.00	D		-	-
			9.00	D	18	-	-
Silty Sands	SM		10.00	D	21	-	-
			11.00	U		-	-
			12.50	D	24	-	-
			14.00	U		-	-
Inorganic clays of low plasticity	CL		15.50	D	26	-	-
			17.00	D		-	-
			18.50	D	18	-	-
			20.00	D		-	-

BH-P88-23211.4870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			20.00	D		-	-
			21.50	D	22	-	-
Inorganic clays of low plasticity	CL		23.00	D		-	-
			24.50	D	35	-	-
Silty Sands	SM		26.00	U		-	-
			27.50	D	37	-	-
Inorganic clays of low plasticity	CL		29.00	U		-	-
Inorganic Silts of low plasticity	ML		30.50	D	48	-	-
			32.00	U		-	-
Inorganic clays of low plasticity	CL		33.50	D	50	-	-
Inorganic Silts of low plasticity	ML		35.00	D		-	-
			36.50	D	55	-	-
Silty Sands	SM		38.00	D		-	-
			40.00	D	62	-	-

APPENDIX-C
PLOT 13: LITHOLOGICAL PLOTS

BH-P89-23247.687

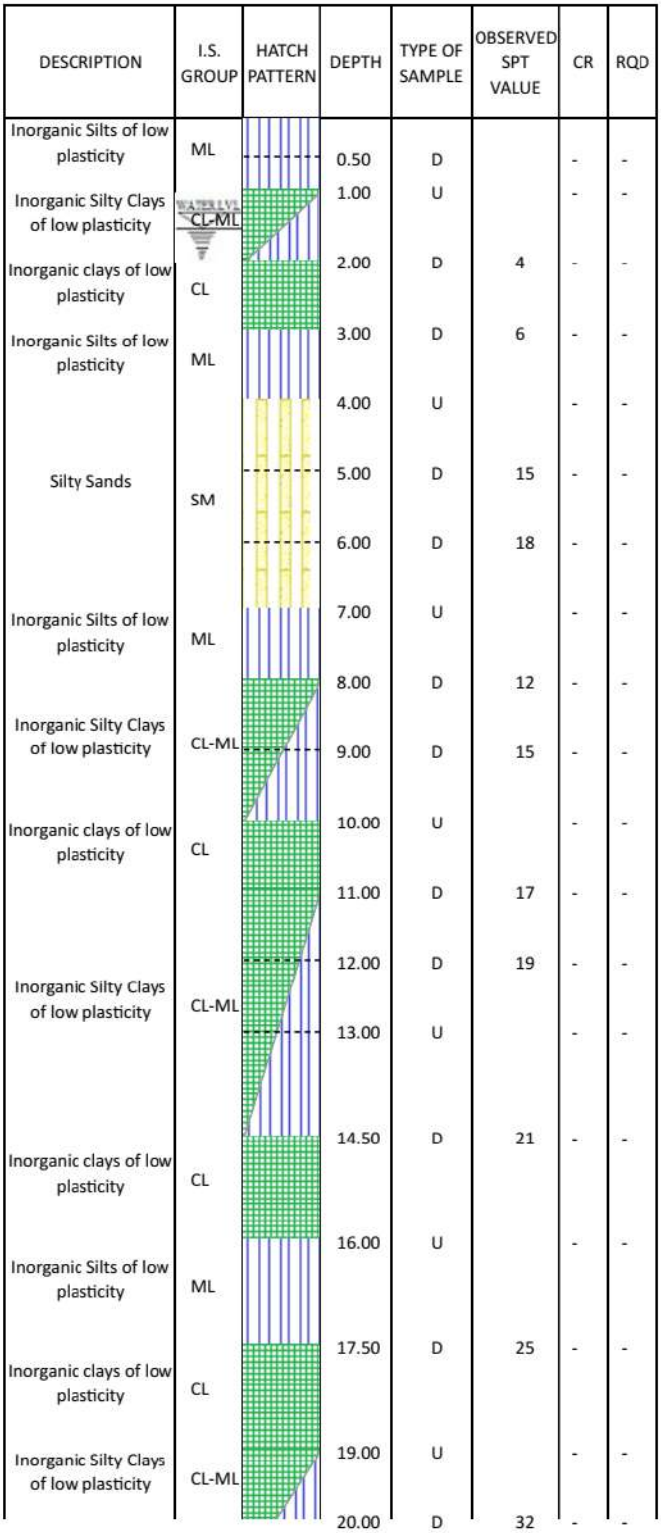
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Inorganic Silts of low plasticity	ML		0.50	D		-	-
			1.00	U		-	-
Inorganic clays of low plasticity	CL		2.00	D	4	-	-
			3.00	D	5	-	-
			4.00	U		-	-
Silty Sands	SM		5.00	D	5	-	-
			6.00	D	7	-	-
Inorganic Silty Clays of low plasticity	CL-ML		7.00	D		-	-
Inorganic Silts of low plasticity	ML		8.00	D	9	-	-
			9.00	D	27	-	-
			10.00	U		-	-
			11.00	D	19	-	-
Inorganic clays of low plasticity	CL		12.00	D	21	-	-
			13.00	D		-	-
			14.50	D	19	-	-
			16.00	U		-	-
Silty Sands	SM		17.50	D	23	-	-
Inorganic Silty Clays of low plasticity	CL-ML		19.00	U		-	-
Inorganic clays of low plasticity	CL		20.00	D	40	-	-

BH-P89-23247.687

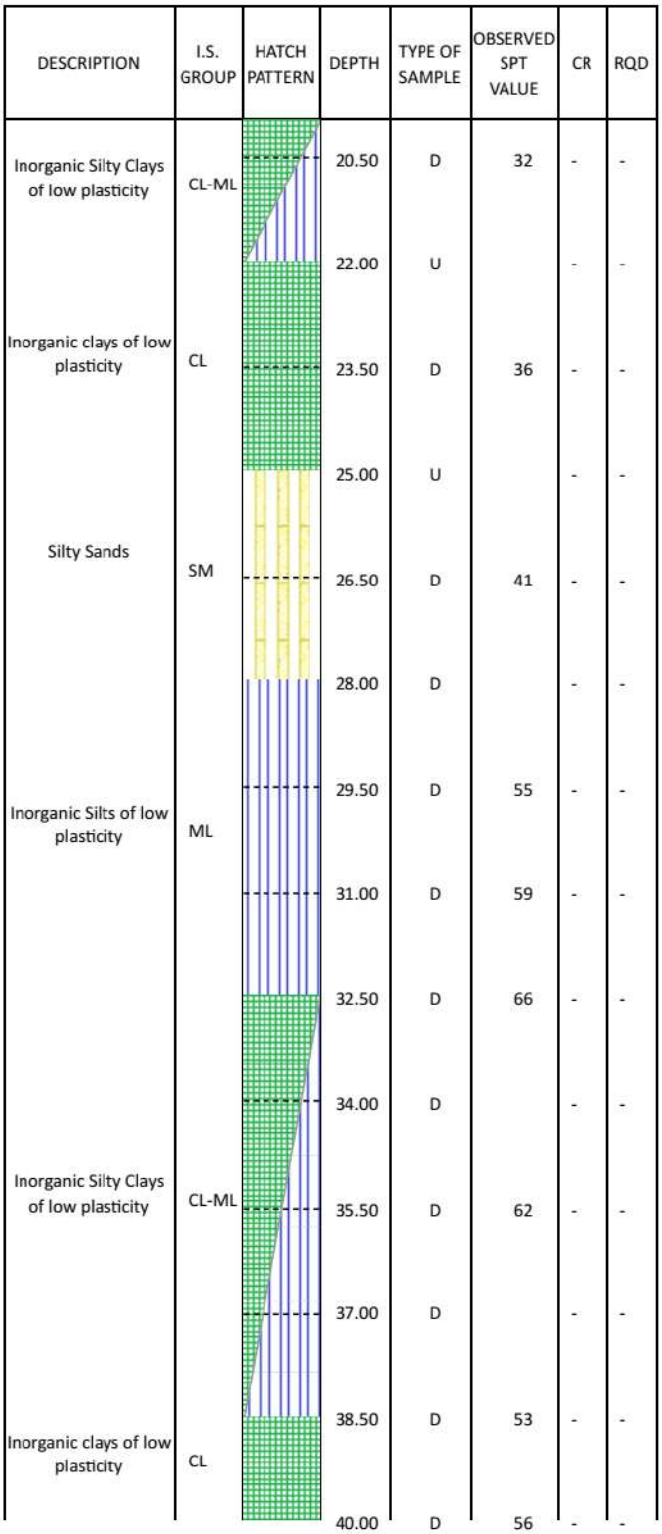
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			20.50	D	40	-	-
Inorganic clays of low plasticity	CL		22.00	U		-	-
			23.50	D	39	-	-
			25.00	U		-	-
Silty Sands	SM		26.50	D	42	-	-
			28.00	D		-	-
Inorganic Silty Clays of low plasticity	CL-ML		29.50	D	52	-	-
			31.00	U		-	-
Silty Sands with clay binder	SM-SC		32.50	D	36	-	-
			34.00	D		-	-
			35.50	D	41	-	-
Inorganic clays of low plasticity	CL		37.00	D		-	-
			38.50	D	53	-	-
			40.00	D	59	-	-

APPENDIX-C
PLOT 14: LITHOLOGICAL PLOTS

BH-P90-23273.887



BH-P90-23273.887



APPENDIX-C
PLOT 15: LITHOLOGICAL PLOTS

BH-P91-23300.0870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Inorganic Silts of low plasticity	ML		0.50	D		-	-
			1.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML		2.00	D	4	-	-
			3.00	D	7	-	-
			4.00	U		-	-
Inorganic Silts of low plasticity	ML		5.00	D	9	-	-
			6.00	D	11	-	-
			7.00	D		-	-
			8.00	D	12	-	-
			9.00	D	27	-	-
			10.00	U		-	-
			11.00	D	21	-	-
			12.00	D	24	-	-
Inorganic clays of low plasticity	CL		13.00	U		-	-
			14.50	D	19	-	-
			16.00	U		-	-
			17.50	D	58	-	-
			19.00	U		-	-
			20.00	D	65	-	-

BH-P91-23300.0870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			20.50	D	65	-	-
			22.00	U		-	-
Inorganic clays of low plasticity	CL		23.50	D	68	-	-
			25.00	D		-	-
			26.50	D	40	-	-
Inorganic Silty Clays of low plasticity	CL-ML		28.00	U		-	-
Inorganic Silts of Intermediate plasticity	MI		29.50	D	40	-	-
Inorganic Silts of low plasticity	ML		31.00	D		-	-
			32.50	D	42	-	-
			34.00	D		-	-
Inorganic clays of low plasticity	CL		35.50	D	45	-	-
			37.00	D		-	-
			38.50	D	56	-	-
			40.00	D	61	-	-

APPENDIX-C
PLOT 16: LITHOLOGICAL PLOTS

BH-P92-23326.2870

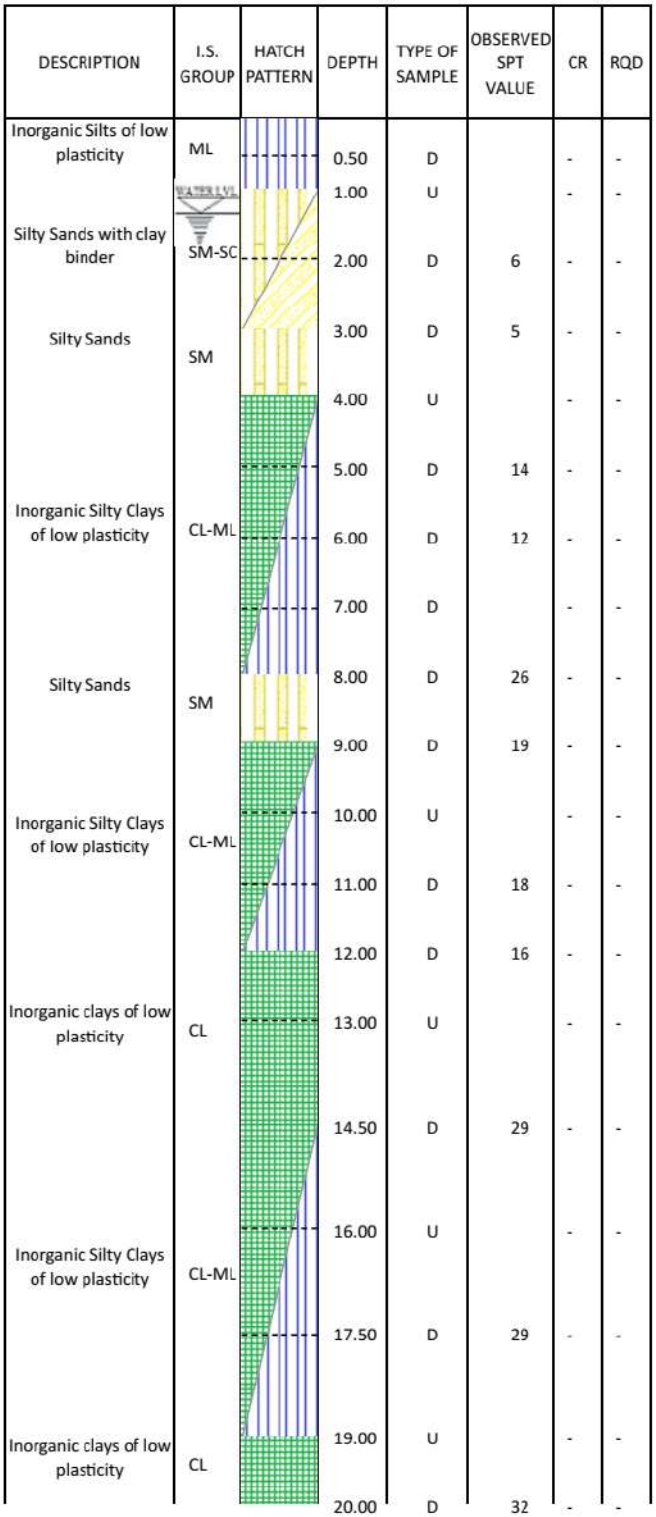
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Inorganic Silts of low plasticity	ML		0.50	D		-	-
			1.00	D		-	-
Inorganic Silty Clays of low plasticity	CL-ML		2.00	D	3	-	-
Silty Sands with clay binder	SM-SC		3.00	D	5	-	-
			4.00	U		-	-
Inorganic Silts of low plasticity	ML		5.00	D	8	-	-
			6.00	D	11	-	-
			7.00	U		-	-
			8.00	D	17	-	-
			9.00	D	18	-	-
			10.00	U		-	-
			11.00	D	16	-	-
Inorganic clays of low plasticity	CL		12.00	D	8	-	-
			13.00	U		-	-
			14.50	D	12	-	-
			16.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML		17.50	D	25	-	-
Inorganic clays of low plasticity	CL		19.00	U		-	-
			20.00	D	30	-	-

BH-P92-23326.2870

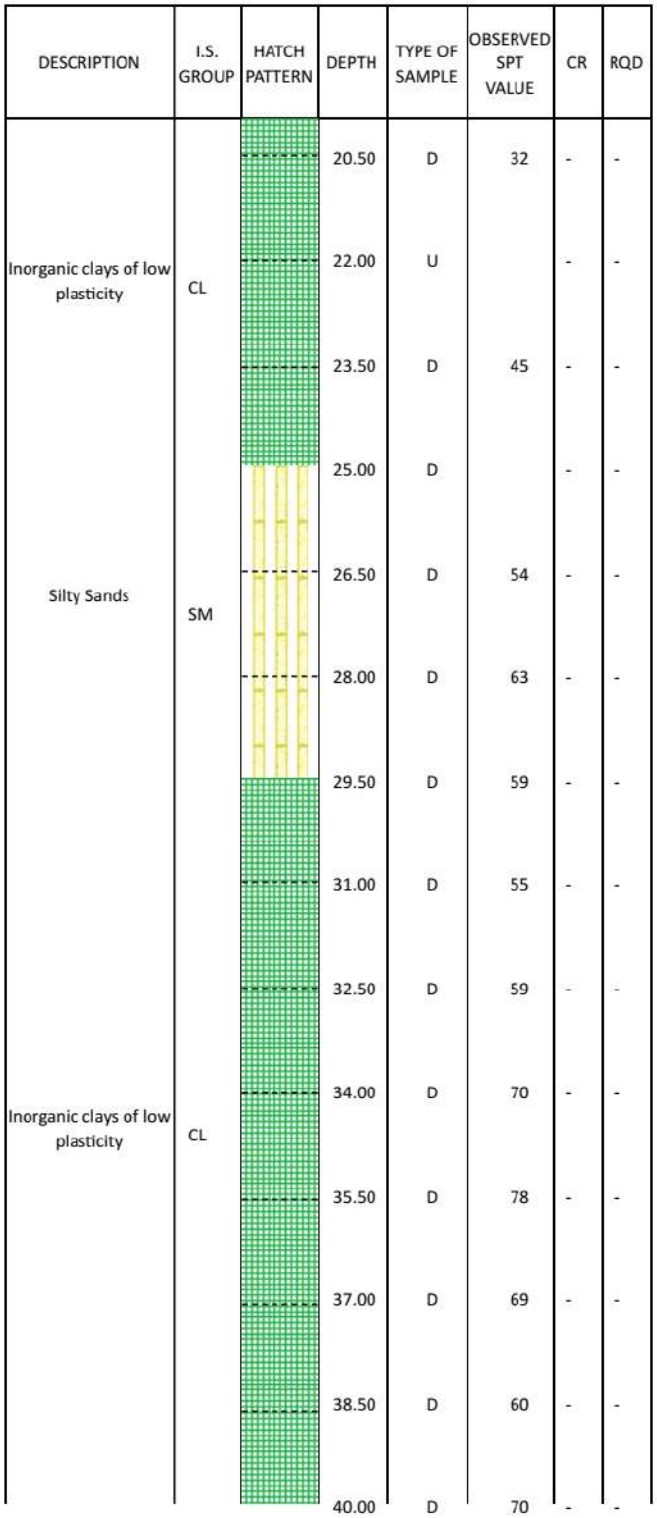
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			20.50	D	30	-	-
			22.00	U		-	-
			23.50	D	48	-	-
			25.00	U		-	-
			26.50	D	48	-	-
			28.00	D		-	-
			29.50	D	39	-	-
Inorganic clays of low plasticity	CL		31.00	D		-	-
			32.50	D	54	-	-
			34.00	D		-	-
			35.50	D	48	-	-
			37.00	D		-	-
			38.50	D	50	-	-
			40.00	D	64	-	-

APPENDIX-C
PLOT 17: LITHOLOGICAL PLOTS

BH-P93-23352.487

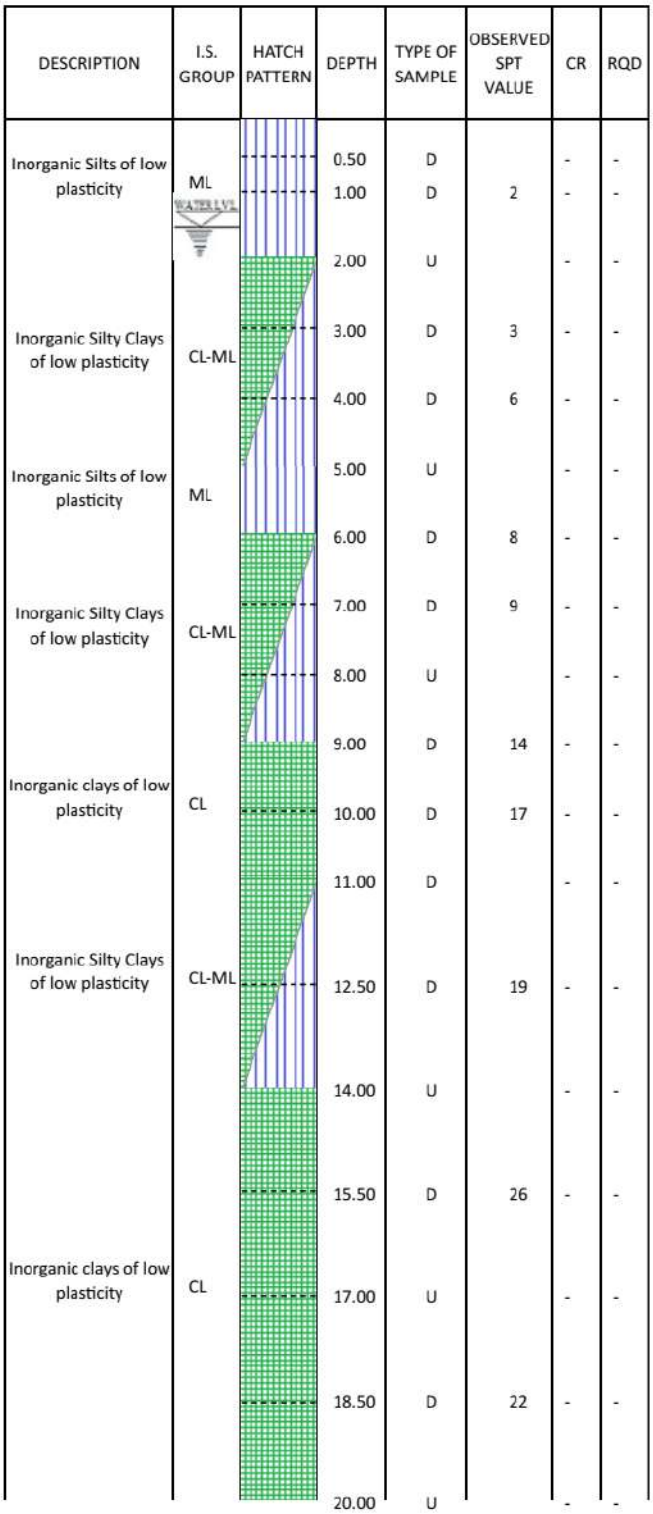


BH-P93-23352.487

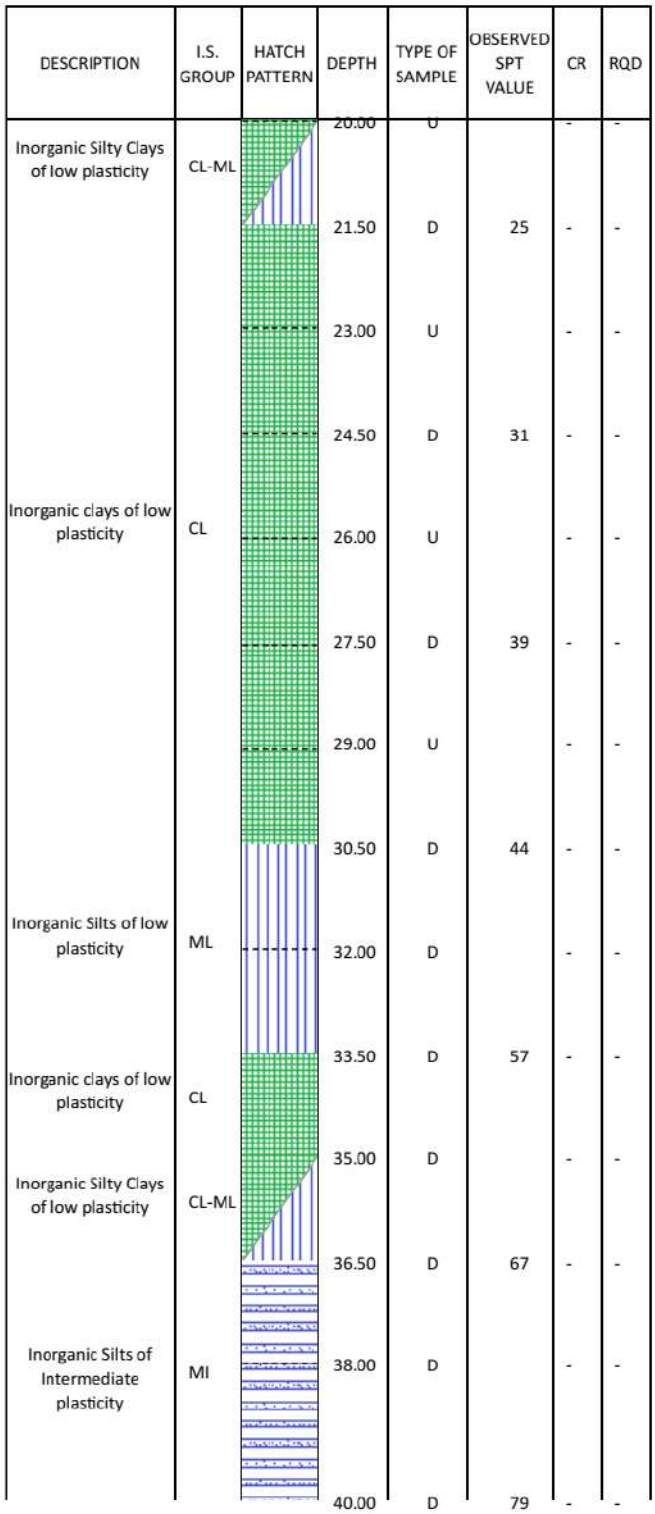


APPENDIX-C
PLOT 18: LITHOLOGICAL PLOTS

BH-P94-23378.6870



BH-P94-23378.6870



APPENDIX-C
PLOT 19: LITHOLOGICAL PLOTS

BH-P95-23404.887

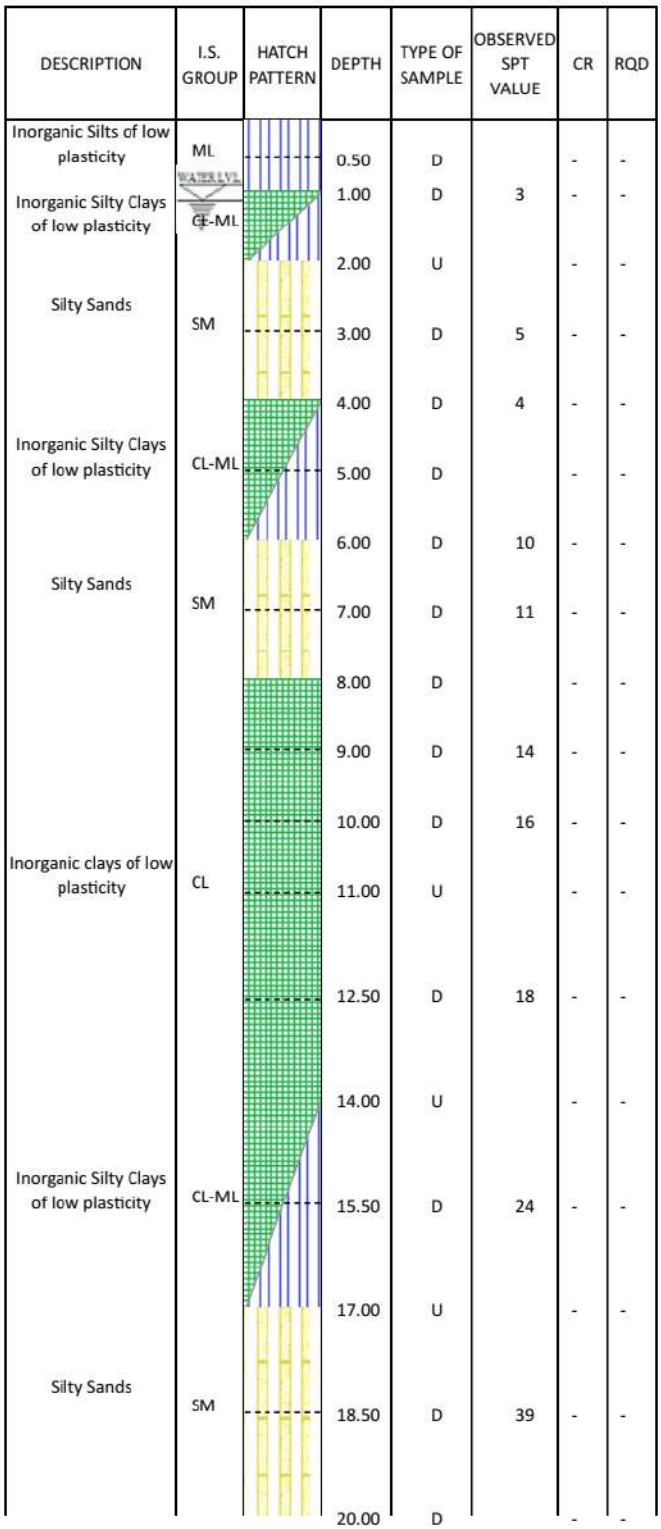
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Inorganic Silty Clays of low plasticity	CL-ML		0.50	D		-	-
			1.00	D	4	-	-
			2.00	U		-	-
Silty Sands with clay binder	SM-SC		3.00	D	7	-	-
Silty Sands	SM		4.00	D	7	-	-
Inorganic Silty Clays of low plasticity	CL-ML		5.00	U		-	-
			6.00	D	16	-	-
Silty Sands	SM		7.00	D	11	-	-
			8.00	U		-	-
			9.00	D	24	-	-
			10.00	D	28	-	-
			11.00	U		-	-
Inorganic clays of low plasticity	CL		12.50	D	15	-	-
			14.00	U		-	-
			15.50	D	25	-	-
			17.00	D		-	-
Inorganic Silty Clays of low plasticity	CL-ML		18.50	D	35	-	-
			20.00	U		-	-

BH-P95-23404.887

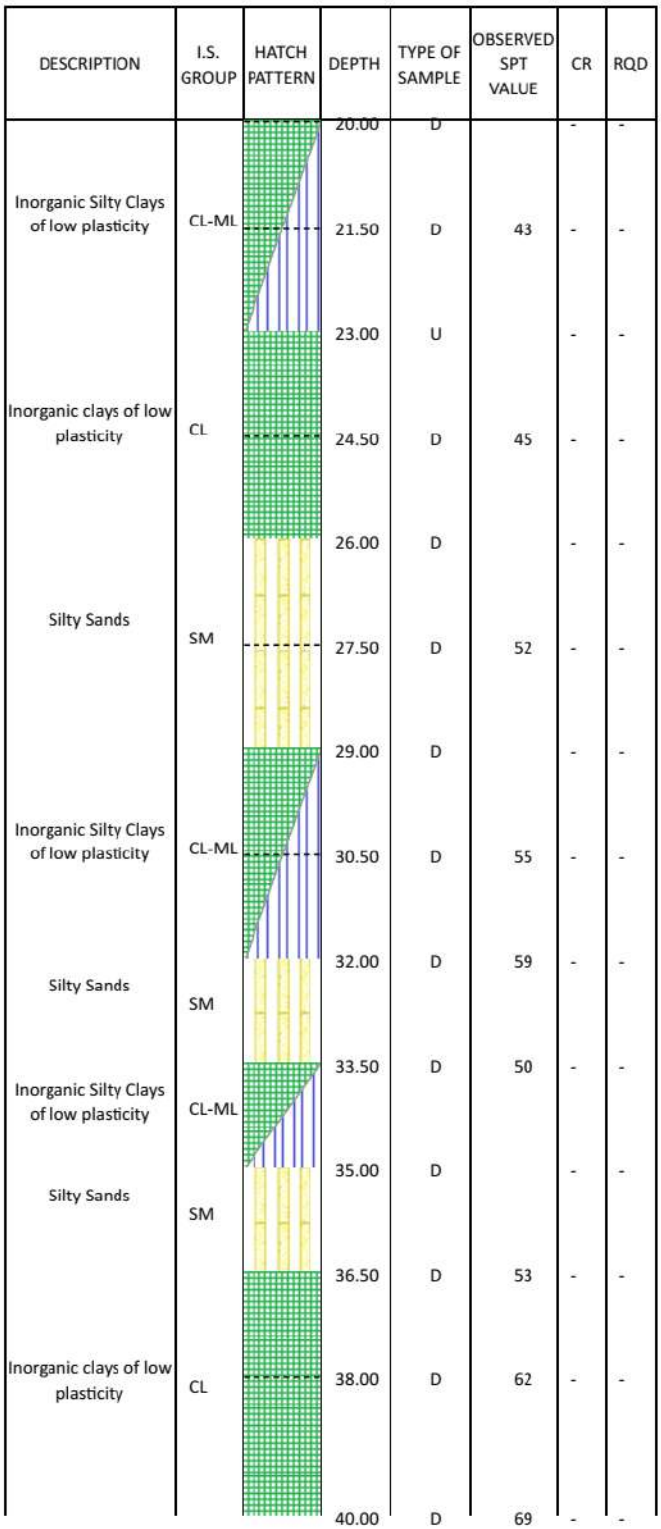
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			20.00	U		-	-
Inorganic clays of low plasticity	CL		21.50	D	46	-	-
			23.00	D		-	-
Inorganic Silty Clays of low plasticity	CL-ML		24.50	D	48	-	-
			26.00	D		-	-
			27.50	D	45	-	-
Inorganic Silts of low plasticity	ML		29.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML		30.50	D	52	-	-
			32.00	D	67	-	-
Inorganic clays of low plasticity	CL		33.50	D	67	-	-
Silty Sands	SM		35.00	D	64	-	-
			36.50	D	58	-	-
Inorganic clays of low plasticity	CL		38.00	D	56	-	-
			40.00	D	58	-	-

APPENDIX-C
PLOT 20: LITHOLOGICAL PLOTS

BH-P96-23431.087



BH-P96-23431.087



APPENDIX-C
PLOT 21: LITHOLOGICAL PLOTS

BH-P97-23457.2870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Inorganic Silty Clays of low plasticity	CL-ML		0.50	D		-	-
			1.00	D		-	-
Inorganic clays of low plasticity	CL		2.00	D	3	-	-
Inorganic Silts of low plasticity	ML		3.00	D	7	-	-
			4.00	U		-	-
Silty Sands	SM		5.00	D	10	-	-
			6.00	D	12	-	-
Inorganic Silts of low plasticity	ML		7.00	U		-	-
			8.00	D	14	-	-
			9.00	D	23	-	-
			10.00	U		-	-
			11.00	D	11	-	-
			12.00	D	14	-	-
			13.00	U		-	-
Inorganic clays of low plasticity	CL		14.50	D	17	-	-
			16.00	U		-	-
			17.50	D	20	-	-
			19.00	D		-	-
			20.00	D	25	-	-

BH-P97-23457.2870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			20.50	D	25	-	-
Inorganic clays of low plasticity	CL		22.00	D		-	-
			23.50	D	43	-	-
			25.00	D		-	-
			26.50	D	39	-	-
Inorganic Silty Clays of low plasticity	CL-ML		28.00	D		-	-
			29.50	D	77	-	-
Silty Sands	SM		31.00	U		-	-
			32.50	D	72	-	-
			34.00	D		-	-
Inorganic Silts of low plasticity	ML		35.50	D	73	-	-
			37.00	U		-	-
			38.50	D	71	-	-
Inorganic Silty Clays of low plasticity	CL-ML		40.00	D	71	-	-

APPENDIX-C
PLOT 22: LITHOLOGICAL PLOTS

BH-P98-23483.487

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Inorganic Silts of low plasticity	ML		0.50	D		-	-
			1.00	U		-	-
			2.00	D	3	-	-
Silty Sands	SM		3.00	D	4	-	-
			4.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML		5.00	D	6	-	-
Inorganic Silts of low plasticity	ML		6.00	D	8	-	-
Inorganic Silty Clays of low plasticity	CL-ML		7.00	U		-	-
			8.00	D	12	-	-
			9.00	D	15	-	-
			10.00	U		-	-
Inorganic clays of low plasticity	CL		11.00	D	18	-	-
			12.00	D	21	-	-
			13.00	U		-	-
			14.50	D	25	-	-
			16.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML		17.50	D	21	-	-
			19.00	U		-	-
Silty Sands	SM		20.00	D	30	-	-

BH-P98-23483.487

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Silty Sands	SM		20.50	D	30	-	-
Inorganic Silty Clays of low plasticity	CL-ML		22.00	D		-	-
Inorganic Silts of low plasticity	ML		23.50	D	37	-	-
			25.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML		26.50	D	42	-	-
			28.00	U		-	-
			29.50	D	54	-	-
			31.00	D	58	-	-
			32.50	D	62	-	-
Silty Sands	SM		34.00	D		-	-
			35.50	D	58	-	-
			37.00	D		-	-
			38.50	D	60	-	-
			40.00	D	62	-	-

APPENDIX-C
PLOT 23: LITHOLOGICAL PLOTS

BH-P99-23509.6870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Inorganic clays of low plasticity	CL		0.50	D		-	-
			1.00	U		-	-
Silty Sands with clay binder	SM-SC		2.00	D	5	-	-
Silty Sands	SM		3.00	D	13	-	-
			4.00	U		-	-
Inorganic Silts of low plasticity	ML		5.00	D	17	-	-
Silty Sands	SM		6.00	D	21	-	-
Inorganic Silty Clays of low plasticity	CL-ML		7.00	D		-	-
			8.00	D	25	-	-
			9.00	D	31	-	-
			10.00	D		-	-
			11.00	D	20	-	-
			12.00	D	11	-	-
Inorganic clays of low plasticity	CL		13.00	U		-	-
			14.50	D	20	-	-
			16.00	U		-	-
			17.50	D	18	-	-
Silty Sands	SM		19.00	U		-	-
			20.00	D	19	-	-

BH-P99-23509.6870

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Silty Sands	SM		20.50	D	19	-	-
			22.00	U		-	-
Inorganic clays of low plasticity	CL		23.50	D	30	-	-
Inorganic Silty Clays of low plasticity	CL-ML		25.00	D		-	-
Silty Sands	SM		26.50	D	48	-	-
			28.00	U		-	-
Inorganic clays of low plasticity	CL		29.50	D	39	-	-
			31.00	D		-	-
			32.50	D	43	-	-
Inorganic Silts of low plasticity	ML		34.00	D		-	-
			35.50	D	56	-	-
			37.00	D		-	-
Silty Sands	SM		38.50	D	58	-	-
			40.00	D	64	-	-

APPENDIX-C
PLOT 24: LITHOLOGICAL PLOTS

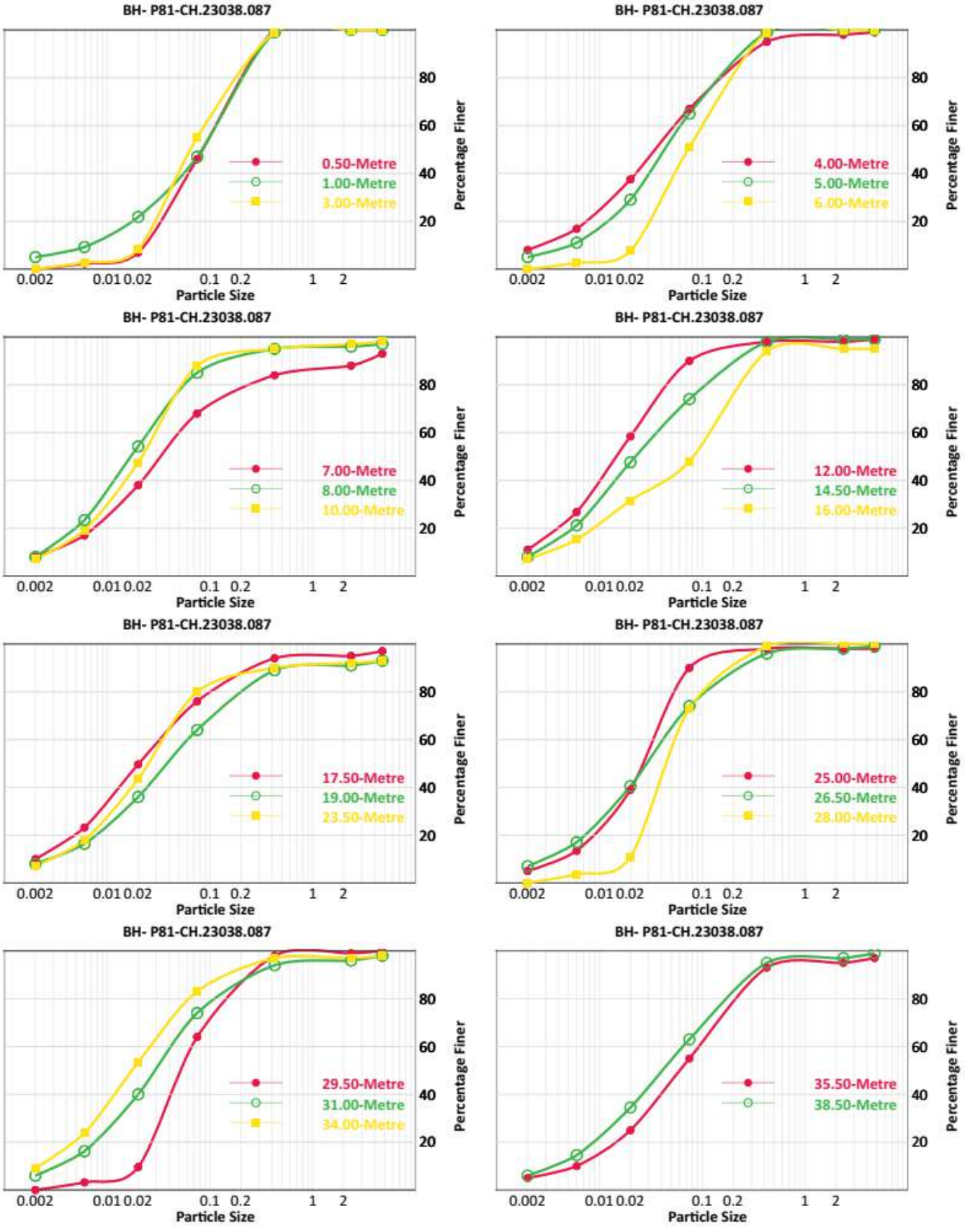
BH-P100-23535.887

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Inorganic Silty Clays of low plasticity	CL-ML		0.50	D		-	-
			1.00	U		-	-
Inorganic Silts of low plasticity	ML		2.00	D	4	-	-
			3.00	D	6	-	-
Inorganic Silty Clays of low plasticity	CL-ML		4.00	D		-	-
Inorganic Silts of low plasticity	ML		5.00	D	8	-	-
			6.00	D	16	-	-
Silty Sands	SM		7.00	D		-	-
			8.00	D	20	-	-
Inorganic Silty Clays of low plasticity	CL-ML		9.00	D	23	-	-
Inorganic clays of low plasticity	CL		10.00	U		-	-
			11.00	D	24	-	-
Inorganic Silts of low plasticity	ML		12.00	D	31	-	-
			13.00	D		-	-
Inorganic clays of low plasticity	CL		14.50	D	18	-	-
			16.00	U		-	-
Silty Sands with clay binder	SM-SC		17.50	D	47	-	-
Silty Sands	SM		19.00	U		-	-
			20.00	D	37	-	-

BH-P100-23535.887

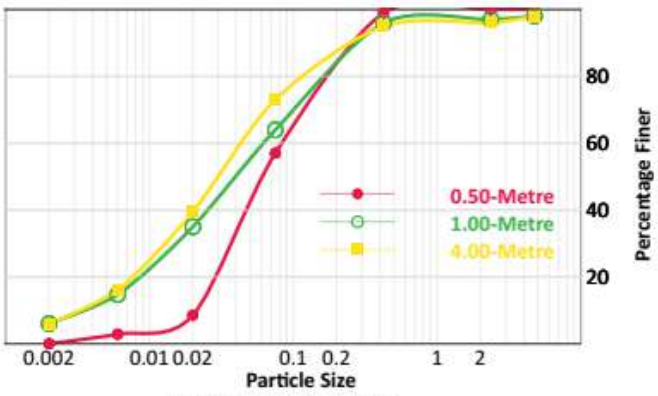
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Silty Sands	SM		20.50	D	37	-	-
Inorganic Silts of low plasticity	ML		22.00	U		-	-
Inorganic clays of low plasticity	CL		23.50	D	30	-	-
			25.00	U		-	-
			26.50	D	38	-	-
Silty Sands	SM		28.00	D		-	-
			29.50	D	44	-	-
			31.00	D		-	-
Inorganic Silts of low plasticity	ML		32.50	D	54	-	-
			34.00	D	50	-	-
			35.50	D	29	-	-
Silty Sands	SM		37.00	D		-	-
			38.50	D	47	-	-
			40.00	D	58	-	-

APPENDIX-D
PLOT 1: GRAIN SIZE DISTRIBUTION PLOTS



APPENDIX-D
PLOT 2: GRAIN SIZE DISTRIBUTION PLOTS

BH- P82-CH.23064.2870



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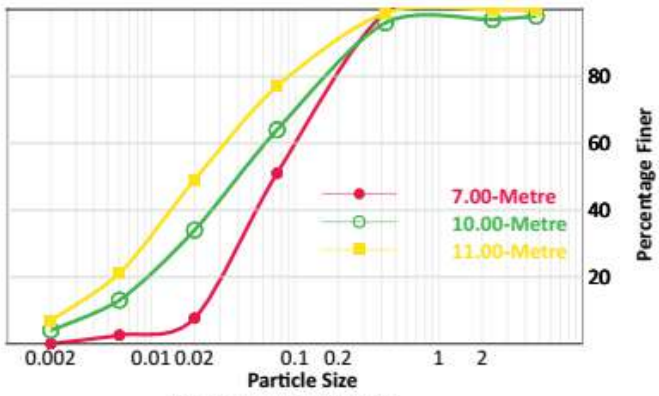
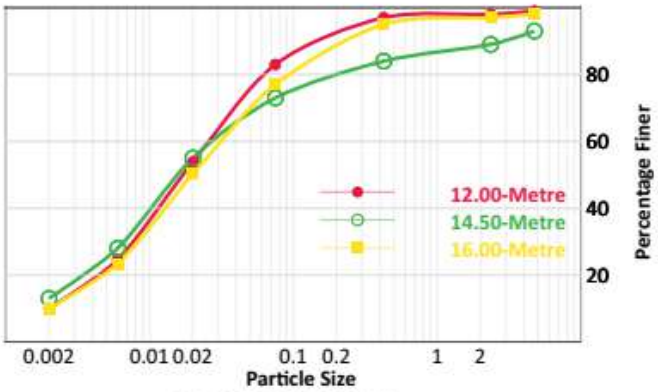
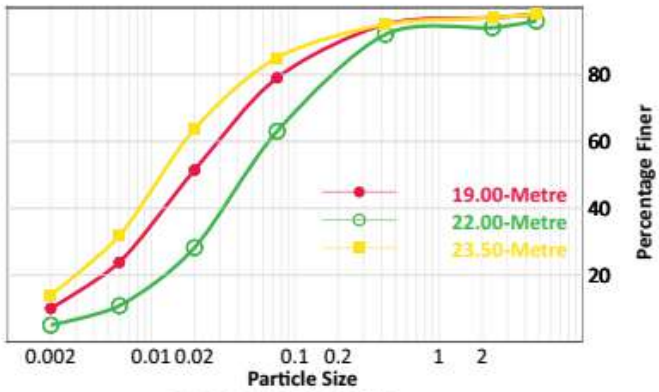


BH- P82-CH.23064.2870



BH- P82-CH.23064.2870



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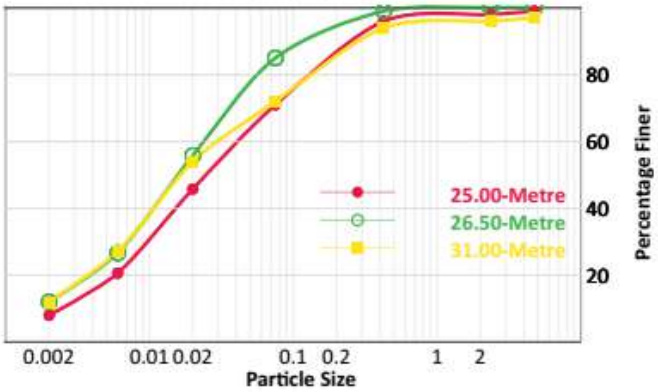

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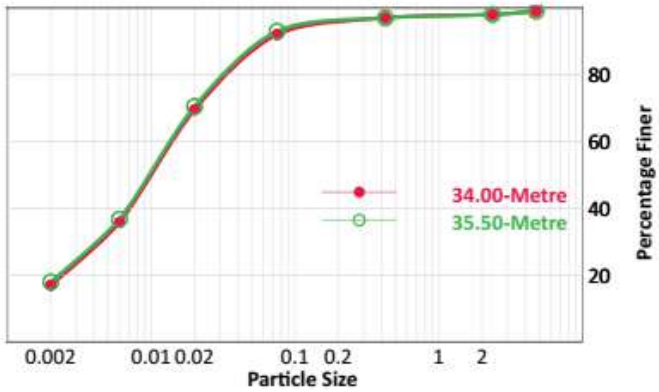
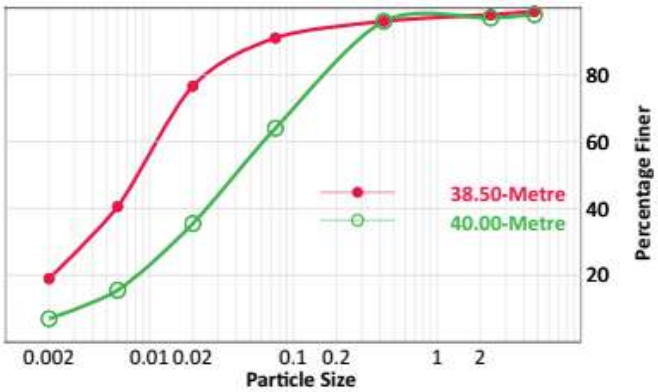
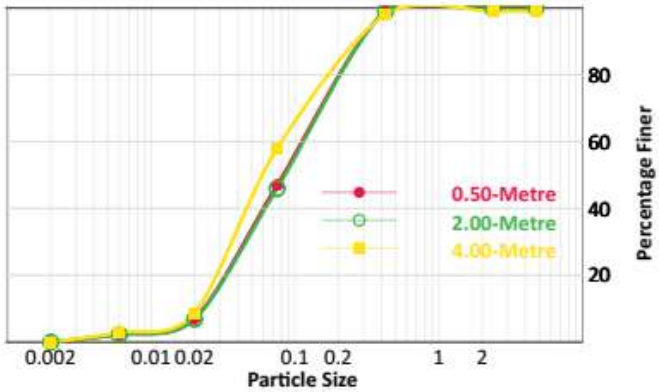


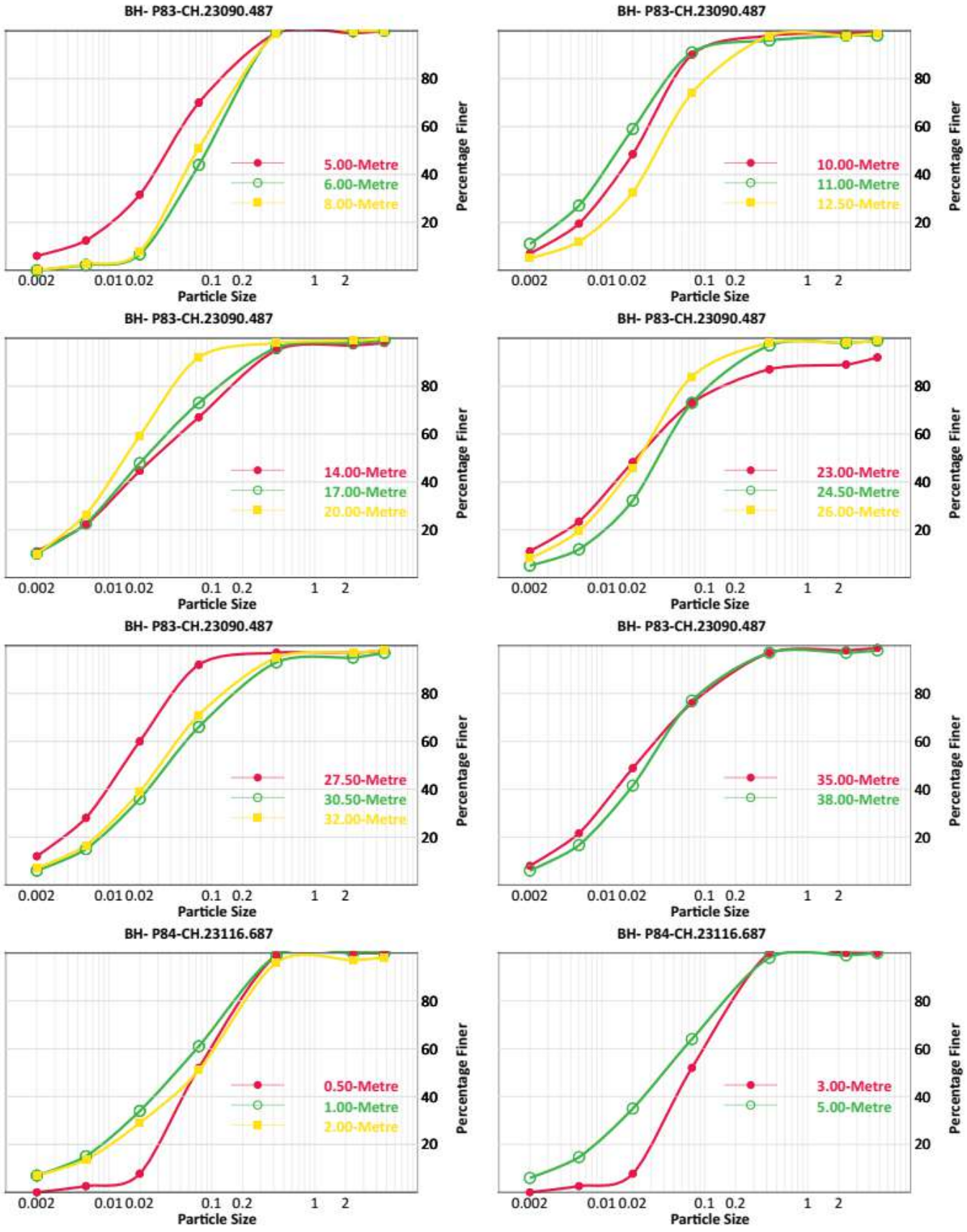
BH- P82-CH.23064.2870



BH- P83-CH.23090.487

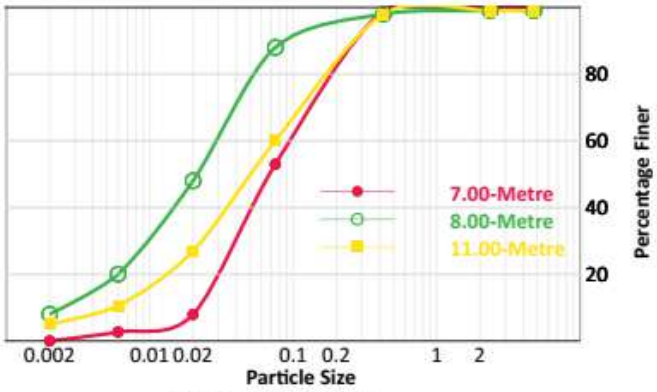


APPENDIX-D
PLOT 3: GRAIN SIZE DISTRIBUTION PLOTS



APPENDIX-D
PLOT 4: GRAIN SIZE DISTRIBUTION PLOTS

BH- P84-CH.23116.687



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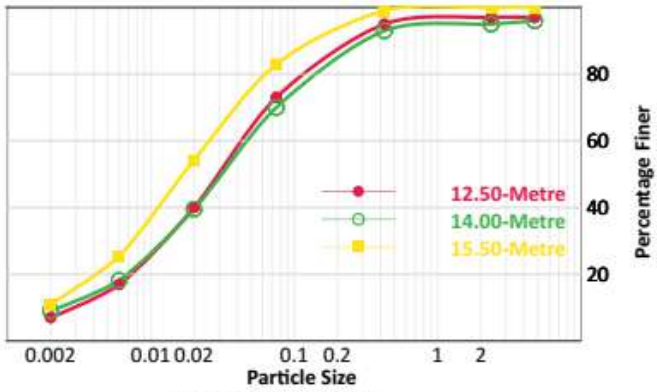

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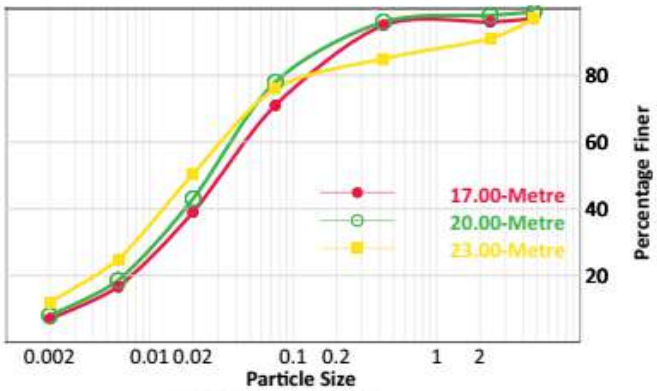
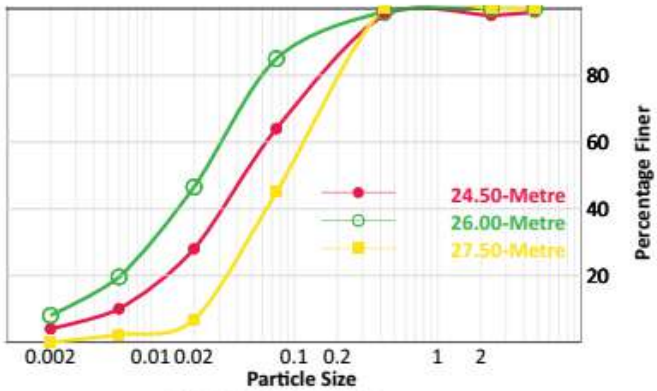
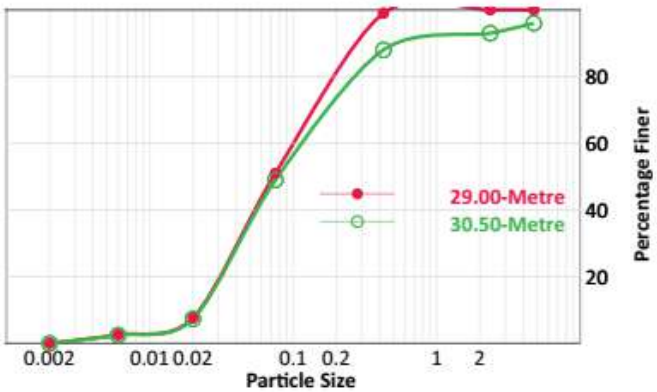


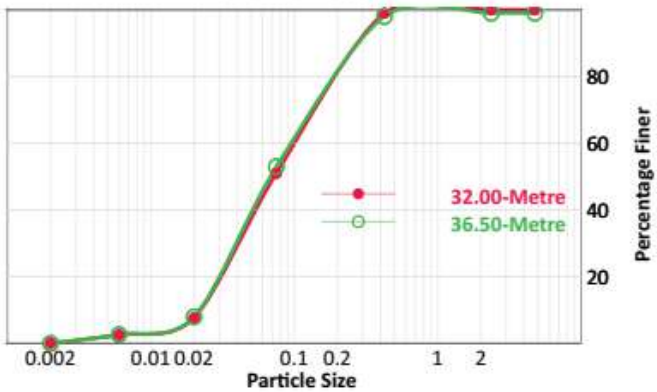
BH- P84-CH.23116.687



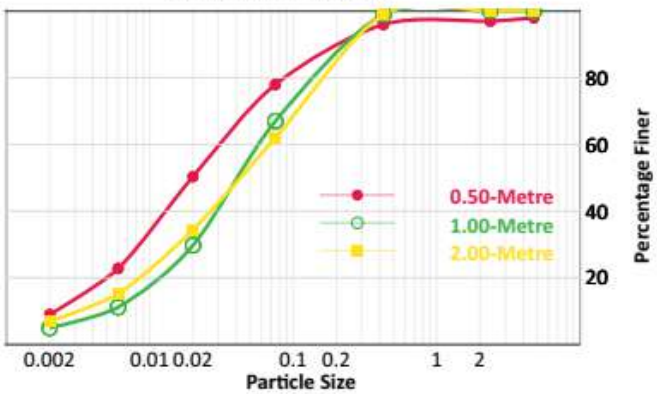
BH- P84-CH.23116.687



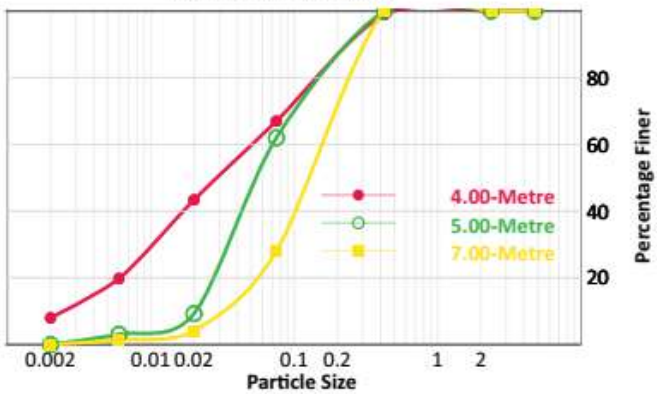
BH- P84-CH.23116.687



BH- P85-CH.23142.8870

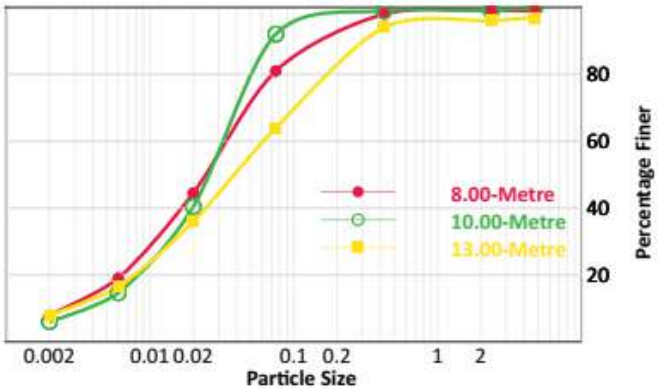


BH- P85-CH.23142.8870

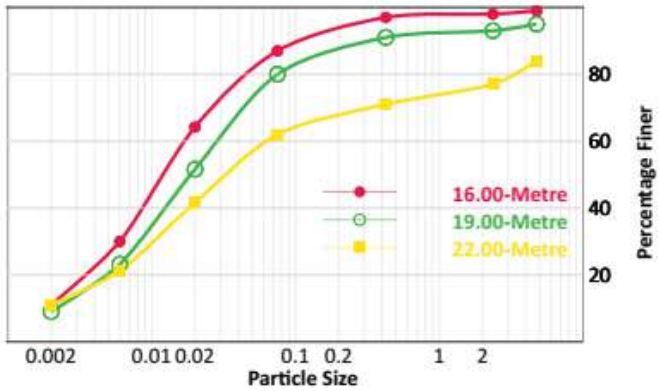


APPENDIX-D
PLOT 5: GRAIN SIZE DISTRIBUTION PLOTS

BH- P85-CH.23142.8870



BH- P85-CH.23142.8870



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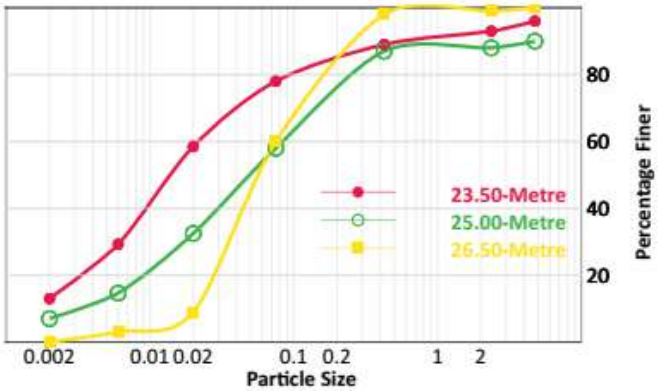
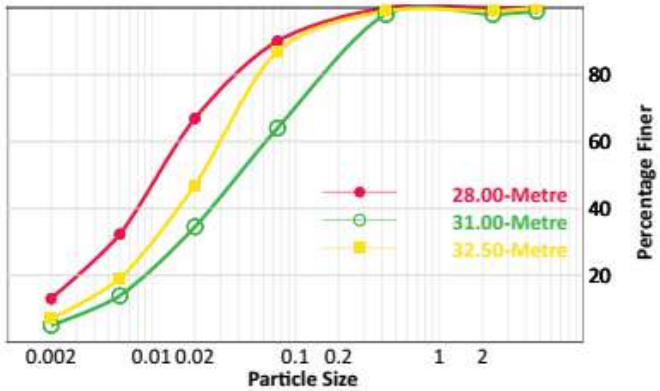
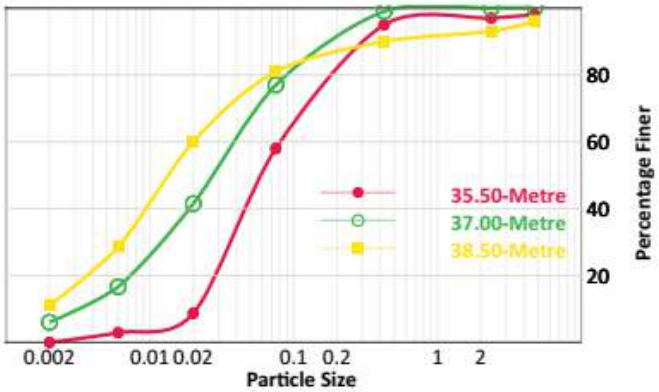


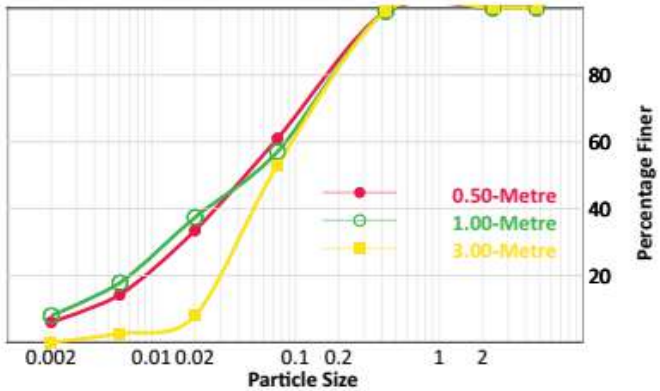
BH- P85-CH.23142.8870



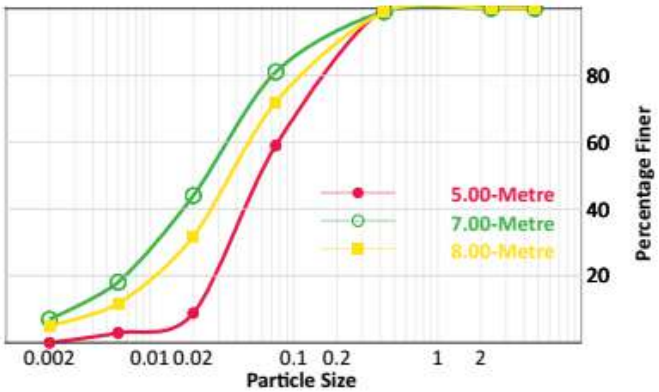
BH- P85-CH.23142.8870



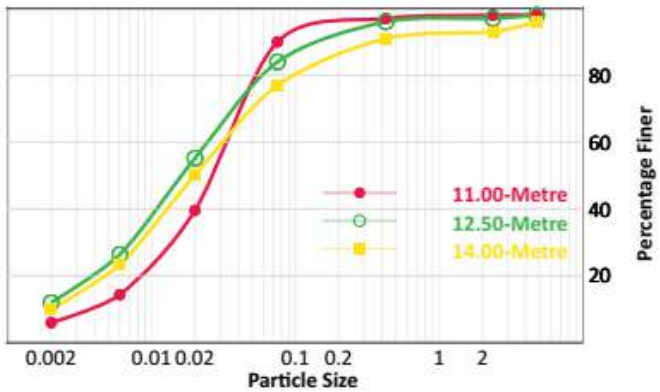
BH- P86-CH.23169.087



BH- P86-CH.23169.087

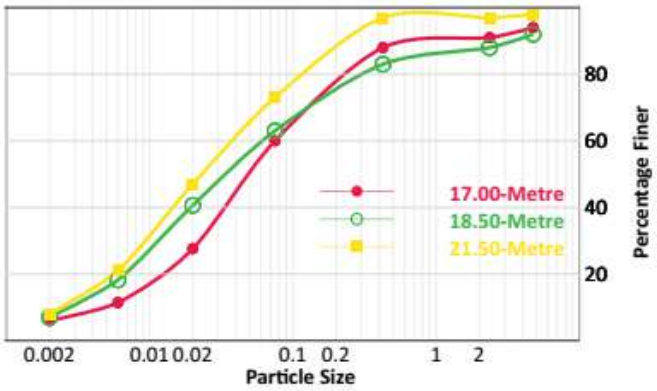


BH- P86-CH.23169.087

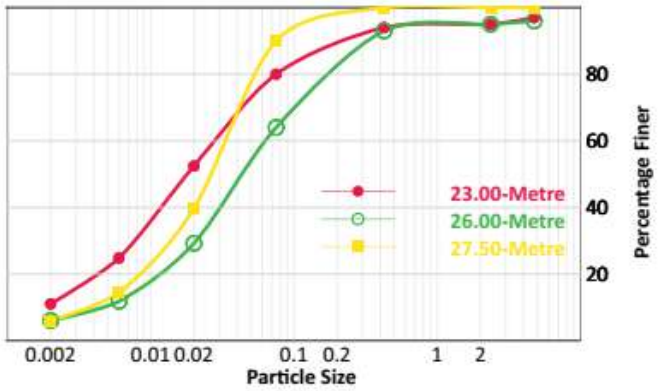


APPENDIX-D
PLOT 6: GRAIN SIZE DISTRIBUTION PLOTS

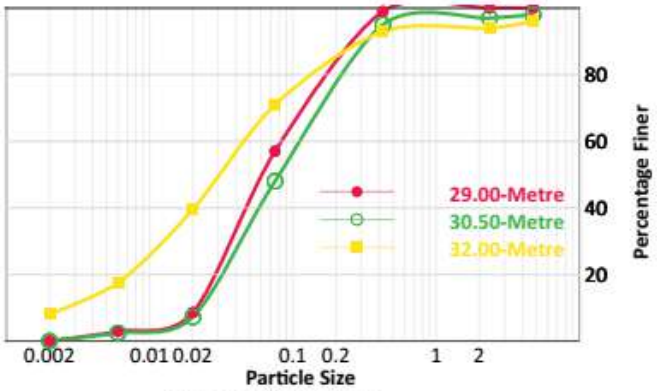
BH- P86-CH.23169.087



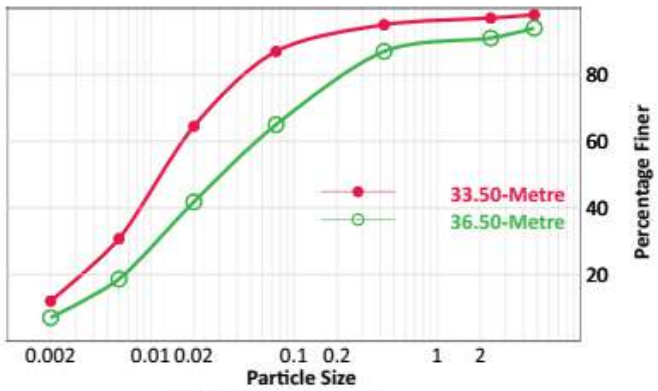
BH- P86-CH.23169.087



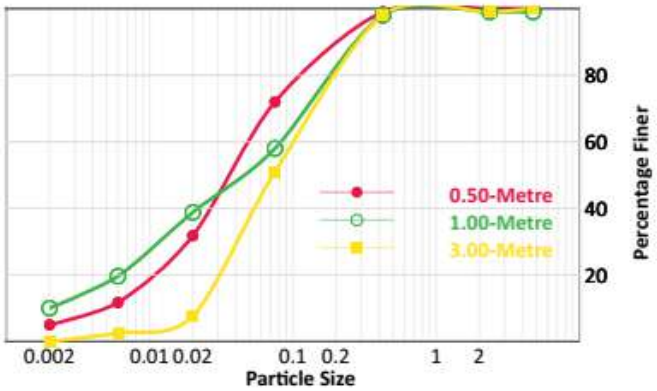
BH- P86-CH.23169.087



BH- P86-CH.23169.087



BH- P87-CH.23195.287



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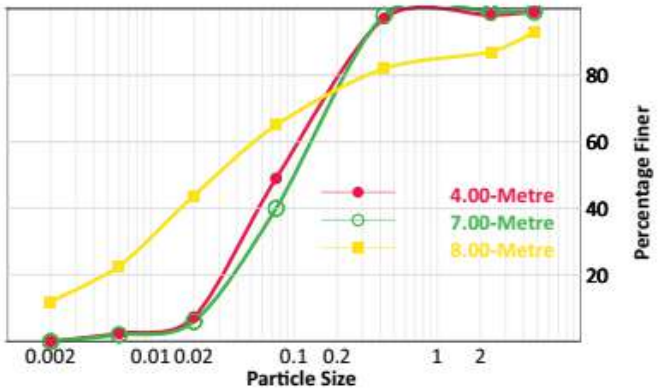

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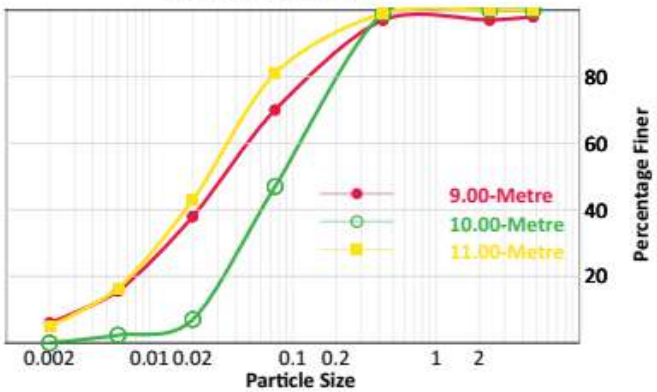

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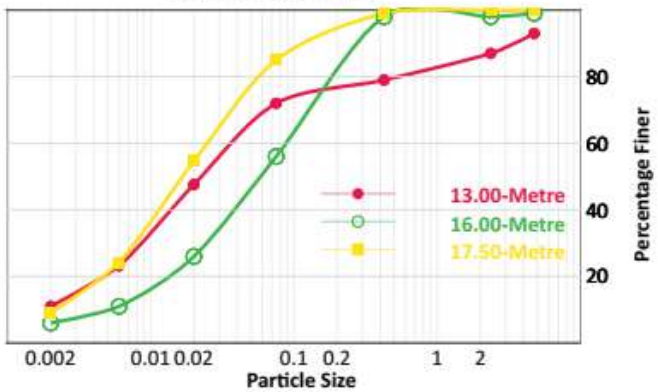
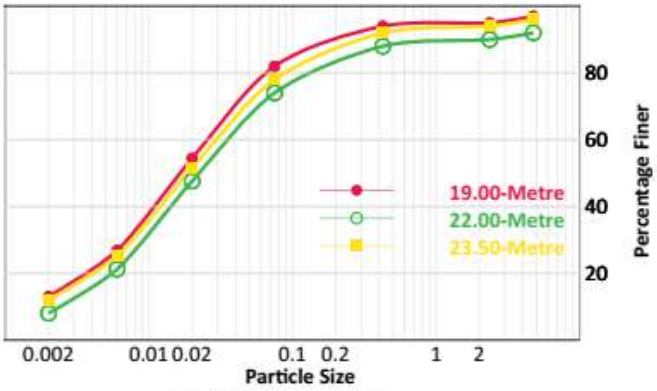


APPENDIX-D
PLOT 7: GRAIN SIZE DISTRIBUTION PLOTS

BH- P87-CH.23195.287



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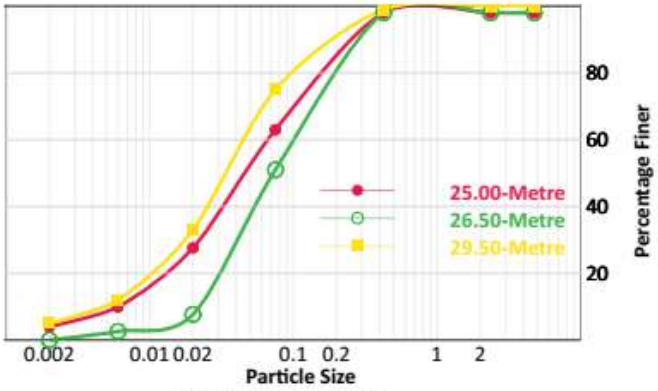

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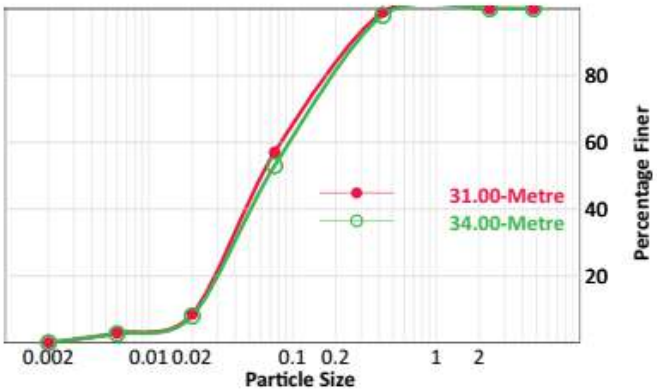
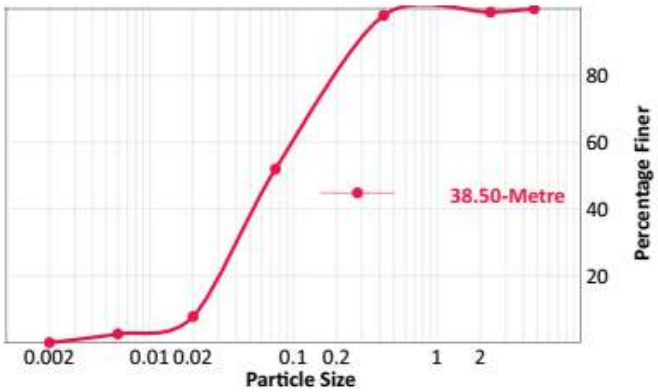
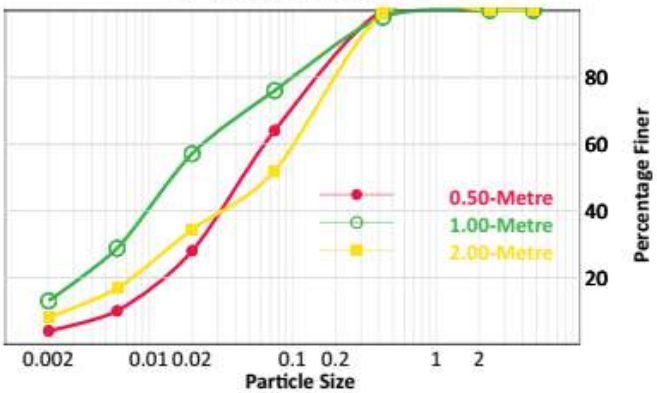


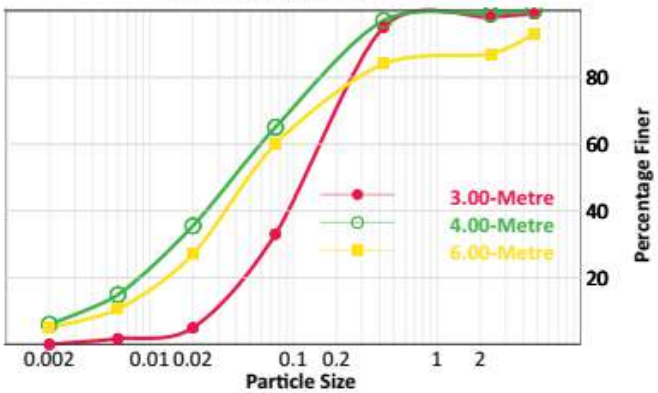
BH- P87-CH.23195.287



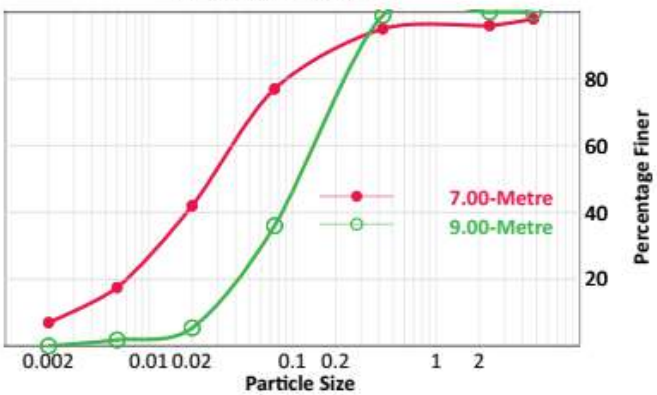
BH- P88-CH.23211.4870



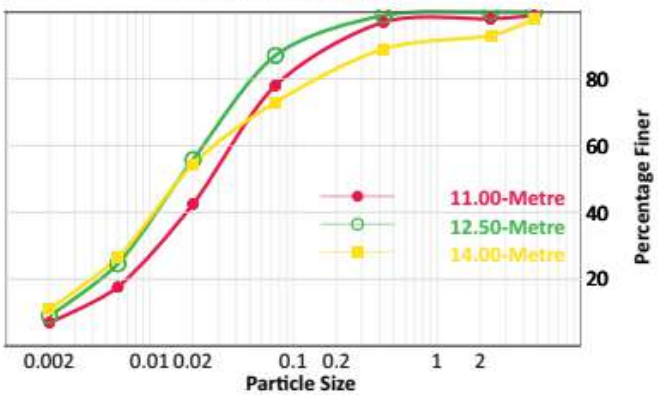
BH- P88-CH.23211.4870



BH- P88-CH.23211.4870

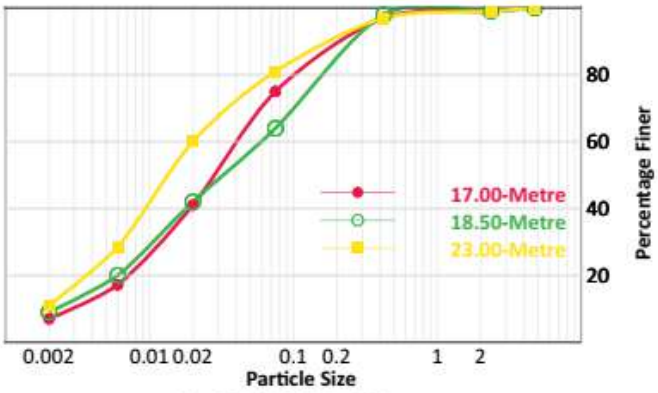


BH- P88-CH.23211.4870

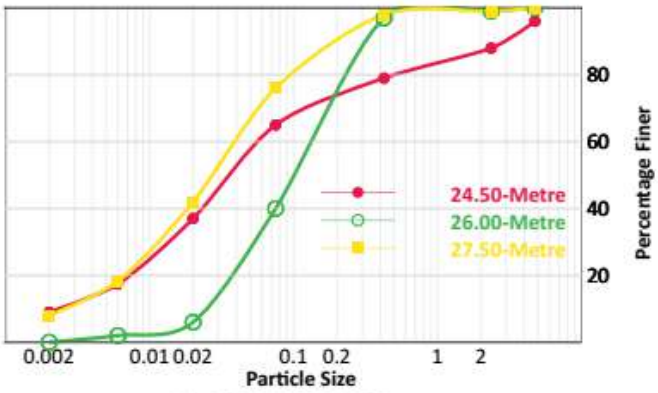


APPENDIX-D
PLOT 8: GRAIN SIZE DISTRIBUTION PLOTS

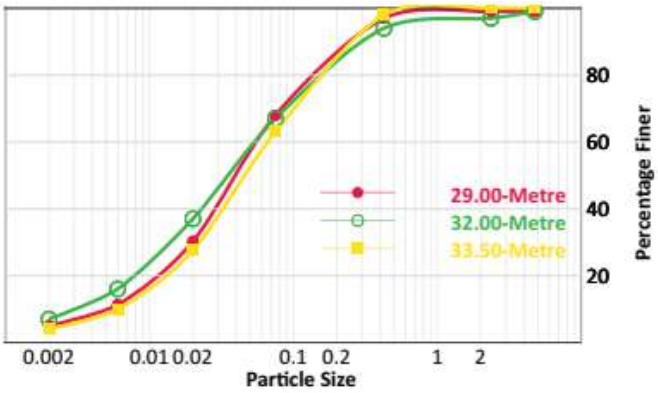
BH- P88-CH.23211.4870



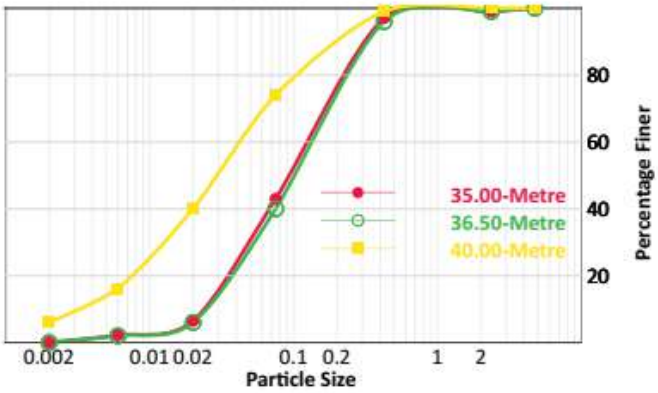
BH- P88-CH.23211.4870



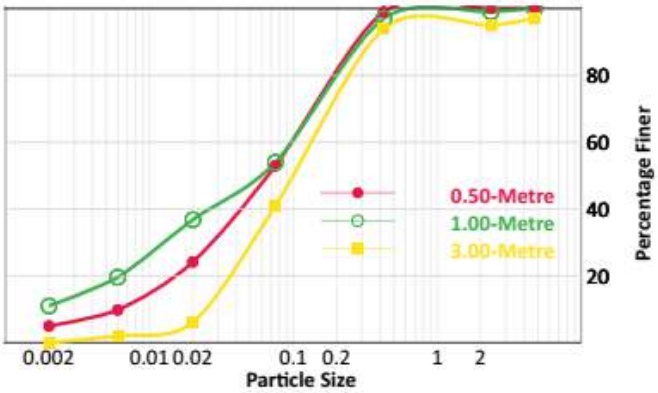
BH- P88-CH.23211.4870



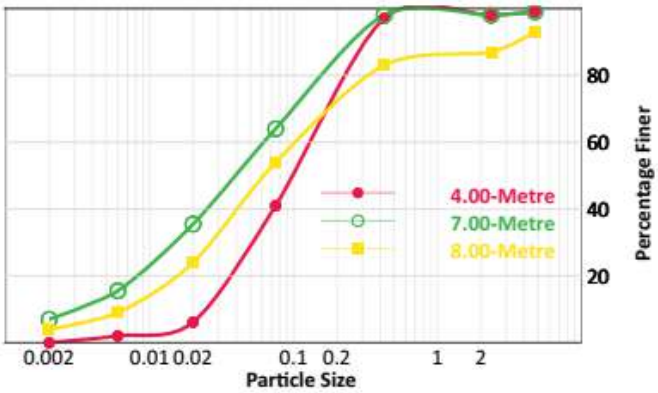
BH- P88-CH.23211.4870



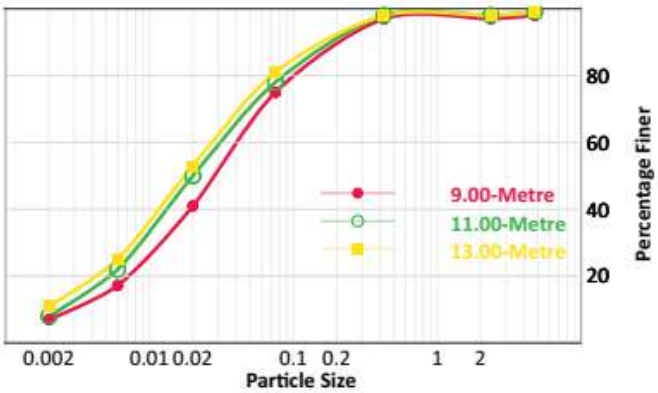
BH- P89-CH.23247.687



BH- P89-CH.23247.687



BH- P89-CH.23247.687



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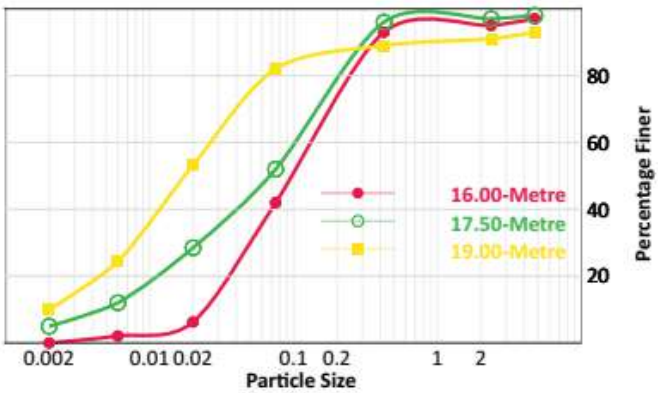
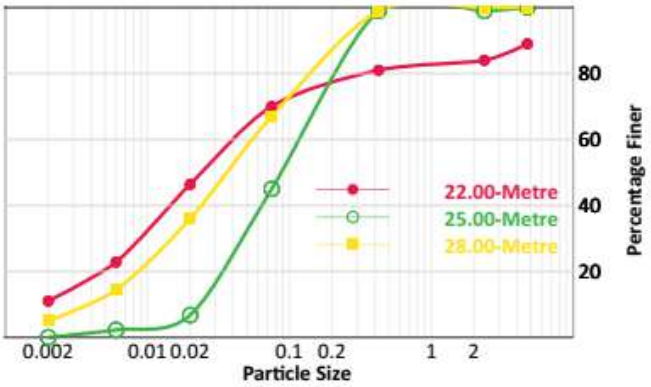


APPENDIX-D
PLOT 9: GRAIN SIZE DISTRIBUTION PLOTS

BH- P89-CH.23247.687



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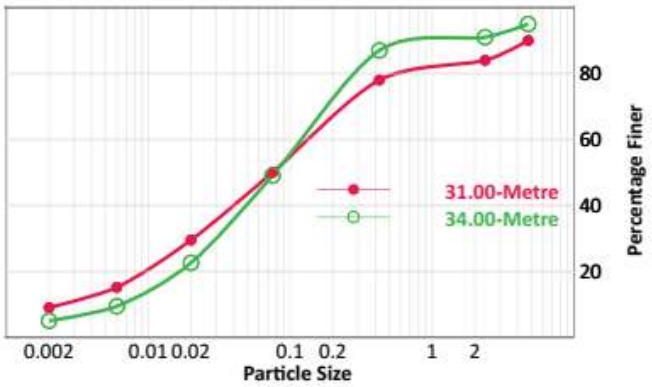

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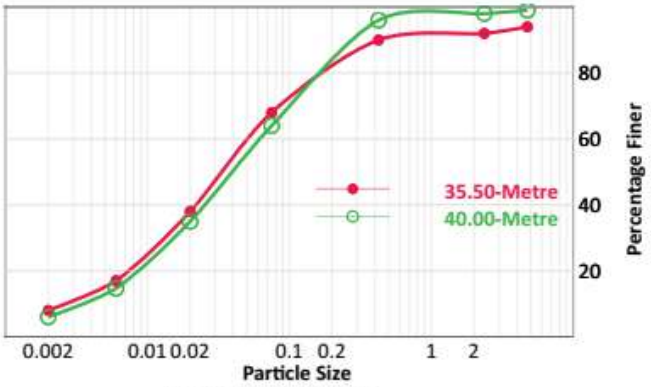
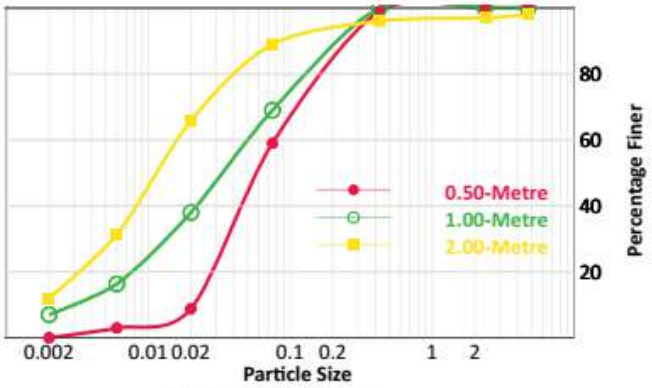
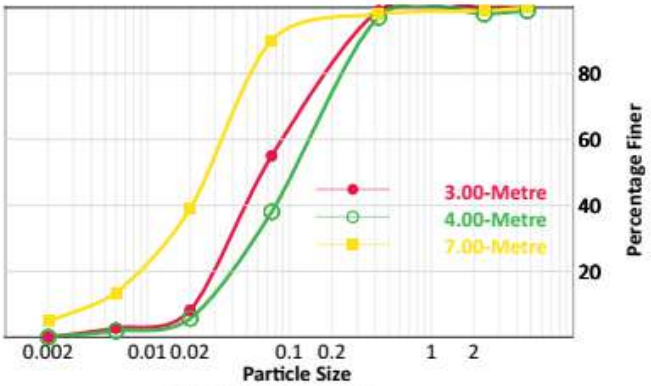


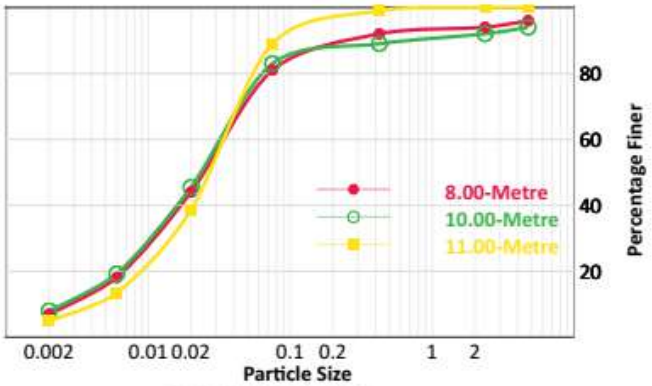
BH- P90-CH.23273.887



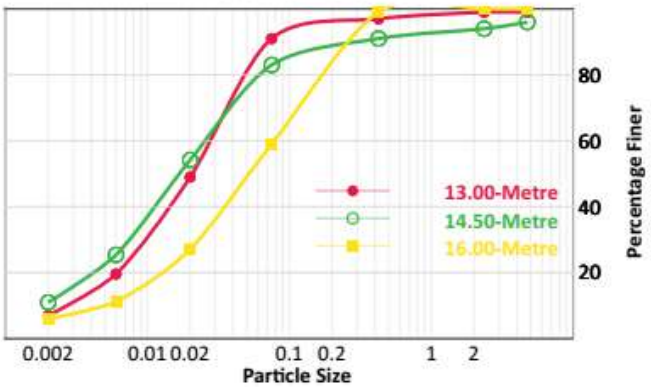
BH- P90-CH.23273.887



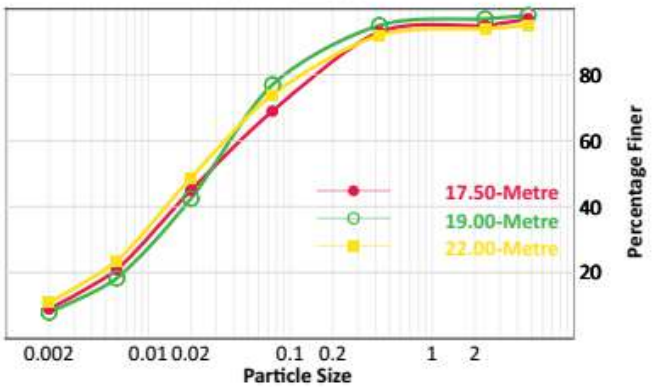
BH- P90-CH.23273.887



BH- P90-CH.23273.887

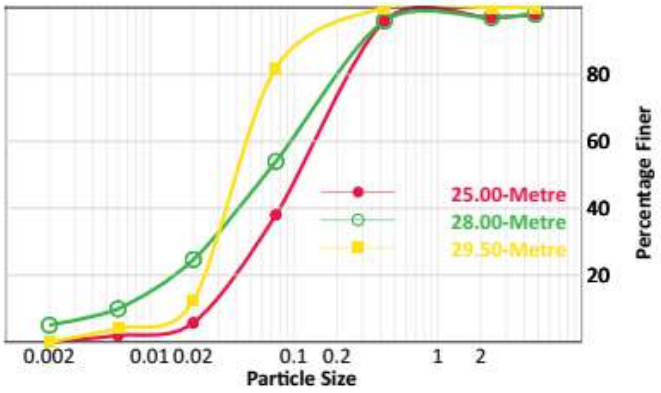


BH- P90-CH.23273.887

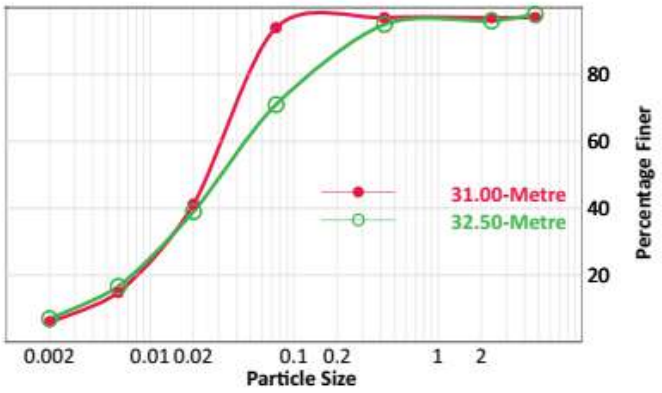


APPENDIX-D
PLOT 10: GRAIN SIZE DISTRIBUTION PLOTS

BH- P90-CH.23273.887



BH- P90-CH.23273.887



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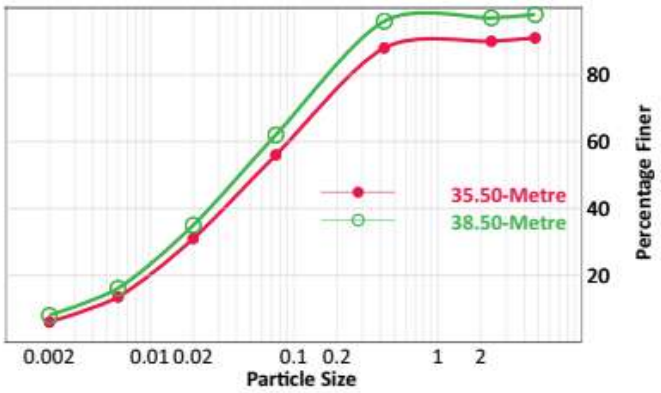
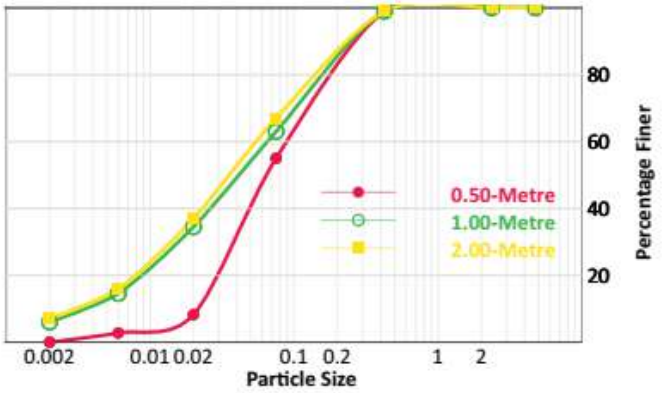
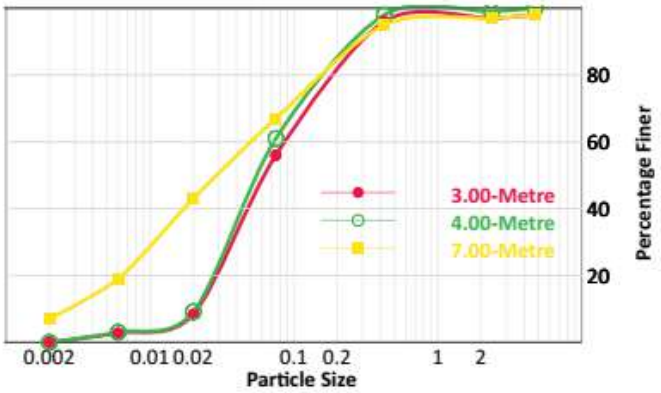


BH- P91-CH.23300.0870



BH- P91-CH.23300.0870



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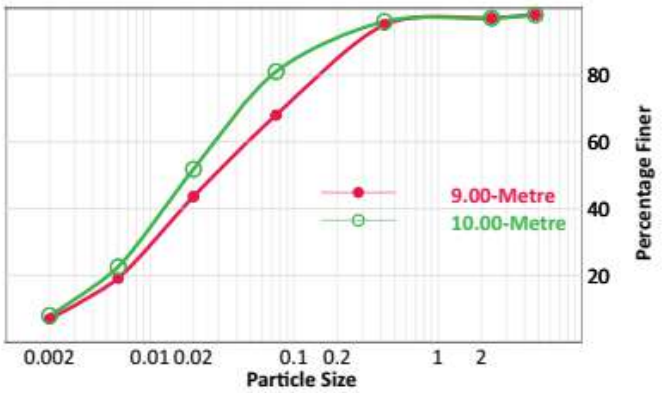
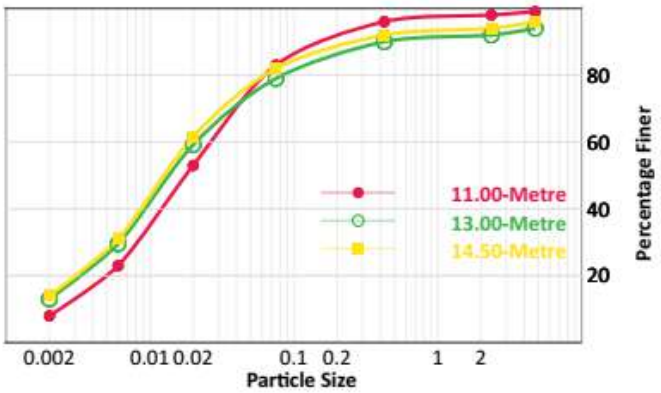
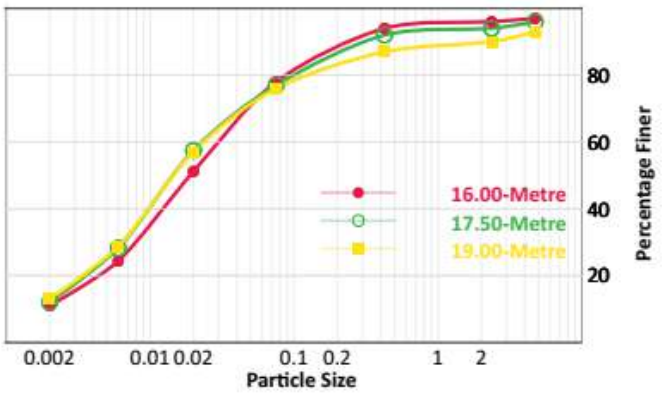


BH- P91-CH.23300.0870

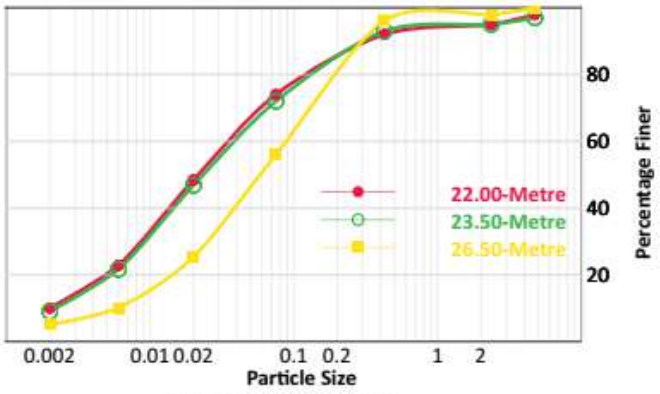


BH- P91-CH.23300.0870

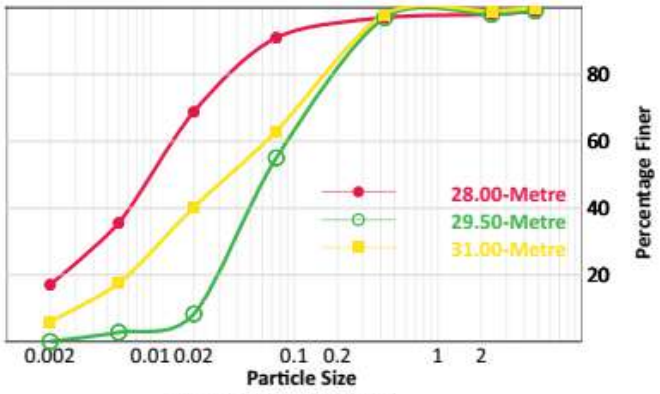


APPENDIX-D
PLOT 11: GRAIN SIZE DISTRIBUTION PLOTS

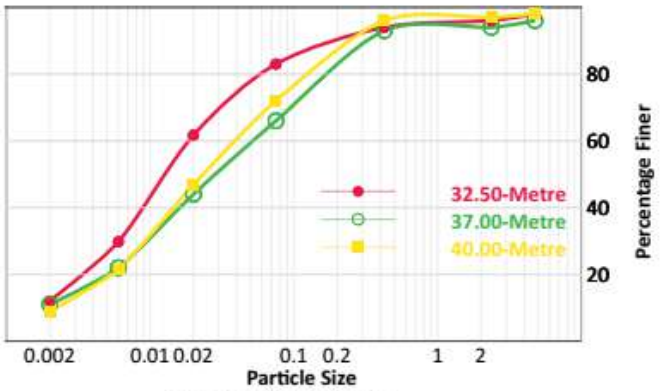
BH- P91-CH.23300.0870



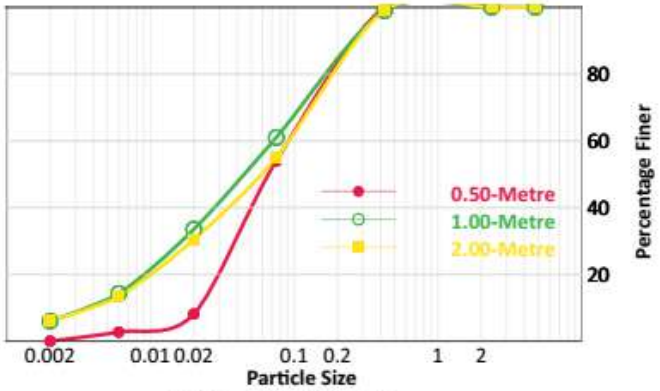
BH- P91-CH.23300.0870



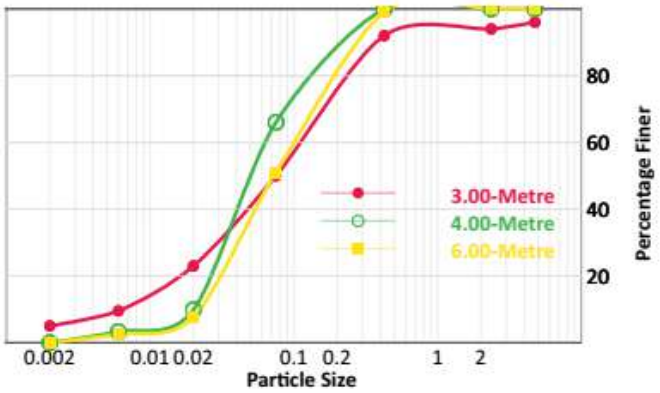
BH- P91-CH.23300.0870



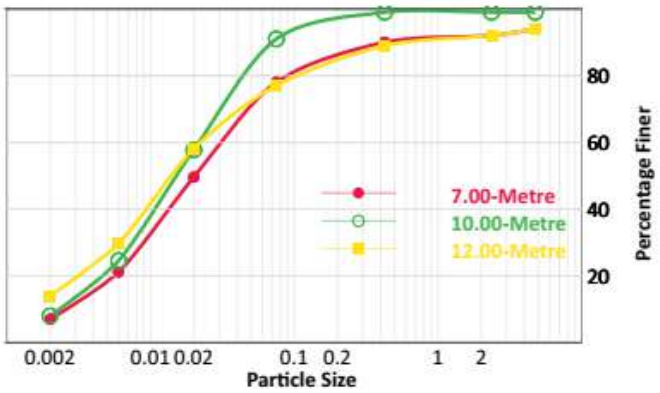
BH- P92-CH.23326.2870



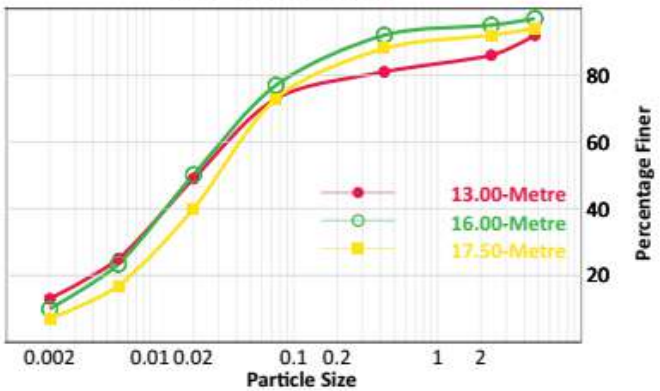
BH- P92-CH.23326.2870



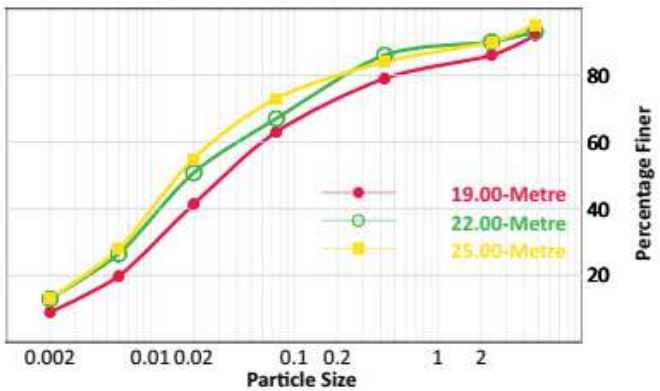
BH- P92-CH.23326.2870



BH- P92-CH.23326.2870

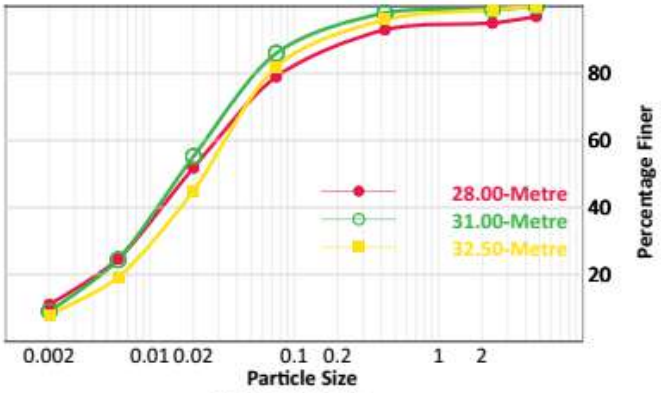


BH- P92-CH.23326.2870

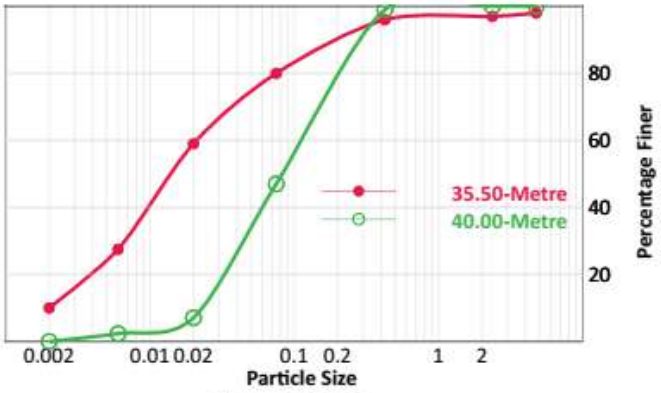


APPENDIX-D
PLOT 12: GRAIN SIZE DISTRIBUTION PLOTS

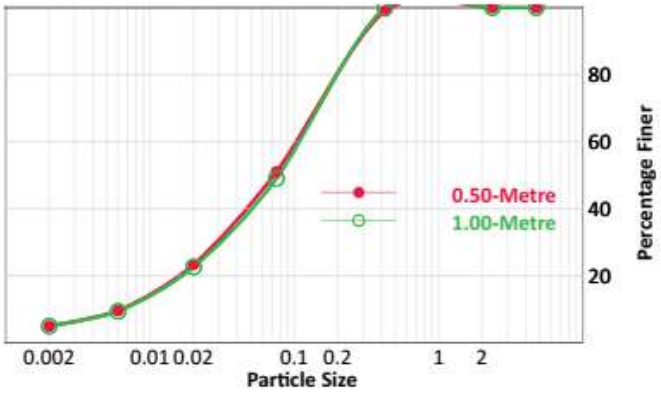
BH- P92-CH.23326.2870



BH- P92-CH.23326.2870



BH-P93-23352.487



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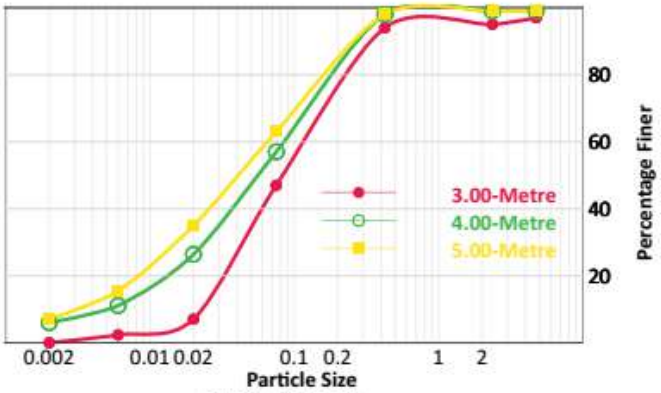

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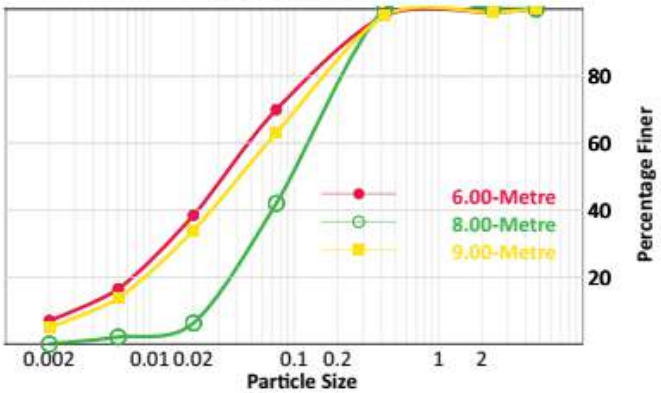

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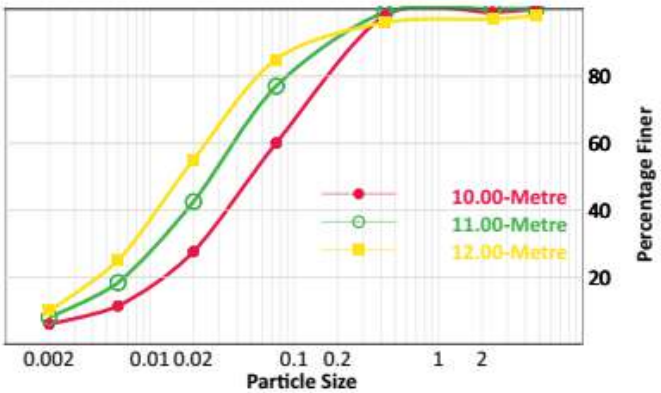

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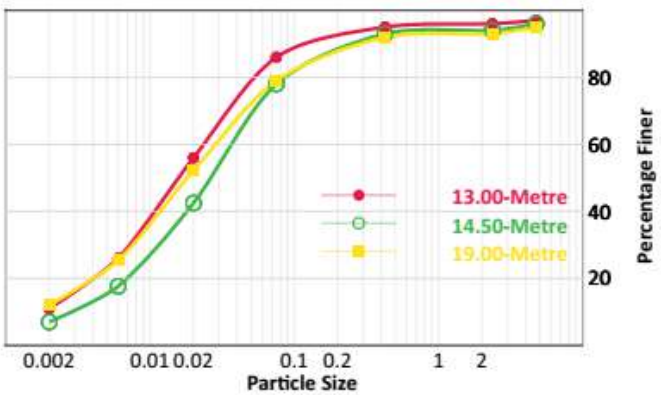

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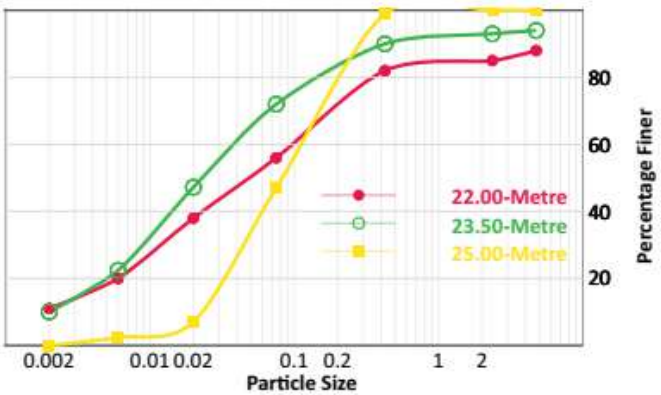
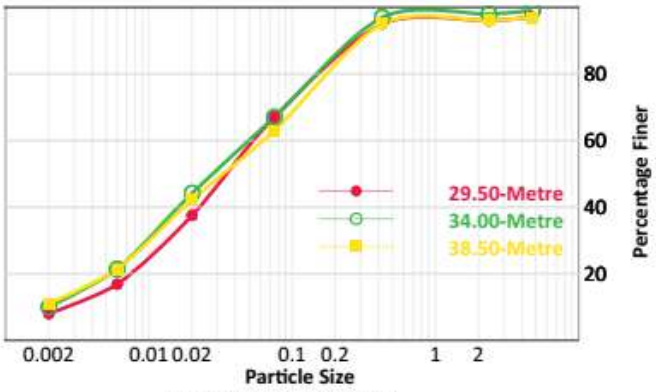
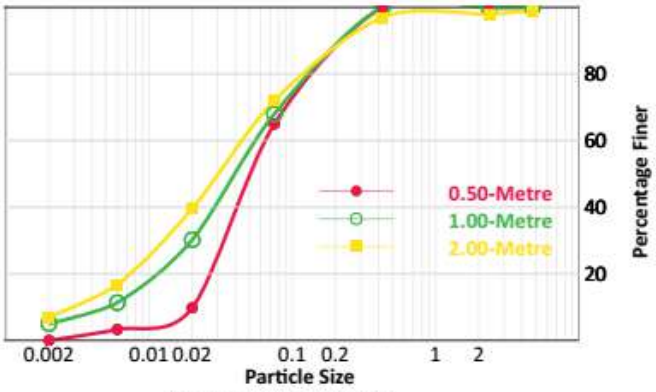


APPENDIX-D
PLOT 13: GRAIN SIZE DISTRIBUTION PLOTS

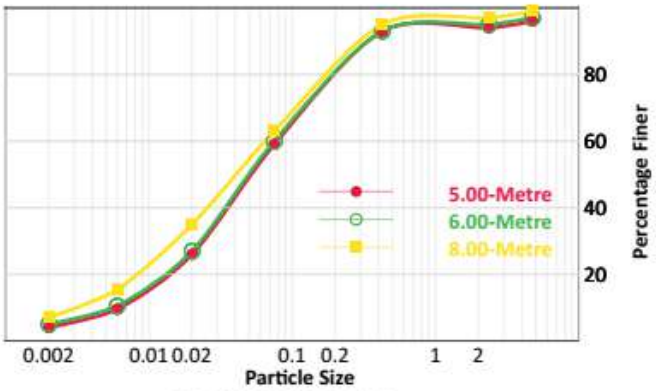
BH-P93-23352.487



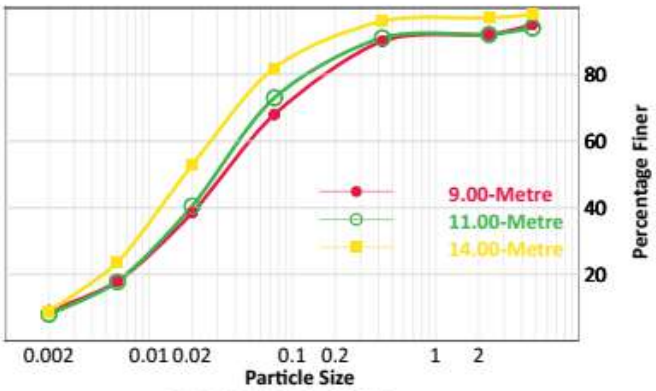
BH- P94-CH.23378.6870



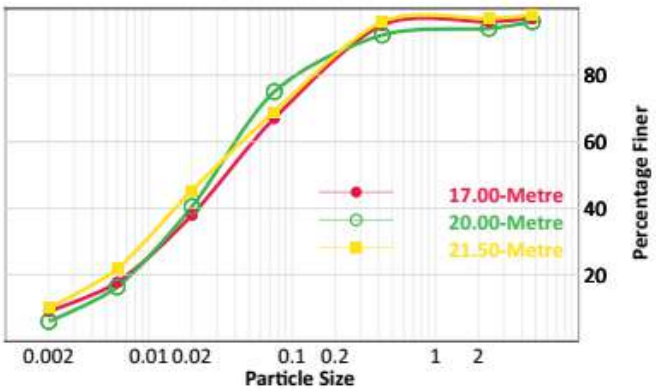
BH- P94-CH.23378.6870



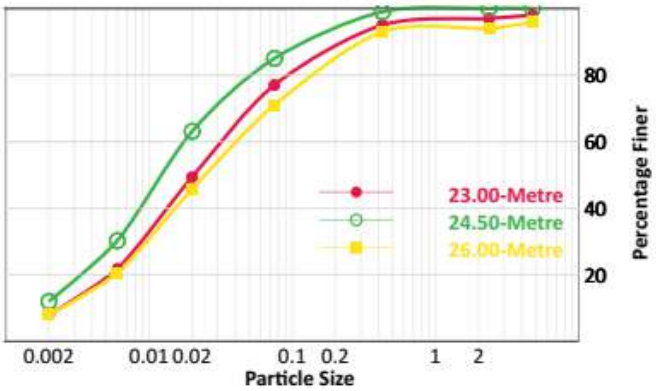
BH- P94-CH.23378.6870



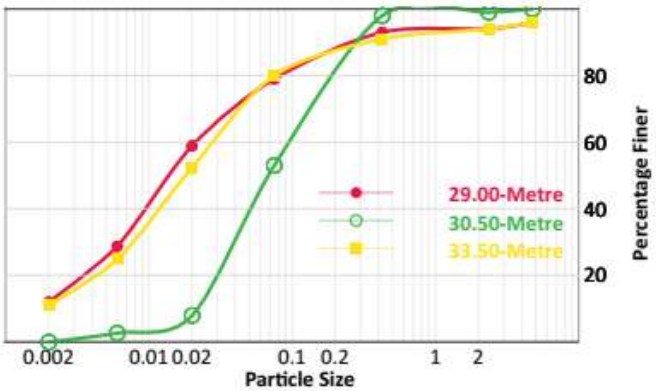
BH- P94-CH.23378.6870



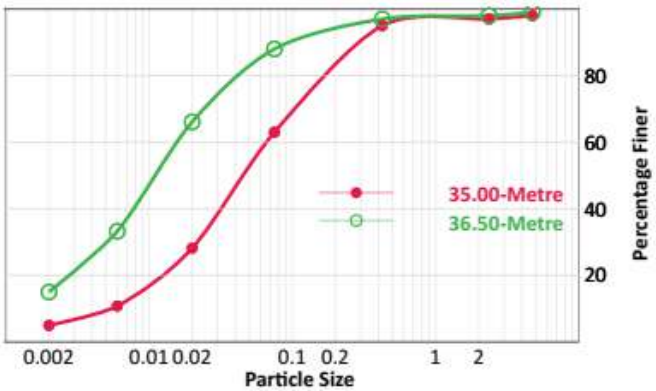
BH- P94-CH.23378.6870



BH- P94-CH.23378.6870

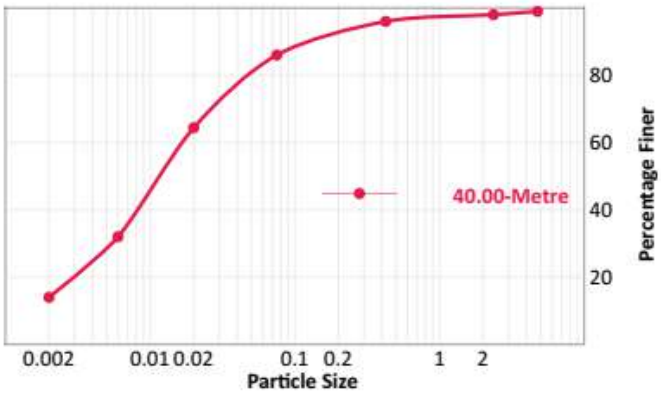


BH- P94-CH.23378.6870

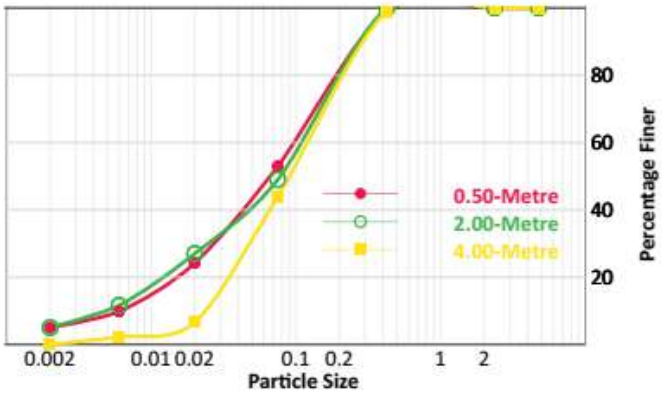


APPENDIX-D
PLOT 14: GRAIN SIZE DISTRIBUTION PLOTS

BH- P94-CH.23378.6870



BH- P95-CH.23404.887



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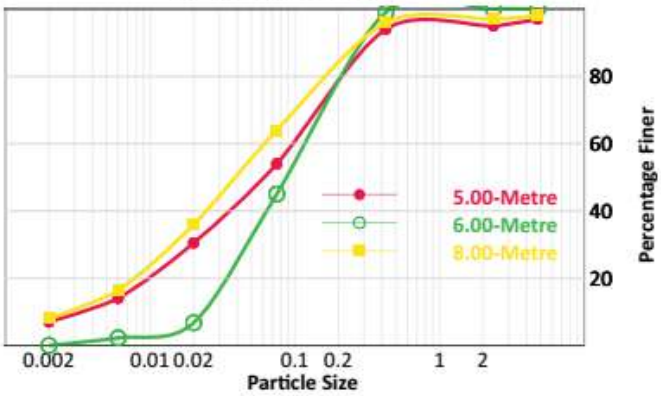

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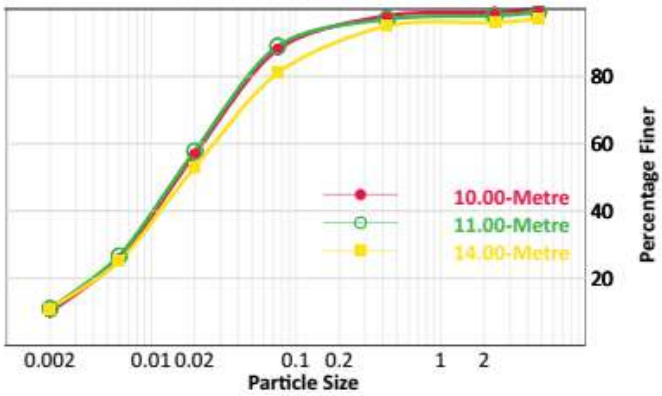
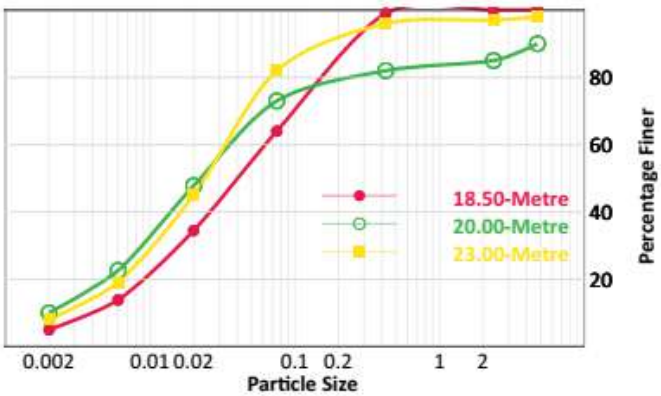
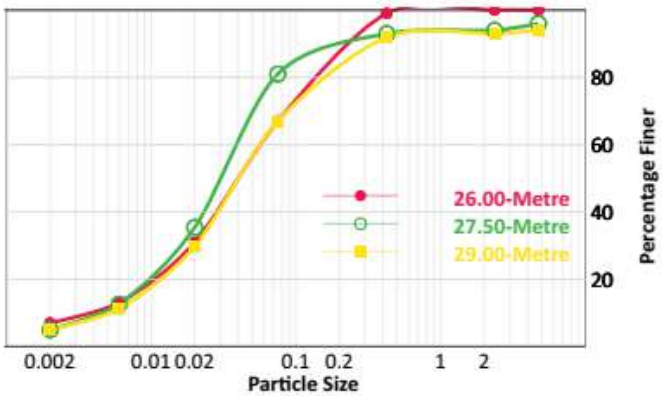


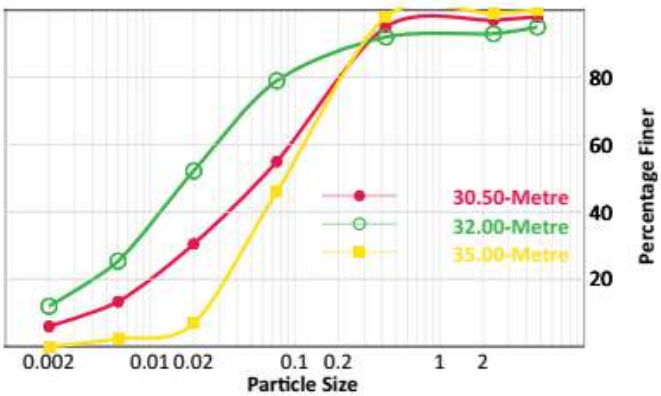
BH- P95-CH.23404.887



BH- P95-CH.23404.887



BH- P95-CH.23404.887



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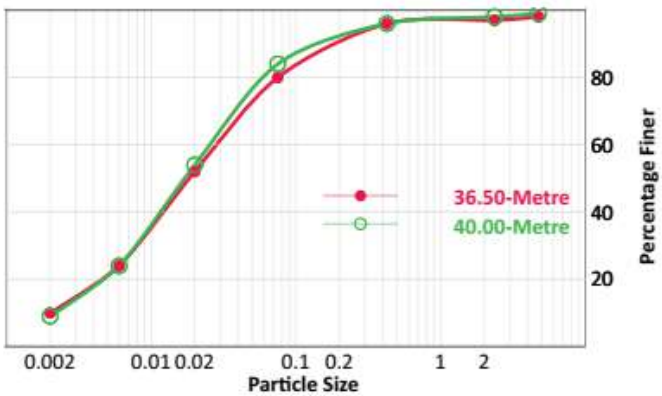
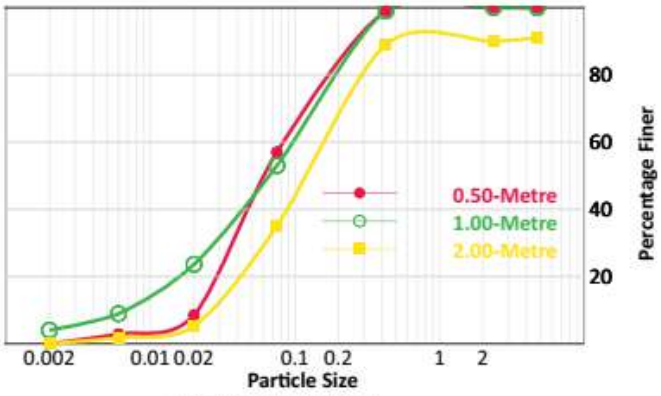


APPENDIX-D
PLOT 15: GRAIN SIZE DISTRIBUTION PLOTS

BH- P96-CH.23431.087



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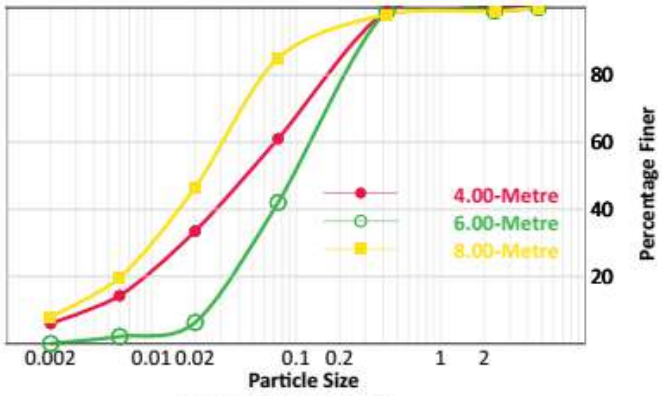

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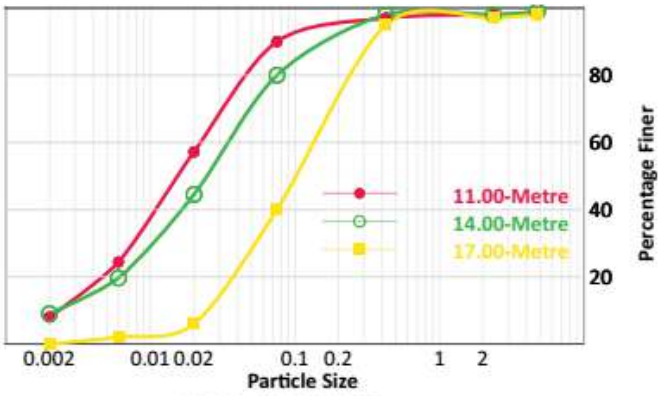
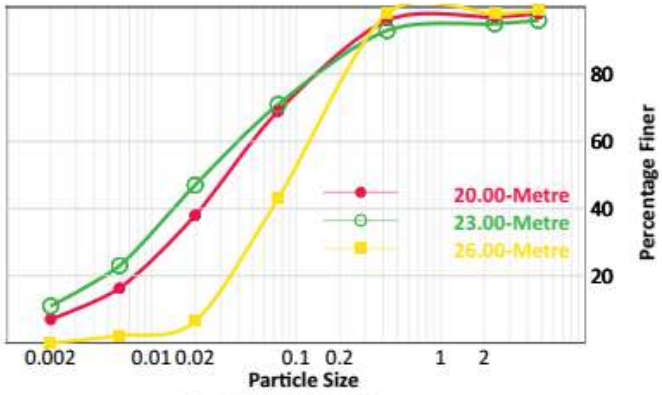
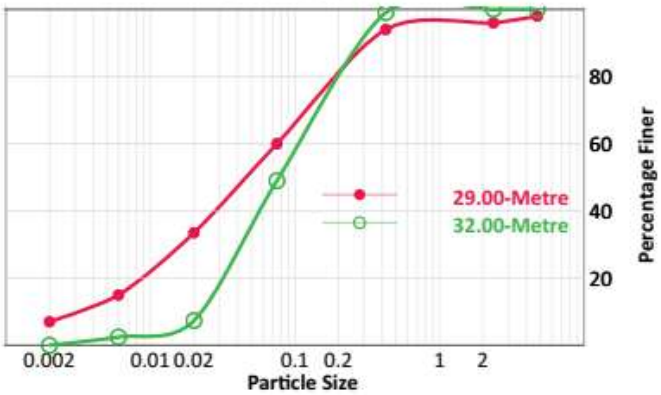


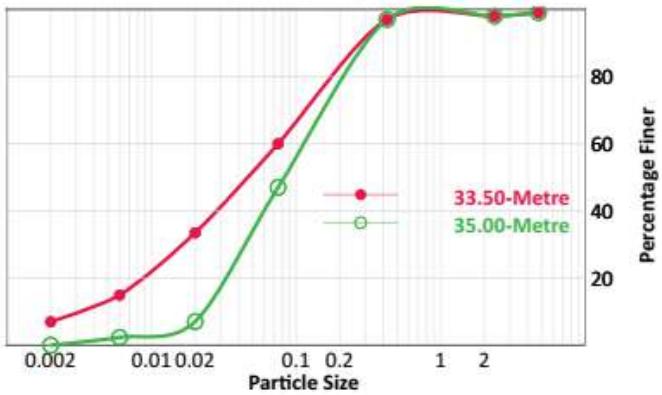
BH- P96-CH.23431.087



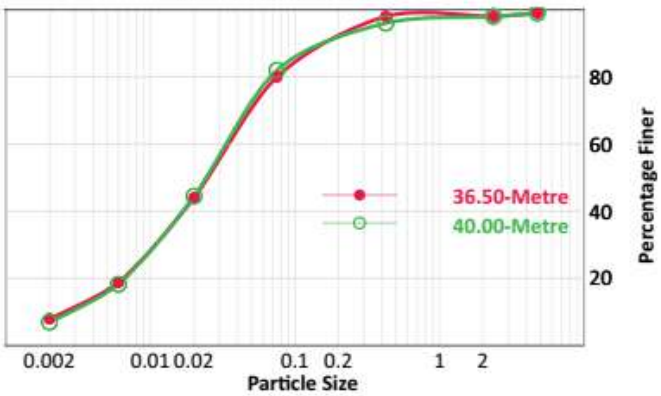
BH- P96-CH.23431.087



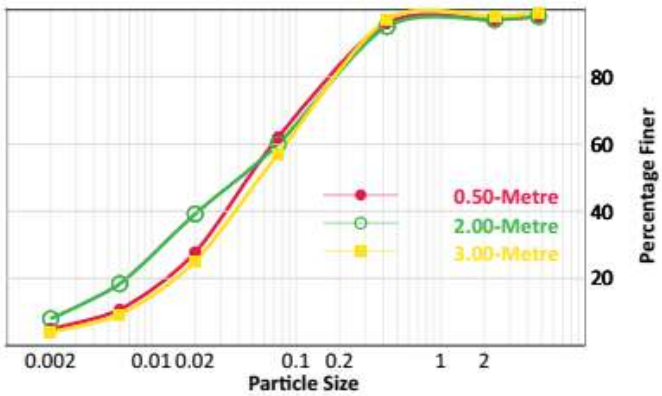
BH- P96-CH.23431.087



BH- P96-CH.23431.087

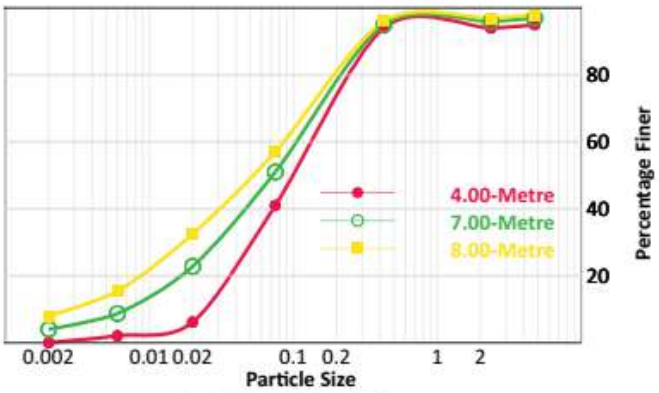


BH- P97-CH.23457.2870

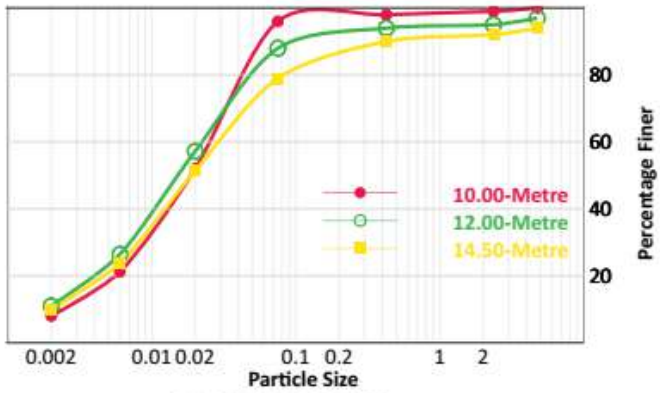


APPENDIX-D
PLOT 16: GRAIN SIZE DISTRIBUTION PLOTS

BH- P97-CH.23457.2870



BH- P97-CH.23457.2870



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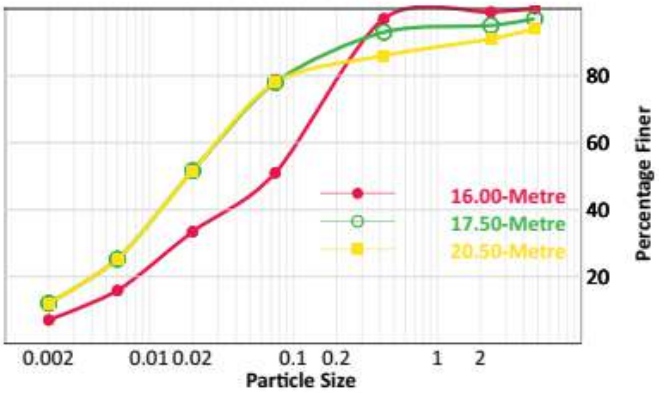
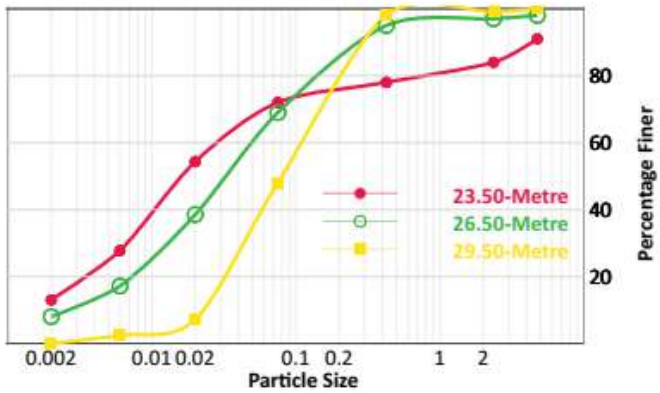
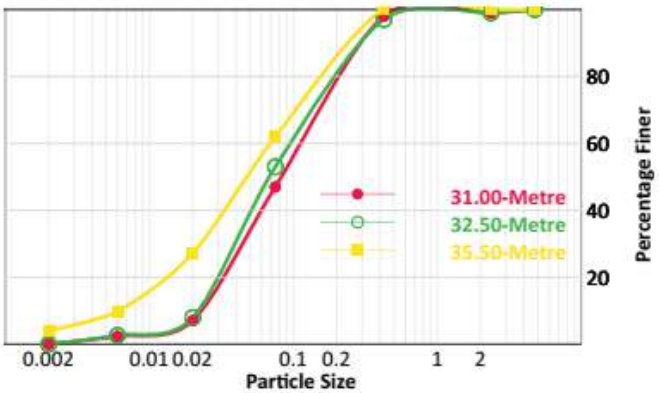


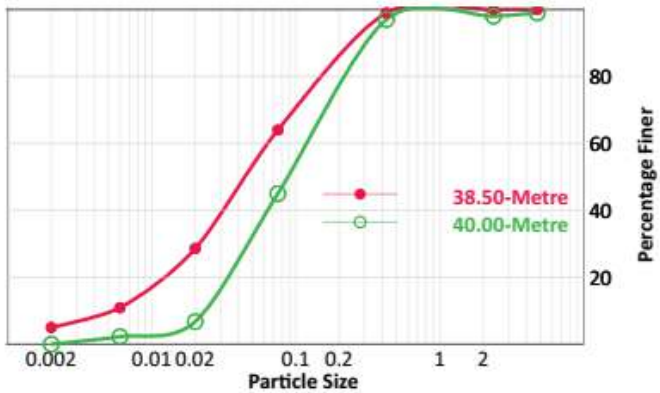
BH- P97-CH.23457.2870



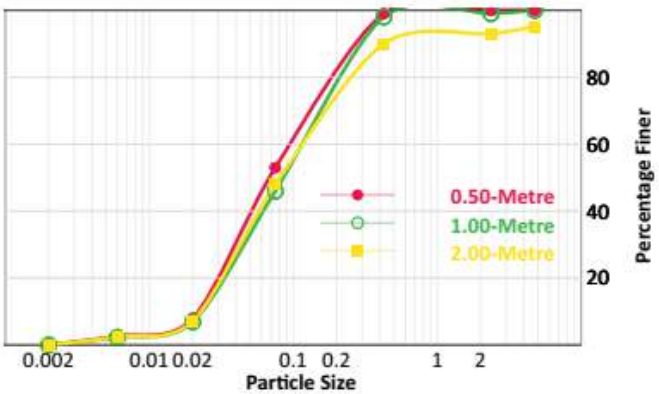
BH- P97-CH.23457.2870



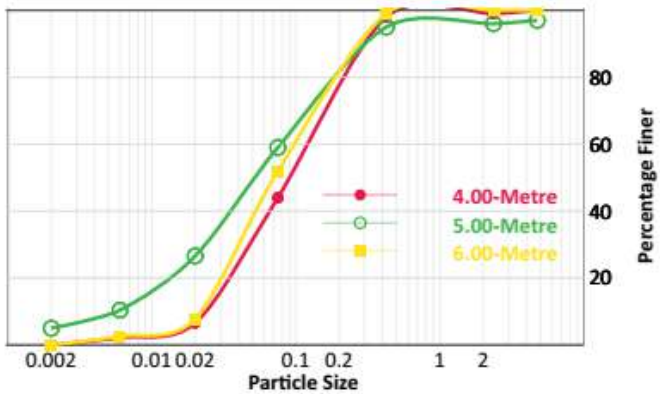
BH- P97-CH.23457.2870



BH- P98-CH.23483.487

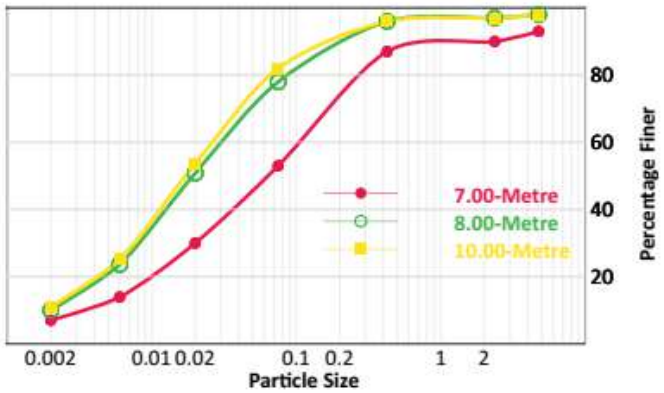


BH- P98-CH.23483.487

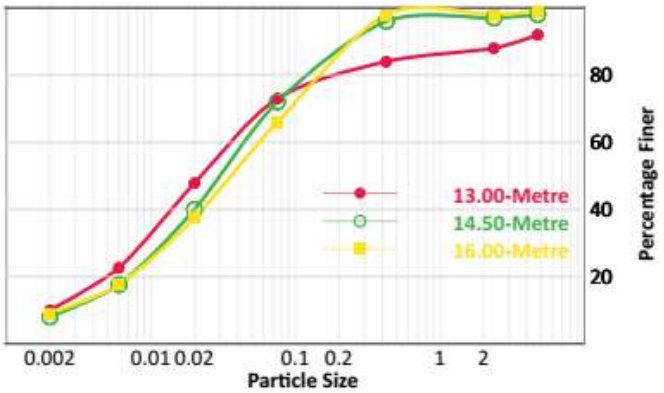


APPENDIX-D
PLOT 17: GRAIN SIZE DISTRIBUTION PLOTS

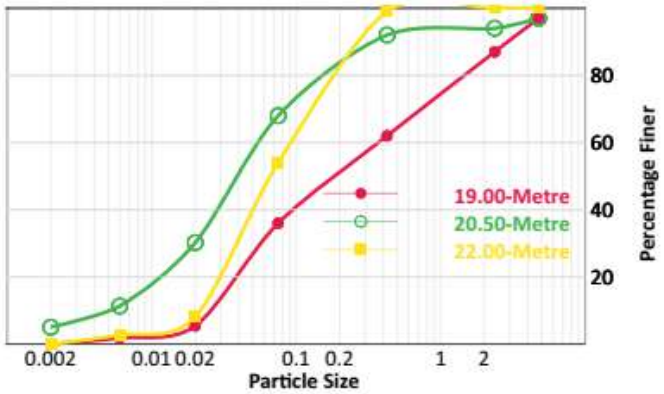
BH- P98-CH.23483.487



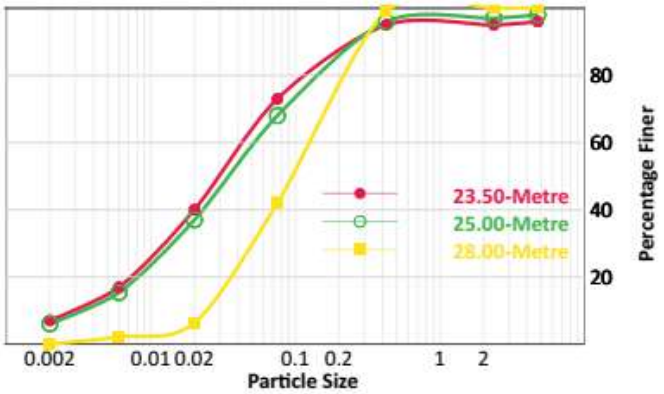
BH- P98-CH.23483.487



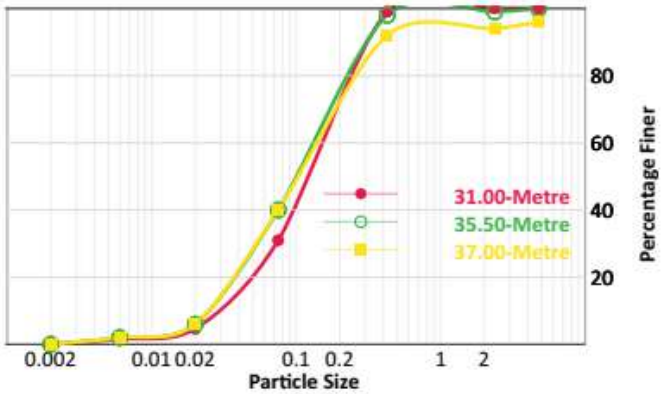
BH- P98-CH.23483.487



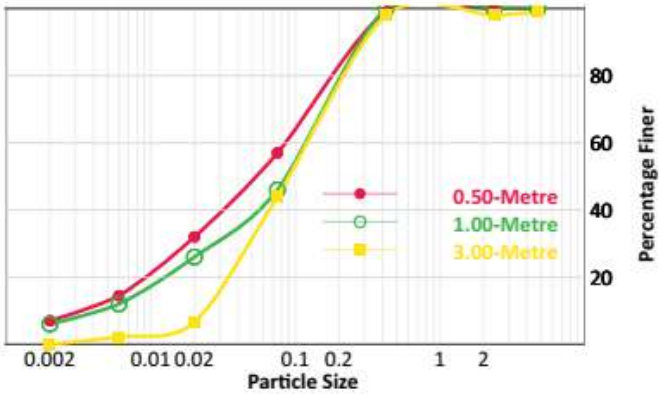
BH- P98-CH.23483.487



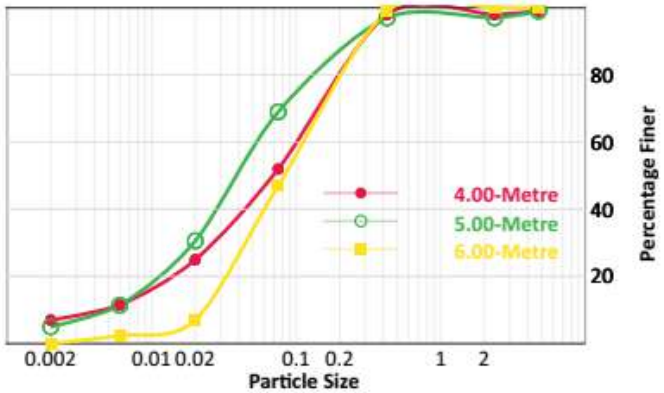
BH- P98-CH.23483.487



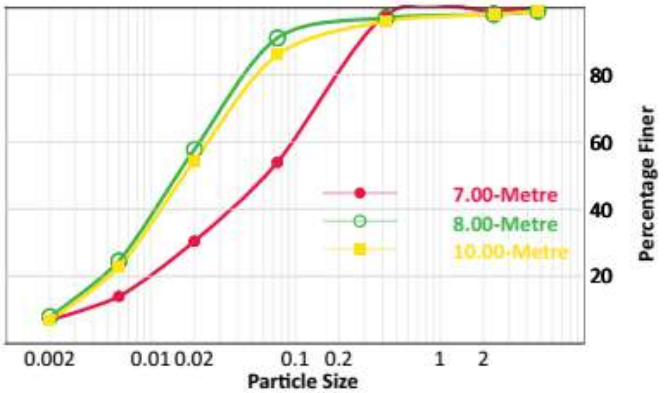
BH- P99-CH.23509.6870



BH- P99-CH.23509.6870

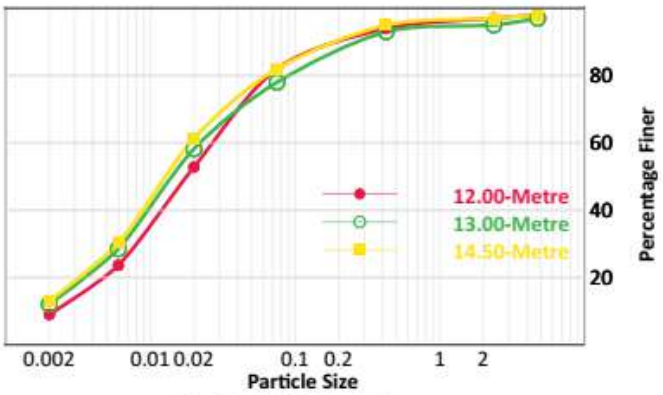


BH- P99-CH.23509.6870

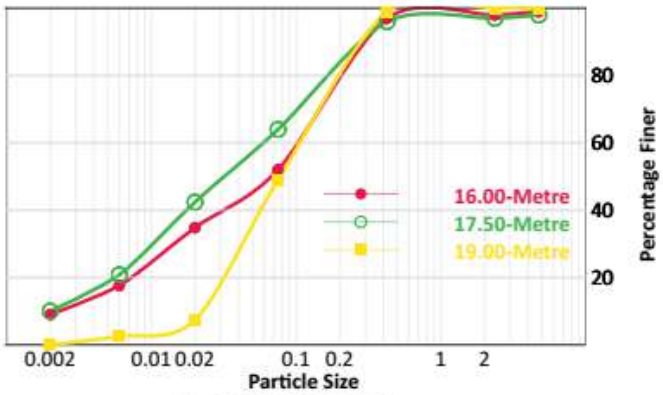


APPENDIX-D
PLOT 18: GRAIN SIZE DISTRIBUTION PLOTS

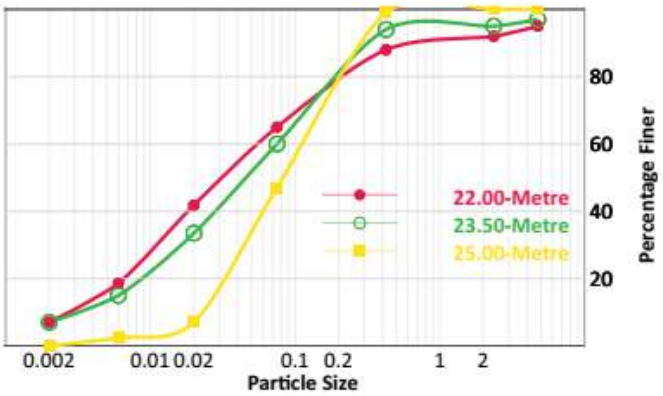
BH- P99-CH.23509.6870



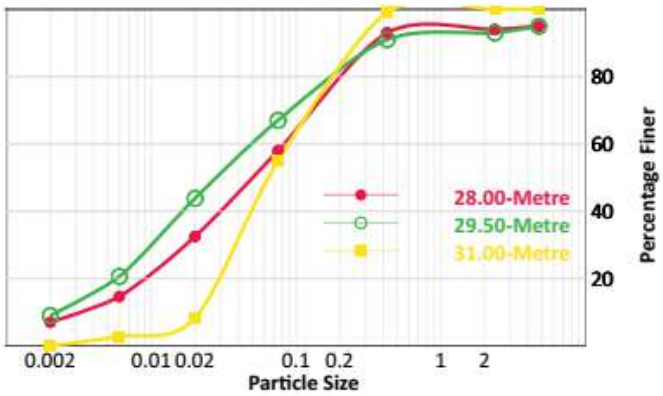
BH- P99-CH.23509.6870



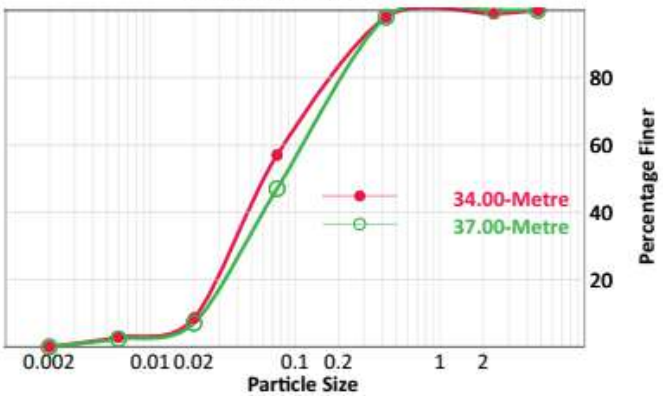
BH- P99-CH.23509.6870



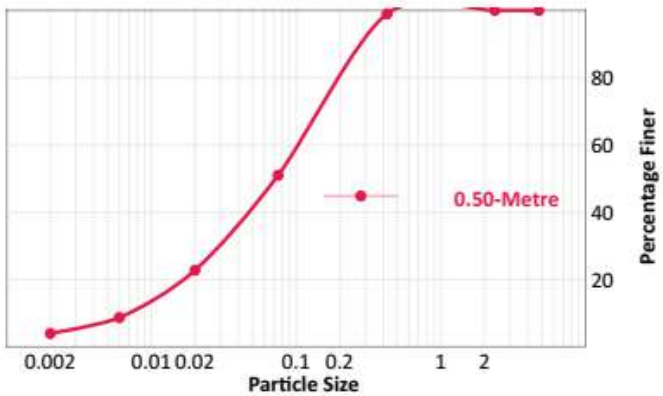
BH- P99-CH.23509.6870



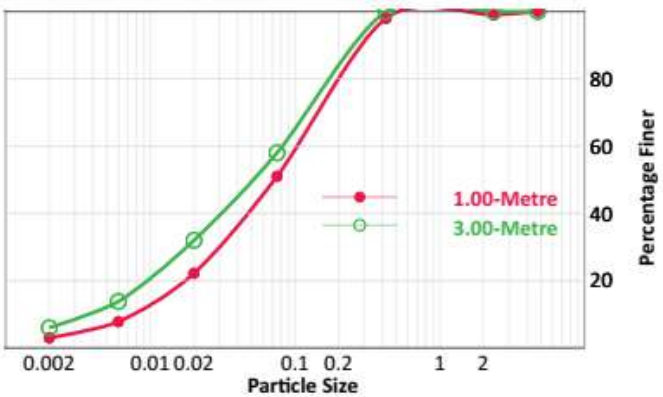
BH- P99-CH.23509.6870



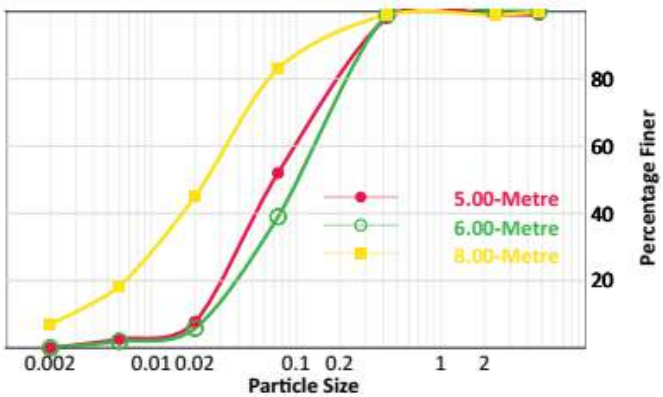
BH- P100-CH.23535.887



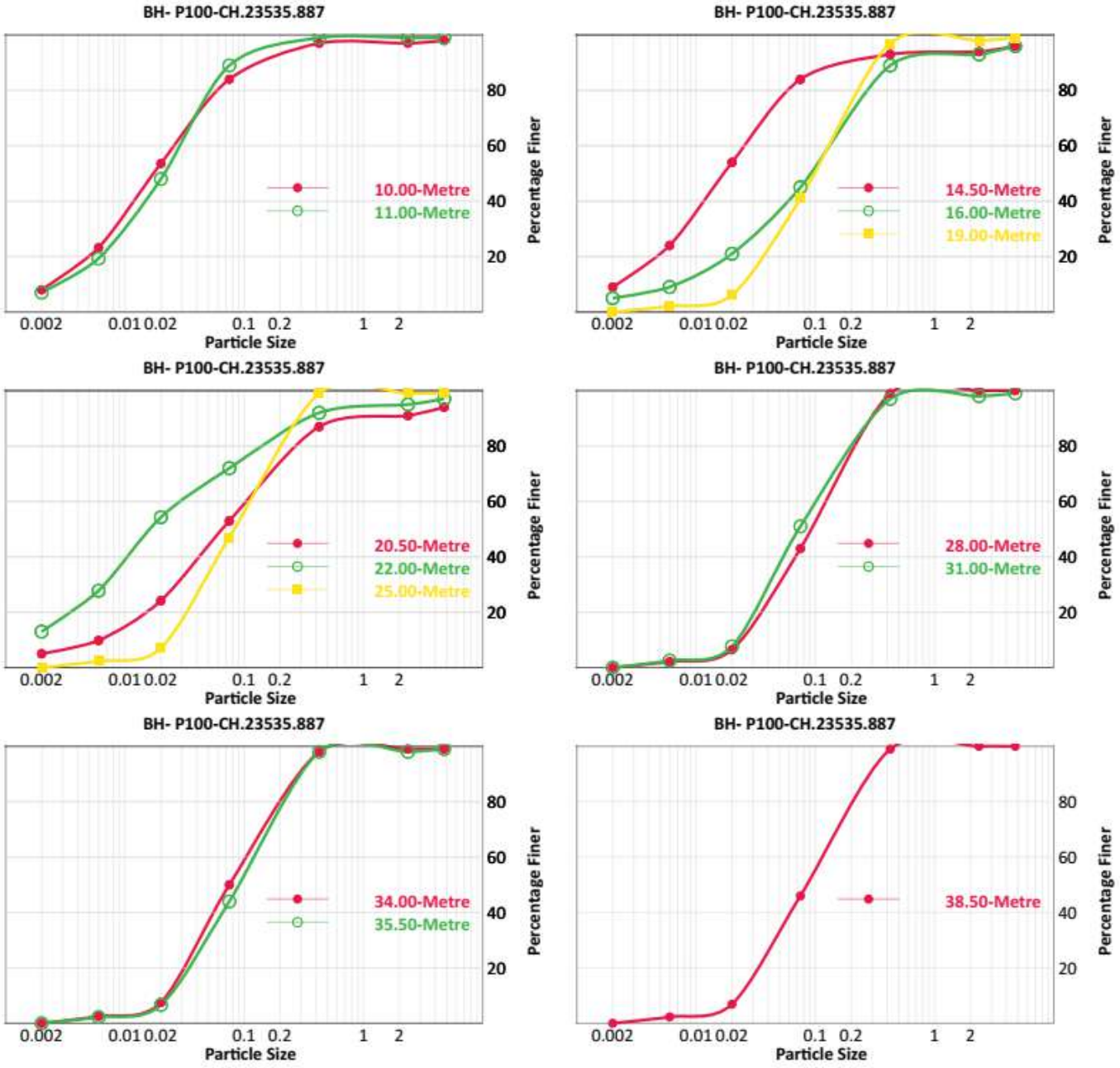
BH- P100-CH.23535.887



BH- P100-CH.23535.887

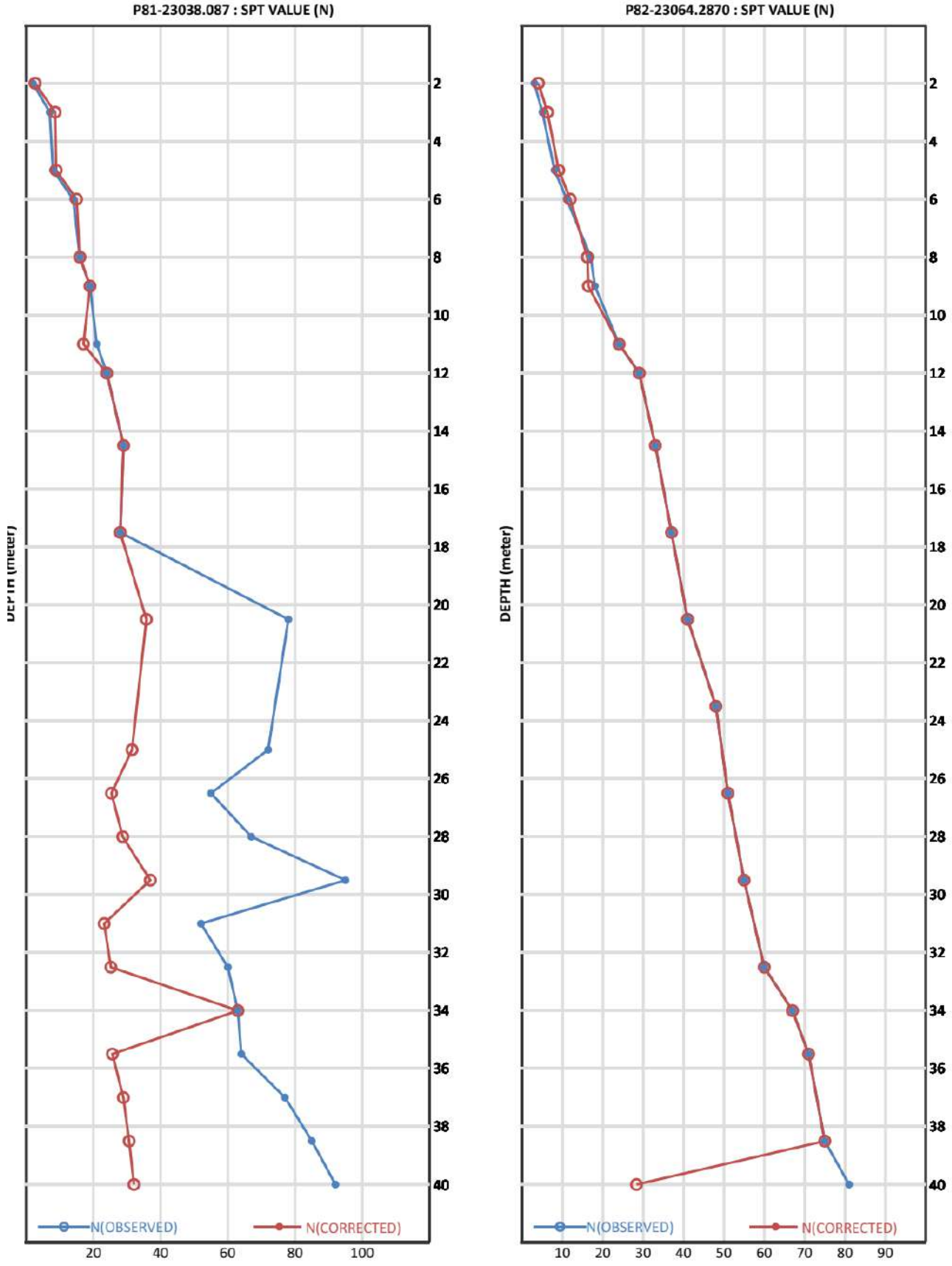


APPENDIX-D
PLOT 19: GRAIN SIZE DISTRIBUTION PLOTS

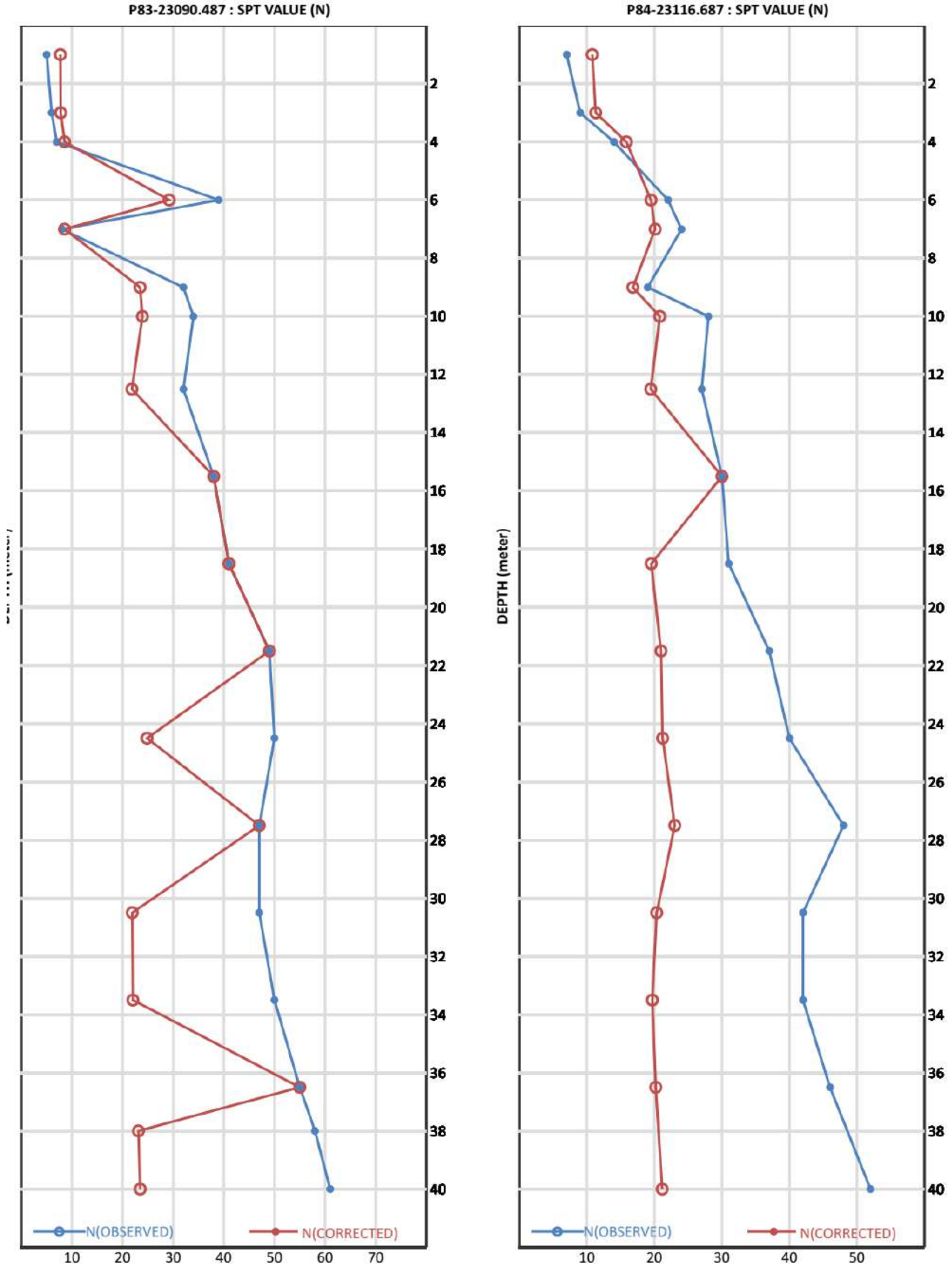


APPENDIX-E

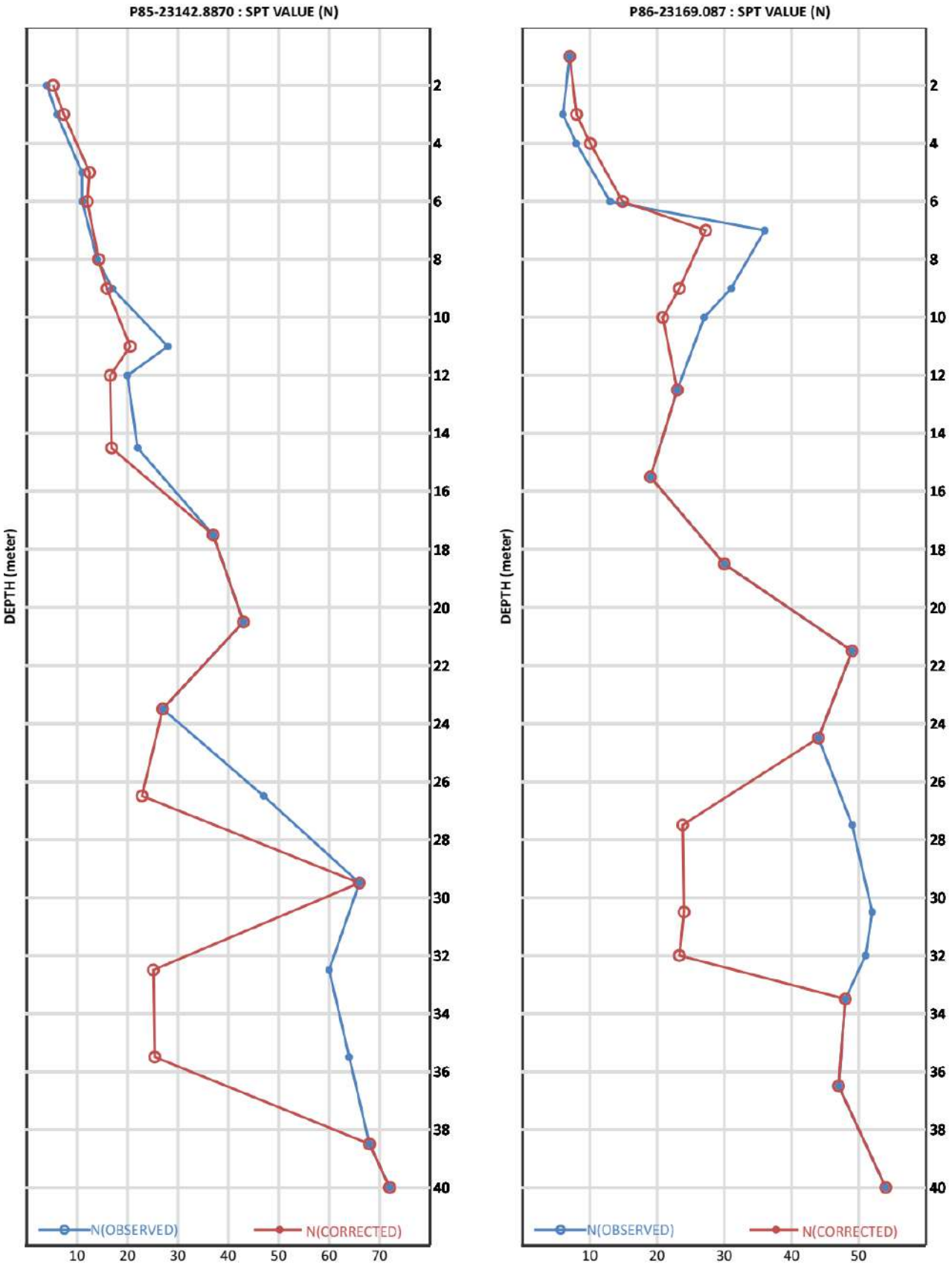
PLOT 1: RECORDED SPT Vs CORRECTED SPT



APPENDIX-E
PLOT 2: RECORDED SPT Vs CORRECTED SPT

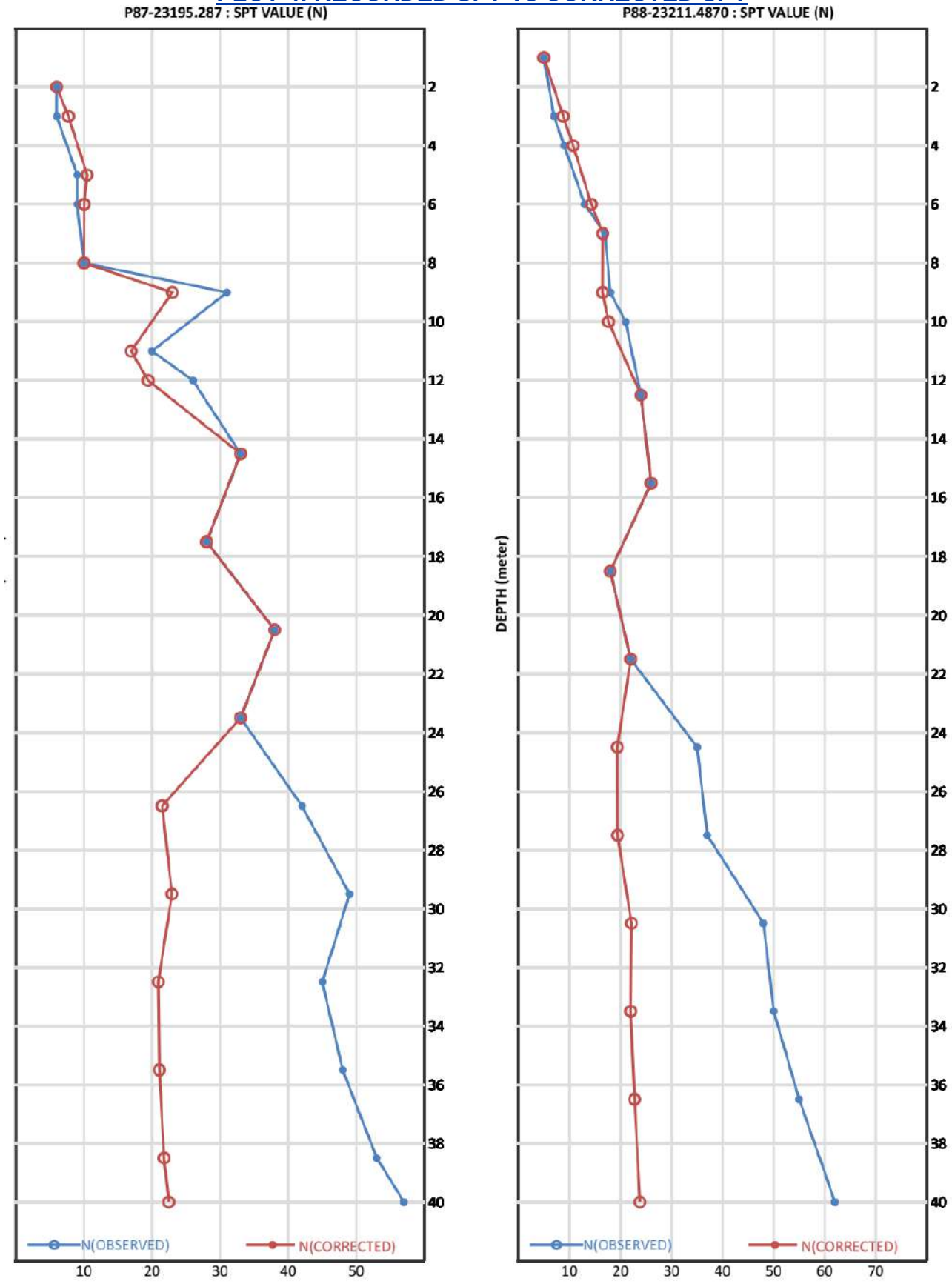


APPENDIX-E
PLOT 3: RECORDED SPT Vs CORRECTED SPT

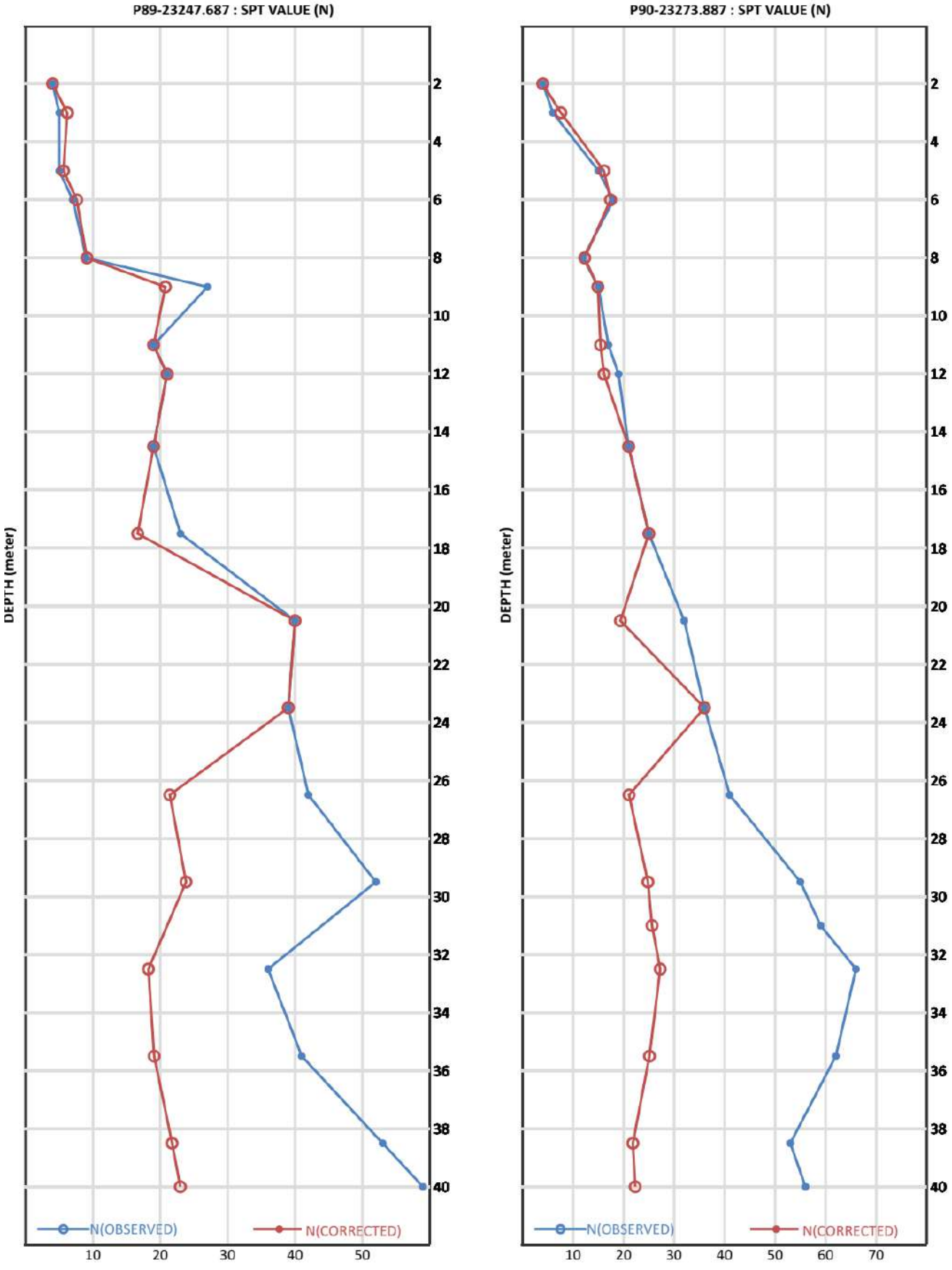


APPENDIX-E

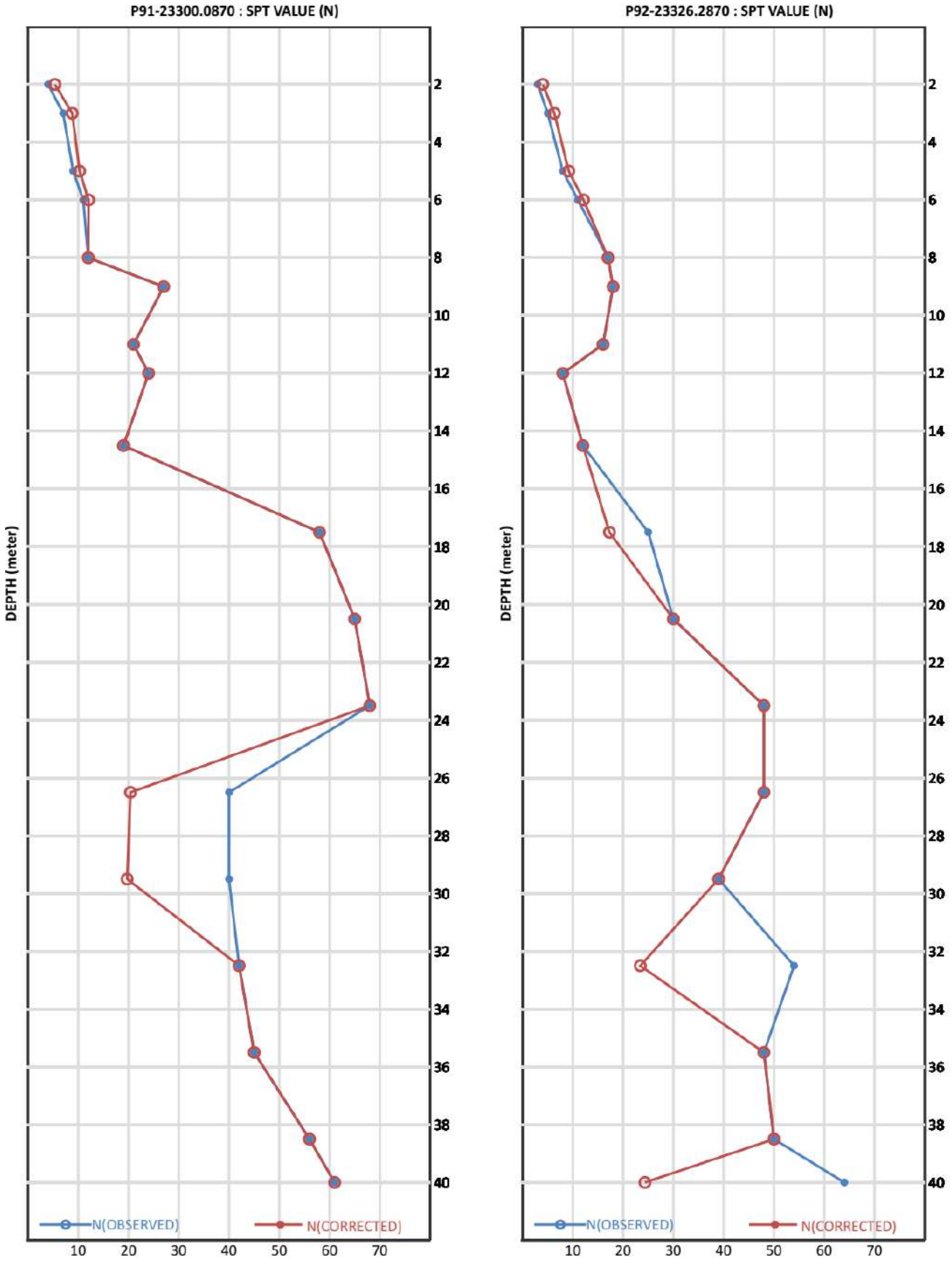
PLOT 4: RECORDED SPT Vs CORRECTED SPT



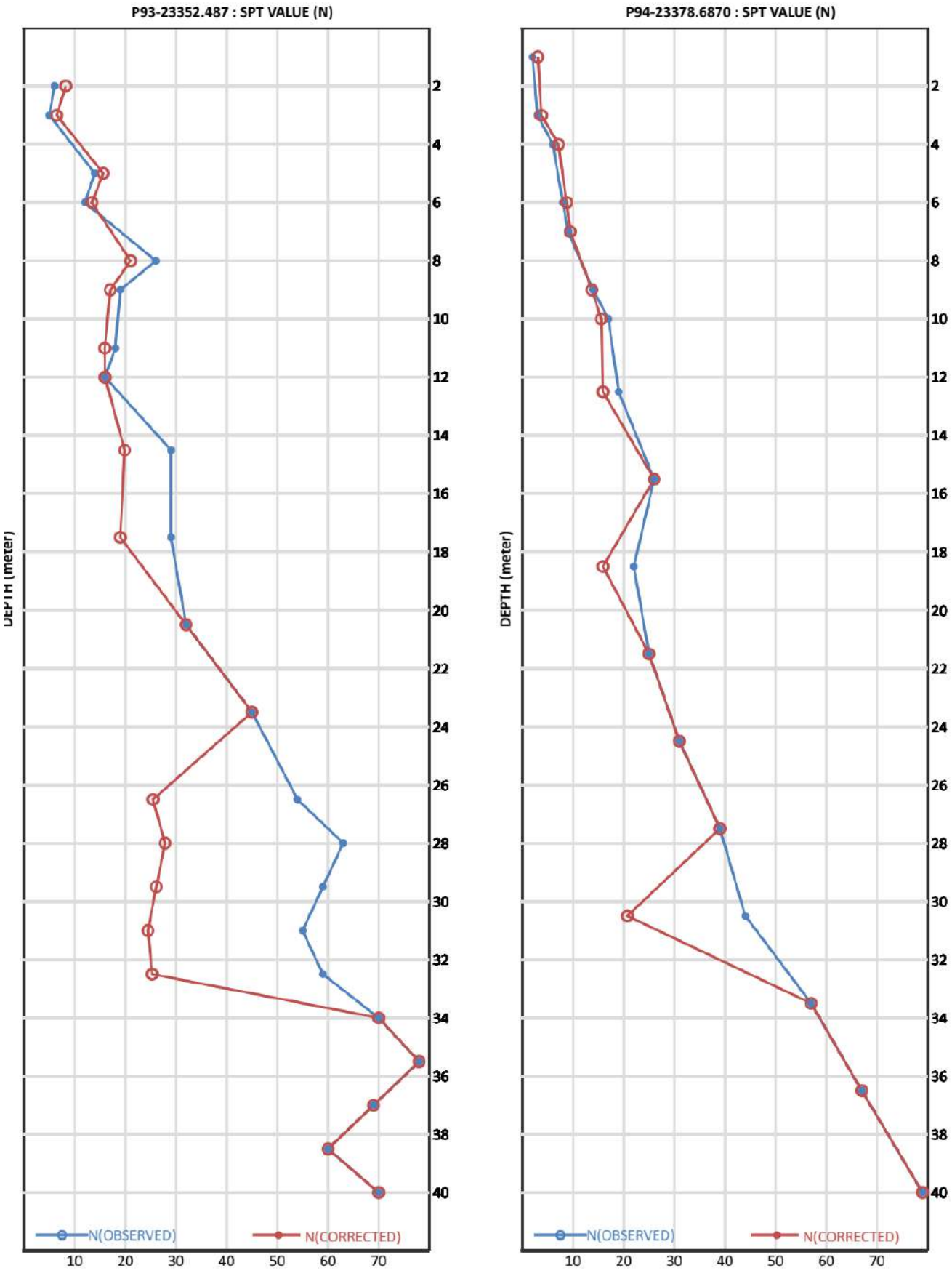
APPENDIX-E
PLOT 5: RECORDED SPT Vs CORRECTED SPT



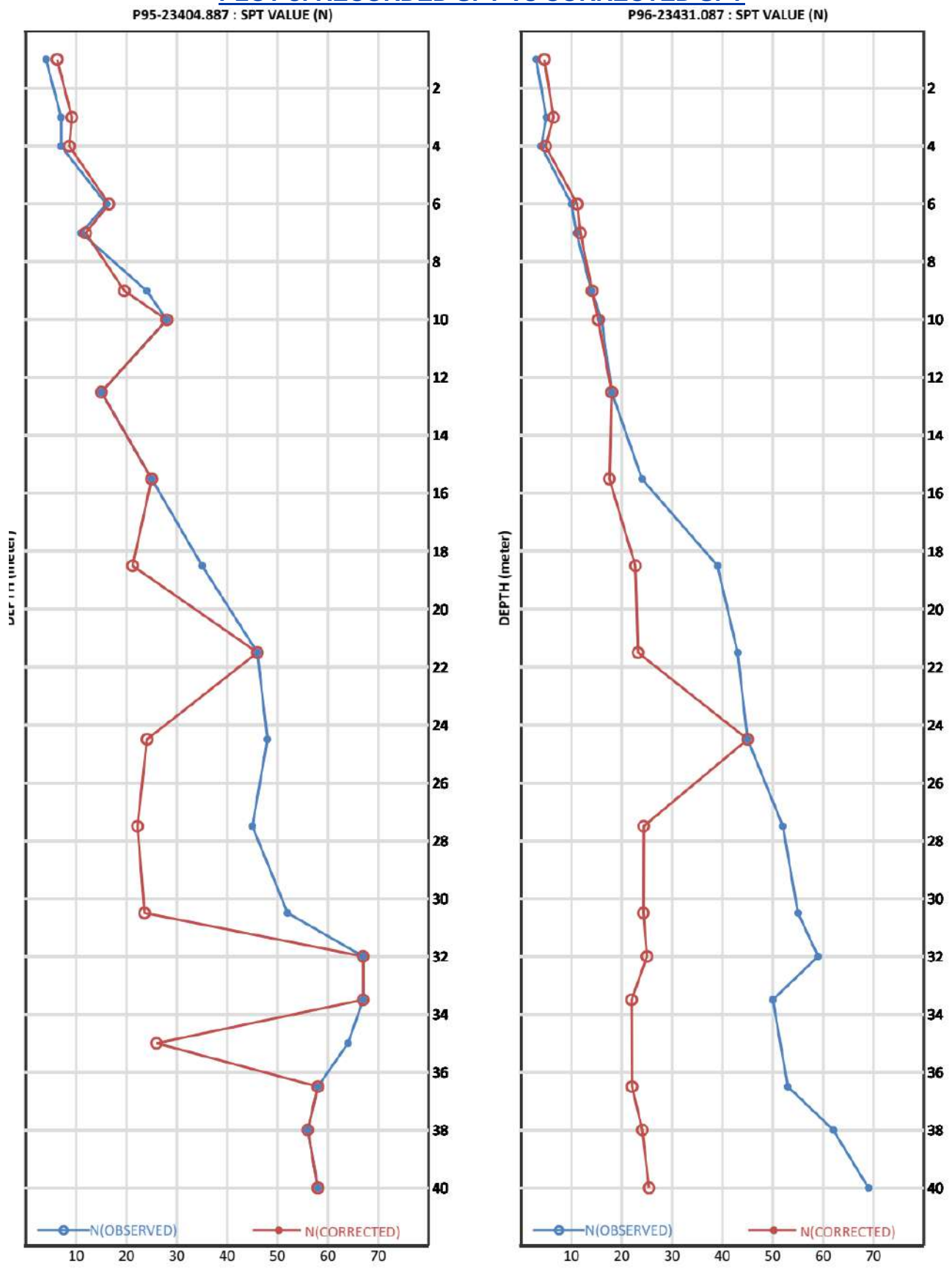
APPENDIX-E
PLOT 6: RECORDED SPT Vs CORRECTED SPT



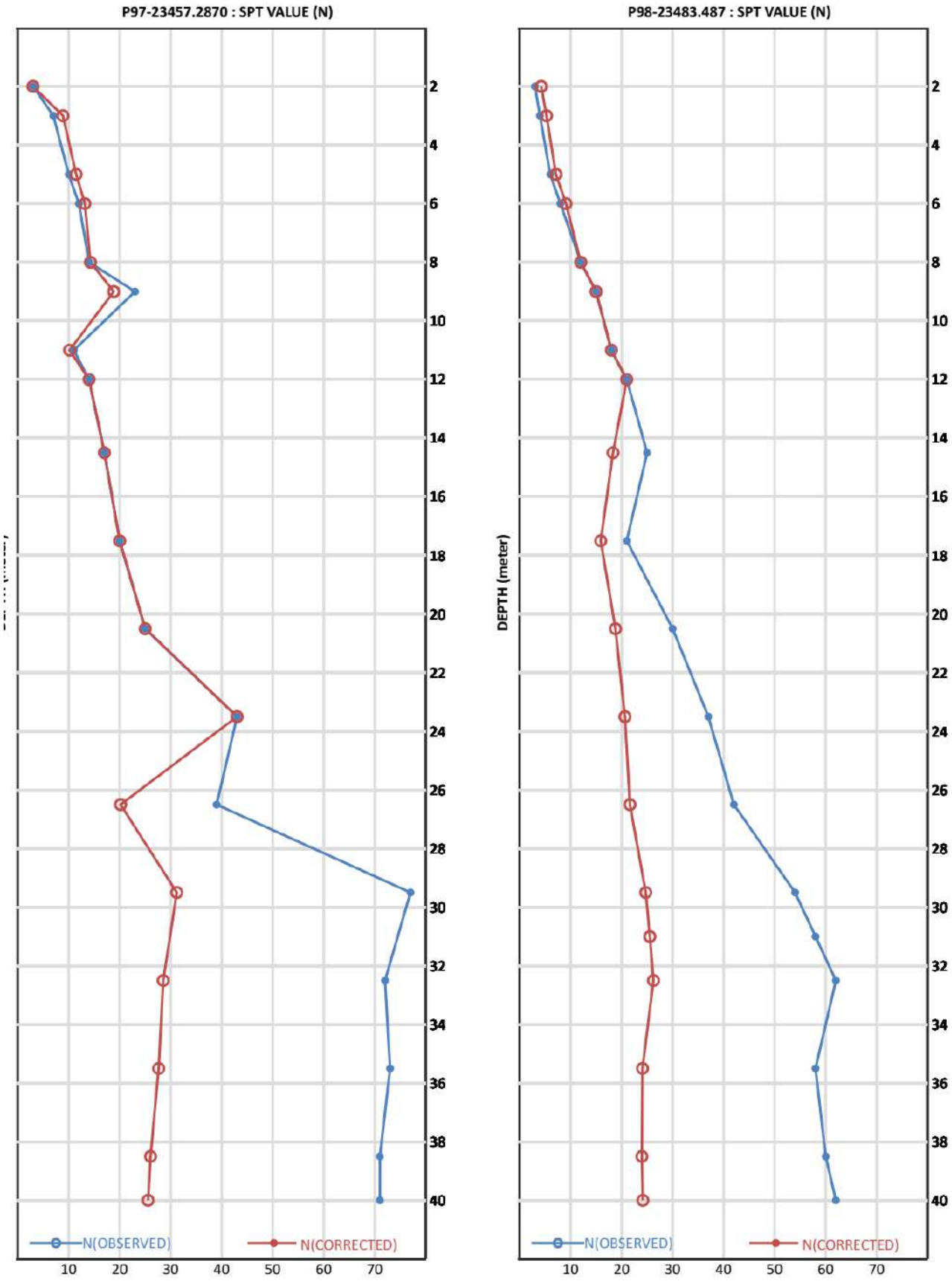
APPENDIX-E
PLOT 7: RECORDED SPT Vs CORRECTED SPT



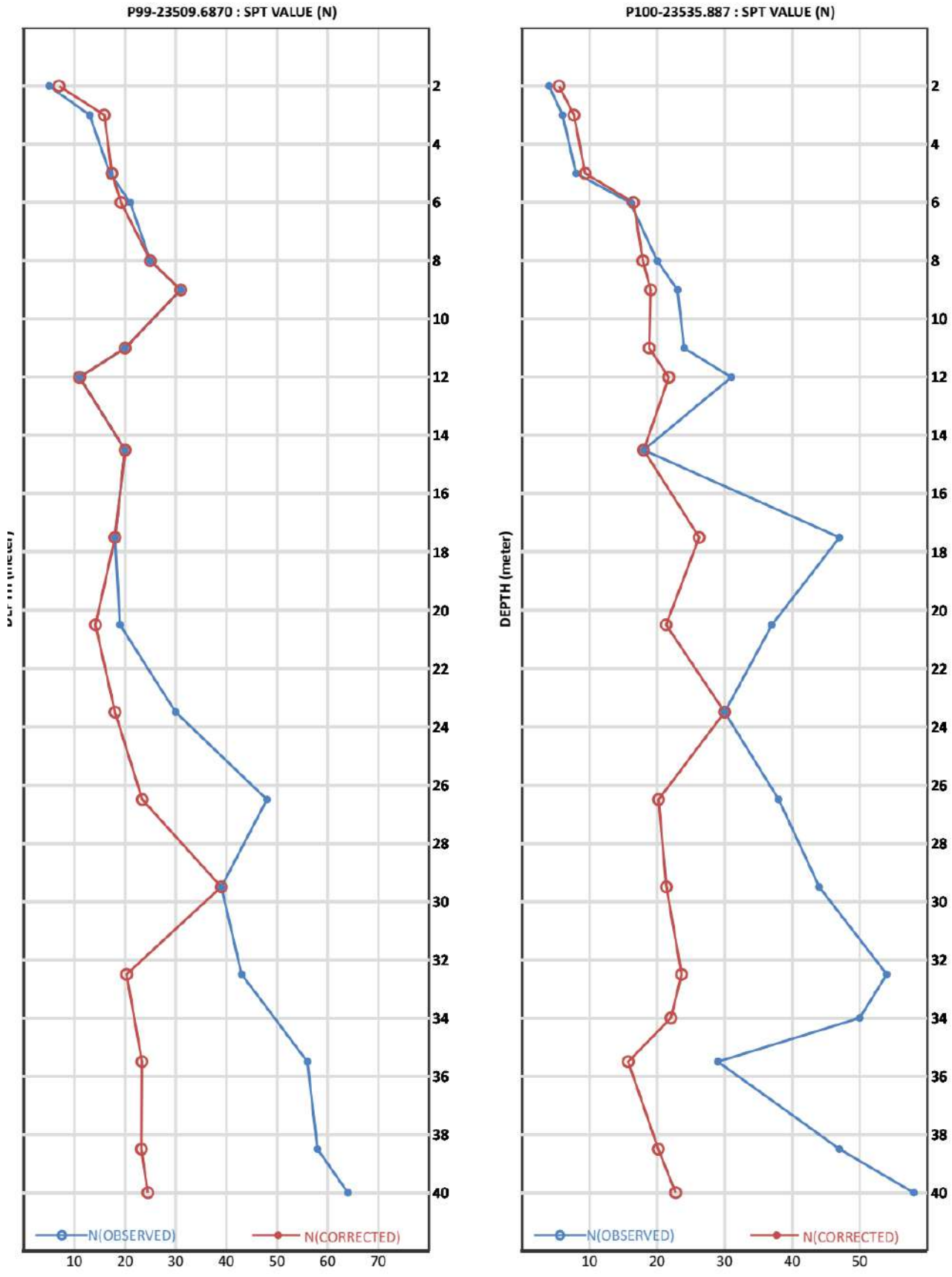
APPENDIX-E
PLOT 8: RECORDED SPT Vs CORRECTED SPT



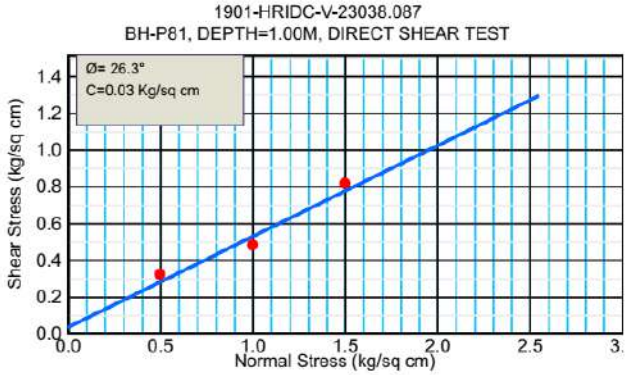
APPENDIX-E
PLOT 9: RECORDED SPT Vs CORRECTED SPT

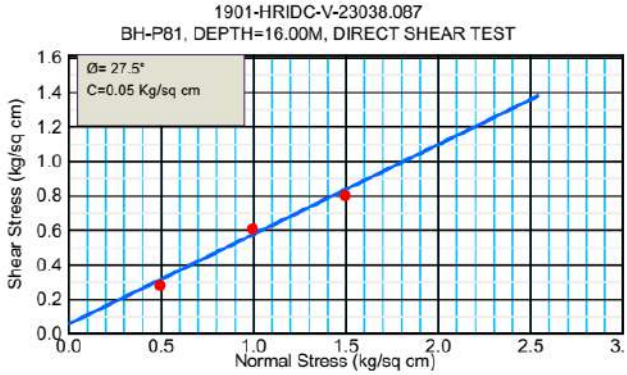


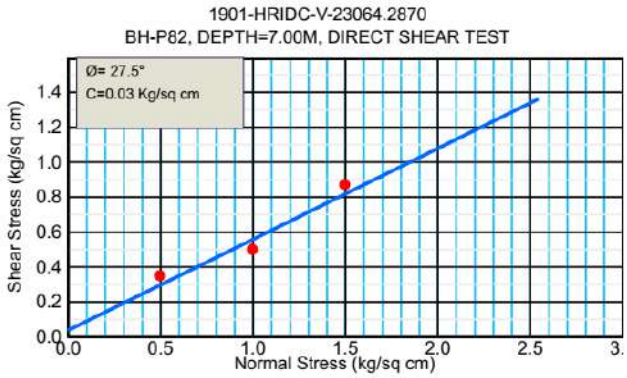
APPENDIX-E
PLOT 10: RECORDED SPT Vs CORRECTED SPT

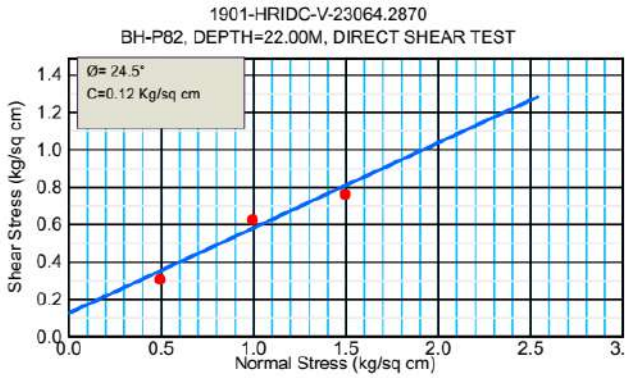


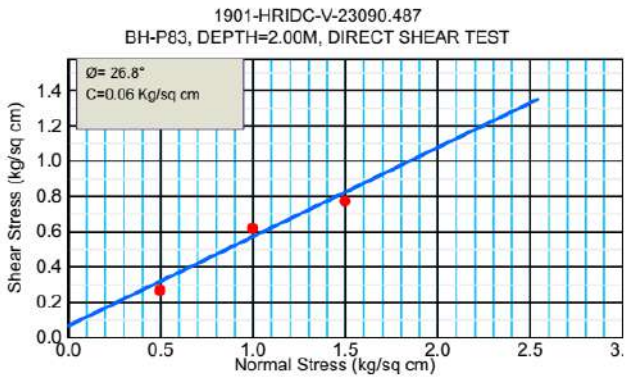
APPENDIX-F
GRAPH 1: DST GRAPH

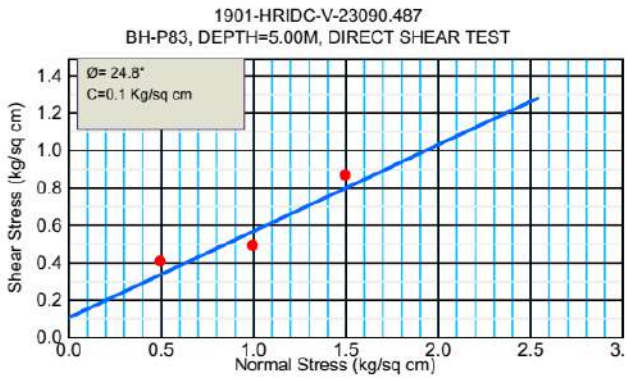


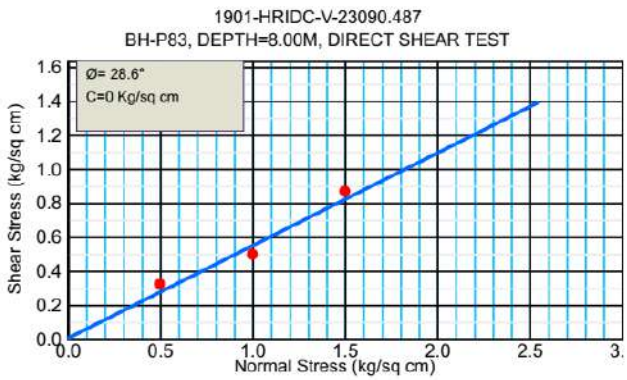


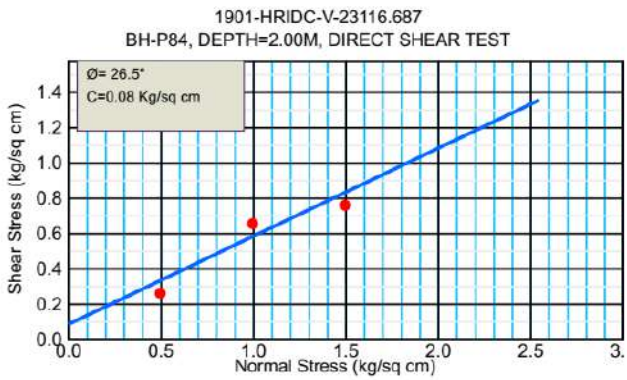




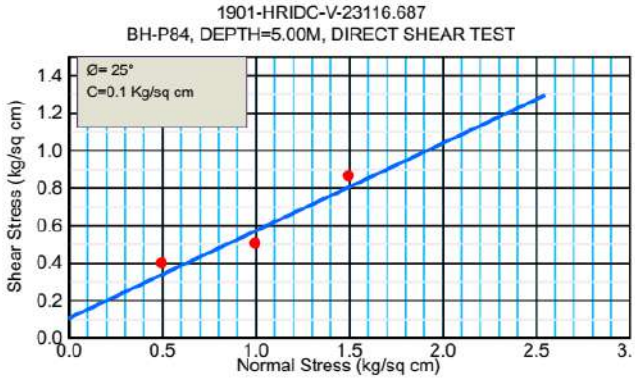


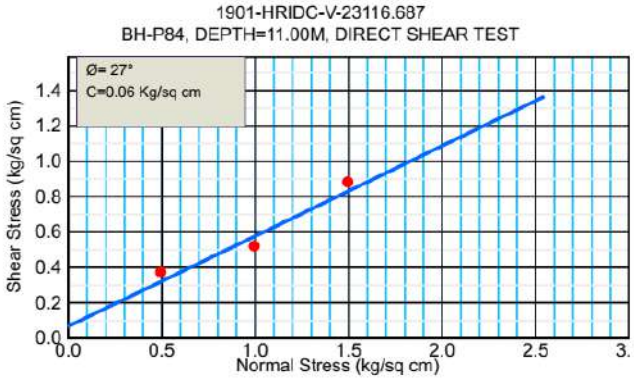


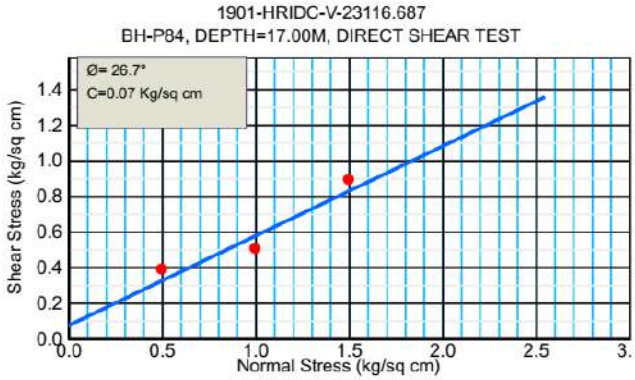


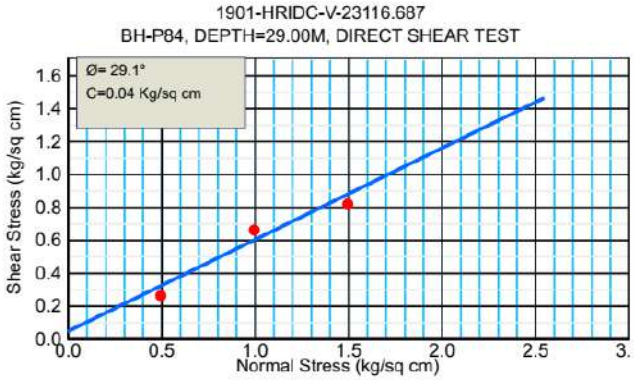


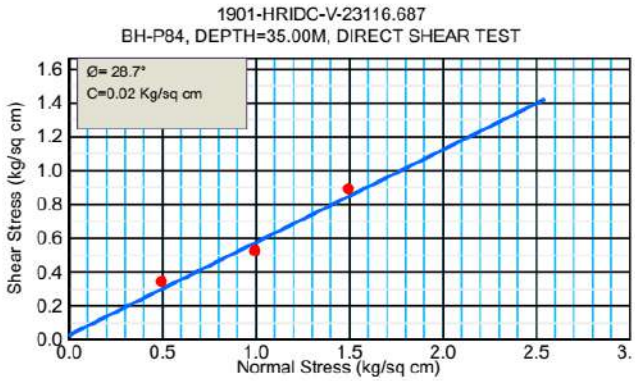
APPENDIX-F
GRAPH 2: DST GRAPH

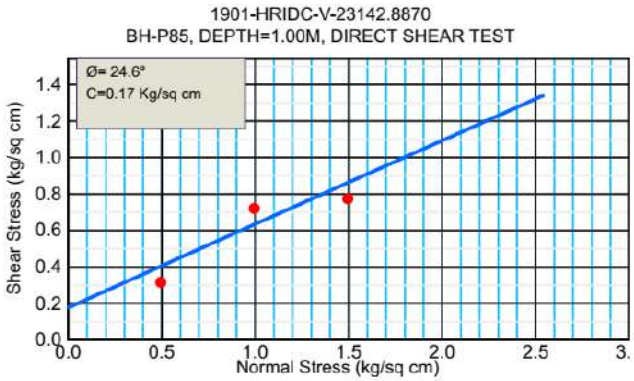


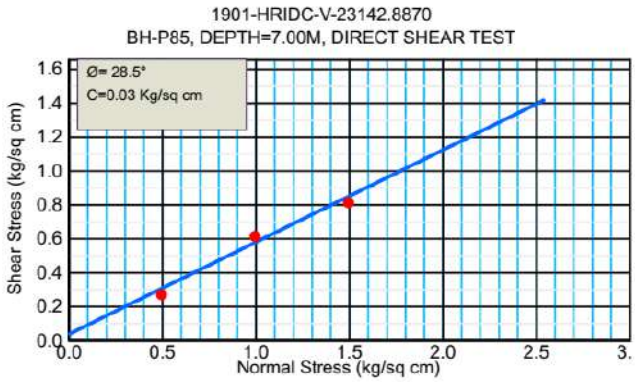


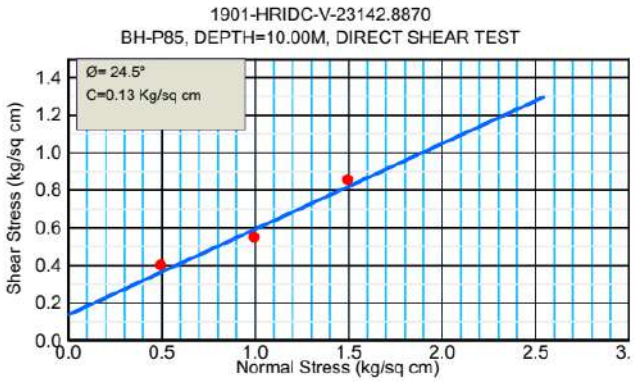






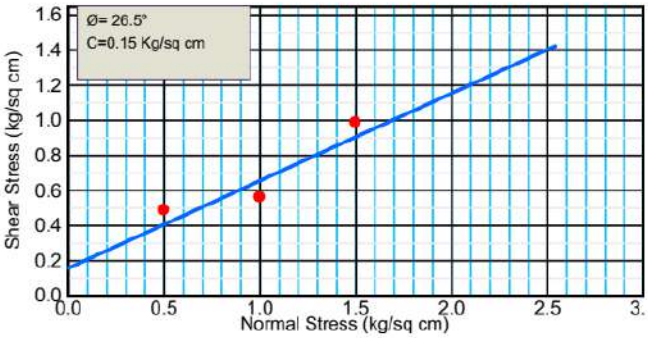




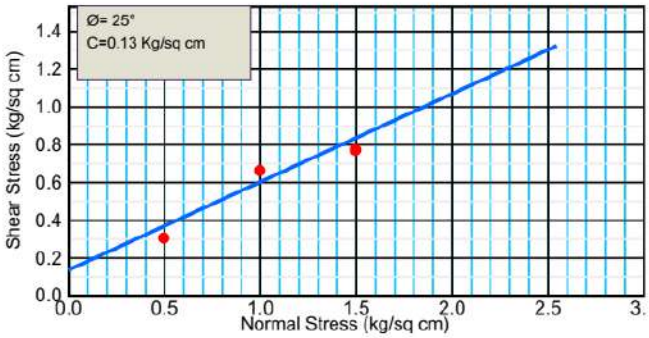


APPENDIX-F
GRAPH 3: DST GRAPH

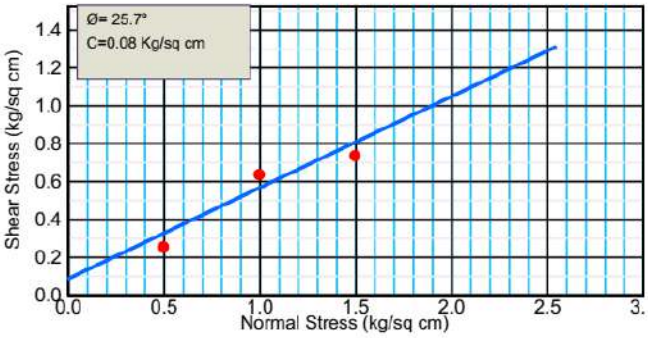
1901-HRIDC-V-23142.8870
BH-P85, DEPTH=13.00M, DIRECT SHEAR TEST



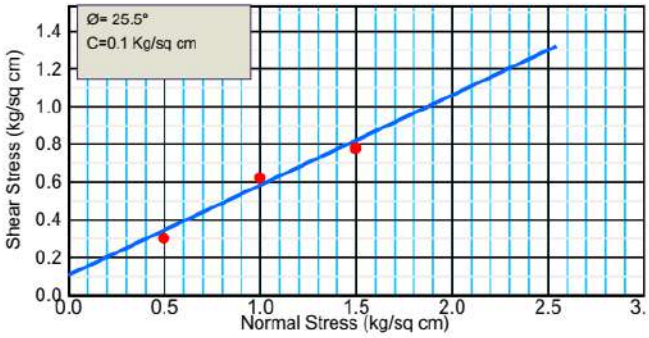
1901-HRIDC-V-23142.8870
BH-P85, DEPTH=25.00M, DIRECT SHEAR TEST



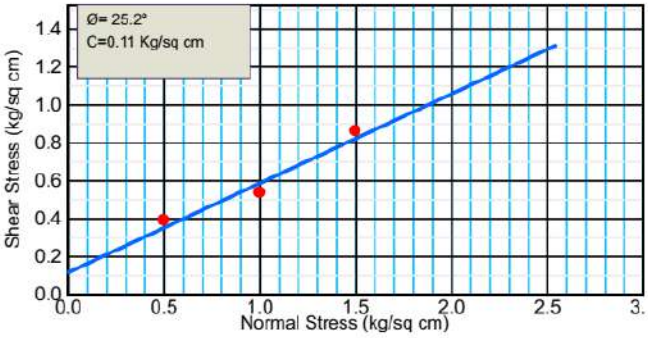
1901-HRIDC-V-23169.087
BH-P86, DEPTH=5.00M, DIRECT SHEAR TEST



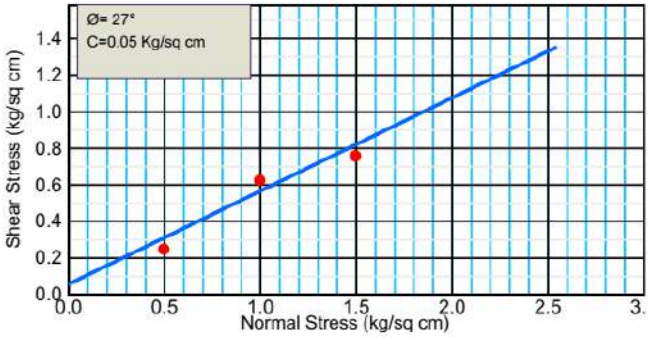
1901-HRIDC-V-23169.087
BH-P86, DEPTH=8.00M, DIRECT SHEAR TEST



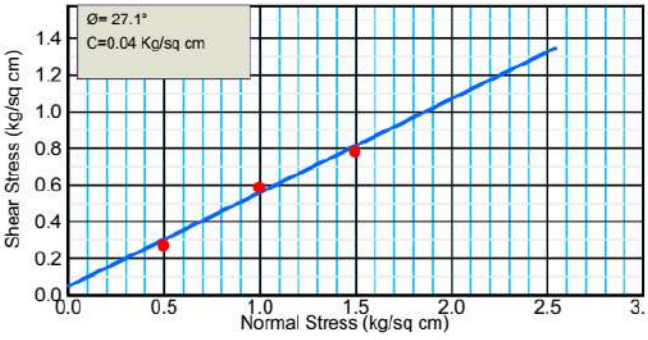
1901-HRIDC-V-23169.087
BH-P86, DEPTH=11.00M, DIRECT SHEAR TEST



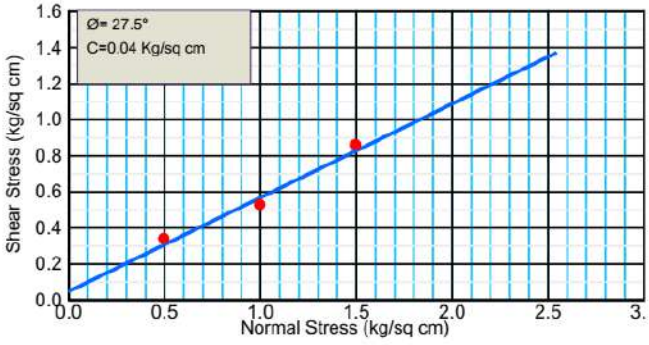
1901-HRIDC-V-23169.087
BH-P86, DEPTH=17.00M, DIRECT SHEAR TEST



1901-HRIDC-V-23169.087
BH-P86, DEPTH=26.00M, DIRECT SHEAR TEST

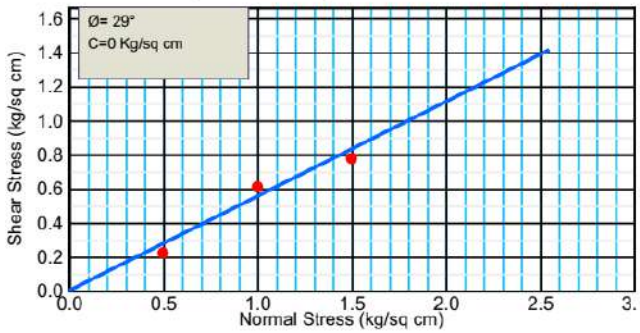


1901-HRIDC-V-23195.287
BH-P87, DEPTH=4.00M, DIRECT SHEAR TEST

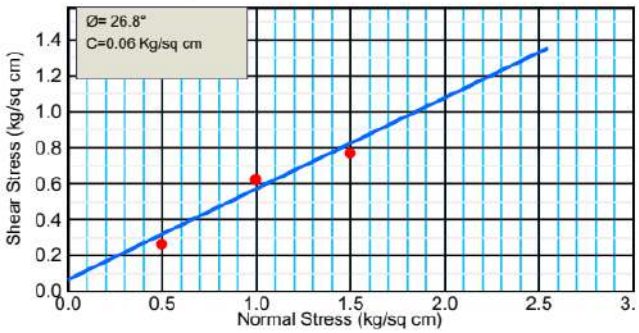


APPENDIX-F
GRAPH 4: DST GRAPH

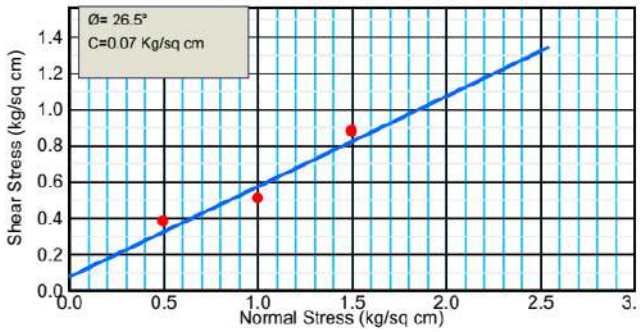
1901-HRIDC-V-23195.287
BH-P87, DEPTH=7.00M, DIRECT SHEAR TEST



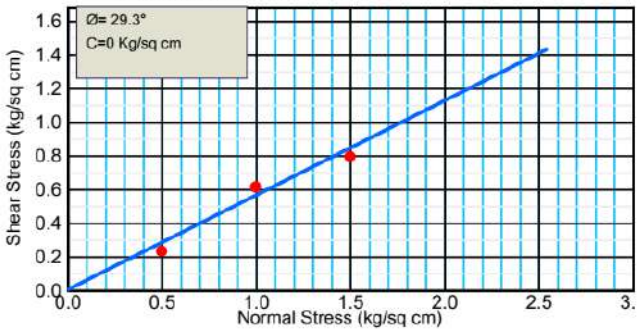
1901-HRIDC-V-23195.287
BH-P87, DEPTH=16.00M, DIRECT SHEAR TEST



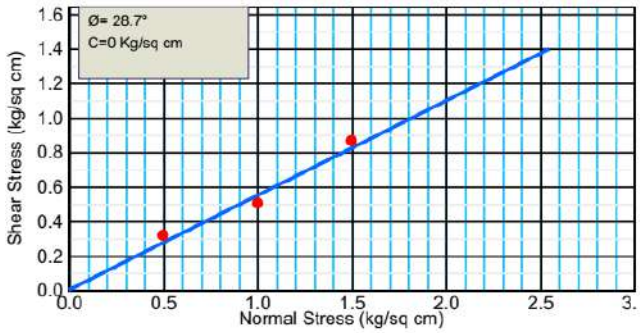
1901-HRIDC-V-23195.287
BH-P87, DEPTH=25.00M, DIRECT SHEAR TEST



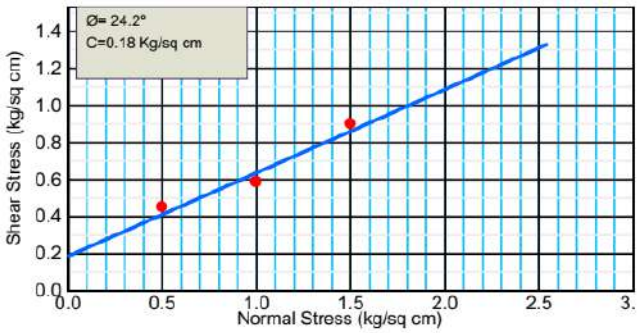
1901-HRIDC-V-23195.287
BH-P87, DEPTH=31.00M, DIRECT SHEAR TEST



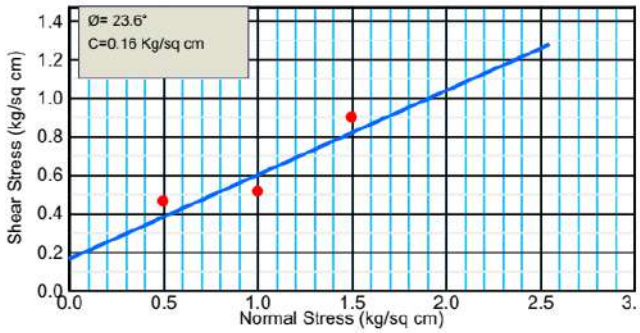
1901-HRIDC-V-23195.287
BH-P87, DEPTH=37.00M, DIRECT SHEAR TEST



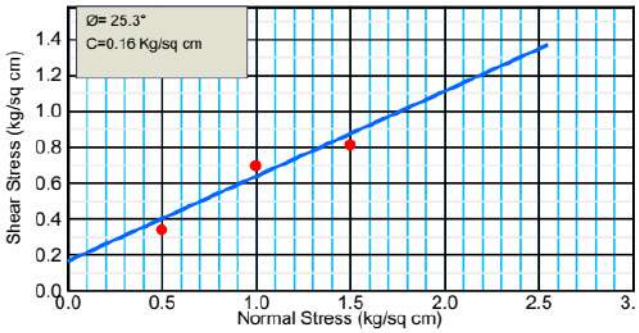
1901-HRIDC-V-23211.4870
BH-P88, DEPTH=2.00M, DIRECT SHEAR TEST



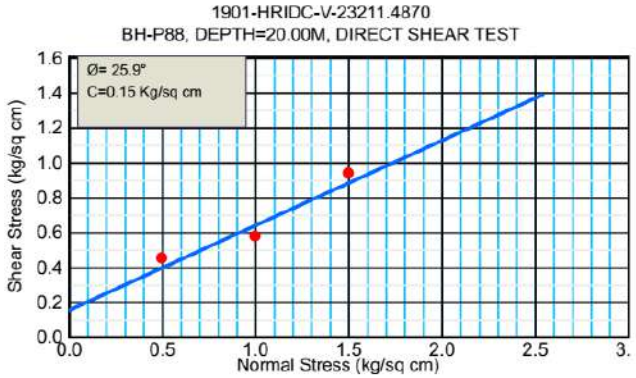
1901-HRIDC-V-23211.4870
BH-P88, DEPTH=5.00M, DIRECT SHEAR TEST

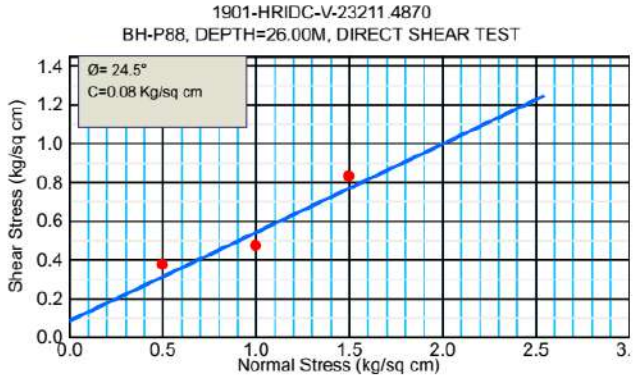


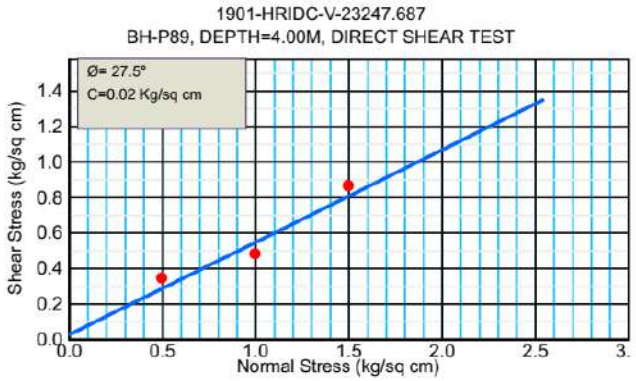
1901-HRIDC-V-23211.4870
BH-P88, DEPTH=11.00M, DIRECT SHEAR TEST

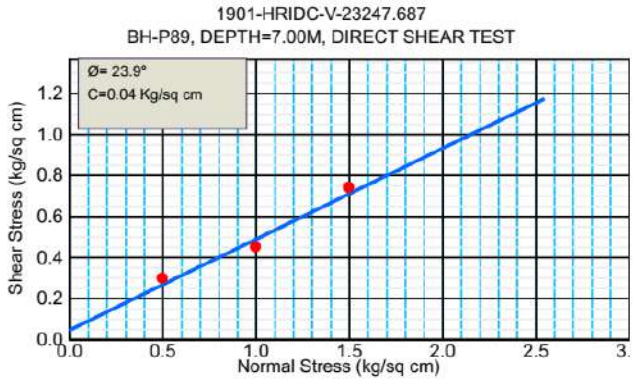


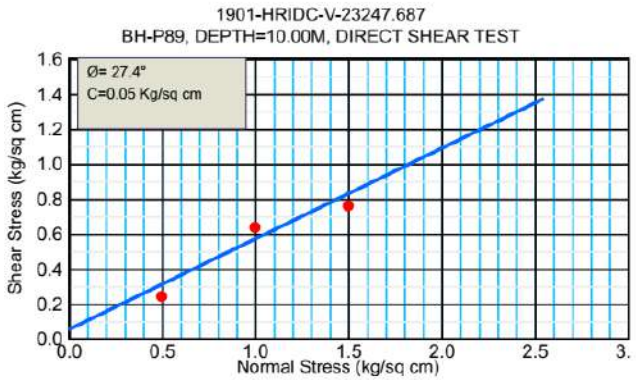
APPENDIX-F
GRAPH 5: DST GRAPH

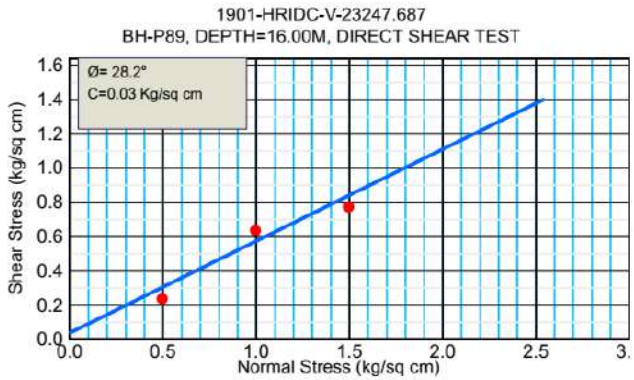


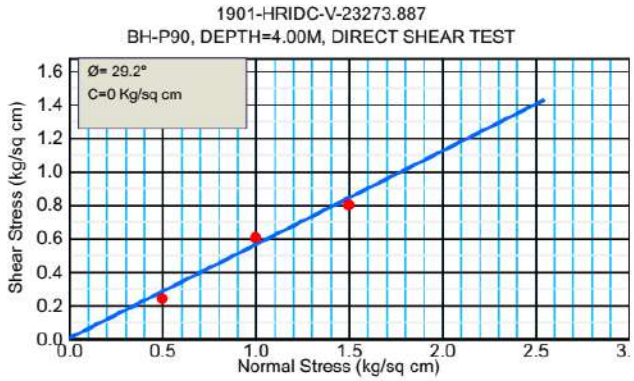






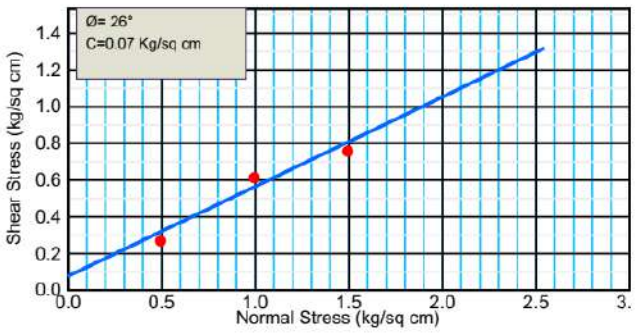




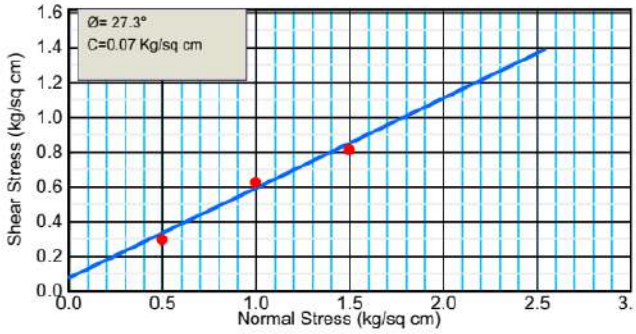


APPENDIX-F
GRAPH 6: DST GRAPH

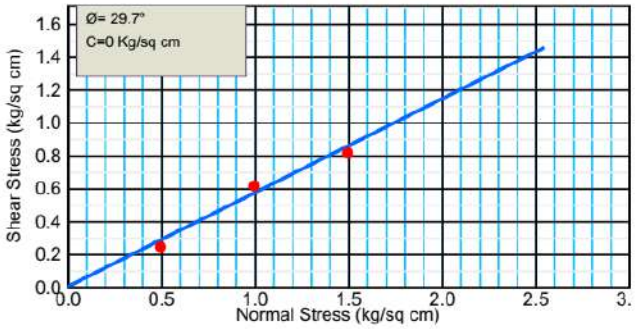
1901-HRIDC-V-23273.887
BH-P90, DEPTH=7.00M, DIRECT SHEAR TEST



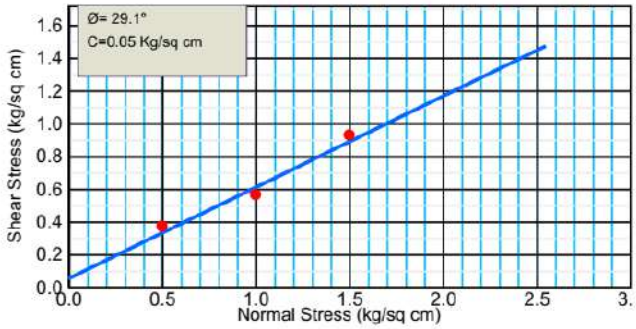
1901-HRIDC-V-23273.887
BH-P90, DEPTH=16.00M, DIRECT SHEAR TEST



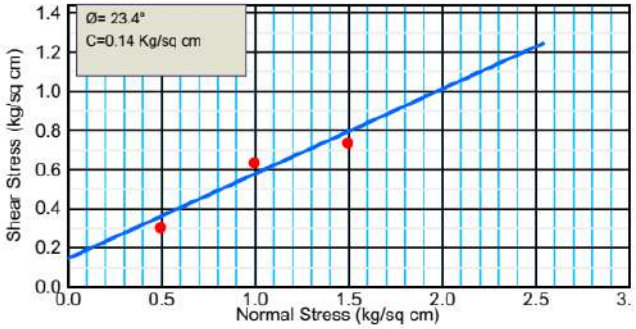
1901-HRIDC-V-23273.887
BH-P90, DEPTH=25.00M, DIRECT SHEAR TEST



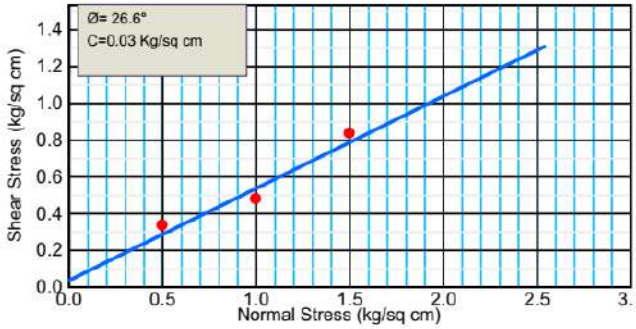
1901-HRIDC-V-23273.887
BH-P90, DEPTH=37.00M, DIRECT SHEAR TEST



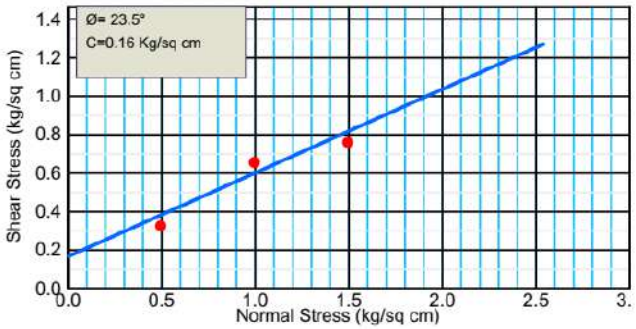
1901-HRIDC-V-23300.0870
BH-P91, DEPTH=1.00M, DIRECT SHEAR TEST



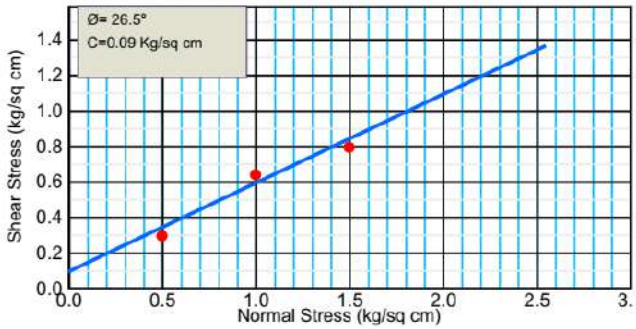
1901-HRIDC-V-23300.0870
BH-P91, DEPTH=4.00M, DIRECT SHEAR TEST



1901-HRIDC-V-23300.0870
BH-P91, DEPTH=22.00M, DIRECT SHEAR TEST

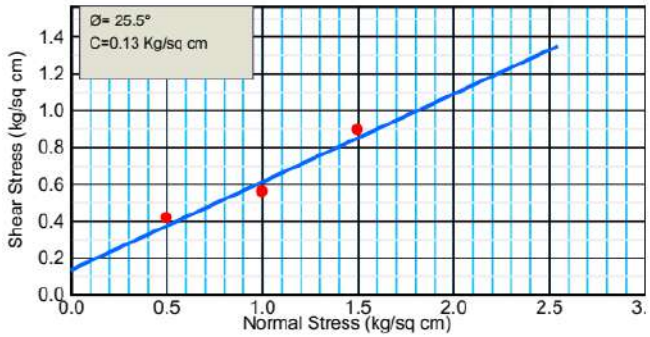


1901-HRIDC-V-23326.2870
BH-P92, DEPTH=4.00M, DIRECT SHEAR TEST

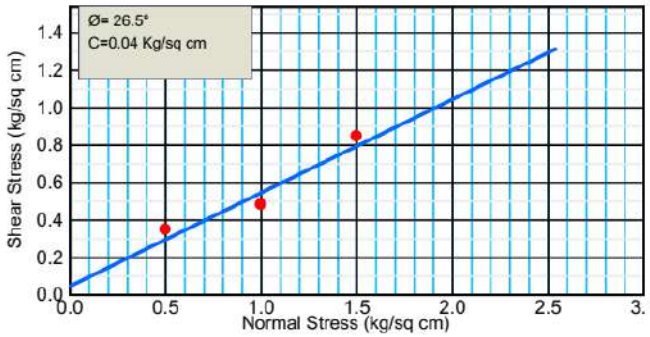


APPENDIX-F
GRAPH 7: DST GRAPH

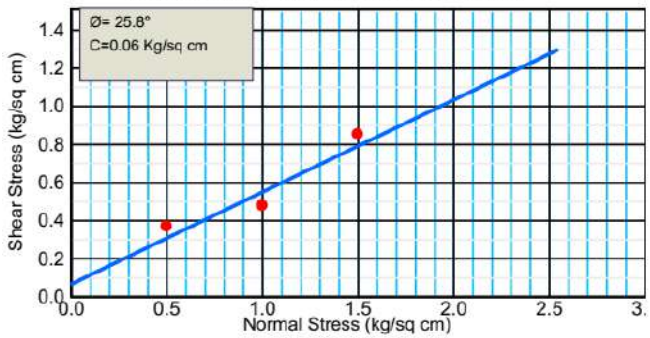
1901-HRIDC-V-23326.2870
BH-P92, DEPTH=7.00M, DIRECT SHEAR TEST



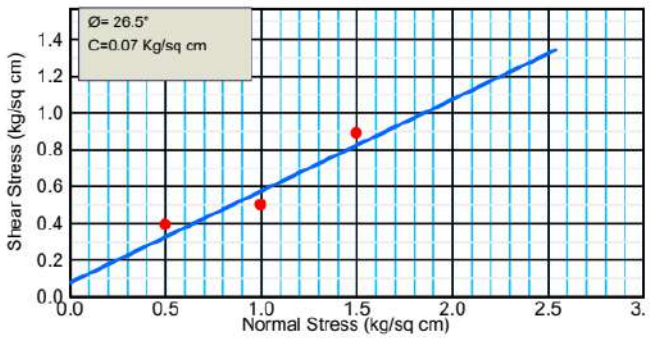
1901-HRIDC-V-23352.487
BH-P93, DEPTH=1.00M, DIRECT SHEAR TEST



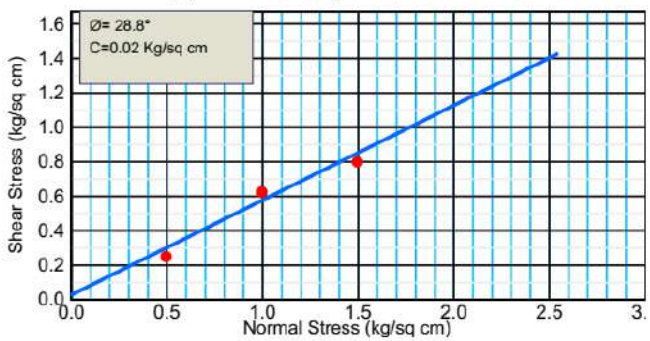
1901-HRIDC-V-23352.487
BH-P93, DEPTH=4.00M, DIRECT SHEAR TEST



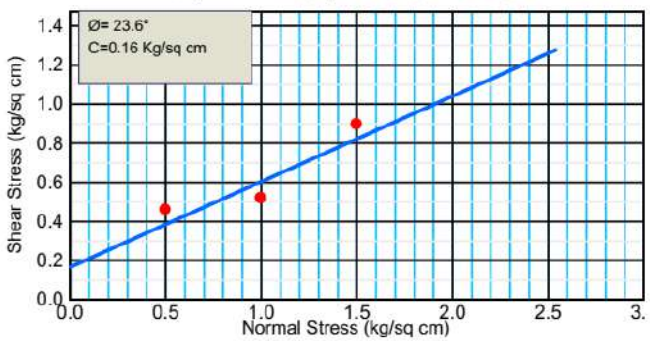
1901-HRIDC-V-23352.487
BH-P93, DEPTH=10.00M, DIRECT SHEAR TEST



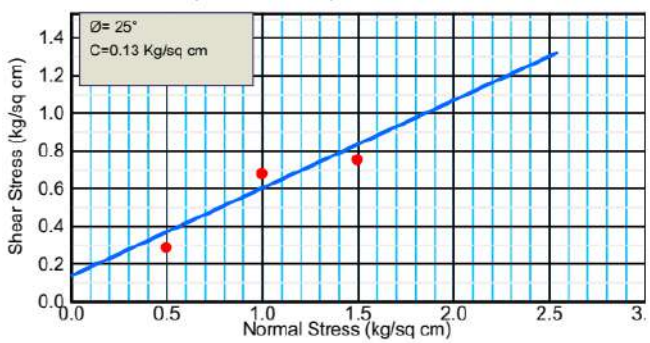
1901-HRIDC-V-23352.487
BH-P93, DEPTH=25.00M, DIRECT SHEAR TEST



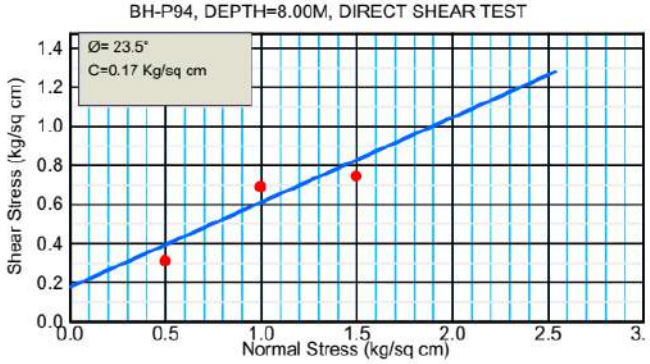
1901-HRIDC-V-23378.6870
BH-P94, DEPTH=2.00M, DIRECT SHEAR TEST



1901-HRIDC-V-23378.6870
BH-P94, DEPTH=5.00M, DIRECT SHEAR TEST

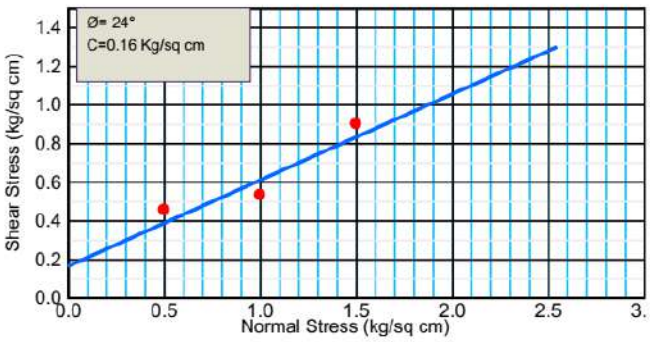


1901-HRIDC-V-23378.6870
BH-P94, DEPTH=8.00M, DIRECT SHEAR TEST

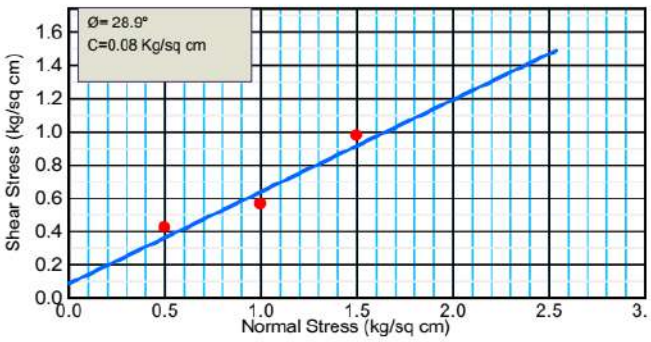


APPENDIX-F
GRAPH 8: DST GRAPH

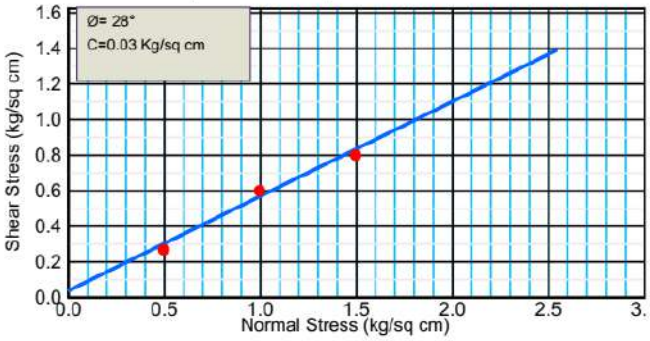
1901-HRIDC-V-23378.6870
BH-P94, DEPTH=20.00M, DIRECT SHEAR TEST



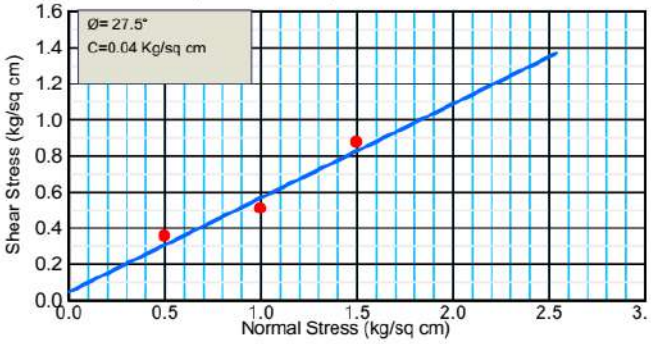
1901-HRIDC-V-23378.6870
BH-P94, DEPTH=35.00M, DIRECT SHEAR TEST



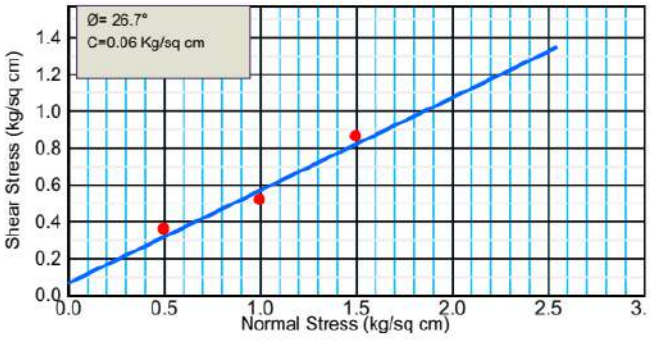
1901-HRIDC-V-23404.887
BH-P95, DEPTH=2.00M, DIRECT SHEAR TEST



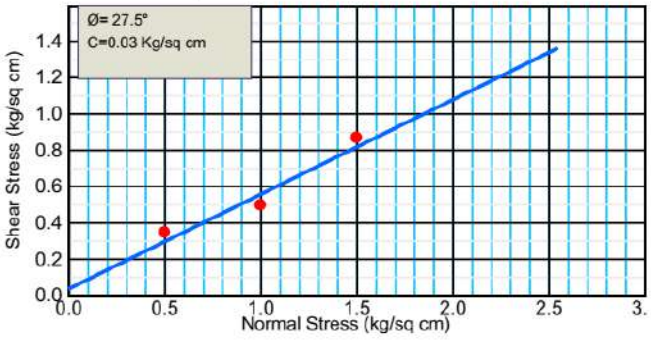
1901-HRIDC-V-23404.887
BH-P95, DEPTH=5.00M, DIRECT SHEAR TEST



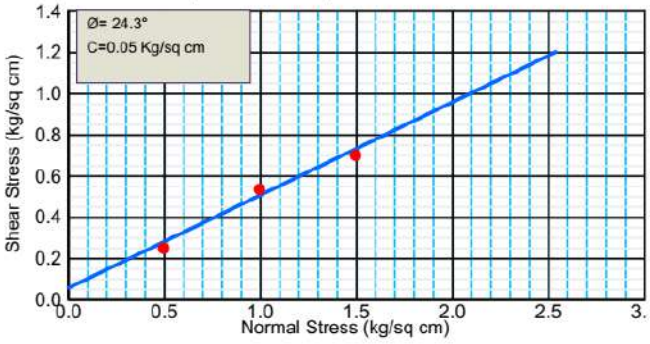
1901-HRIDC-V-23404.887
BH-P95, DEPTH=29.00M, DIRECT SHEAR TEST



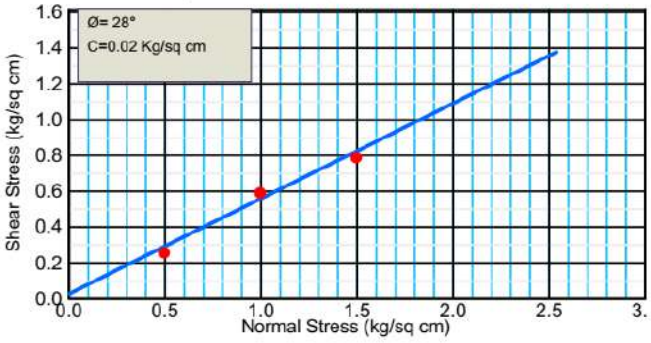
1901-HRIDC-V-23431.087
BH-P96, DEPTH=2.00M, DIRECT SHEAR TEST



1901-HRIDC-V-23431.087
BH-P96, DEPTH=5.00M, DIRECT SHEAR TEST

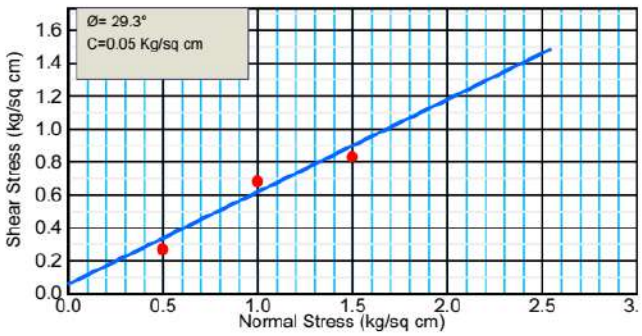


1901-HRIDC-V-23431.087
BH-P96, DEPTH=17.00M, DIRECT SHEAR TEST

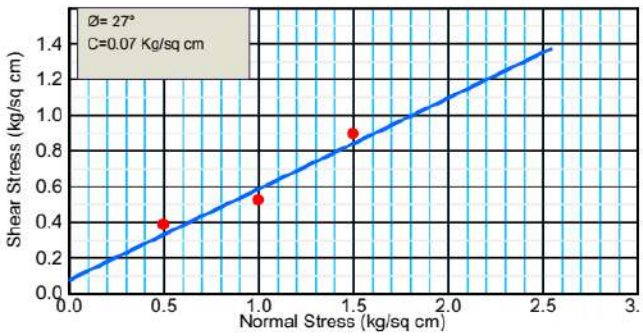


APPENDIX-F
GRAPH 9: DST GRAPH

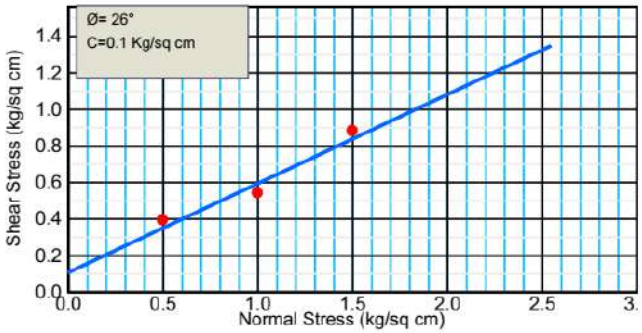
1901-HRIDC-V-23431.087
BH-P96, DEPTH=35.00M, DIRECT SHEAR TEST



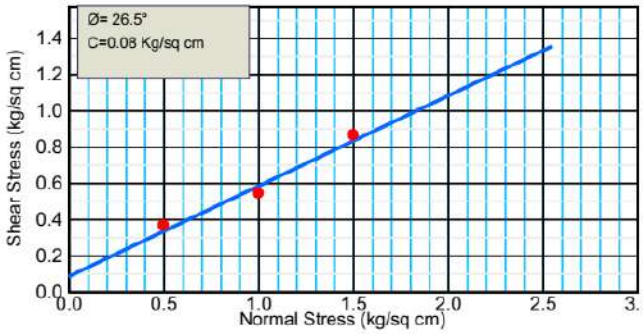
1901-HRIDC-V-23457.2870
BH-P97, DEPTH=4.00M, DIRECT SHEAR TEST



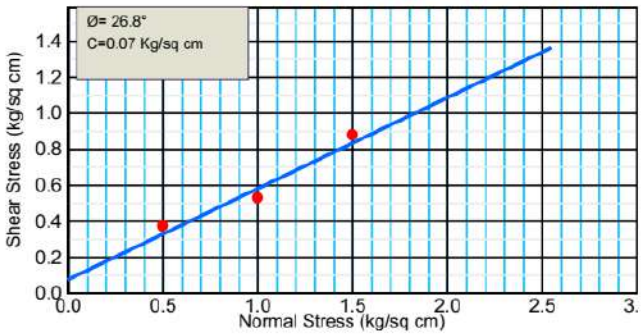
1901-HRIDC-V-23457.2870
BH-P97, DEPTH=7.00M, DIRECT SHEAR TEST



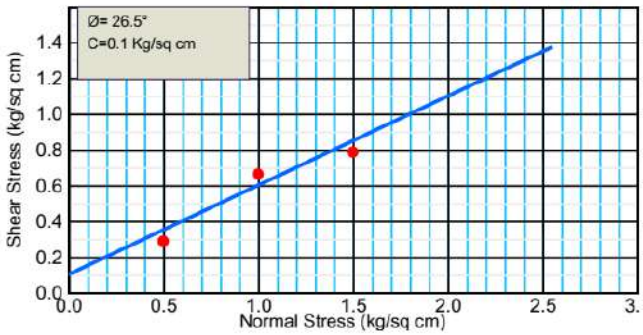
1901-HRIDC-V-23457.2870
BH-P97, DEPTH=16.00M, DIRECT SHEAR TEST



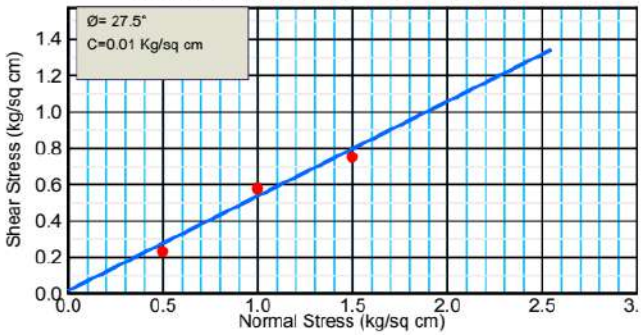
1901-HRIDC-V-23457.2870
BH-P97, DEPTH=31.00M, DIRECT SHEAR TEST



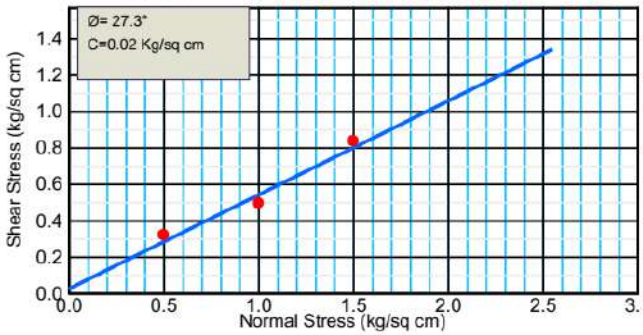
1901-HRIDC-V-23457.2870
BH-P97, DEPTH=37.00M, DIRECT SHEAR TEST



1901-HRIDC-V-23483.487
BH-P98, DEPTH=1.00M, DIRECT SHEAR TEST

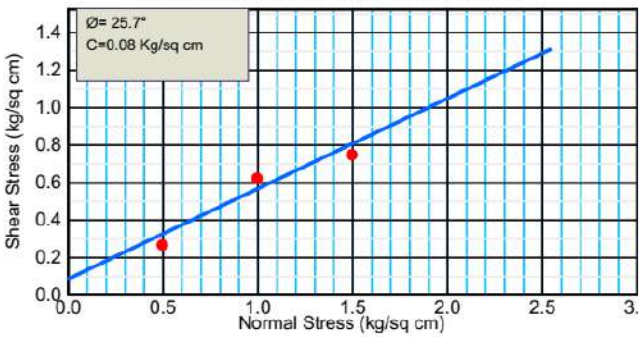


1901-HRIDC-V-23483.487
BH-P98, DEPTH=4.00M, DIRECT SHEAR TEST

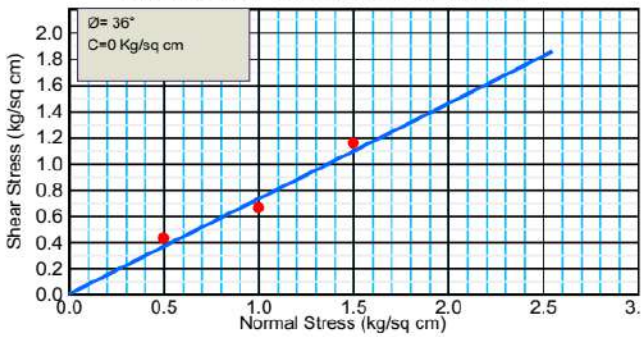


APPENDIX-F
GRAPH 10: DST GRAPH

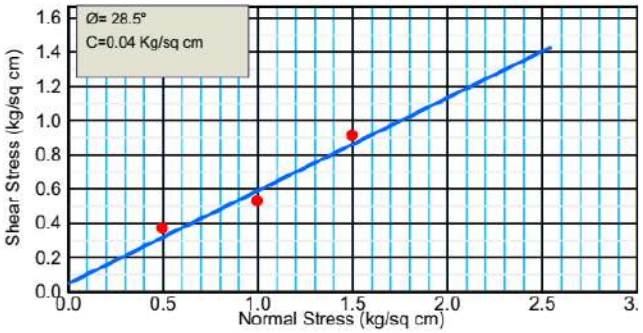
1901-HRIDC-V-23483.487
BH-P98, DEPTH=7.00M, DIRECT SHEAR TEST



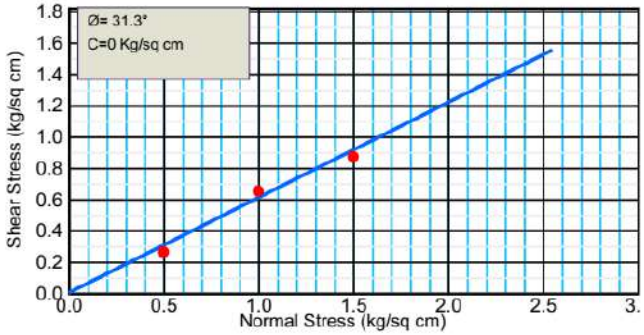
1901-HRIDC-V-23483.487
BH-P98, DEPTH=19.00M, DIRECT SHEAR TEST



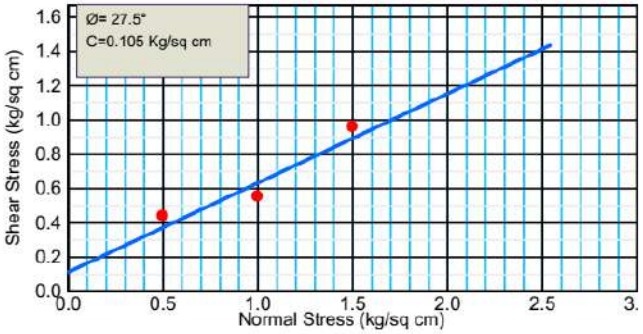
1901-HRIDC-V-23483.487
BH-P98, DEPTH=28.00M, DIRECT SHEAR TEST



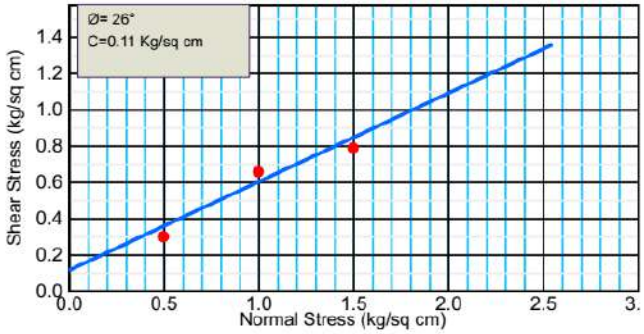
1901-HRIDC-V-23483.487
BH-P98, DEPTH=34.00M, DIRECT SHEAR TEST



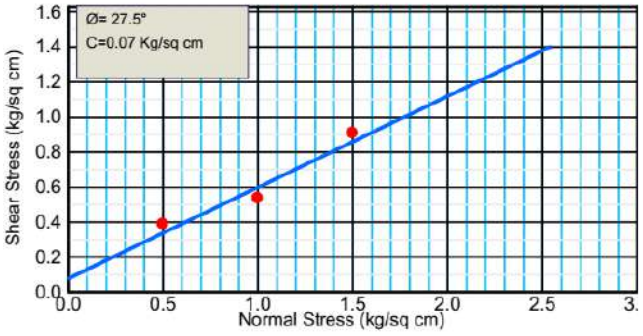
1901-HRIDC-V-23509.6870
BH-P99, DEPTH=1.00M, DIRECT SHEAR TEST



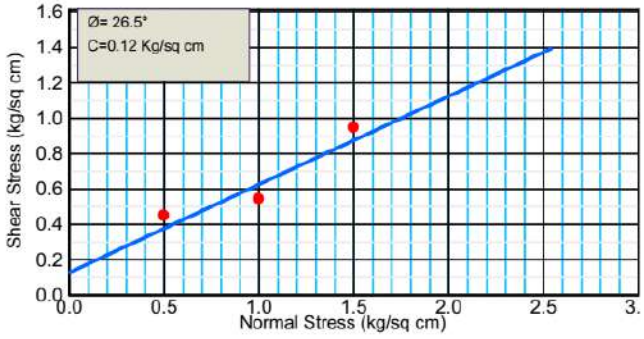
1901-HRIDC-V-23509.6870
BH-P99, DEPTH=4.00M, DIRECT SHEAR TEST



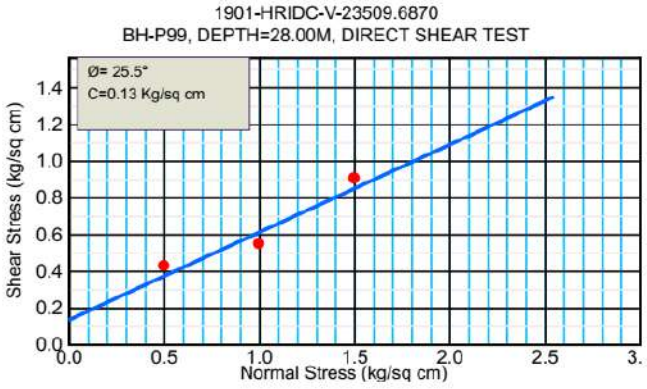
1901-HRIDC-V-23509.6870
BH-P99, DEPTH=16.00M, DIRECT SHEAR TEST

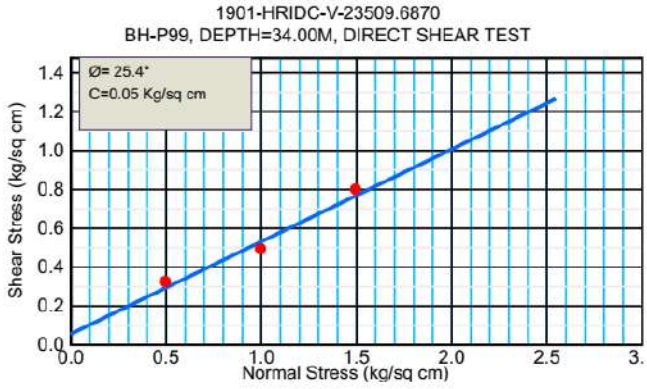


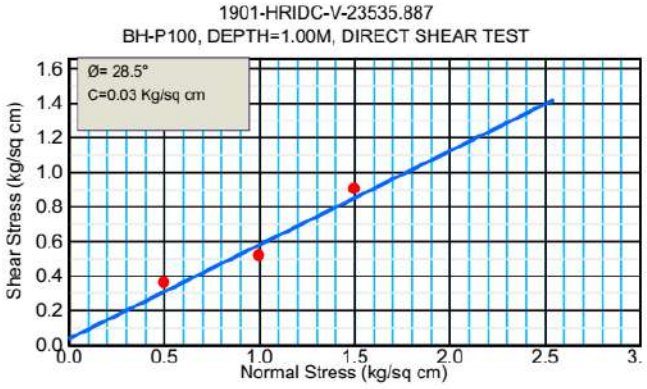
1901-HRIDC-V-23509.6870
BH-P99, DEPTH=22.00M, DIRECT SHEAR TEST

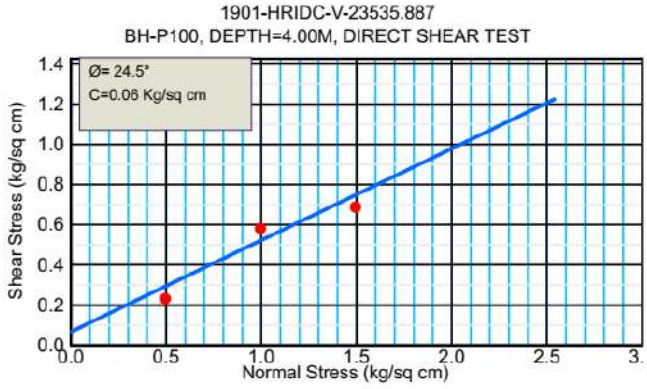


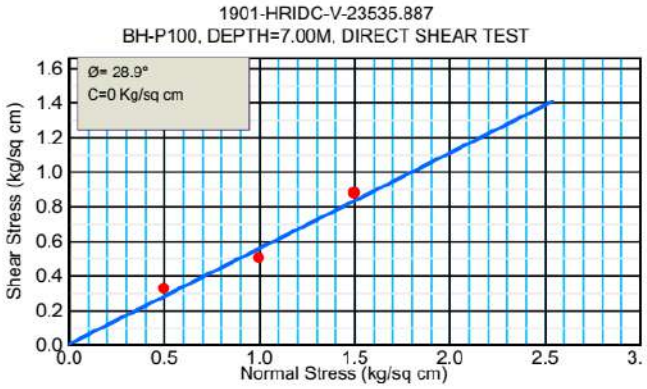
APPENDIX-F
GRAPH 11: DST GRAPH

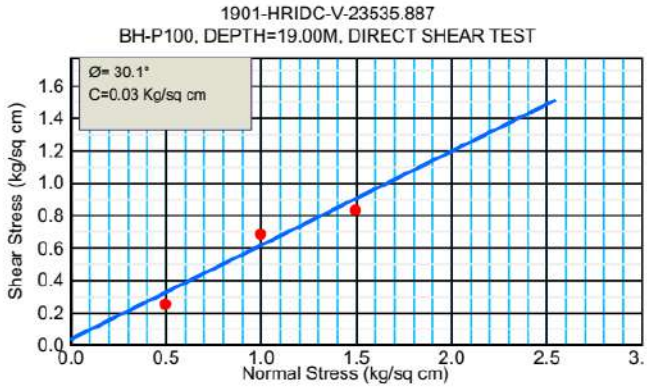




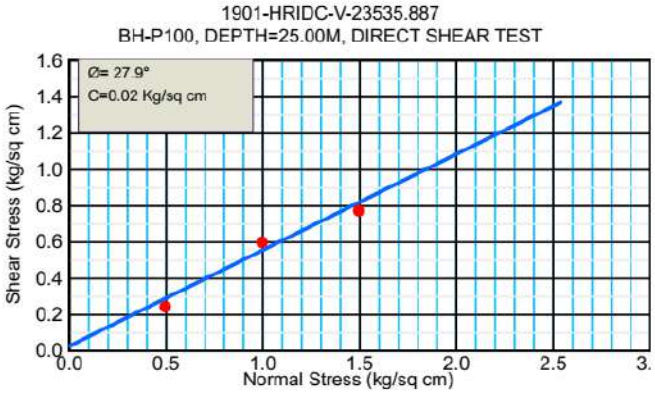


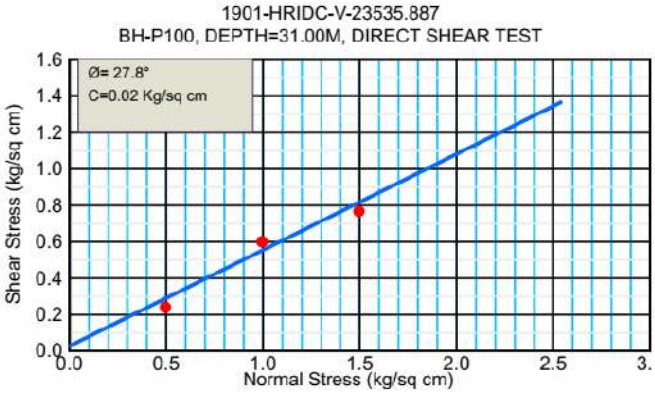


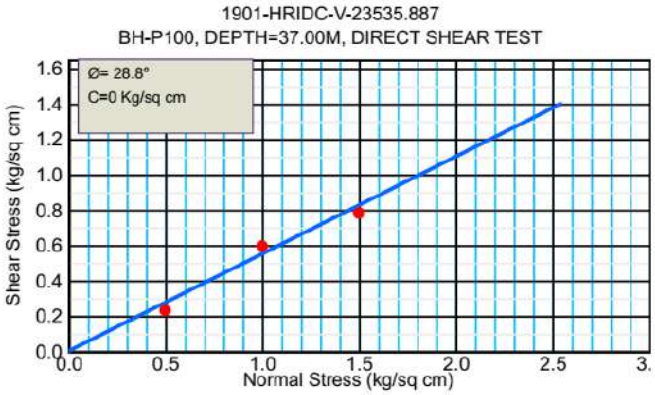




APPENDIX-F
GRAPH 12: DST GRAPH

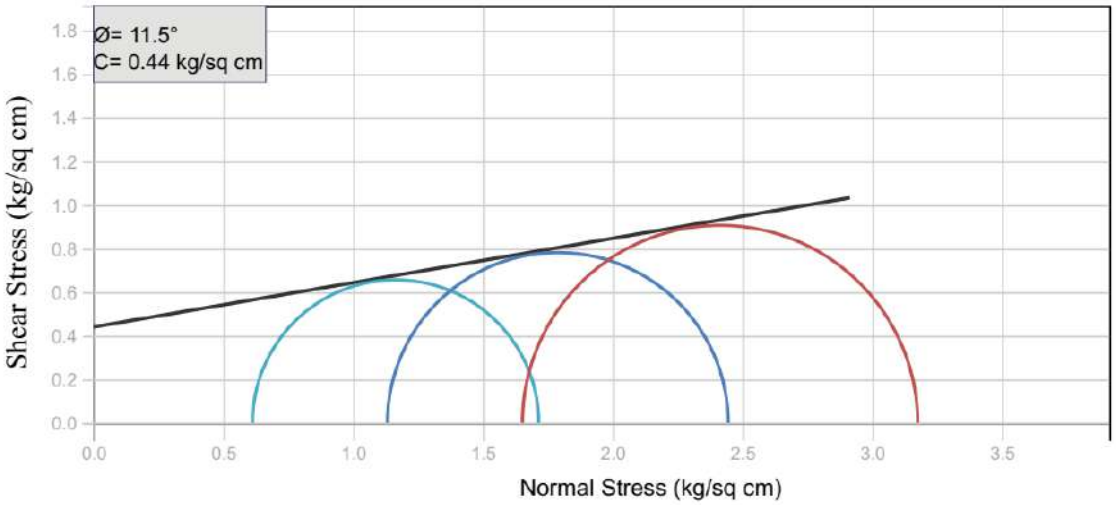




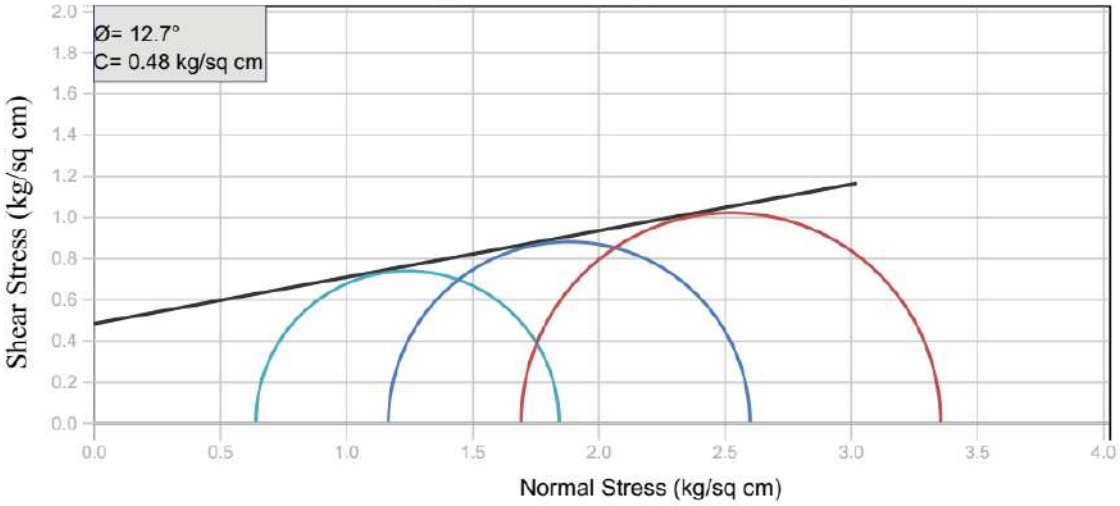


APPENDIX-G
GRAPH 1: UU GRAPH

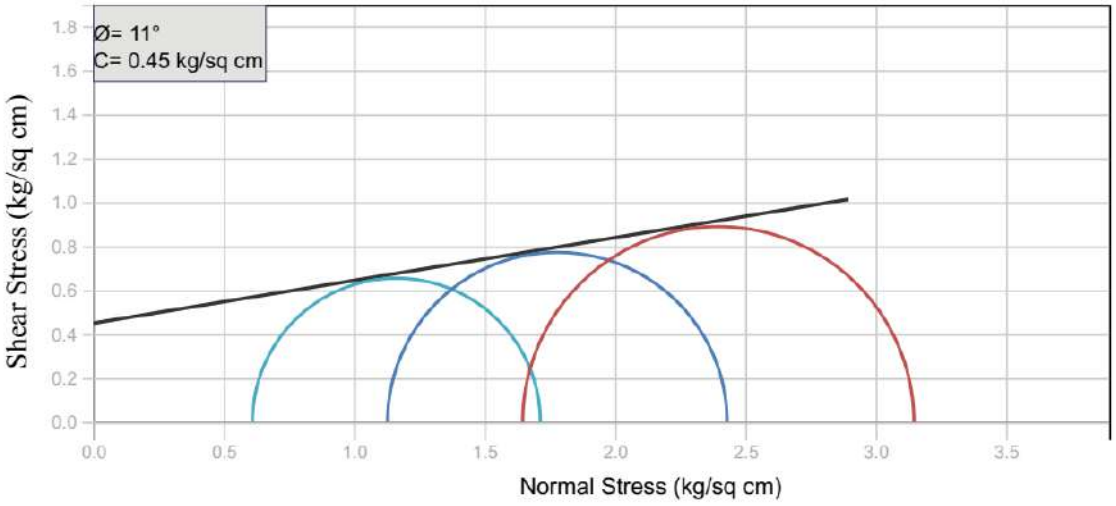
1901-HRIDC-V-23038.087
BH-NO.P81, DEPTH-4.00M, TRIAXIAL GRAPH



1901-HRIDC-V-23038.087
BH-NO.P81, DEPTH-7.00M, TRIAXIAL GRAPH

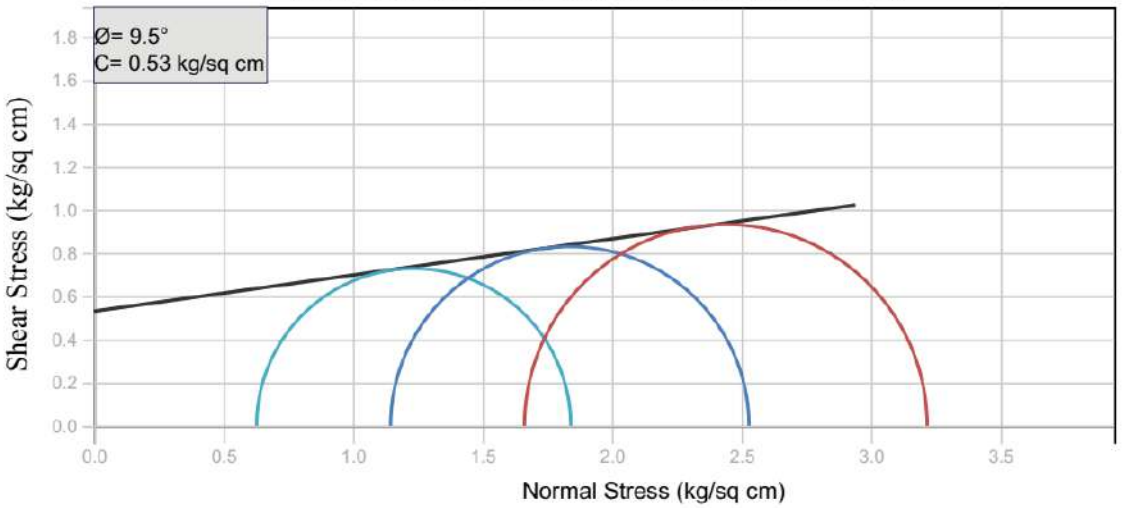


1901-HRIDC-V-23038.087
BH-NO.P81, DEPTH-10.00M, TRIAXIAL GRAPH

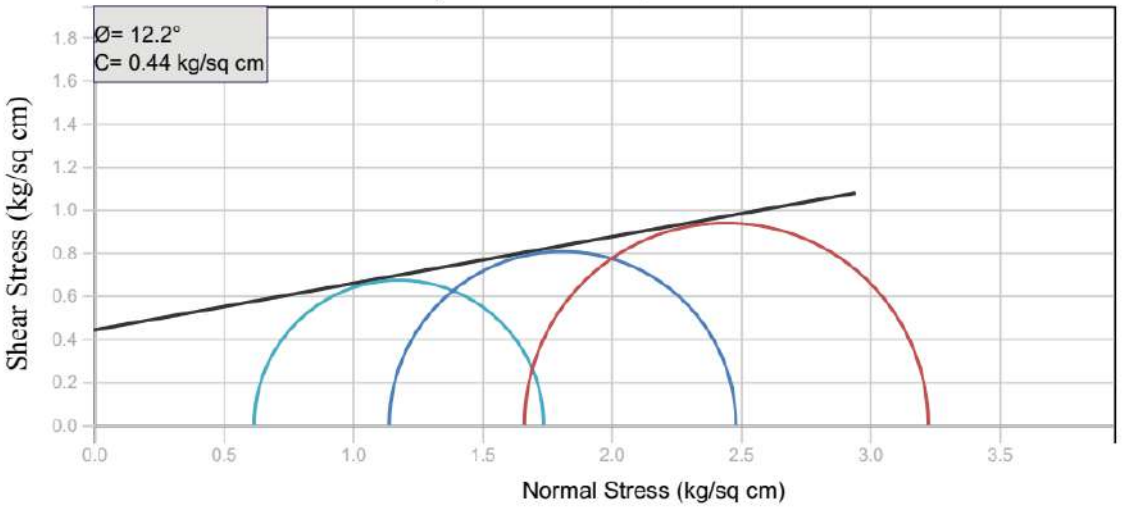


APPENDIX-G
GRAPH 2: UU GRAPH

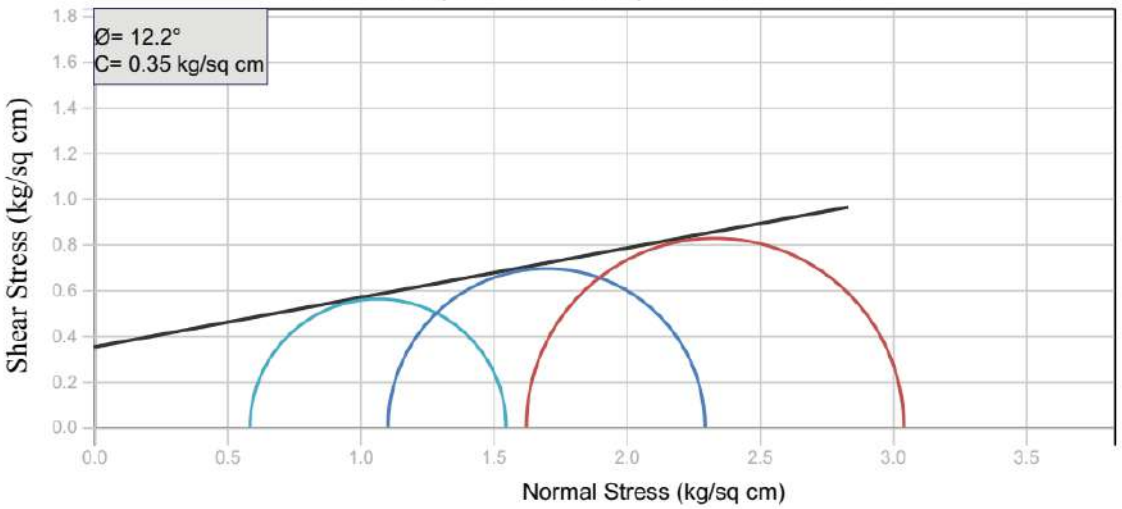
1901-HRIDC-V-23038.087
BH-NO.P81, DEPTH-13.00M, TRIAXIAL GRAPH



1901-HRIDC-V-23038.087
BH-NO.P81, DEPTH-19.00M, TRIAXIAL GRAPH

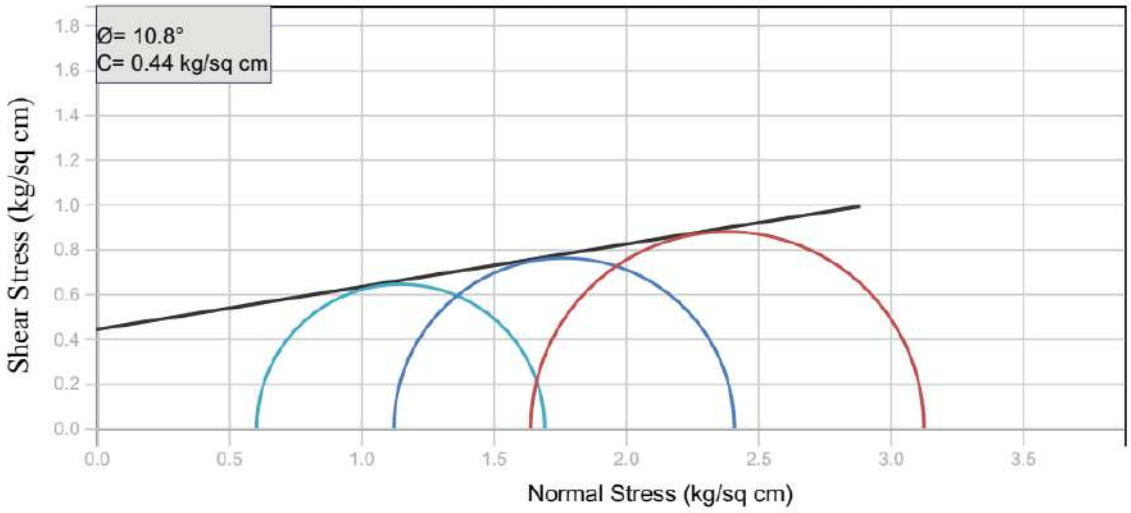


1901-HRIDC-V-23064.2870
BH-NO.P82, DEPTH-1.00M, TRIAXIAL GRAPH



APPENDIX-G
GRAPH 3: UU GRAPH

1901-HRIDC-V-23064.2870
BH-NO.P82, DEPTH-4.00M, TRIAXIAL GRAPH



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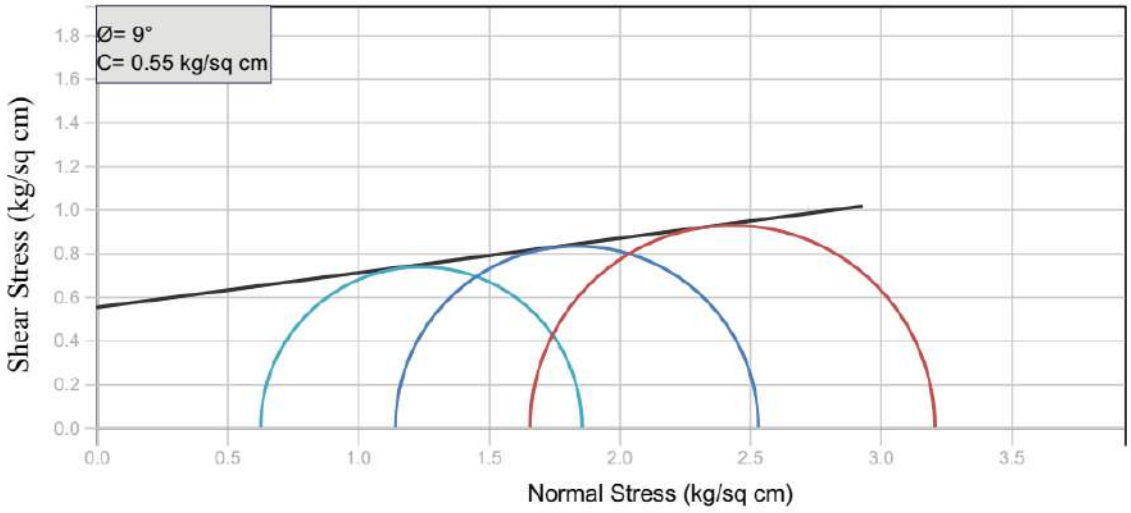
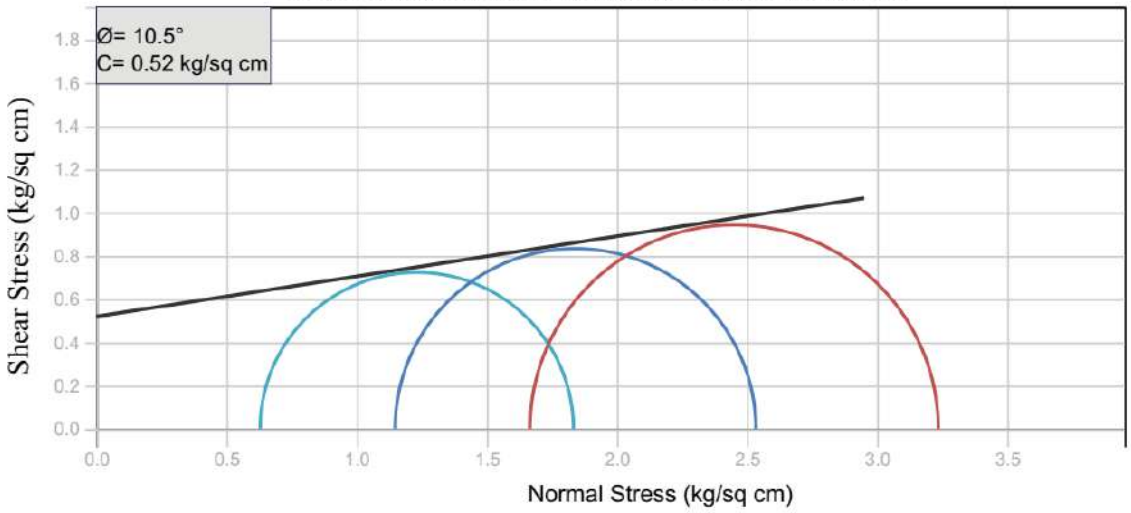
BH-NO.P82, DEPTH-13.00M, TRIAXIAL GRAPH

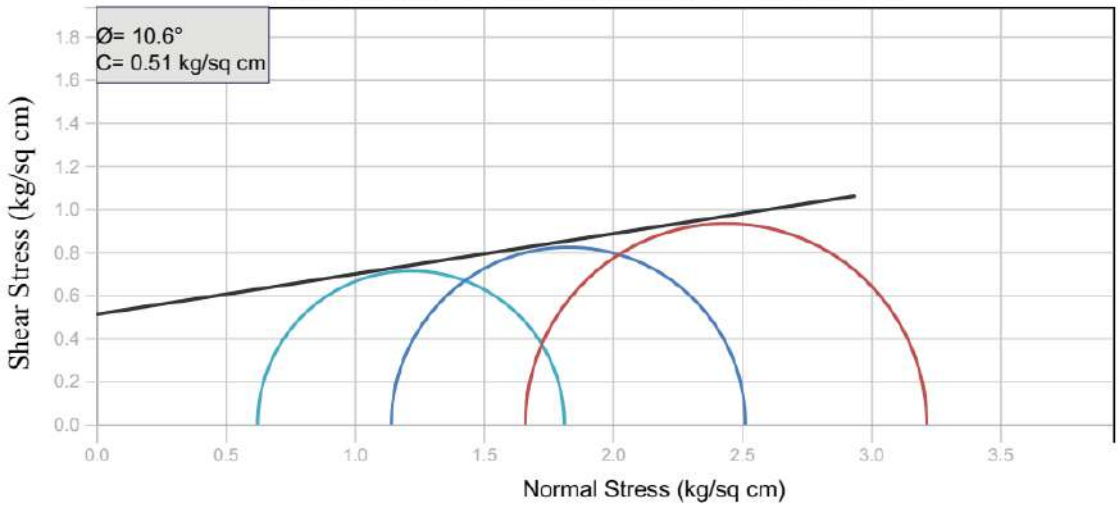


1901-HRIDC-V-23064.2870
BH-NO.P82, DEPTH-16.00M, TRIAXIAL GRAPH

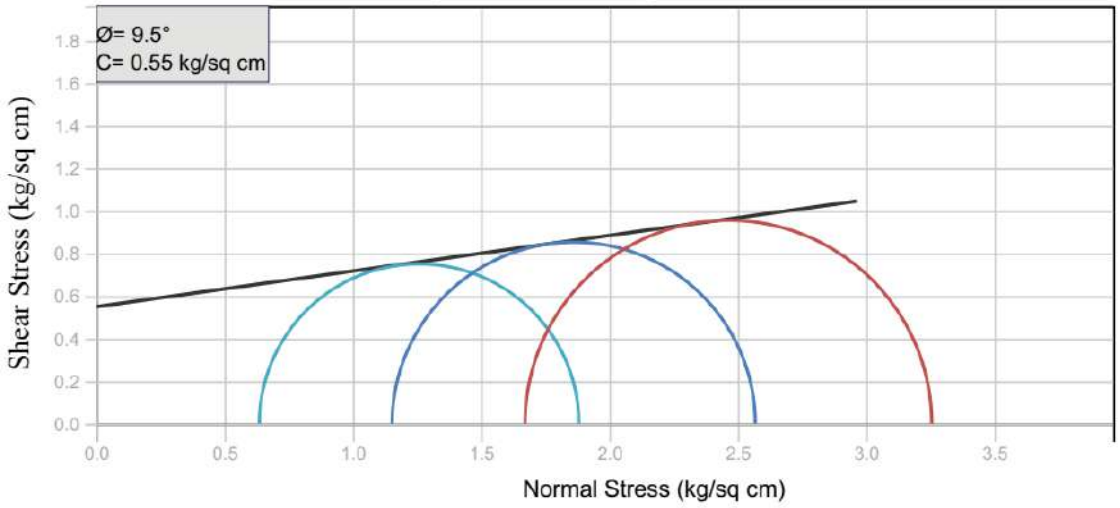


APPENDIX-G
GRAPH 4: UU GRAPH

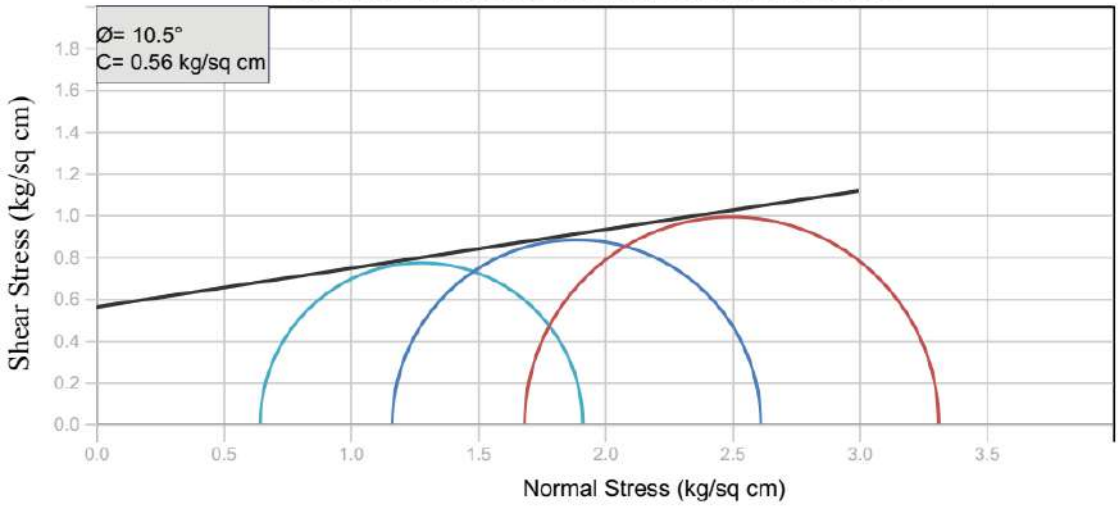
1901-HRIDC-V-23064.2870
BH-NO.P82, DEPTH-19.00M, TRIAXIAL GRAPH



1901-HRIDC-V-23064.2870
BH-NO.P82, DEPTH-28.00M, TRIAXIAL GRAPH

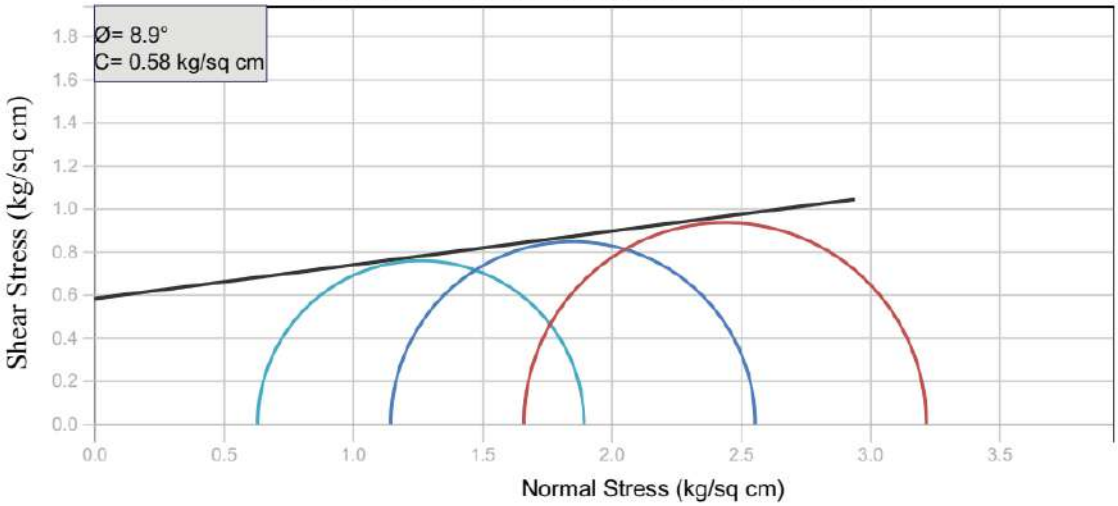


1901-HRIDC-V-23064.2870
BH-NO.P82, DEPTH-31.00M, TRIAXIAL GRAPH

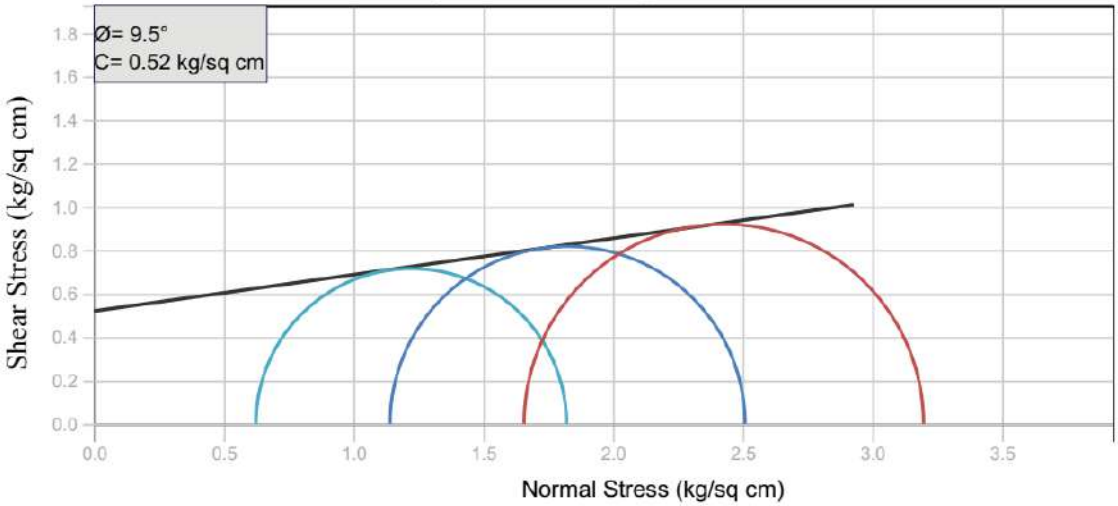


APPENDIX-G
GRAPH 5: UU GRAPH

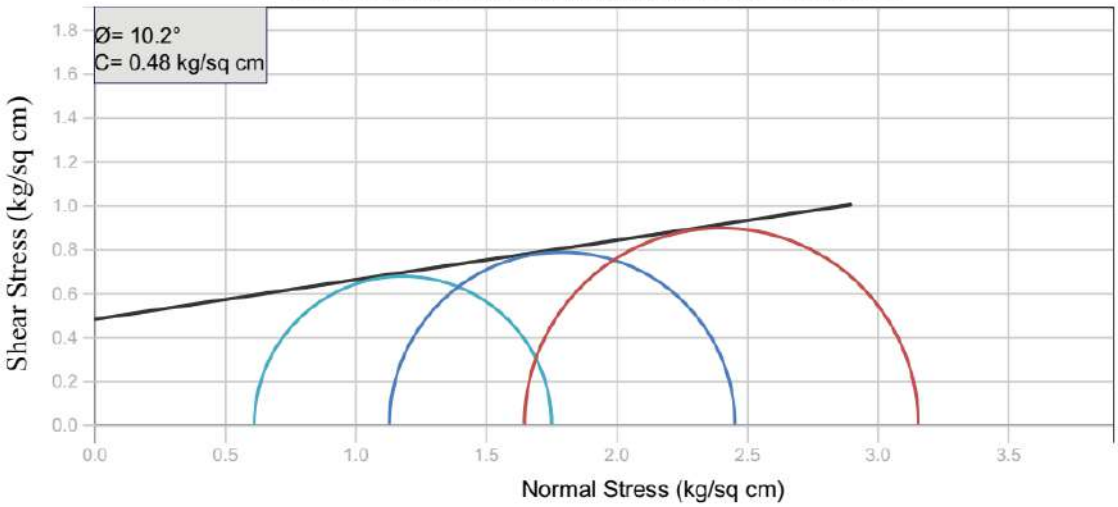
1901-HRIDC-V-23090.487
BH-NO.P83, DEPTH-11.00M, TRIAXIAL GRAPH



1901-HRIDC-V-23090.487
BH-NO.P83, DEPTH-14.00M, TRIAXIAL GRAPH

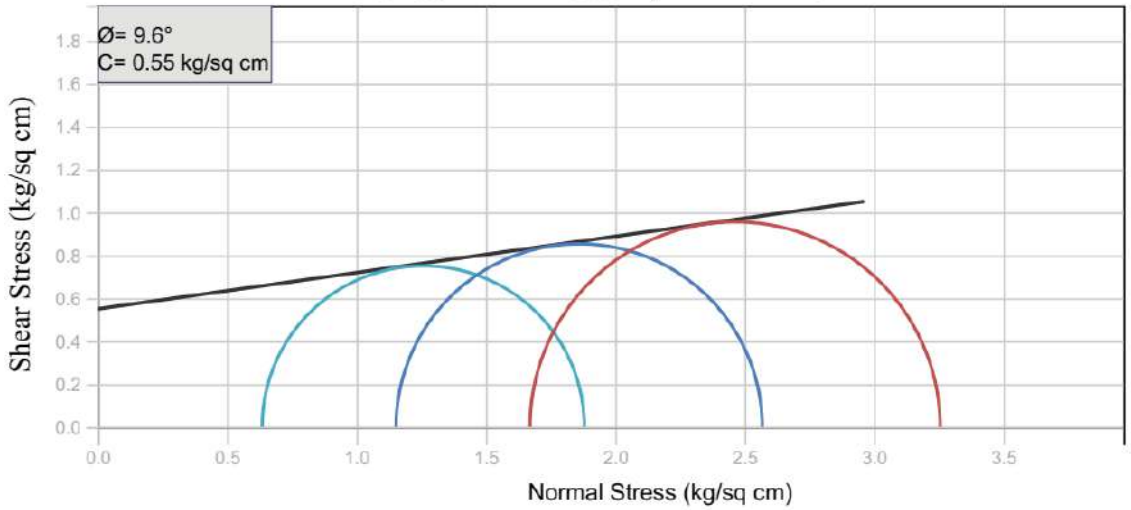


1901-HRIDC-V-23090.487
BH-NO.P83, DEPTH-20.00M, TRIAXIAL GRAPH

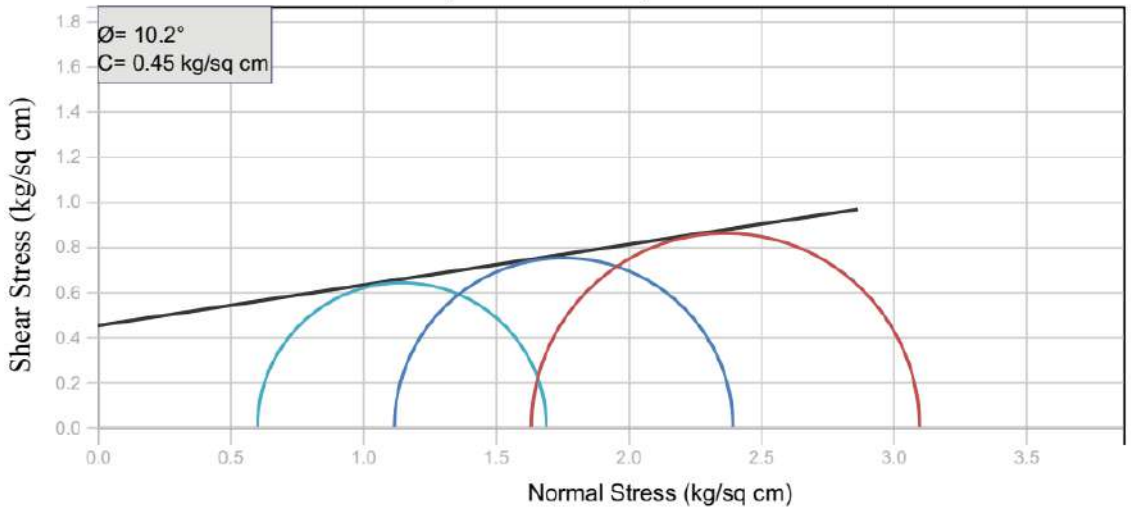


APPENDIX-G
GRAPH 6: UU GRAPH

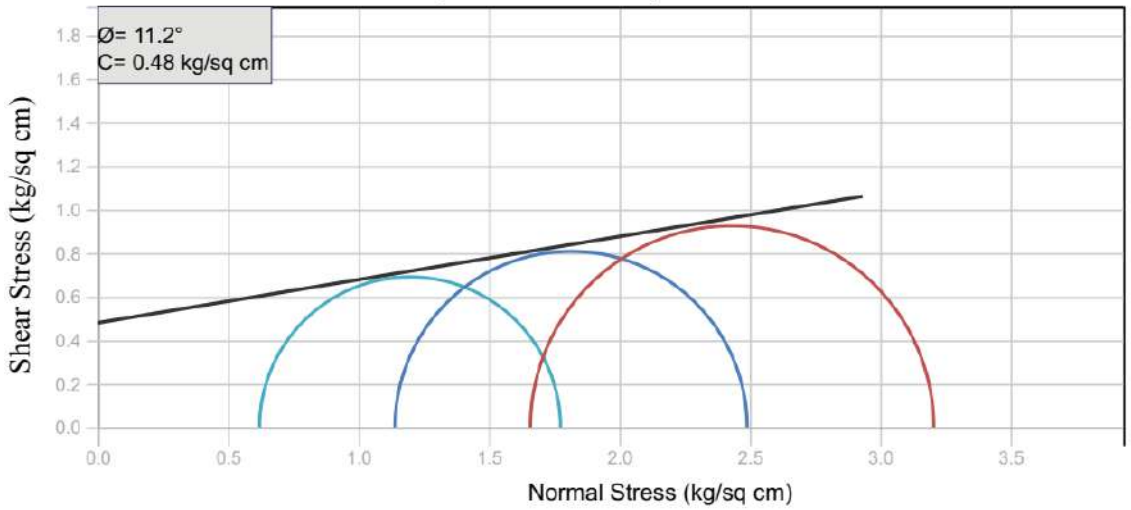
1901-HRIDC-V-23090.487
BH-NO.P83, DEPTH-23.00M, TRIAXIAL GRAPH



1901-HRIDC-V-23116.687
BH-NO.P84, DEPTH-8.00M, TRIAXIAL GRAPH

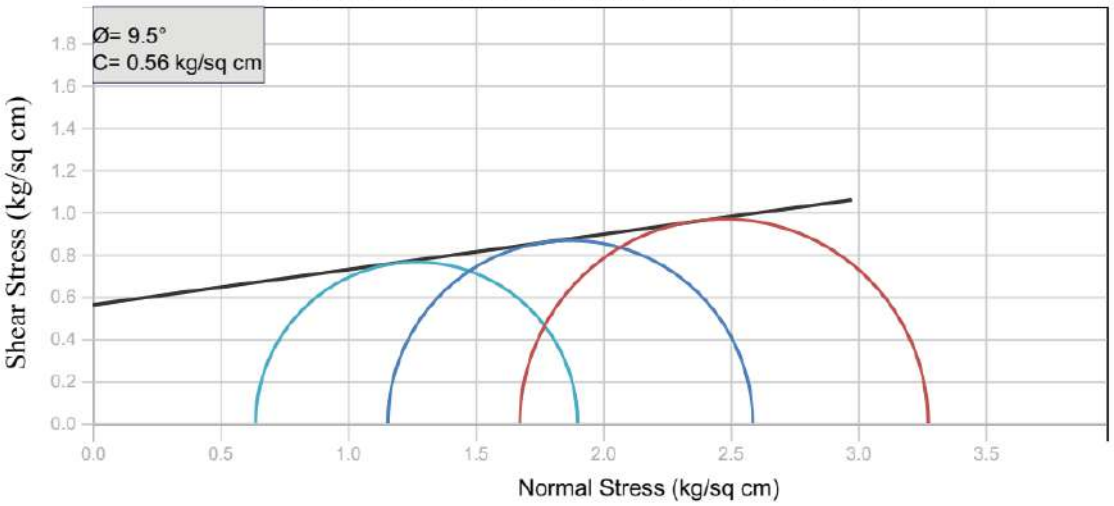


1901-HRIDC-V-23116.687
BH-NO.P84, DEPTH-14.00M, TRIAXIAL GRAPH

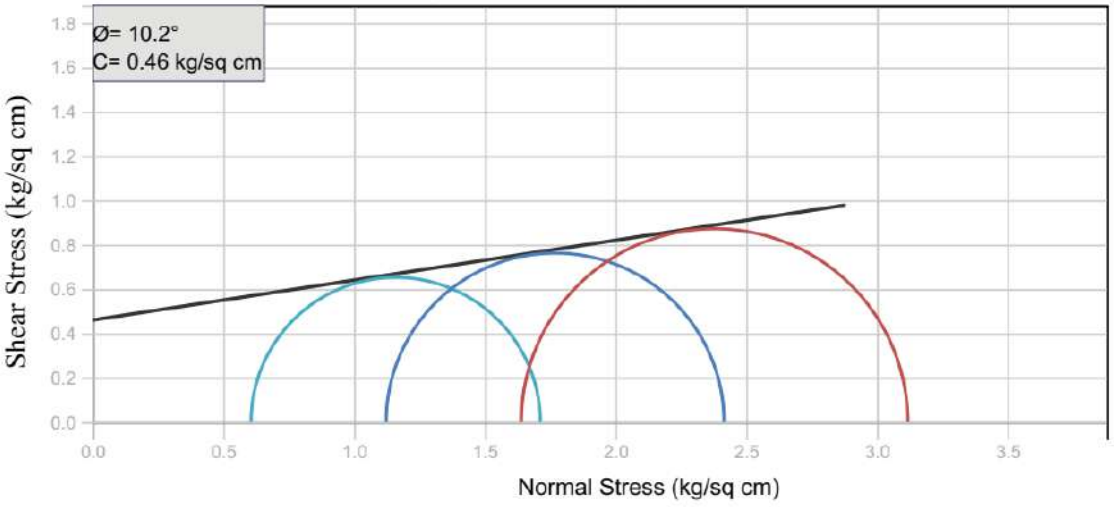


APPENDIX-G
GRAPH 7: UU GRAPH

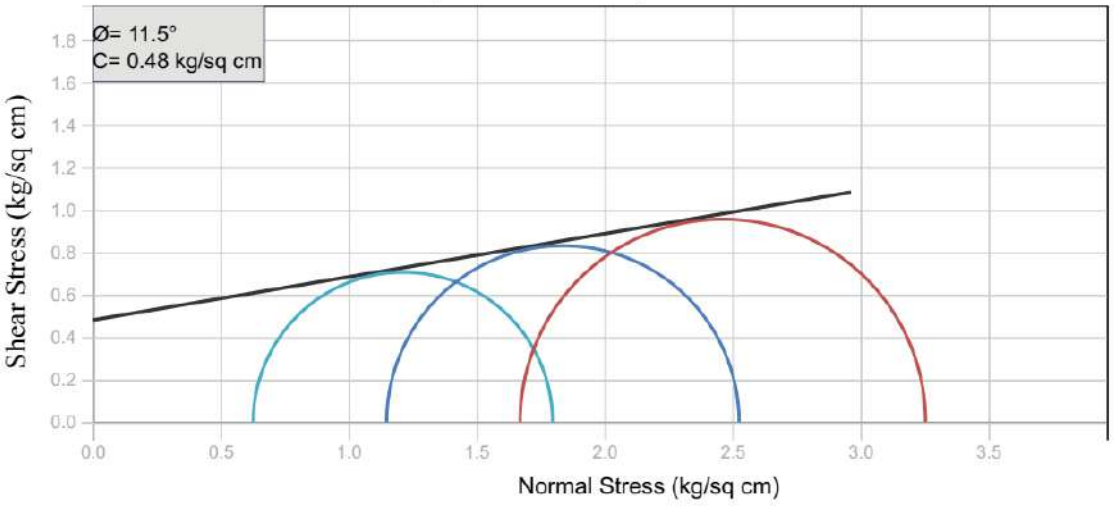
1901-HRIDC-V-23116.687
BH-NO.P84, DEPTH-23.00M, TRIAXIAL GRAPH



1901-HRIDC-V-23142.8870
BH-NO.P85, DEPTH-16.00M, TRIAXIAL GRAPH

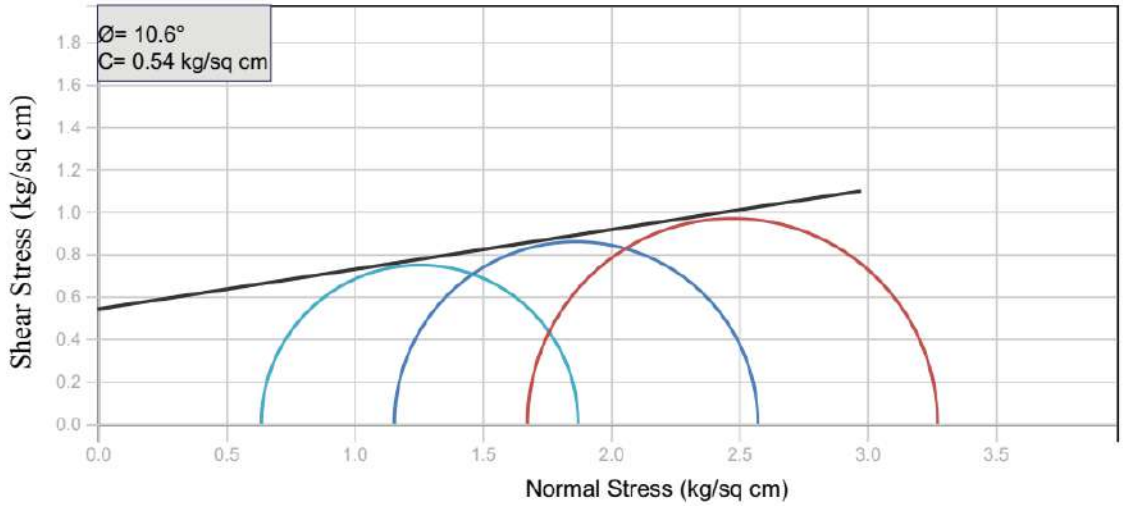


1901-HRIDC-V-23142.8870
BH-NO.P85, DEPTH-19.00M, TRIAXIAL GRAPH

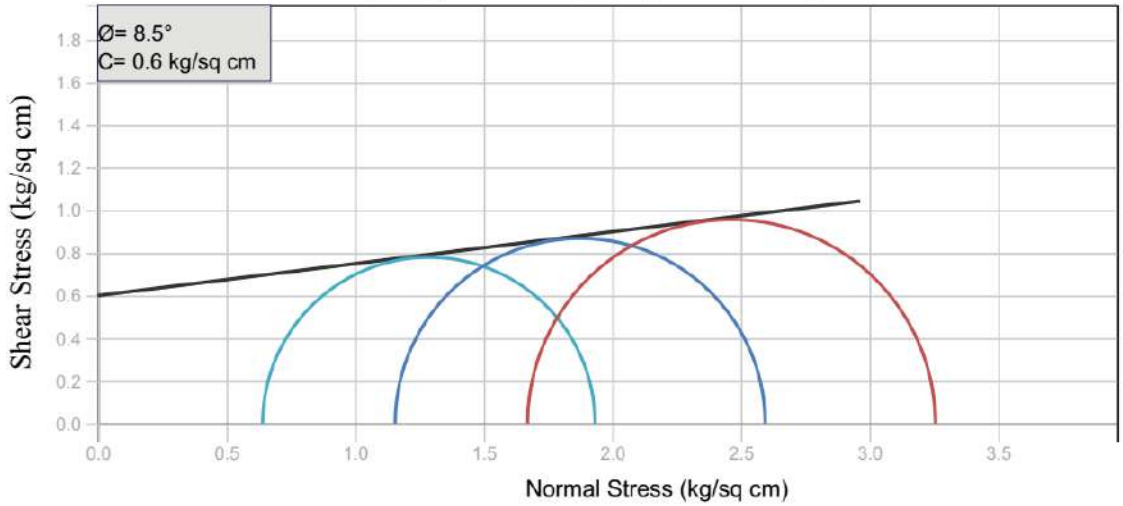


APPENDIX-G
GRAPH 8: UU GRAPH

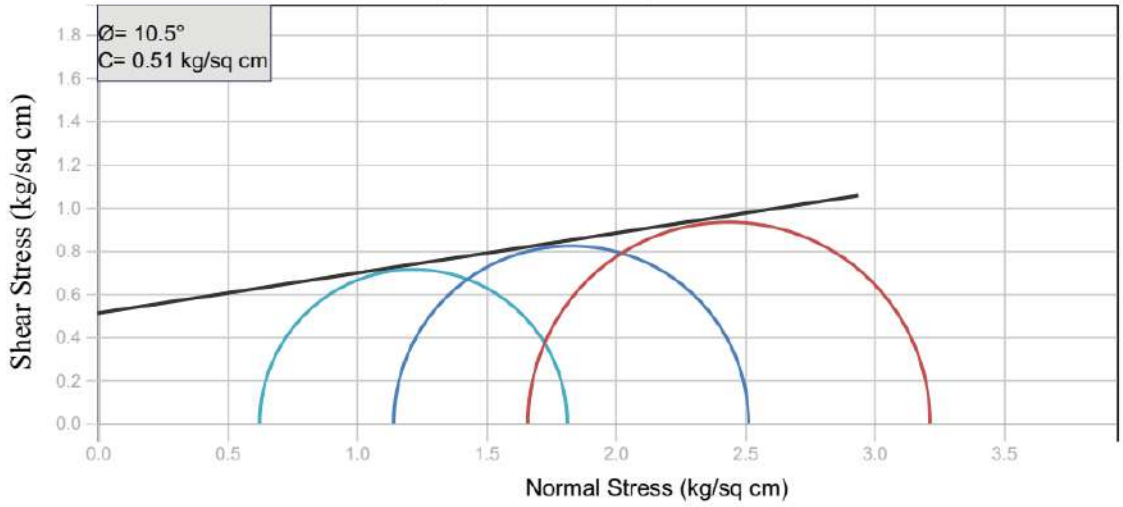
1901-HRIDC-V-23142.8870
BH-NO.P85, DEPTH-22.00M, TRIAXIAL GRAPH



1901-HRIDC-V-23142.8870
BH-NO.P85, DEPTH-28.00M, TRIAXIAL GRAPH

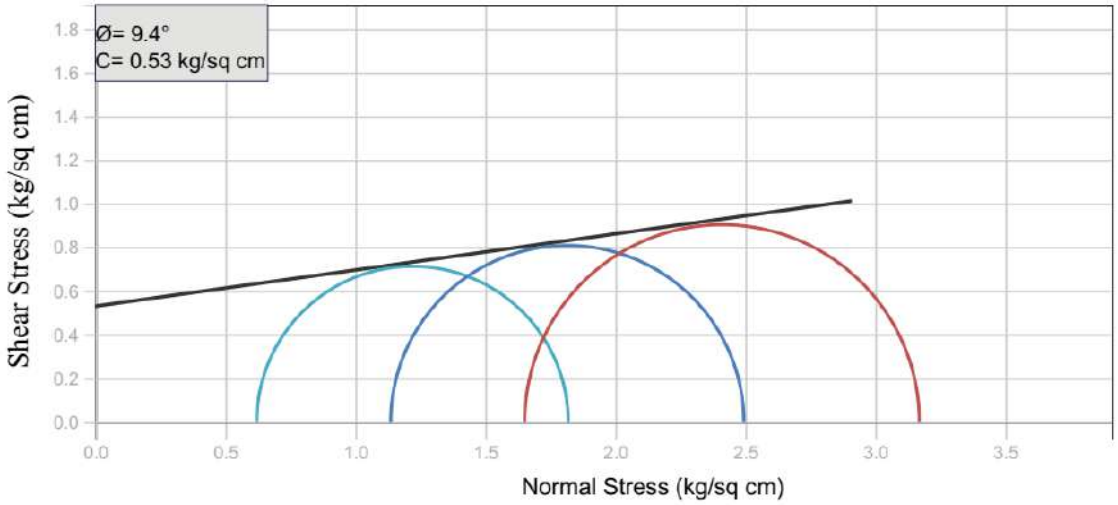


1901-HRIDC-V-23169.087
BH-NO.P86, DEPTH-14.00M, TRIAXIAL GRAPH

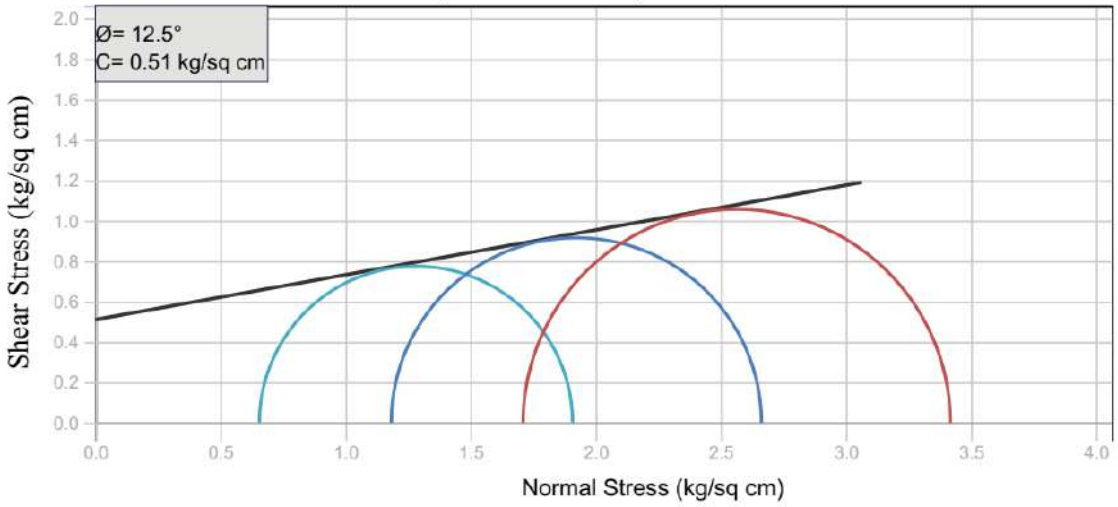


APPENDIX-G
GRAPH 9: UU GRAPH

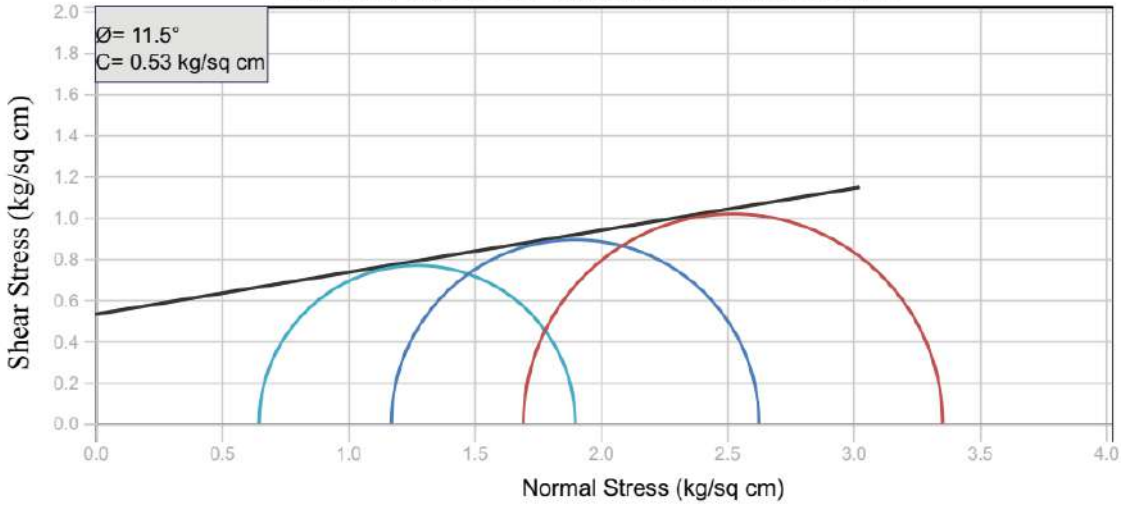
1901-HRIDC-V-23169.087
BH-NO.P86, DEPTH-23.00M, TRIAXIAL GRAPH



1901-HRIDC-V-23195.287
BH-NO.P87, DEPTH-1.00M, TRIAXIAL GRAPH

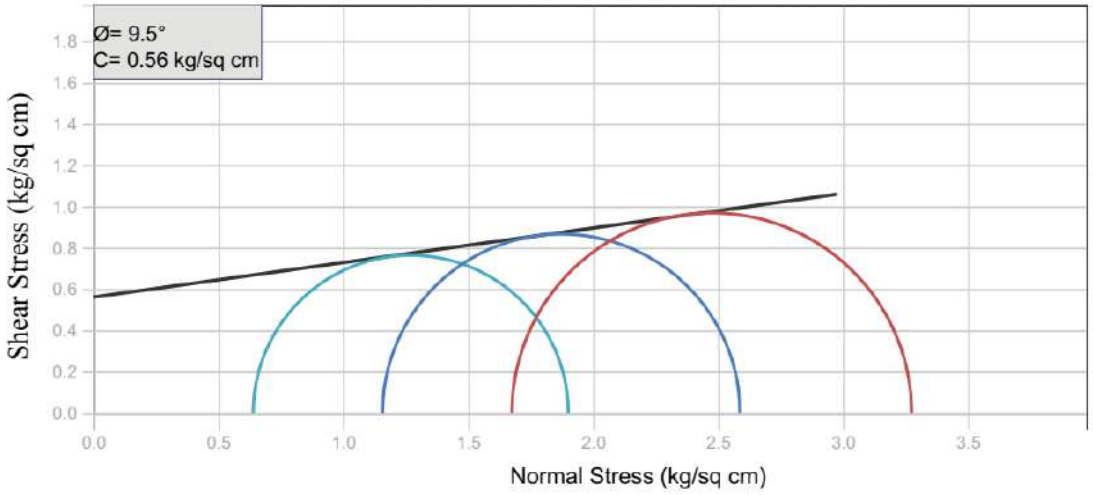


1901-HRIDC-V-23195.287
BH-NO.P87, DEPTH-13.00M, TRIAXIAL GRAPH

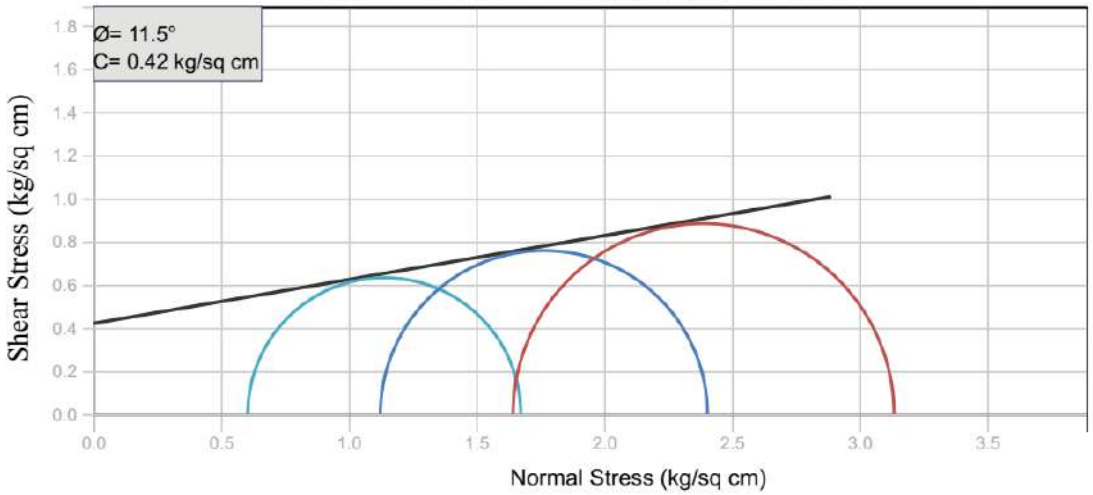


APPENDIX-G
GRAPH 10: UU GRAPH

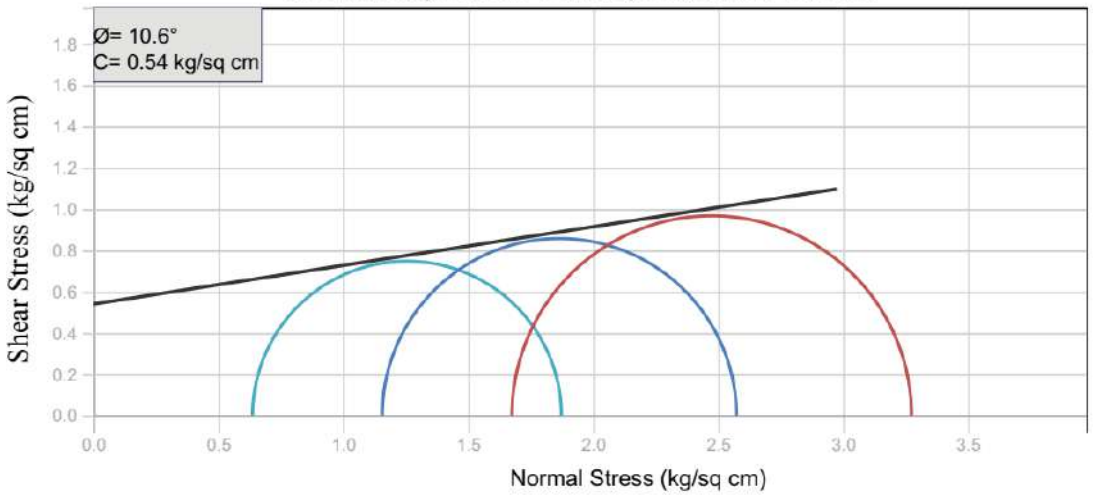
1901-HRIDC-V-23195.287
BH-NO.P87, DEPTH-19.00M, TRIAXIAL GRAPH



1901-HRIDC-V-23195.287
BH-NO.P87, DEPTH-22.00M, TRIAXIAL GRAPH

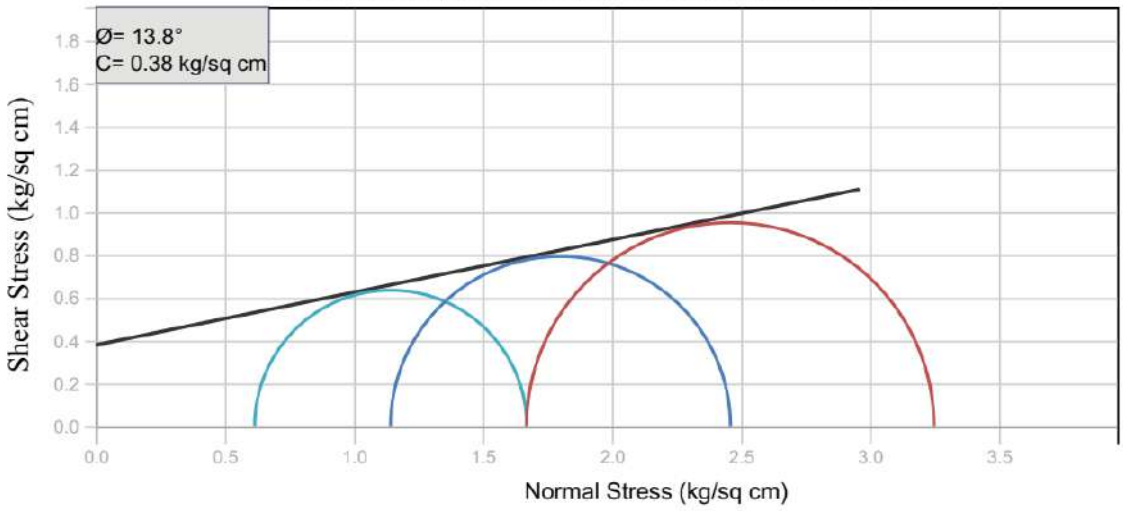


1901-HRIDC-V-23211.4870
BH-NO.P88, DEPTH-14.00M, TRIAXIAL GRAPH

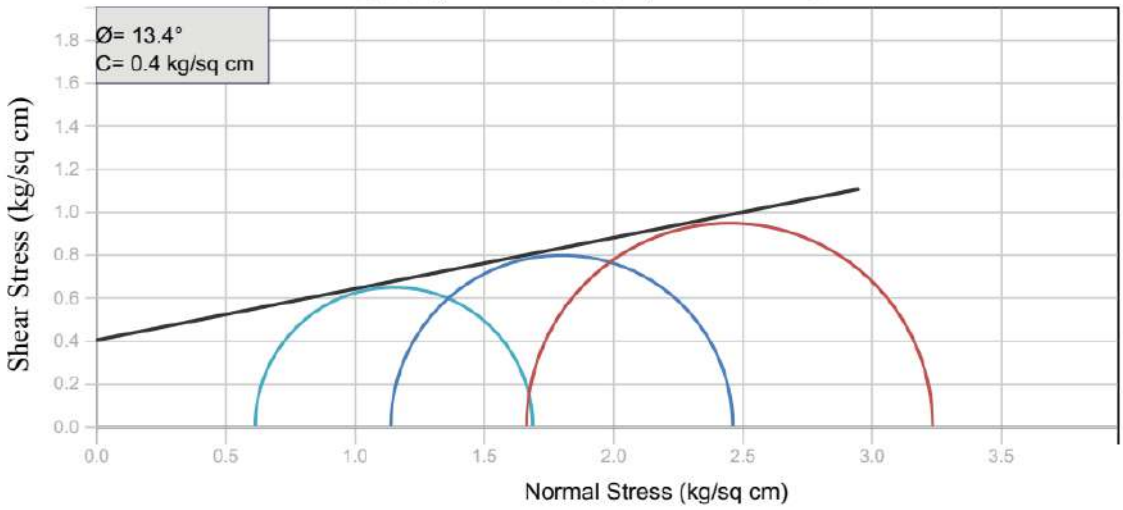


APPENDIX-G
GRAPH 11: UU GRAPH

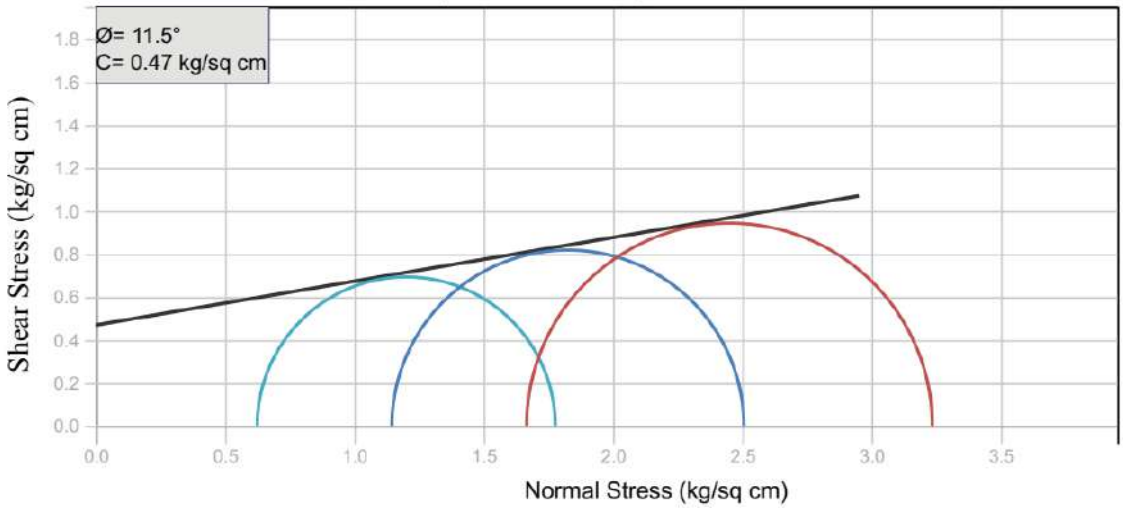
1901-HRIDC-V-23211.4870
BH-NO.P88, DEPTH-29.00M, TRIAXIAL GRAPH



1901-HRIDC-V-23211.4870
BH-NO.P88, DEPTH-32.00M, TRIAXIAL GRAPH

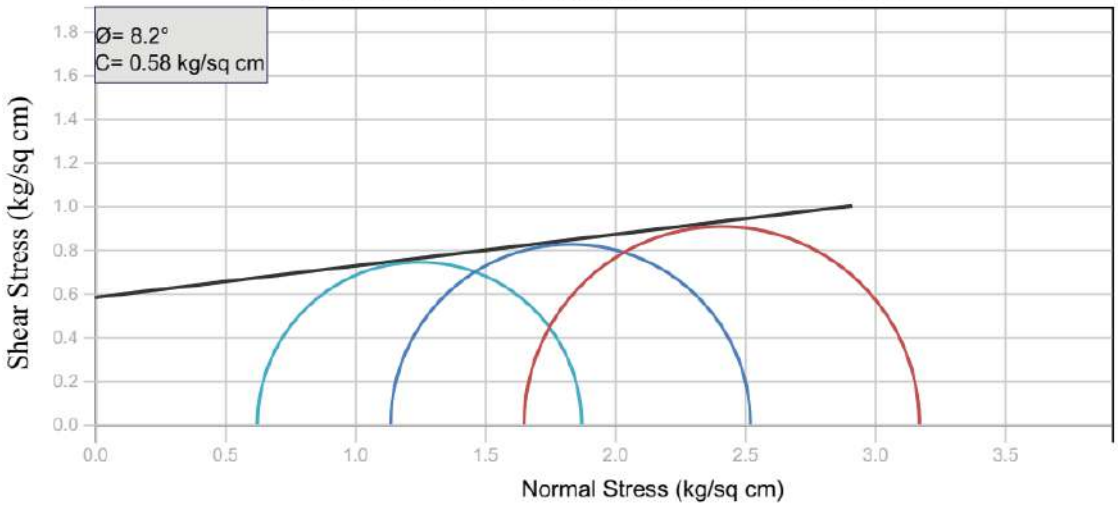


1901-HRIDC-V-23247.687
BH-NO.P89, DEPTH-1.00M, TRIAXIAL GRAPH

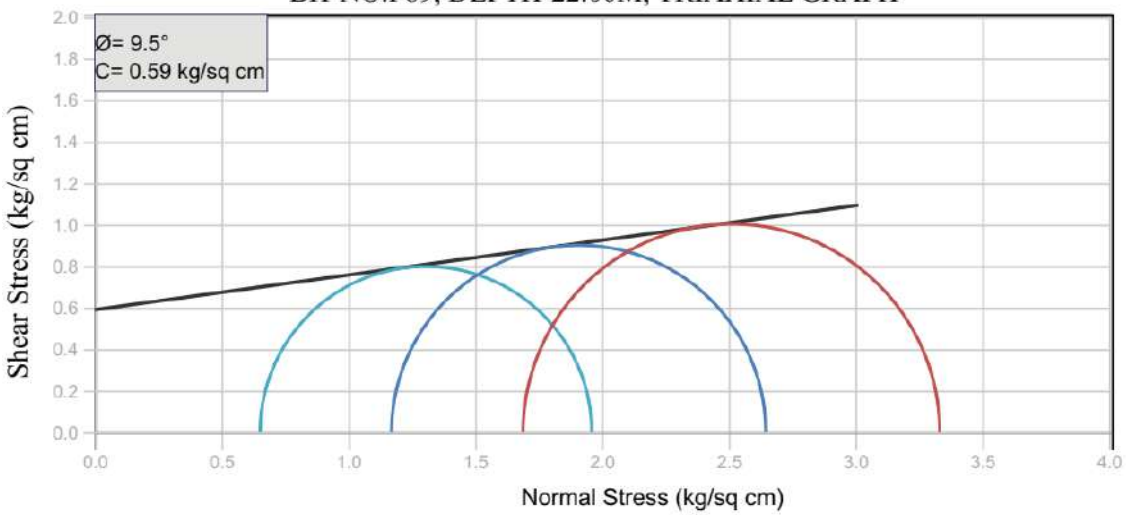


APPENDIX-G
GRAPH 12: UU GRAPH

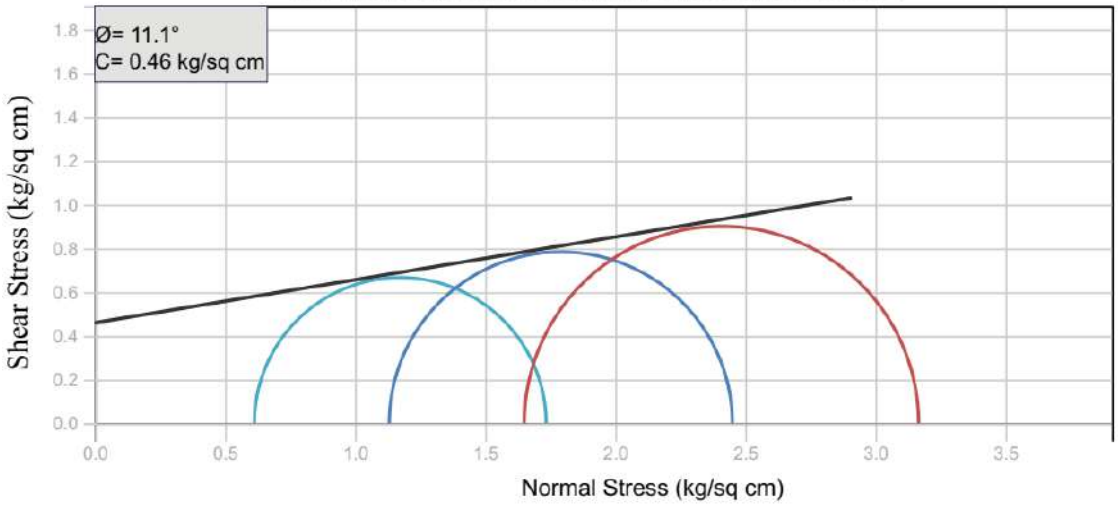
1901-HRIDC-V-23247.687
BH-NO.P89, DEPTH-19.00M, TRIAXIAL GRAPH



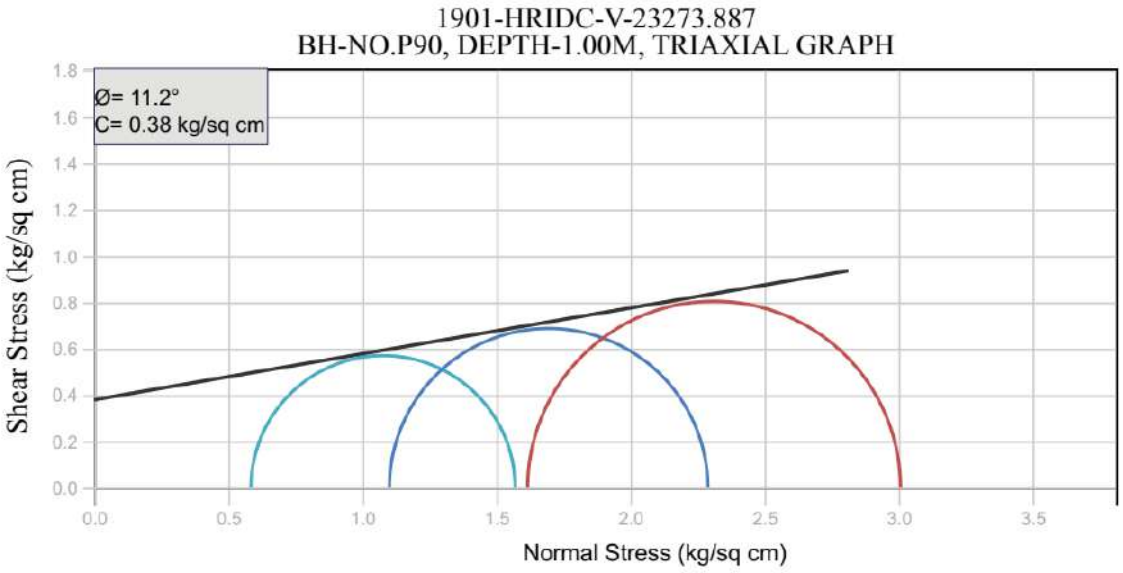
1901-HRIDC-V-23247.687
BH-NO.P89, DEPTH-22.00M, TRIAXIAL GRAPH

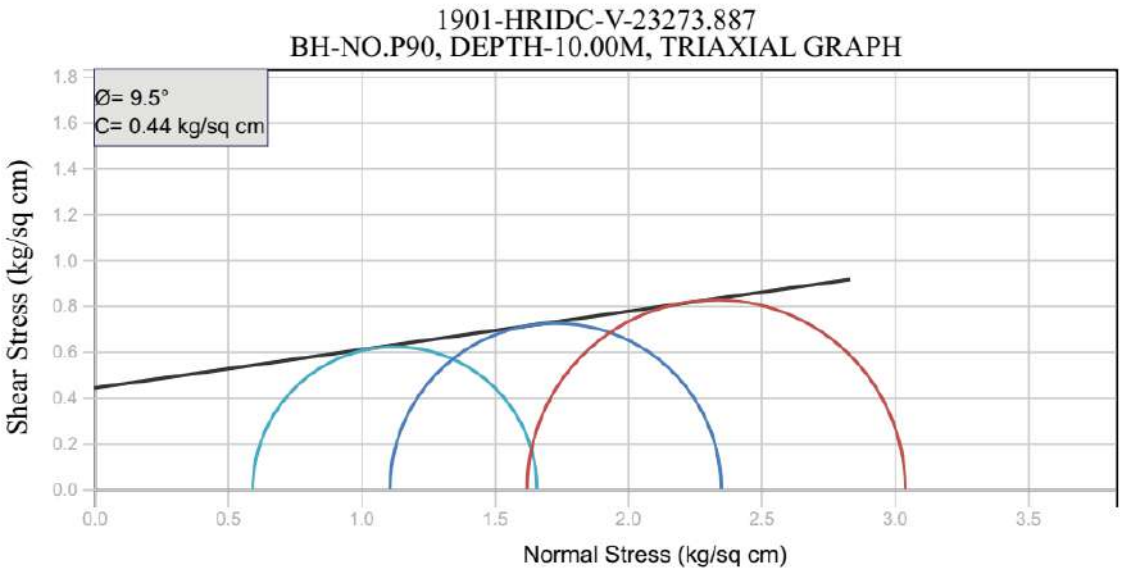


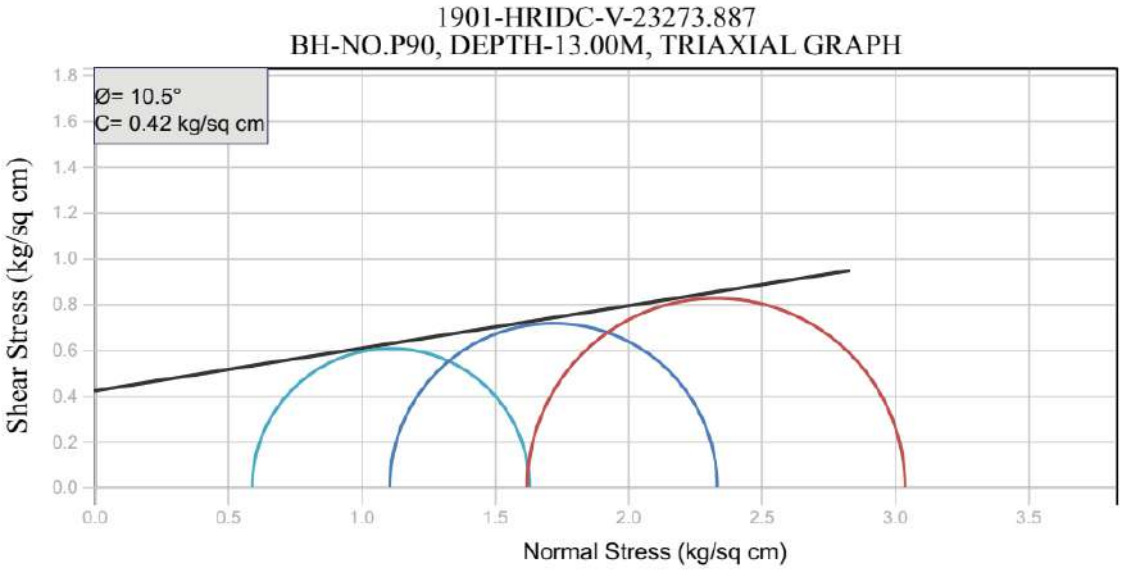
1901-HRIDC-V-23247.687
BH-NO.P89, DEPTH-31.00M, TRIAXIAL GRAPH



APPENDIX-G
GRAPH 13: UU GRAPH

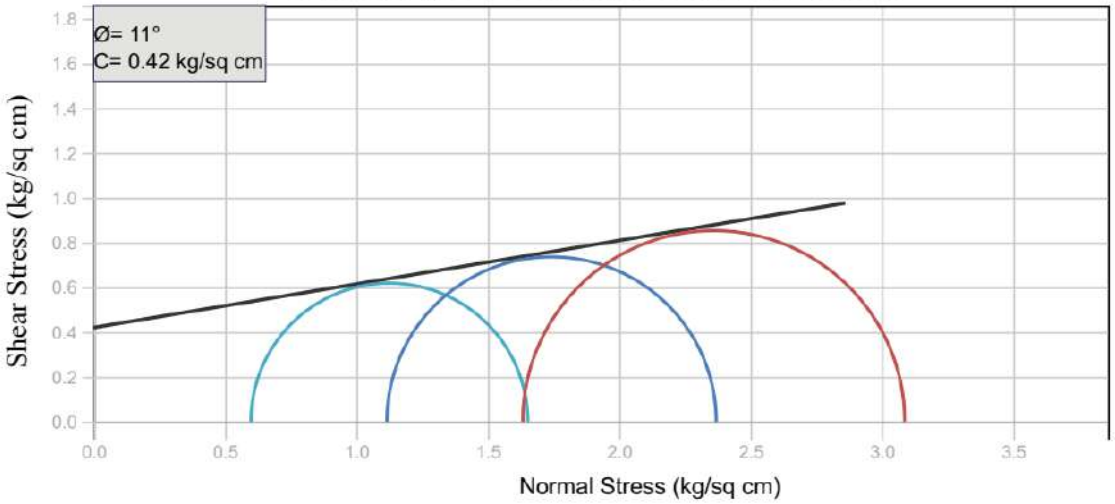




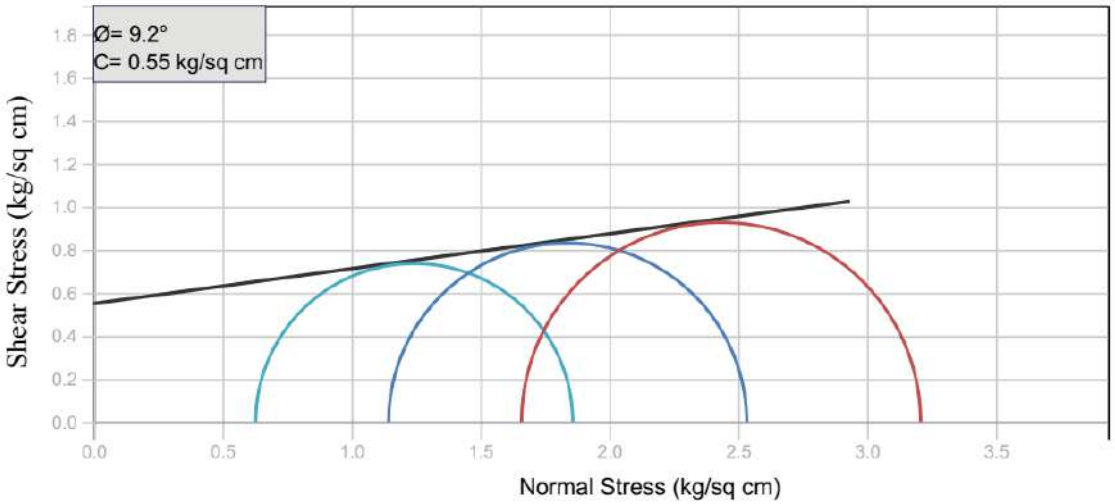


APPENDIX-G
GRAPH 14: UU GRAPH

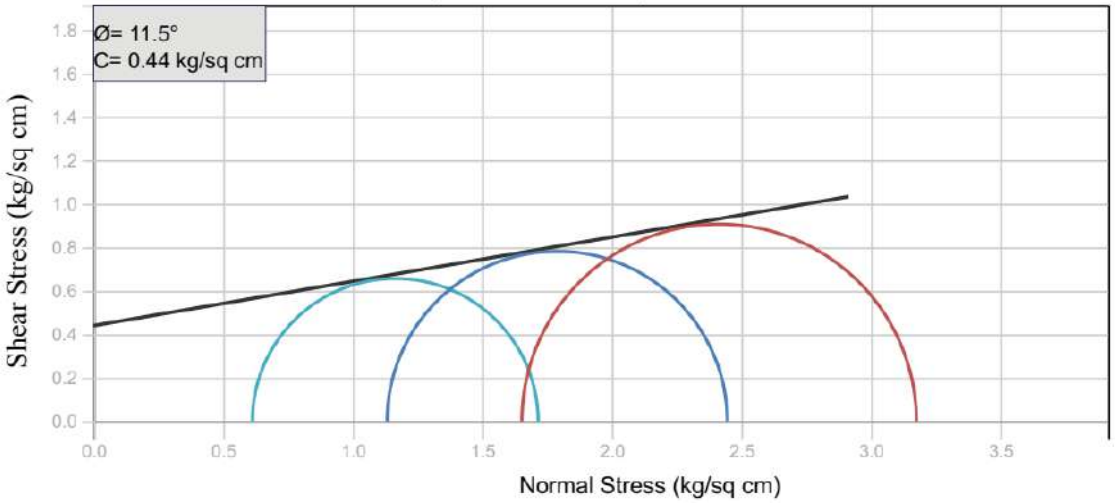
1901-HRIDC-V-23273.887
BH-NO.P90, DEPTH-19.00M, TRIAXIAL GRAPH



1901-HRIDC-V-23273.887
BH-NO.P90, DEPTH-22.00M, TRIAXIAL GRAPH

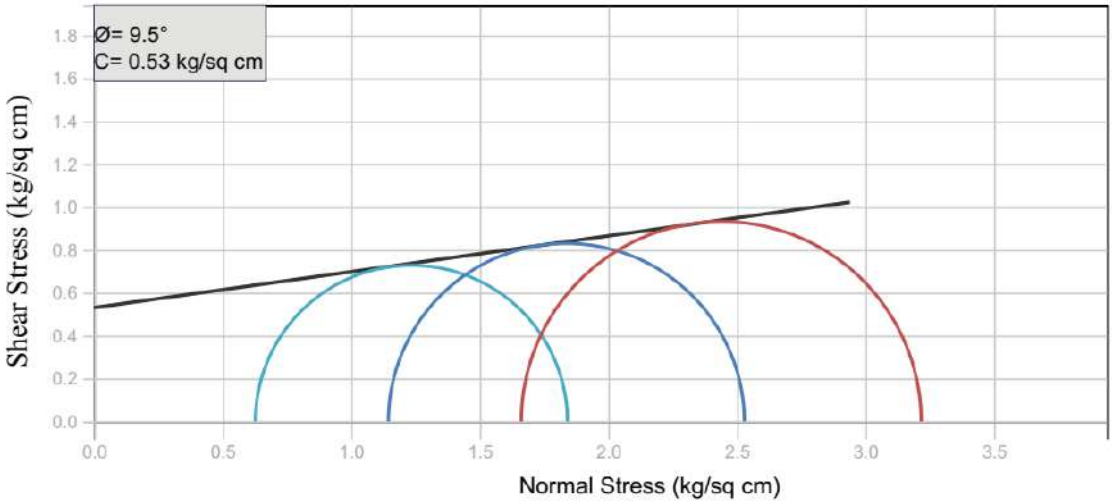


1901-HRIDC-V-23300.0870
BH-NO.P91, DEPTH-10.00M, TRIAXIAL GRAPH

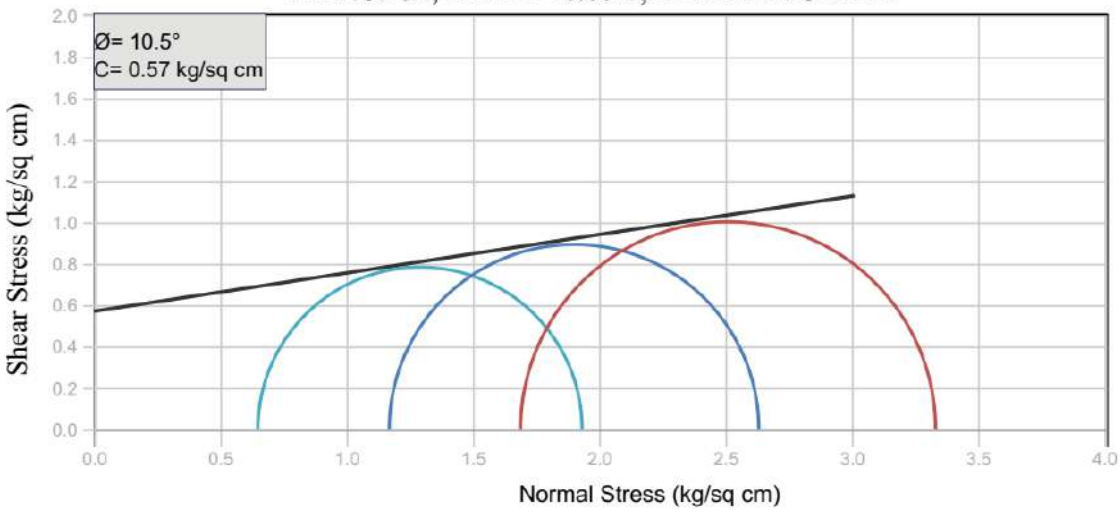


APPENDIX-G
GRAPH 15: UU GRAPH

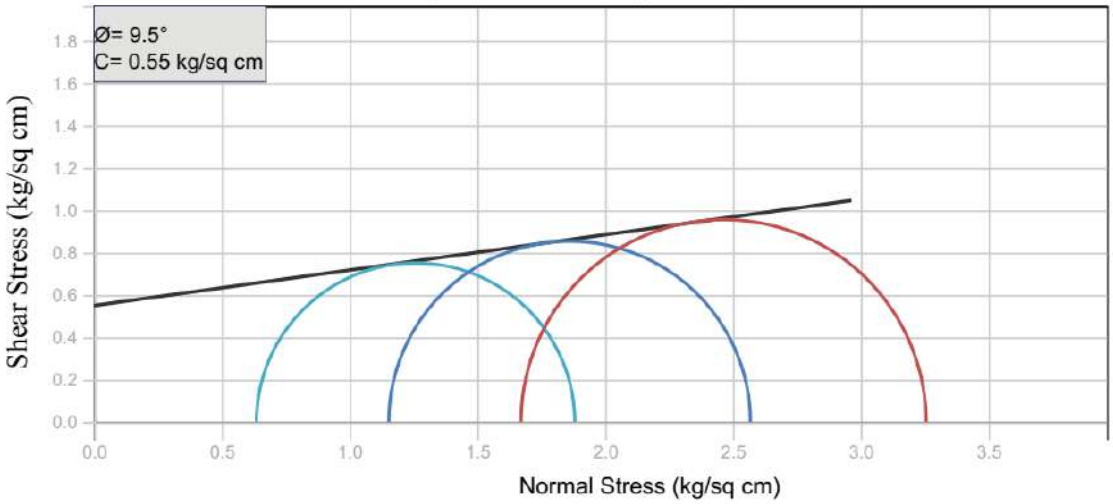
1901-HRIDC-V-23300.0870
BH-NO.P91, DEPTH-13.00M, TRIAXIAL GRAPH



1901-HRIDC-V-23300.0870
BH-NO.P91, DEPTH-16.00M, TRIAXIAL GRAPH

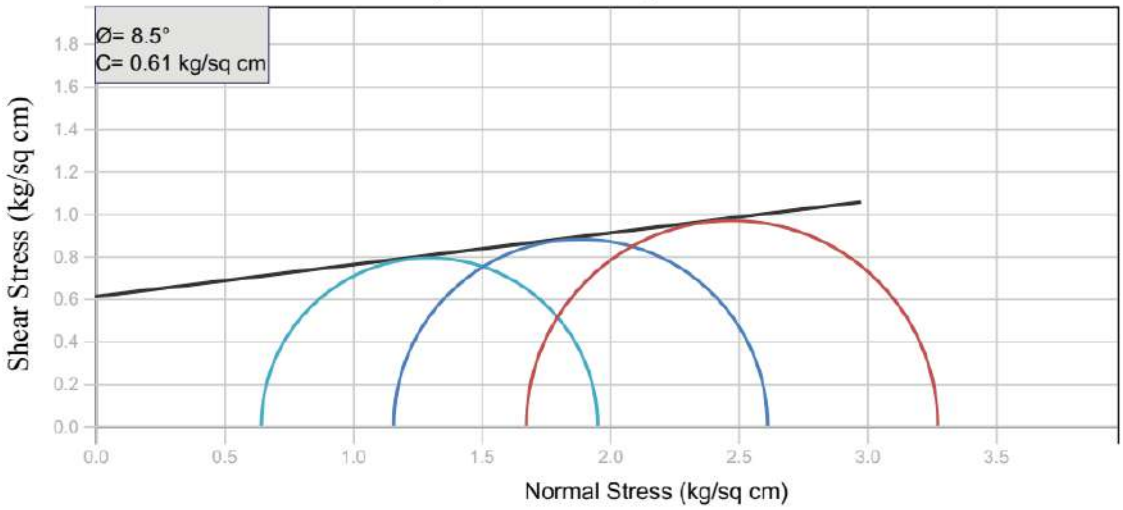


1901-HRIDC-V-23300.0870
BH-NO.P91, DEPTH-19.00M, TRIAXIAL GRAPH

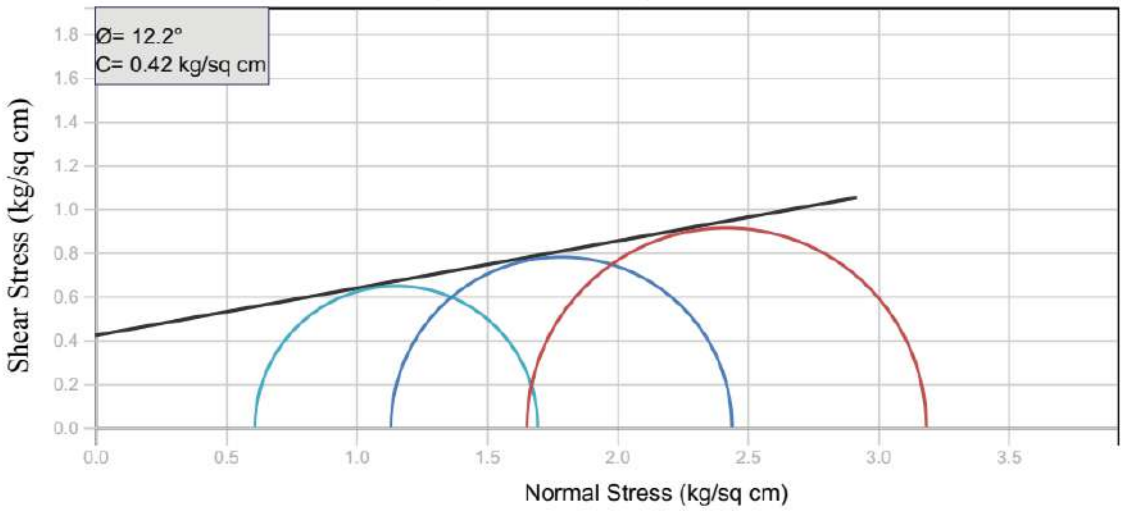


APPENDIX-G
GRAPH 16: UU GRAPH

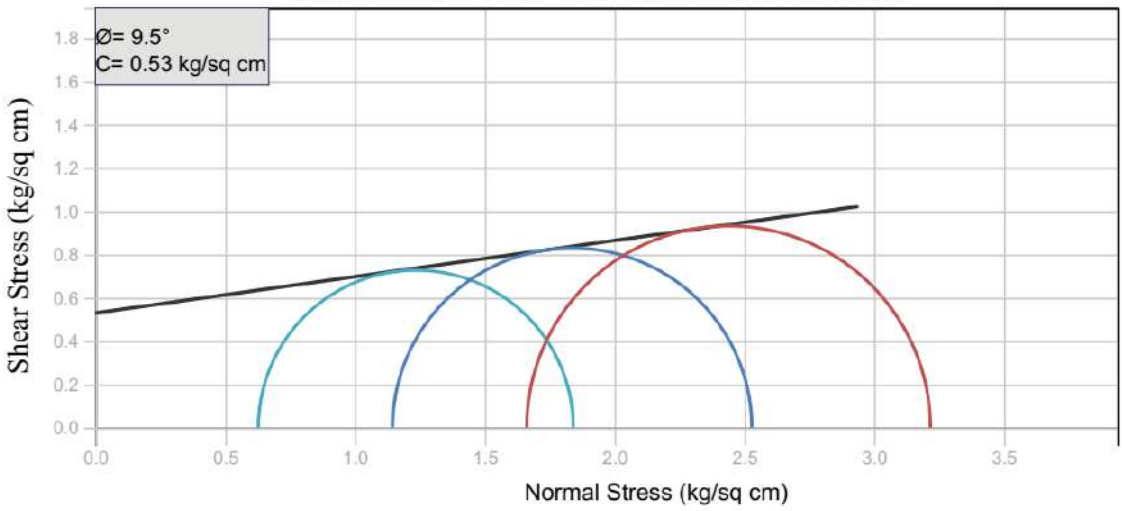
1901-HRIDC-V-23300.0870
BH-NO.P91, DEPTH-28.00M, TRIAXIAL GRAPH



1901-HRIDC-V-23326.2870
BH-NO.P92, DEPTH-10.00M, TRIAXIAL GRAPH

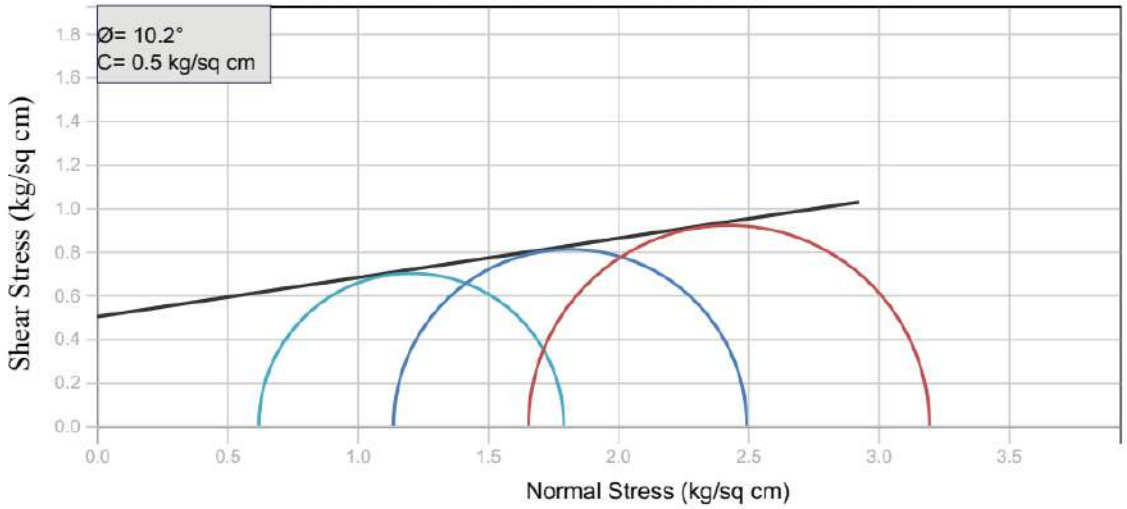


1901-HRIDC-V-23326.2870
BH-NO.P92, DEPTH-13.00M, TRIAXIAL GRAPH

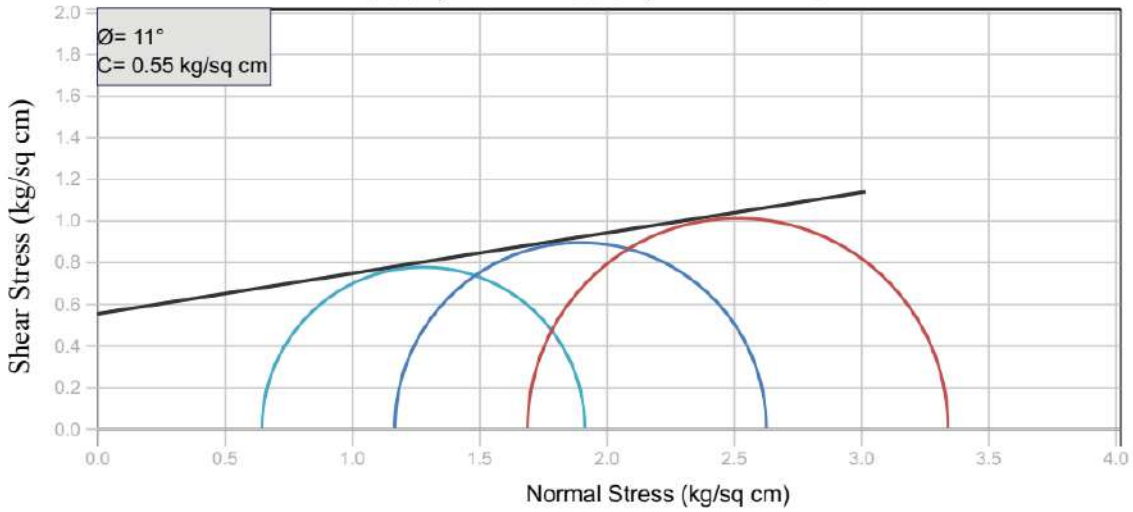


APPENDIX-G
GRAPH 17: UU GRAPH

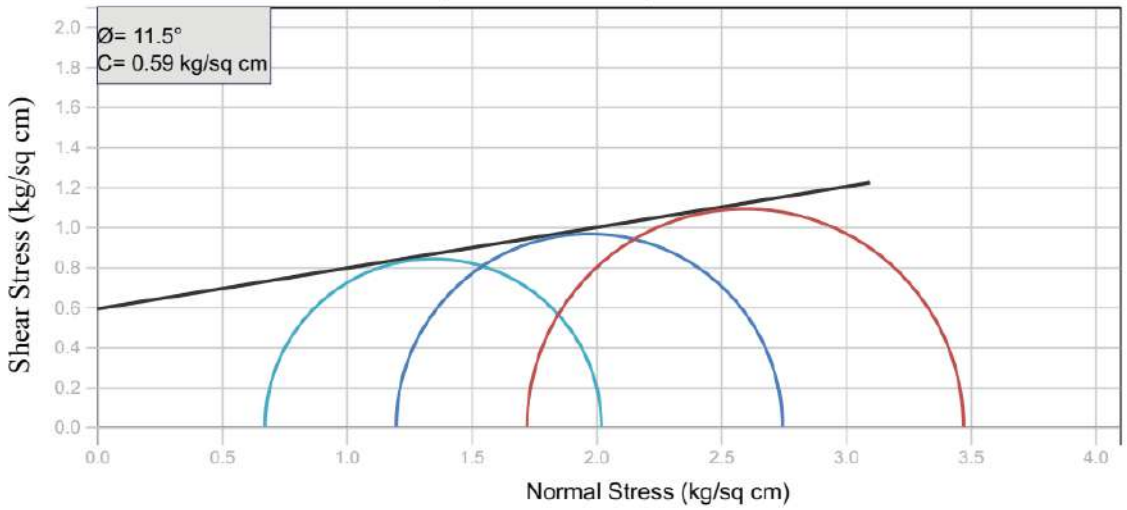
1901-HRIDC-V-23326.2870
BH-NO.P92, DEPTH-16.00M, TRIAXIAL GRAPH



1901-HRIDC-V-23326.2870
BH-NO.P92, DEPTH-19.00M, TRIAXIAL GRAPH

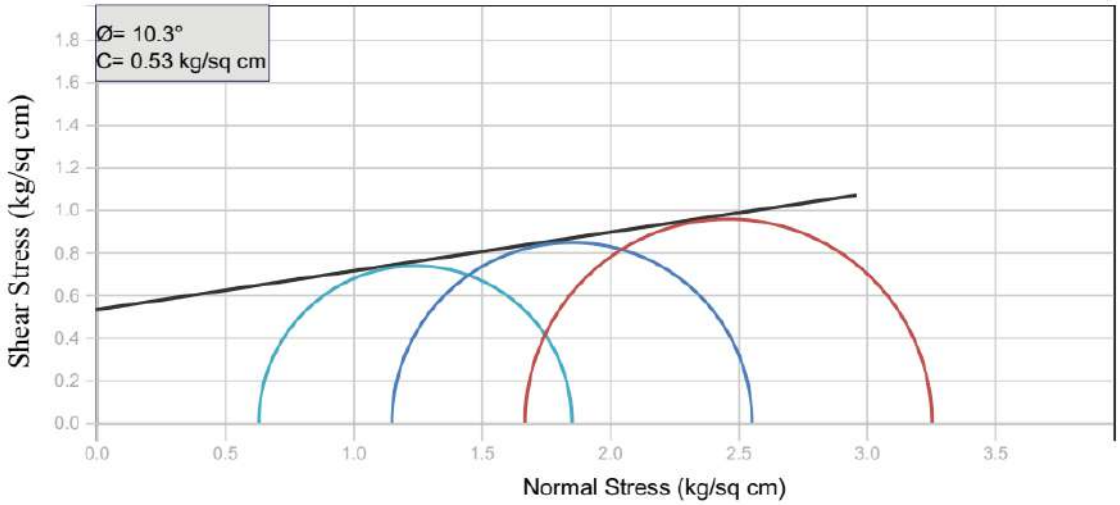


1901-HRIDC-V-23326.2870
BH-NO.P92, DEPTH-22.00M, TRIAXIAL GRAPH

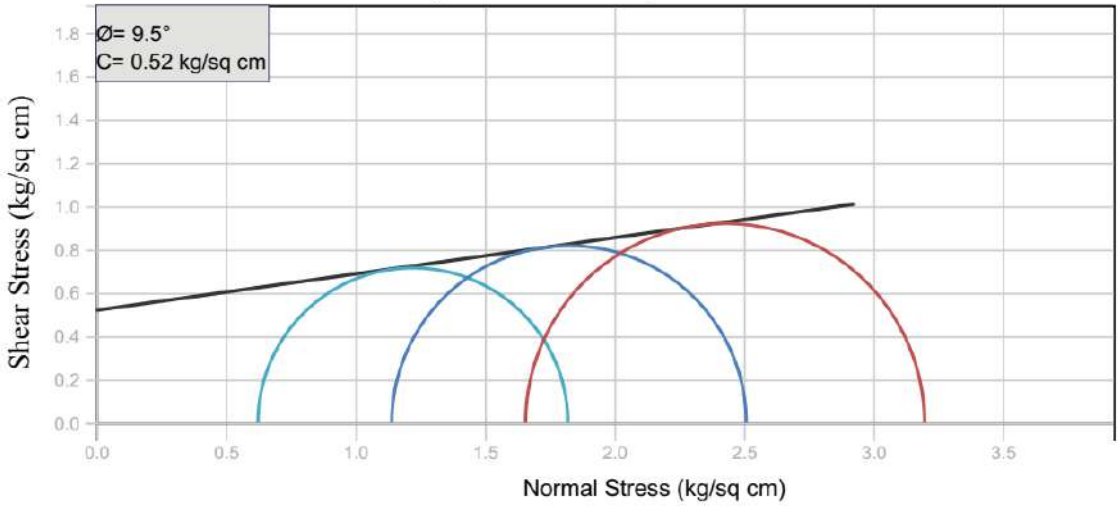


APPENDIX-G
GRAPH 18: UU GRAPH

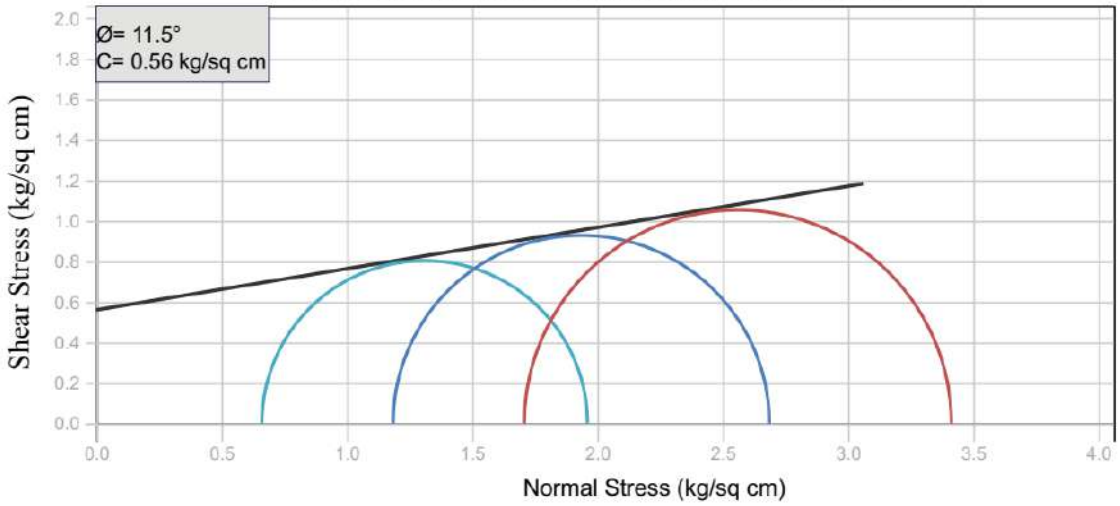
1901-HRIDC-V-23326.2870
BH-NO.P92, DEPTH-25.00M, TRIAXIAL GRAPH



1901-HRIDC-V-23352.487
BH-NO.P93, DEPTH-13.00M, TRIAXIAL GRAPH

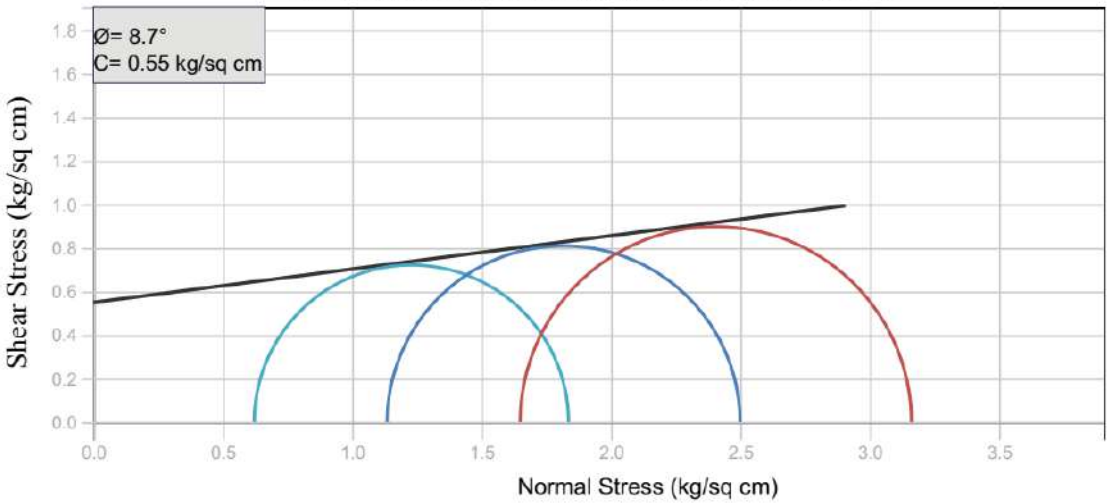


1901-HRIDC-V-23352.487
BH-NO.P93, DEPTH-16.00M, TRIAXIAL GRAPH

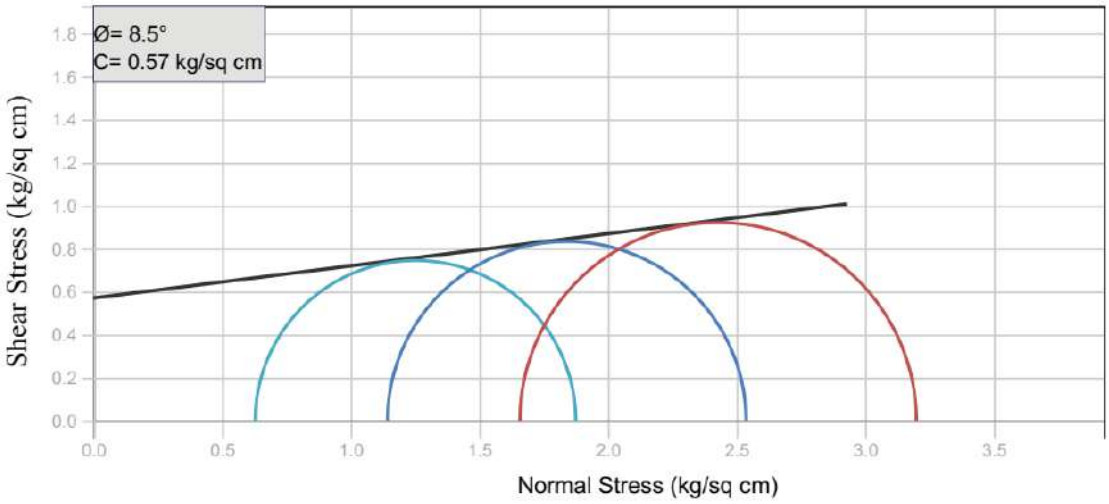


APPENDIX-G
GRAPH 19: UU GRAPH

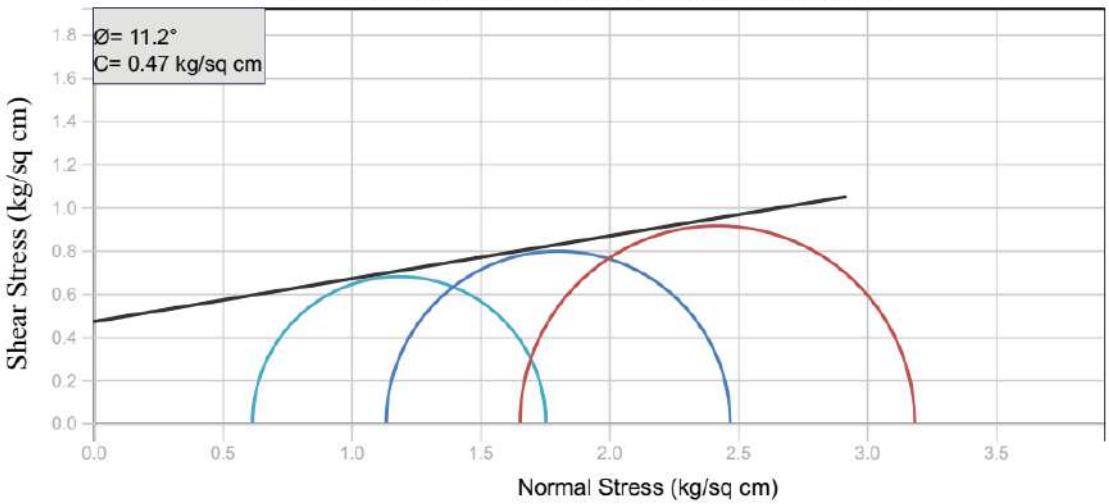
1901-HRIDC-V-23352.487
BH-NO.P93, DEPTH-19.00M, TRIAXIAL GRAPH



1901-HRIDC-V-23352.487
BH-NO.P93, DEPTH-22.00M, TRIAXIAL GRAPH

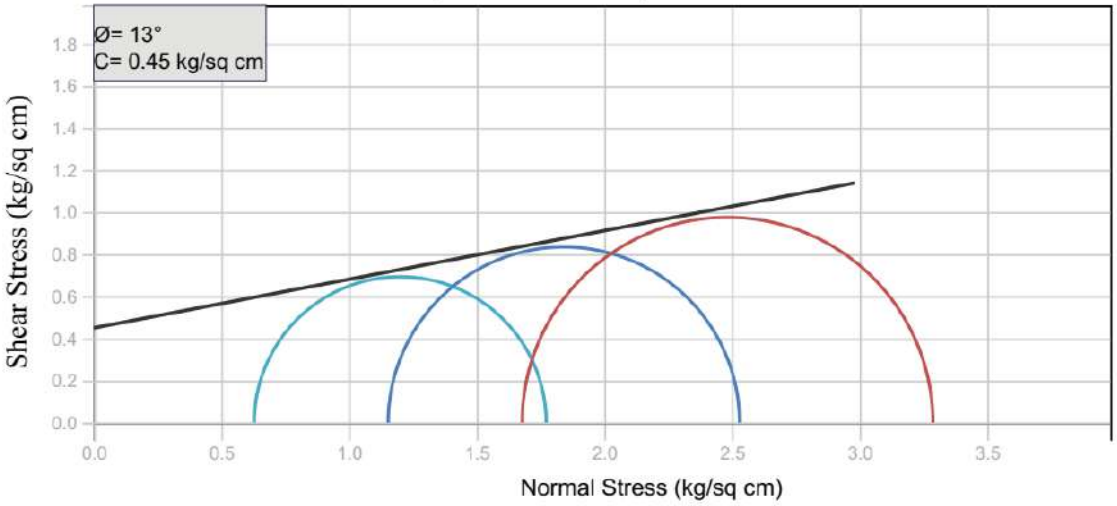


1901-HRIDC-V-23378.6870
BH-NO.P94, DEPTH-14.00M, TRIAXIAL GRAPH

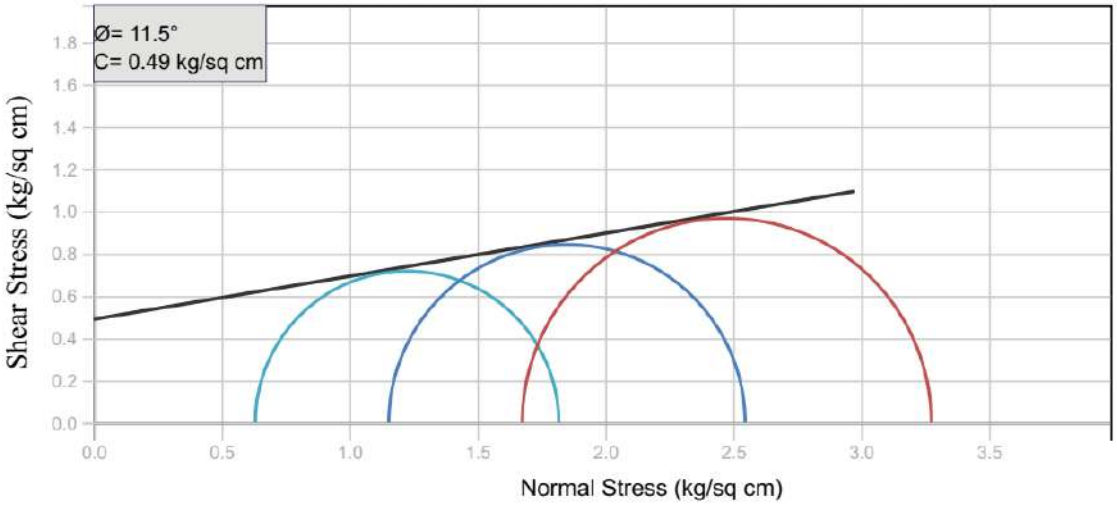


APPENDIX-G
GRAPH 20: UU GRAPH

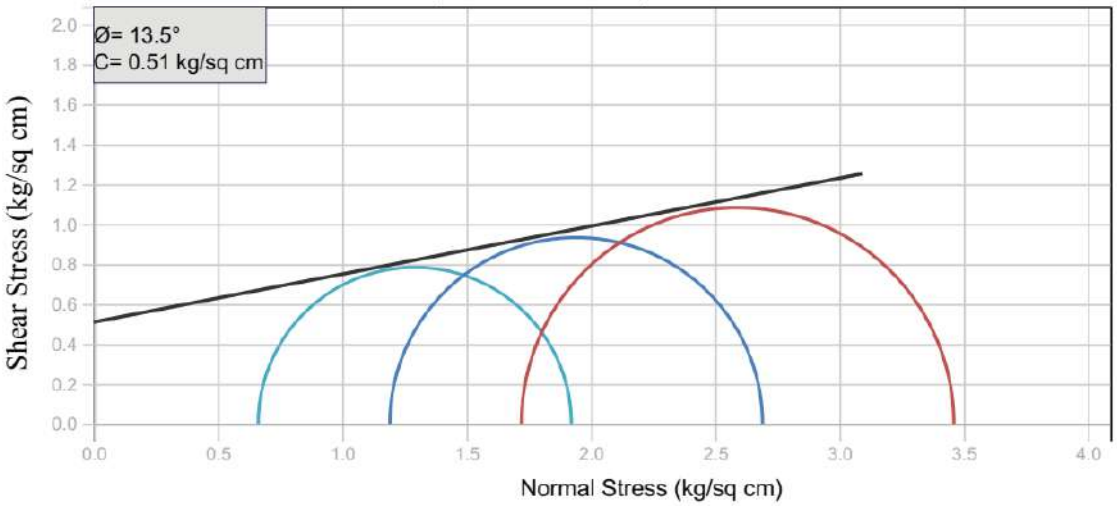
1901-HRIDC-V-23378.6870
BH-NO.P94, DEPTH-17.00M, TRIAXIAL GRAPH



1901-HRIDC-V-23378.6870
BH-NO.P94, DEPTH-23.00M, TRIAXIAL GRAPH

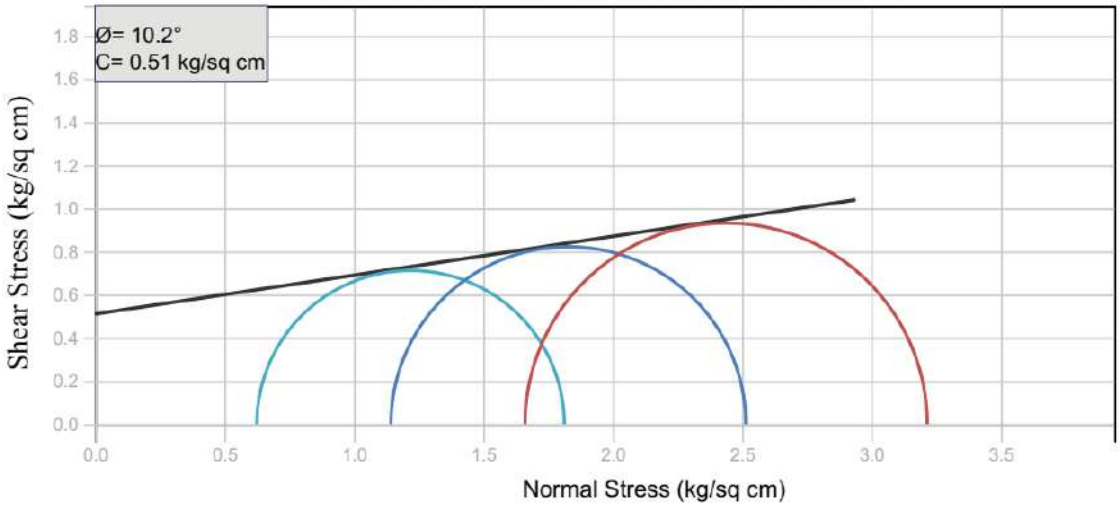


1901-HRIDC-V-23378.6870
BH-NO.P94, DEPTH-26.00M, TRIAXIAL GRAPH

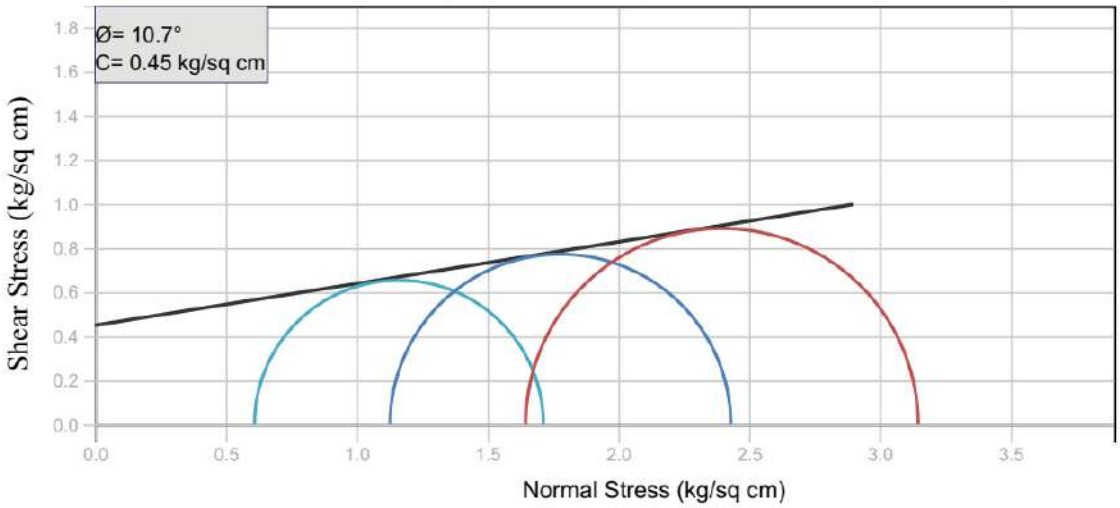


APPENDIX-G
GRAPH 21: UU GRAPH

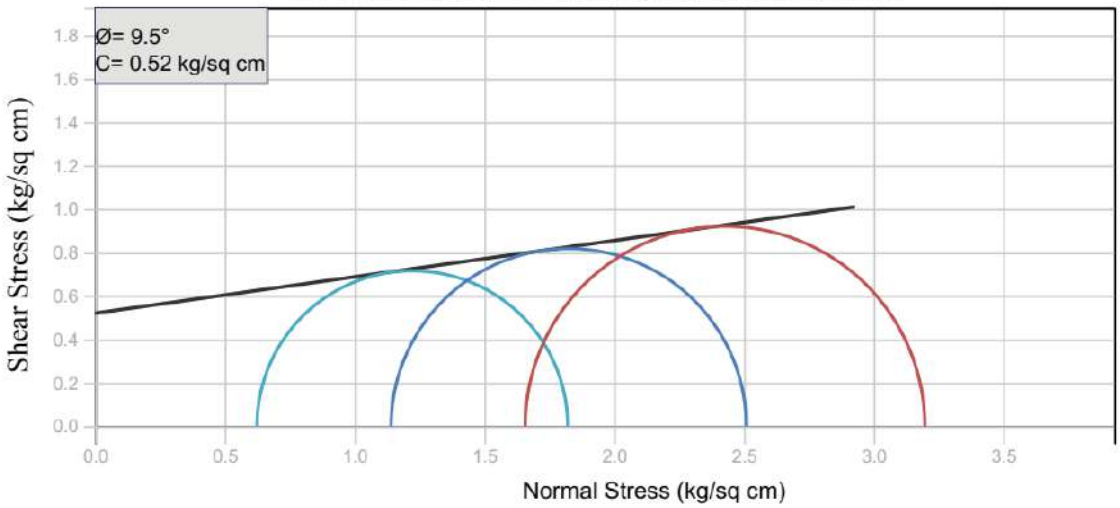
1901-HRIDC-V-23378.6870
BH-NO.P94, DEPTH-29.00M, TRIAXIAL GRAPH



1901-HRIDC-V-23404.887
BH-NO.P95, DEPTH-8.00M, TRIAXIAL GRAPH

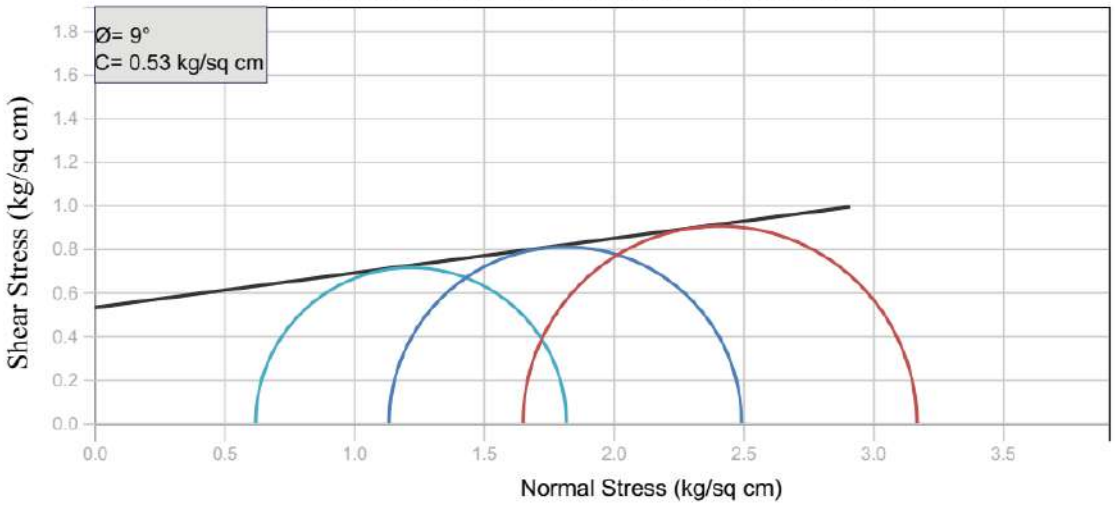


1901-HRIDC-V-23404.887
BH-NO.P95, DEPTH-11.00M, TRIAXIAL GRAPH

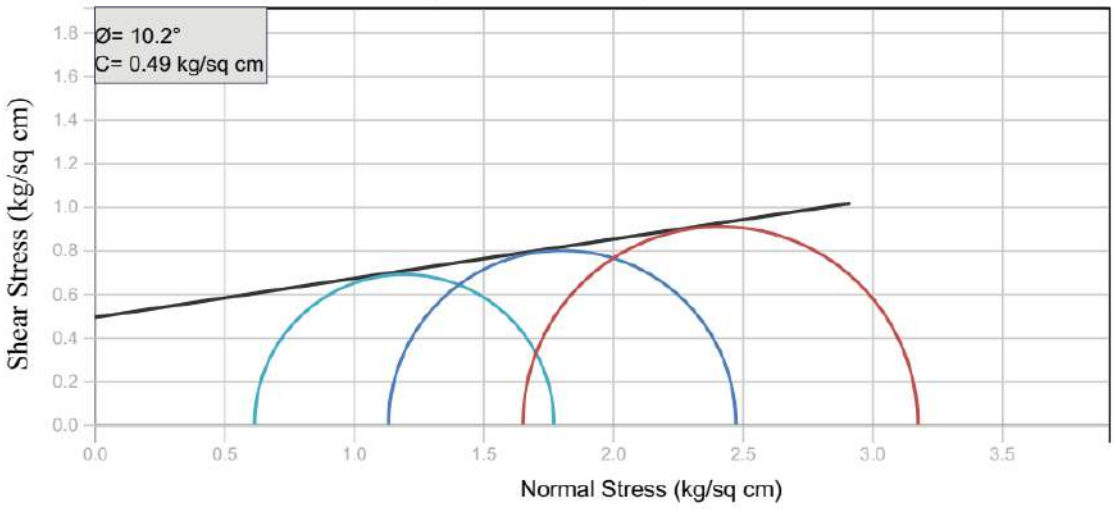


APPENDIX-G
GRAPH 22: UU GRAPH

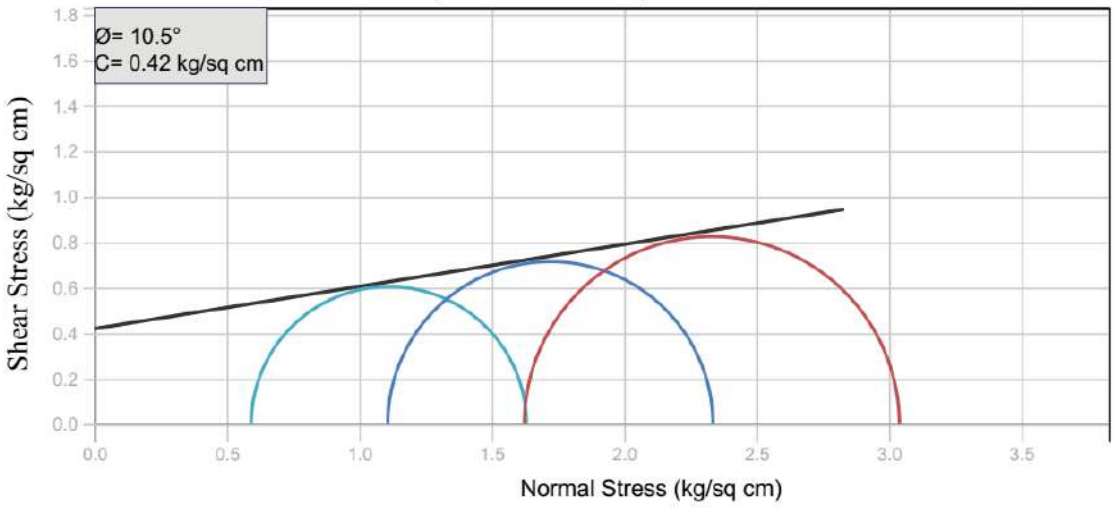
1901-HRIDC-V-23404.887
BH-NO.P95, DEPTH-14.00M, TRIAXIAL GRAPH



1901-HRIDC-V-23404.887
BH-NO.P95, DEPTH-20.00M, TRIAXIAL GRAPH

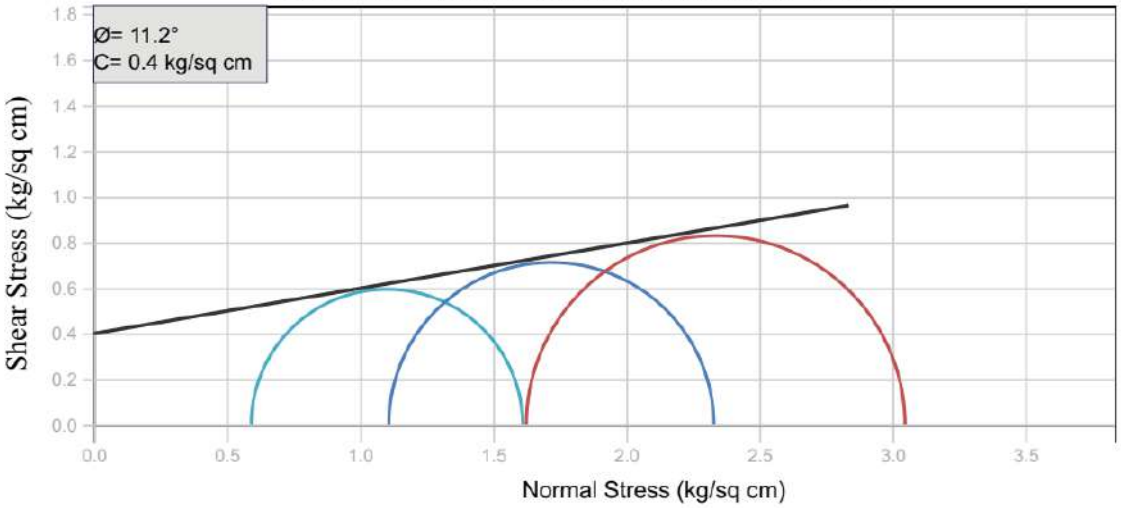


1901-HRIDC-V-23431.087
BH-NO.P96, DEPTH-11.00M, TRIAXIAL GRAPH

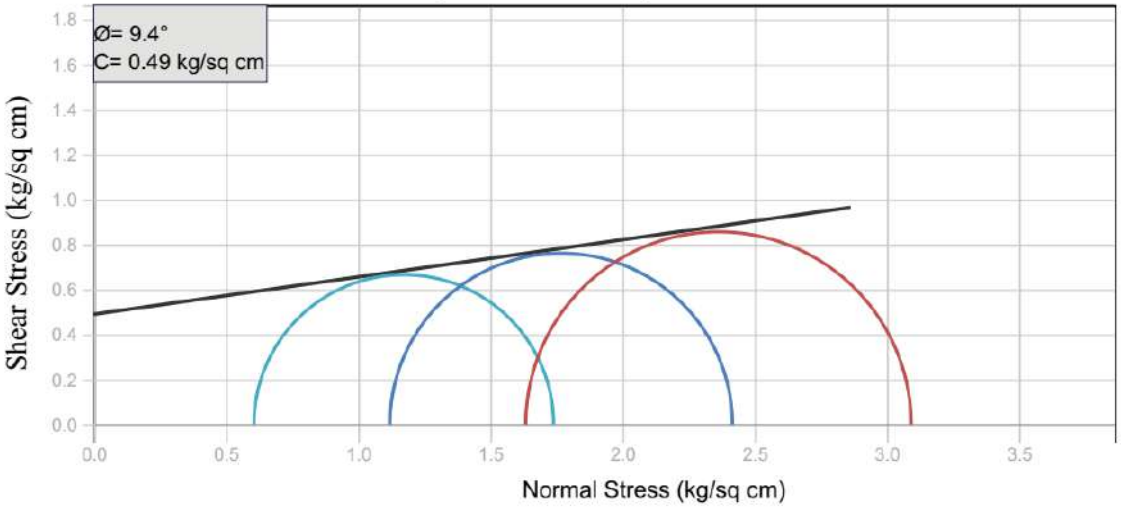


APPENDIX-G
GRAPH 23: UU GRAPH

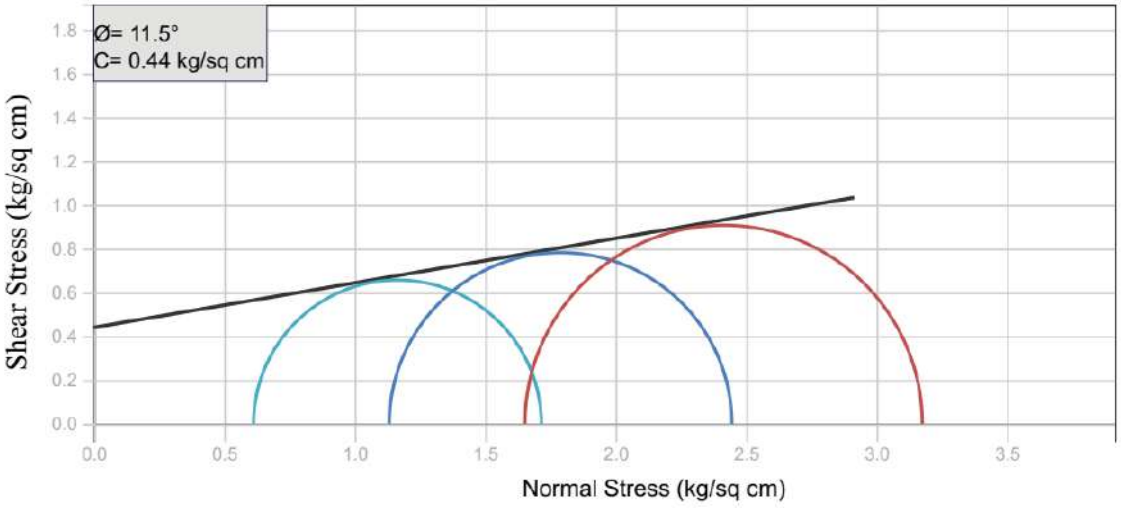
1901-HRIDC-V-23431.087
BH-NO.P96, DEPTH-14.00M, TRIAXIAL GRAPH



1901-HRIDC-V-23431.087
BH-NO.P96, DEPTH-23.00M, TRIAXIAL GRAPH

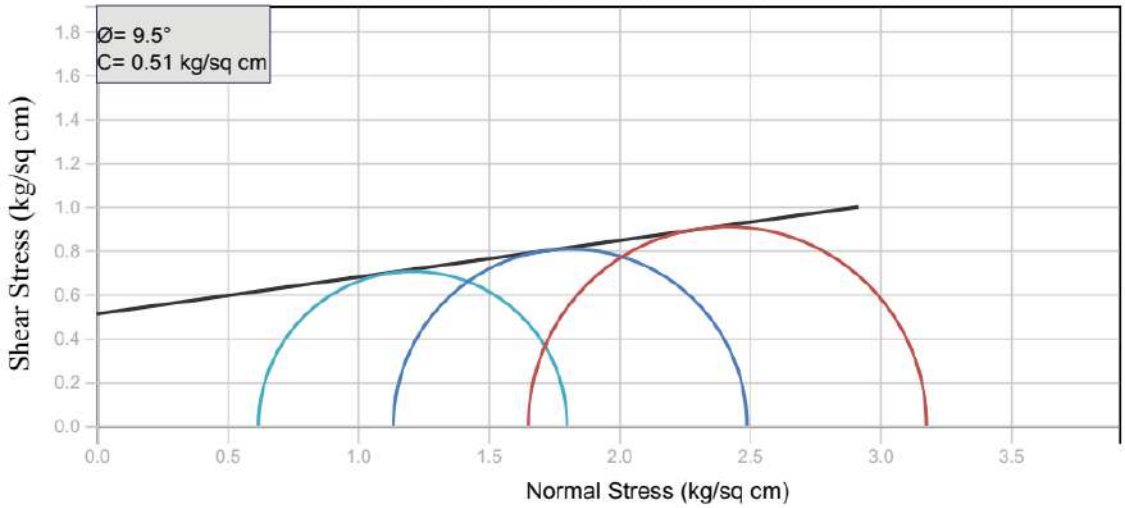


1901-HRIDC-V-23457.2870
BH-NO.P97, DEPTH-10.00M, TRIAXIAL GRAPH

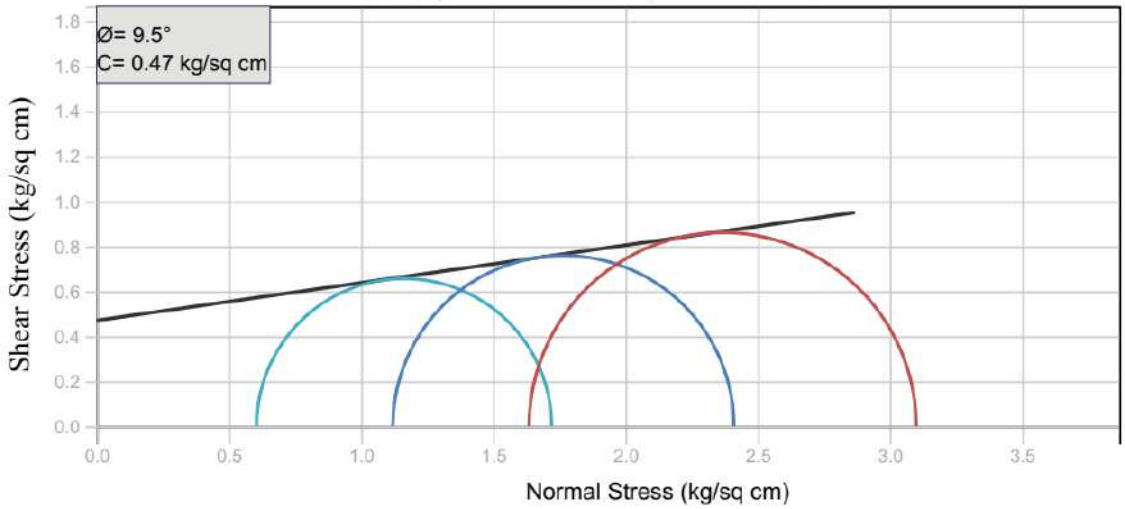


APPENDIX-G
GRAPH 24: UU GRAPH

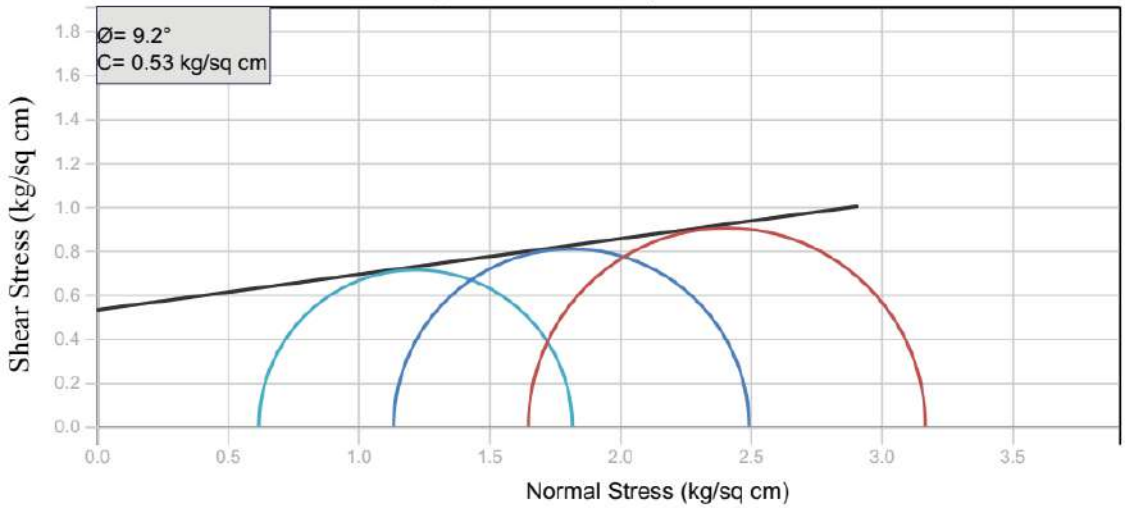
1901-HRIDC-V-23457.2870
BH-NO.P97, DEPTH-13.00M, TRIAXIAL GRAPH



1901-HRIDC-V-23483.487
BH-NO.P98, DEPTH-10.00M, TRIAXIAL GRAPH

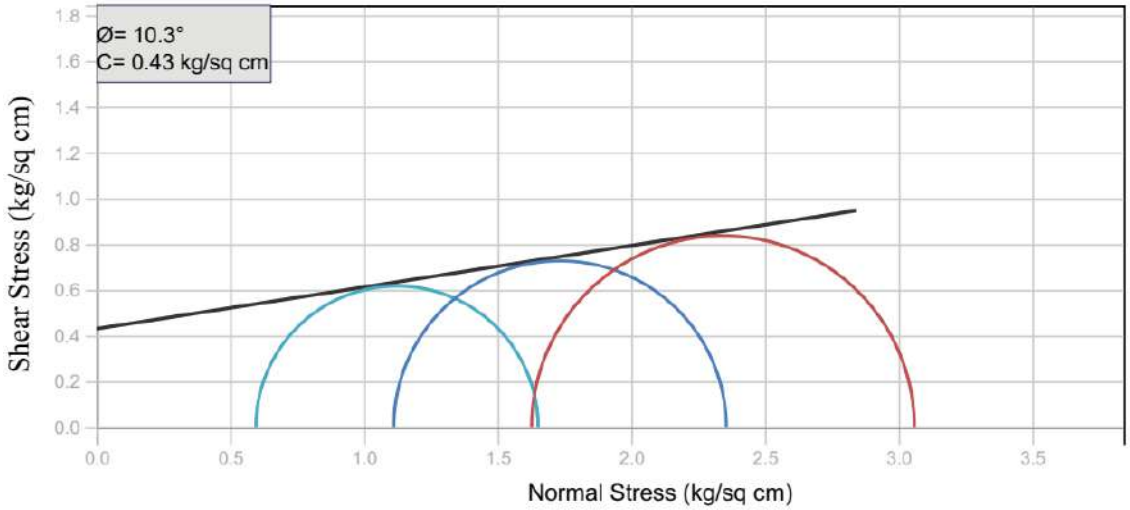


1901-HRIDC-V-23483.487
BH-NO.P98, DEPTH-13.00M, TRIAXIAL GRAPH

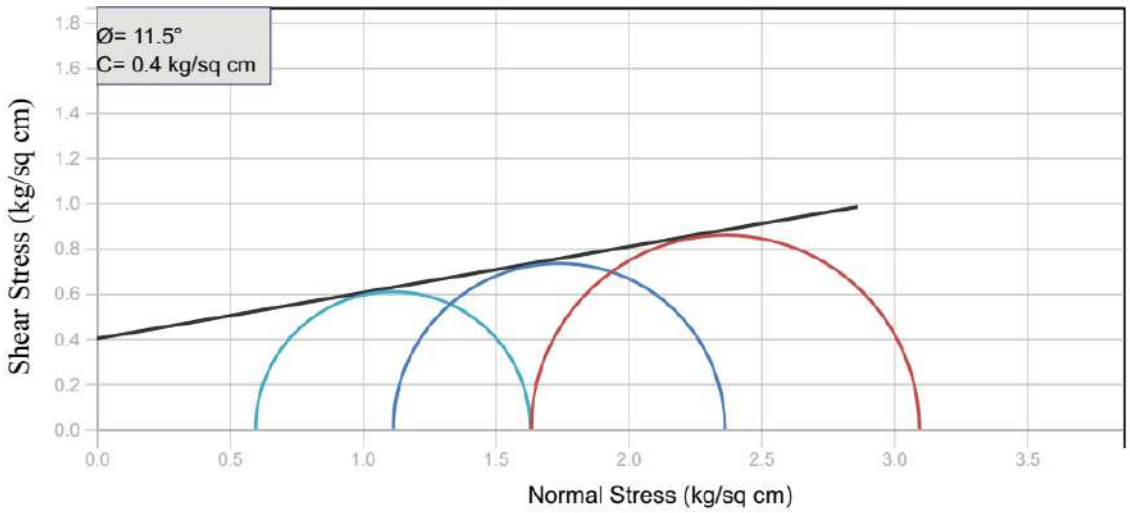


APPENDIX-G
GRAPH 25: UU GRAPH

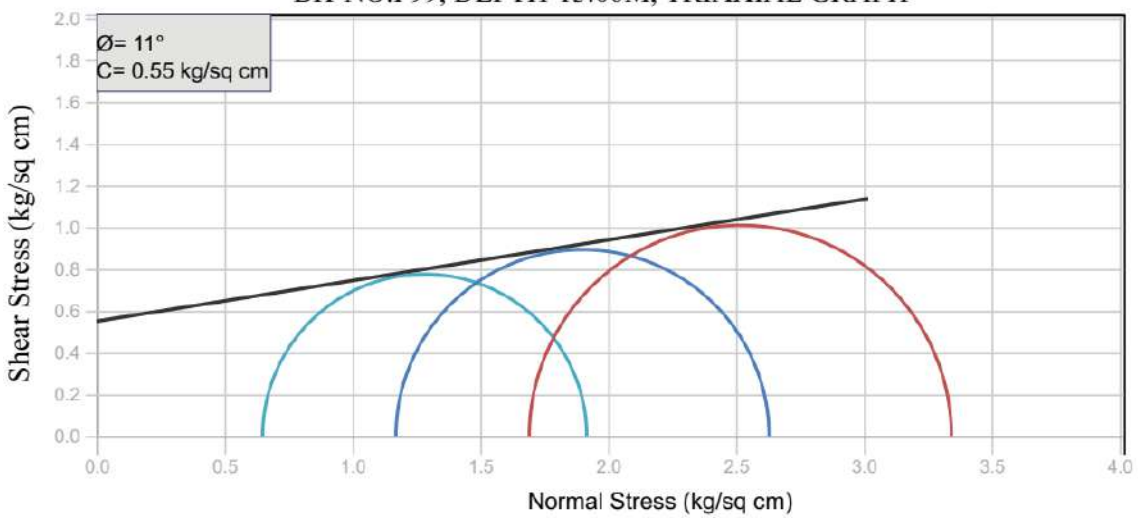
1901-HRIDC-V-23483.487
BH-NO.P98, DEPTH-16.00M, TRIAXIAL GRAPH



1901-HRIDC-V-23483.487
BH-NO.P98, DEPTH-25.00M, TRIAXIAL GRAPH

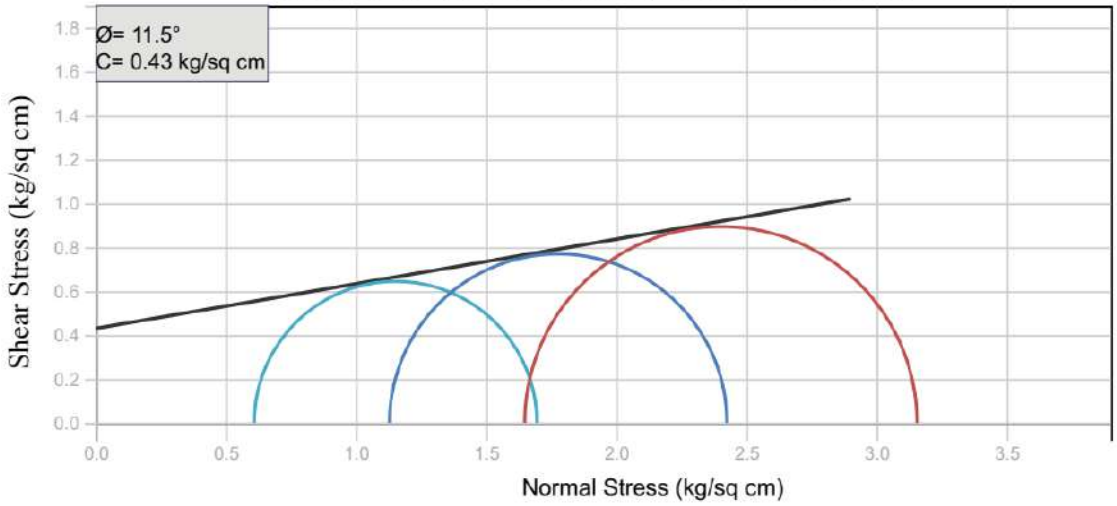


1901-HRIDC-V-23509.6870
BH-NO.P99, DEPTH-13.00M, TRIAXIAL GRAPH

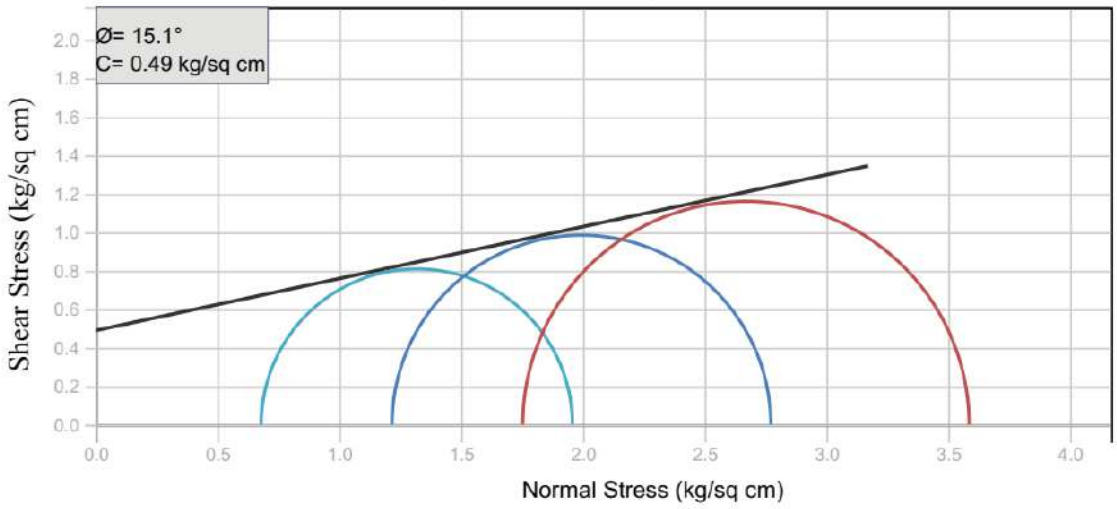


APPENDIX-G
GRAPH 26: UU GRAPH

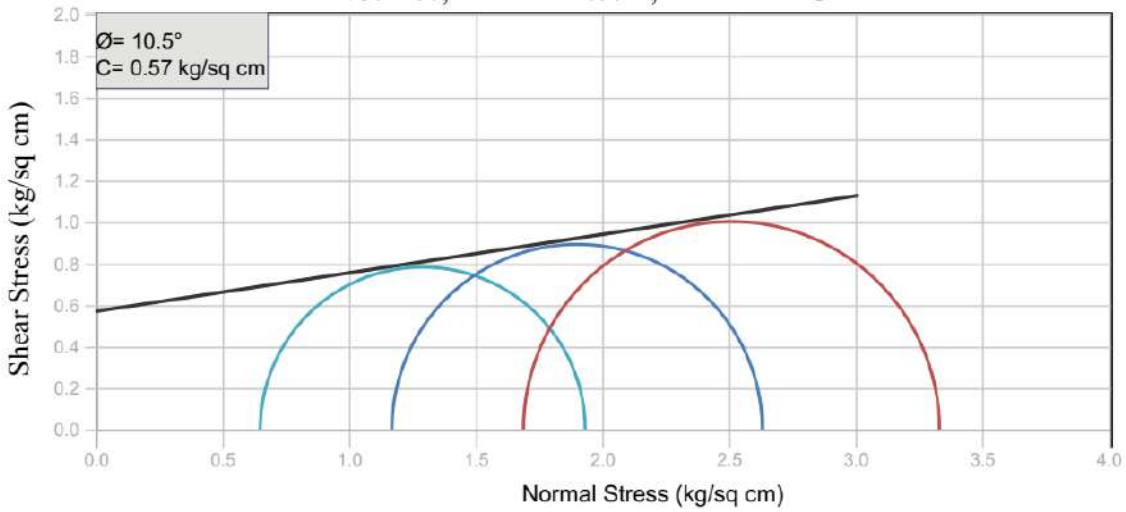
1901-HRIDC-V-23535.887
BH-NO.P100, DEPTH-10.00M, TRIAXIAL GRAPH



1901-HRIDC-V-23535.887
BH-NO.P100, DEPTH-16.00M, TRIAXIAL GRAPH

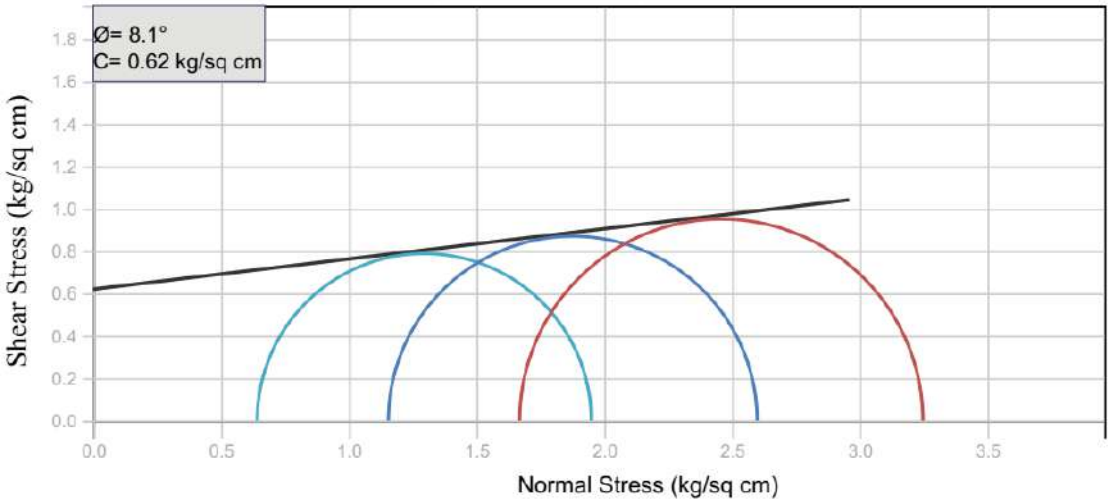


1901-HRIDC-V-23535.887
BH-NO.P100, DEPTH-22.00M, TRIAXIAL GRAPH

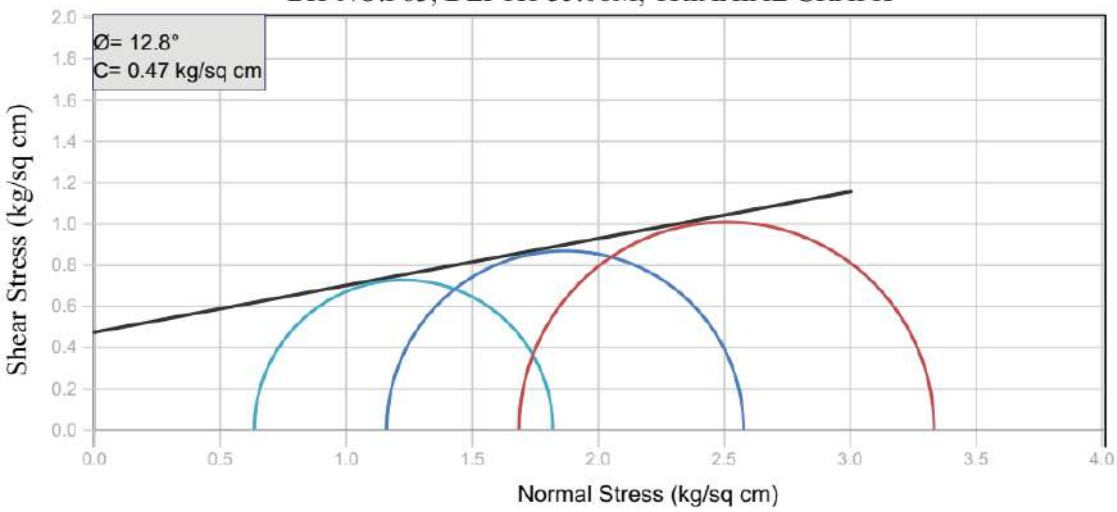


APPENDIX-G
GRAPH 27: RUU GRAPH

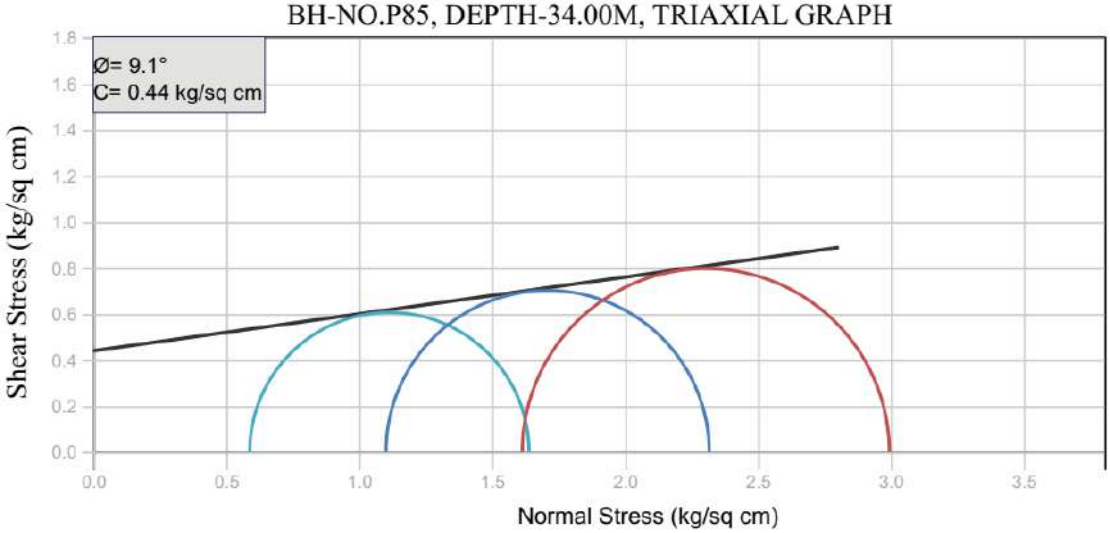
1901-HRIDC-V-23090.487
BH-NO.P83, DEPTH-29.00M, TRIAXIAL GRAPH



1901-HRIDC-V-23090.487
BH-NO.P83, DEPTH-35.00M, TRIAXIAL GRAPH

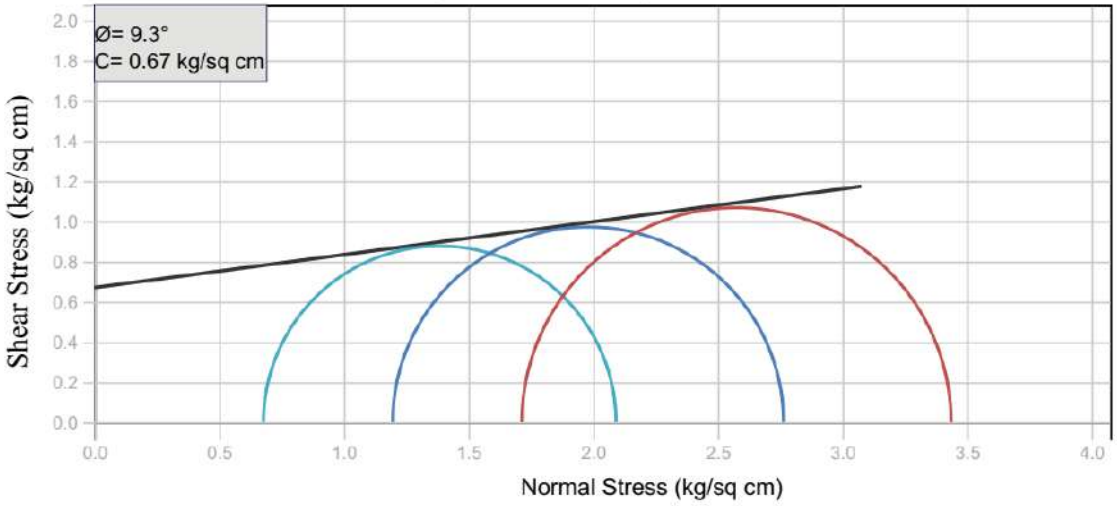


1901-HRIDC-V-23142.8870
BH-NO.P85, DEPTH-34.00M, TRIAXIAL GRAPH

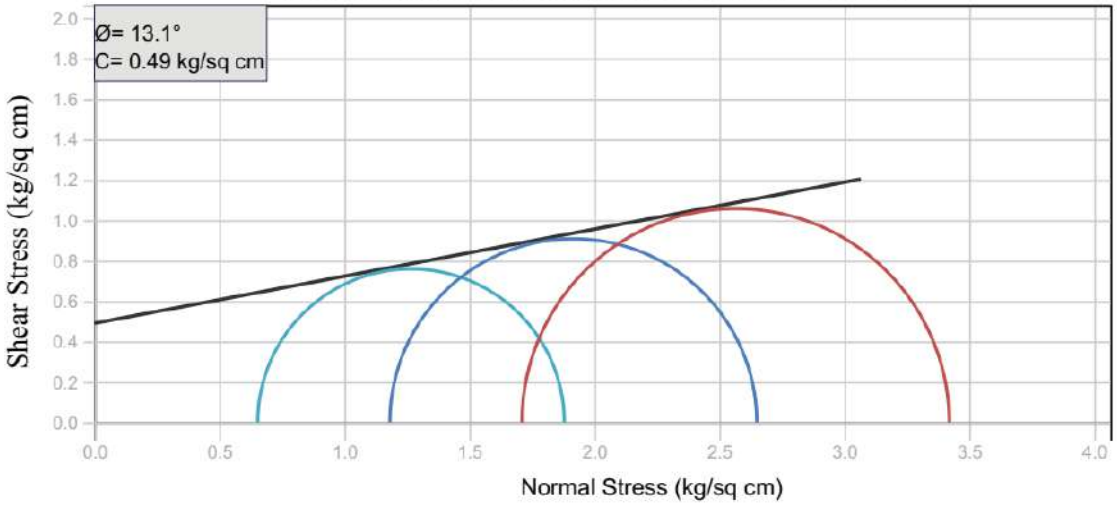


APPENDIX-G
GRAPH 28: RUU GRAPH

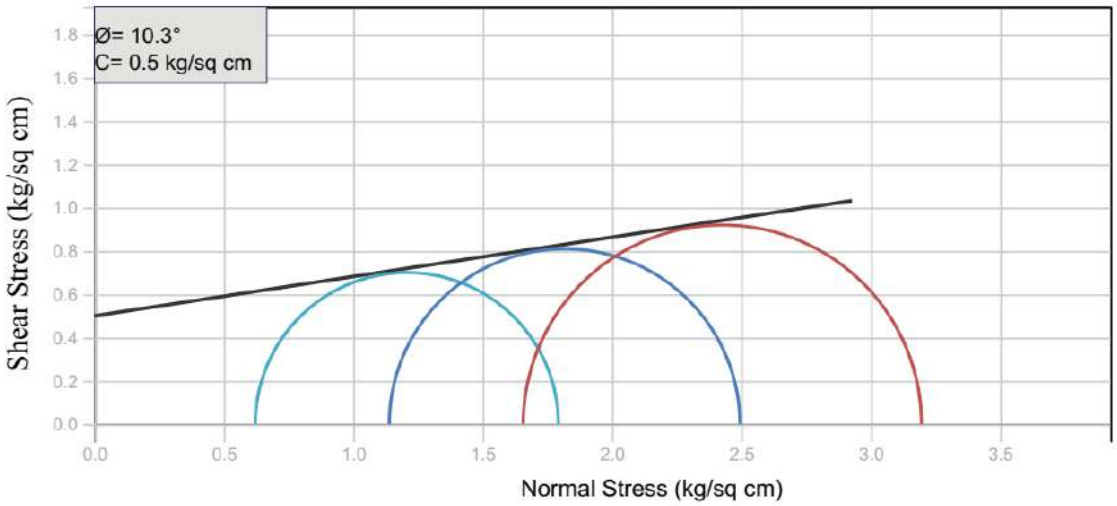
1901-HRIDC-V-23169.087
BH-NO.P86, DEPTH-35.00M, TRIAXIAL GRAPH



1901-HRIDC-V-23169.087
BH-NO.P86, DEPTH-38.00M, TRIAXIAL GRAPH

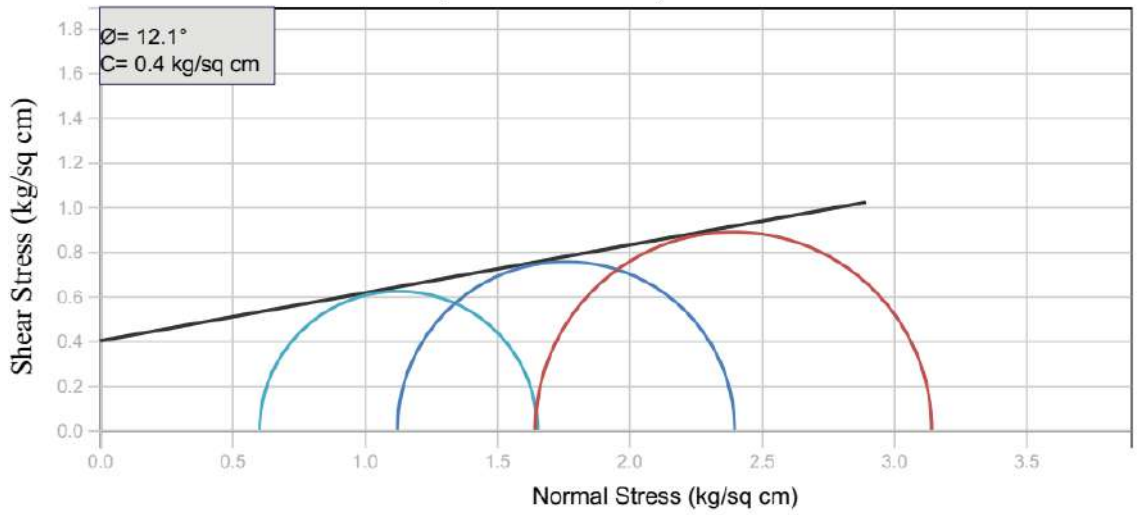


1901-HRIDC-V-23247.687
BH-NO.P89, DEPTH-37.00M, TRIAXIAL GRAPH

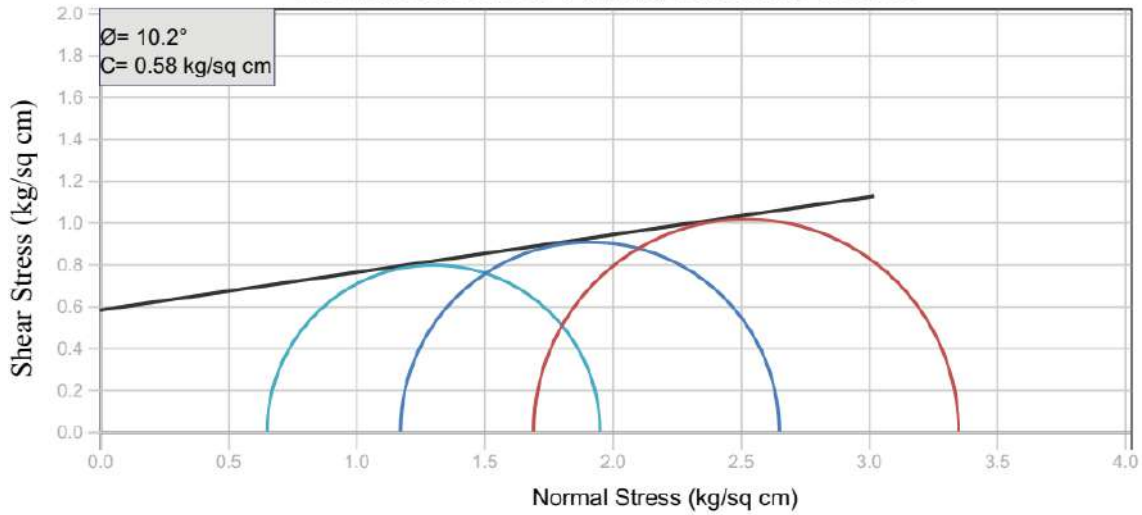


APPENDIX-G
GRAPH 29: RUU GRAPH

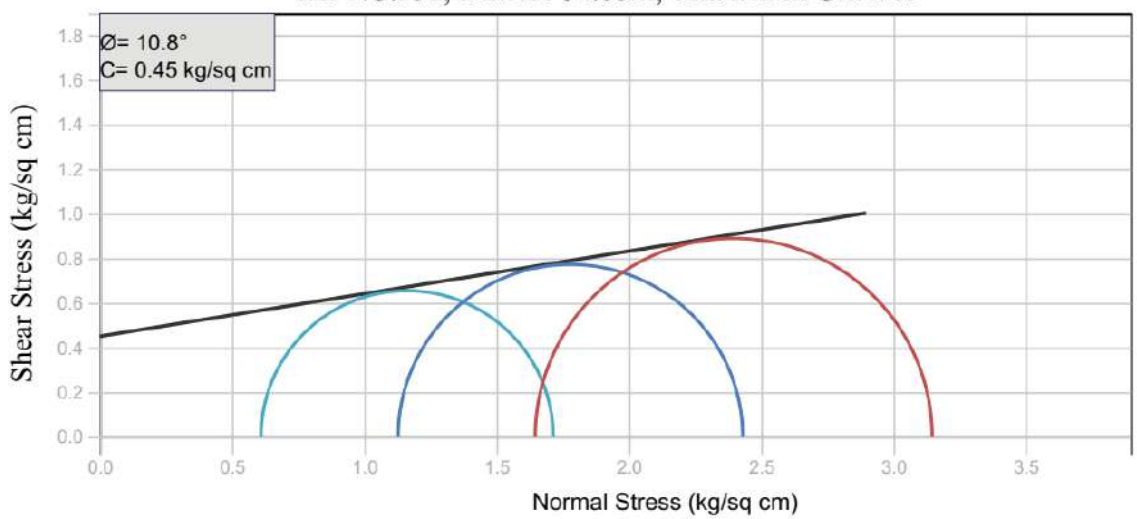
1901-HRIDC-V-23273.887
BH-NO.P90, DEPTH-34.00M, TRIAXIAL GRAPH



1901-HRIDC-V-23300.0870
BH-NO.P91, DEPTH-34.00M, TRIAXIAL GRAPH

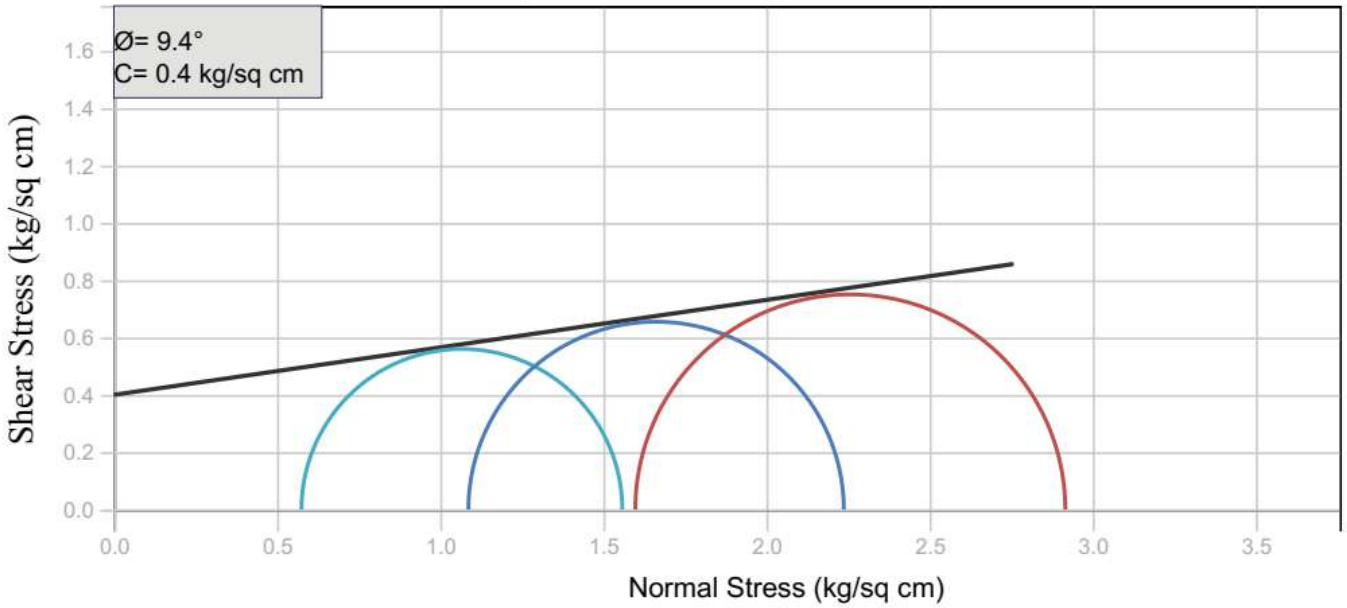


1901-HRIDC-V-23326.2870
BH-NO.P92, DEPTH-34.00M, TRIAXIAL GRAPH

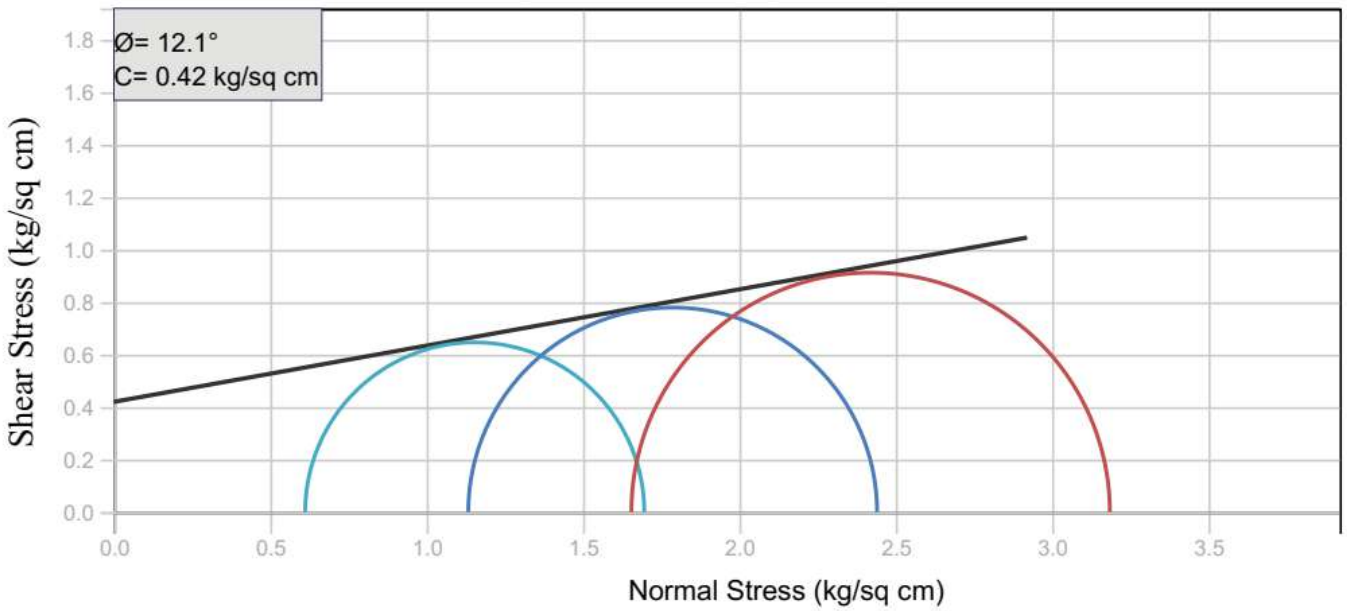


APPENDIX-G
GRAPH 30: RUU GRAPH

1901-HRIDC-V-23404.887
BH-NO.P95, DEPTH-23.00M, TRIAXIAL GRAPH

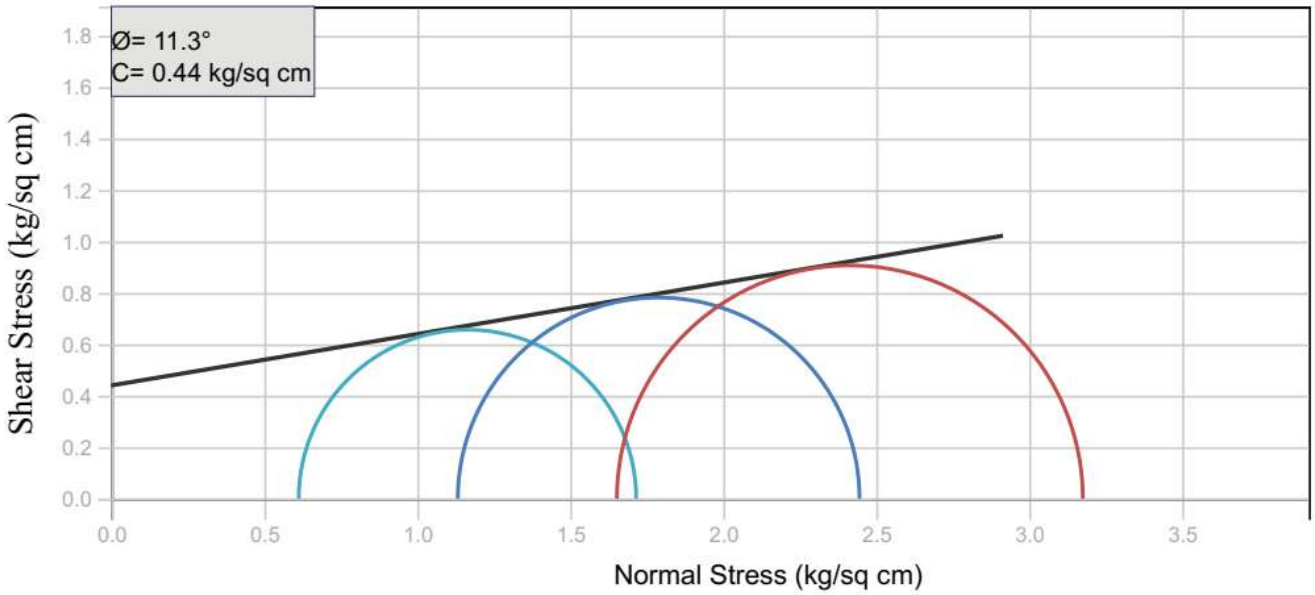


1901-HRIDC-V-23431.087
BH-NO.P96, DEPTH-29.00M, TRIAXIAL GRAPH

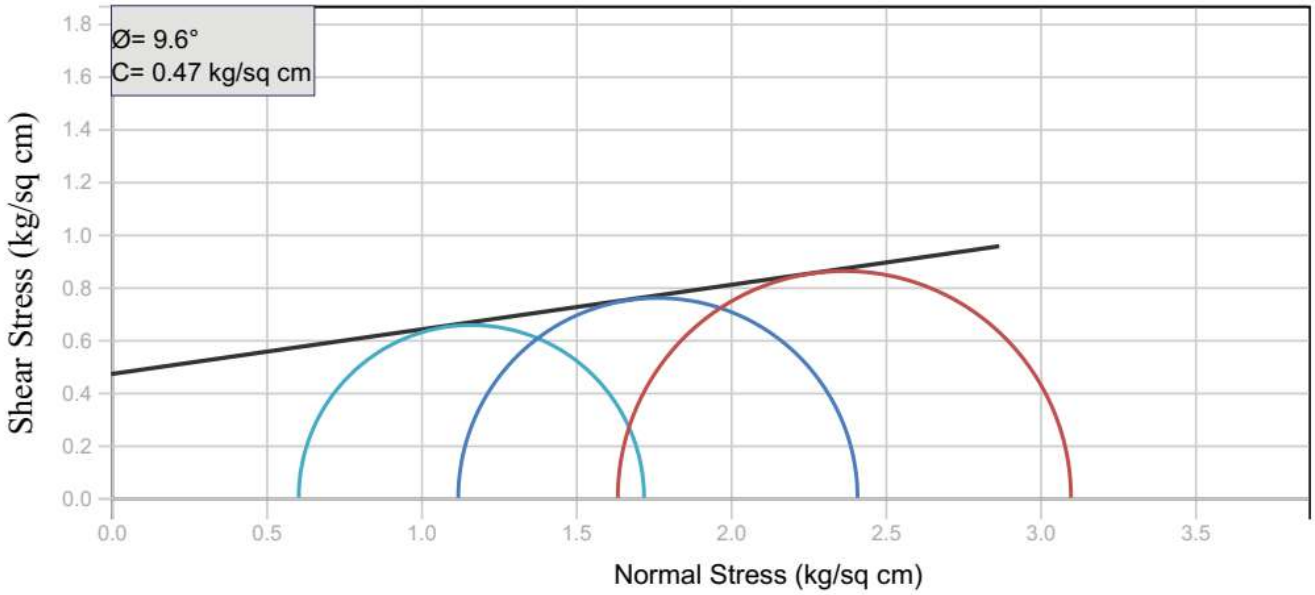


APPENDIX-G
GRAPH 31: RUU GRAPH

1901-HRIDC-V-23457.2870
BH-NO.P97, DEPTH-22.00M, TRIAXIAL GRAPH



1901-HRIDC-V-23509.6870
BH-NO.P99, DEPTH-10.00M, TRIAXIAL GRAPH



APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
BORE NO: P81, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	18.85	8.85	24.34	1.57	26.3	26.3	1.0	18.90	0	3	1.0	4.7	0	3.0	23.6	0	8.85	8.99	9.34	26.6	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.50	18.85	8.85	30.98	3.14	23.6	23.6	1.0	42.53	0	0	1.0	0.0	0	4.0	11.5	44	10.17	2.91	1.65	35.4	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	5.00	4.50	1.00	2.50	20.17	10.17	40.49	3.14	11.5	11.5	1.0	25.89	0	44	1.0	138.3	0	5.0	12.7	48	10.17	3.26	1.99	45.6	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.50	20.17	10.17	50.66	3.14	12.7	12.7	1.0	35.88	0	48	1.0	150.9	0	6.0	12.7	48	10.17	3.26	1.99	55.7	490.3	490.3	41.3	41.3	**196.11**	**13.75**
6.00	7.00	6.50	1.00	4.50	20.17	10.17	60.83	3.14	12.7	12.7	1.0	43.08	43.08	48	1.0	150.9	150.86	7.0	12.7	48	10.27	3.26	1.99	65.9	516.4	710.4	53.0	247.0	**284.14**	**82.32**
7.00	8.00	7.50	1.00	5.50	20.27	10.27	71.05	3.14	12.7	12.7	1.0	50.32	93.40	48	1.0	150.9	301.71	8.0	11.0	45	10.27	2.76	1.51	76.2	489.7	884.8	64.8	459.9	**353.94**	**153.31**
8.00	9.00	8.50	1.00	6.50	20.27	10.27	81.32	3.14	11.0	11.0	1.0	49.68	143.08	45	1.0	141.4	443.14	9.0	11.0	45	10.27	2.76	1.51	86.5	512.0	1098.3	76.6	662.8	**439.30**	**220.94**
9.00	10.00	9.50	1.00	7.50	20.27	10.27	91.59	3.14	11.0	11.0	1.0	55.95	199.03	45	1.0	141.4	584.57	10.0	11.0	45	10.19	2.76	1.51	96.7	534.3	1317.9	88.4	872.0	**527.16**	**290.66**
10.00	11.00	10.50	1.00	8.50	20.19	10.19	101.82	3.14	11.0	11.0	1.0	62.20	261.23	45	1.0	141.4	726.00	11.0	11.0	45	10.19	2.76	1.51	106.9	556.4	1543.6	100.2	1087.4	**617.46**	**362.47**
11.00	12.00	11.50	1.00	9.50	20.19	10.19	112.01	3.14	11.0	11.0	1.0	68.42	329.65	45	1.0	141.4	867.43	12.0	9.5	55	10.36	2.38	1.14	117.1	612.6	1809.6	112.0	1309.0	**723.85**	**436.35**
12.00	14.50	13.25	2.50	12.00	20.36	10.36	130.05	7.86	9.5	9.5	1.0	170.99	500.65	55	1.0	432.1	1299.57	14.5	9.5	53	10.36	2.38	1.14	143.0	646.8	2447.1	141.4	1941.6	**978.83**	**647.22**
14.50	16.00	15.25	1.50	13.50	20.36	10.36	130.05	4.71	9.5	9.5	1.0	102.60	603.24	53	1.0	249.9	1549.43	16.0	27.5	0	9.82	15.63	16.64	143.0	1820.3	3973.0	159.1	2311.8	**1589.19**	**770.59**
16.00	17.50	16.75	1.50	15.00	19.82	9.82	130.05	4.71	27.5	27.5	1.0	319.16	922.40	0	1.0	0.0	1549.43	17.5	11.4	64	9.82	2.88	1.62	143.0	782.6	3254.4	176.8	2648.6	**1301.77**	**882.87**
17.50	19.00	18.25	1.50	16.50	19.82	9.82	130.05	4.71	11.4	11.4	1.0	123.62	1046.02	64	1.0	301.7	1851.14	19.0	12.2	44	10.40	3.12	1.85	143.0	668.8	3566.0	194.5	3091.6	**1426.40**	**1030.54**
19.00	20.50	19.75	1.50	18.00	20.40	10.40	130.05	4.71	12.2	12.2	1.0	132.56	1178.57	44	1.0	207.4	2058.57	20.5	12.2	44	10.40	3.12	1.85	143.0	668.8	3906.0	212.1	3449.3	**1562.40**	**1149.76**
20.50	23.50	22.00	3.00	21.00	20.40	10.40	130.05	9.43	12.2	12.2	1.0	265.11	1443.69	44	1.0	414.9	2473.43	23.5	10.0	44	9.50	2.47	1.22	143.0	593.2	4510.3	247.5	4164.6	**1804.13**	**1388.20**
23.50	25.00	24.25	1.50	22.50	19.50	9.50	130.05	4.71	10.0	10.0	1.0	108.10	1551.79	44	1.0	207.4	2680.86	25.0	13.0	48	9.87	3.35	2.08	143.0	723.9	4956.5	265.2	4497.8	**1982.61**	**1499.28**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
25.00	26.50	25.75	1.50	24.00	19.87	9.87	130.05	4.71	13.0	13.0	1.0	141.54	1693.33	48	1.0	226.3	2907.14	26.5	13.0	48	8.83	3.35	2.08	143.0	723.0	5323.5	282.9	4883.3	**2129.40**	**1627.78**
26.50	27.50	27.00	1.00	25.00	18.83	8.83	130.05	3.14	13.0	13.0	1.0	94.36	1787.70	48	1.0	150.9	3058.00	27.5	13.0	48	8.83	3.35	2.08	143.0	723.0	5568.7	294.6	5140.3	**2227.49**	**1713.45**
27.50	28.00	27.75	0.50	25.50	18.83	8.83	130.05	1.57	13.0	13.0	1.0	47.18	1834.88	48	1.0	75.4	3133.43	28.0	18.0	28	9.79	5.42	4.29	143.0	823.0	5791.3	300.5	5268.8	**2316.54**	**1756.28**
28.00	29.50	28.75	1.50	27.00	19.79	9.79	130.05	4.71	18.0	18.0	1.0	199.21	2034.08	28	1.0	132.0	3265.43	29.5	18.0	28	8.99	5.42	4.29	143.0	821.7	6121.2	318.2	5617.7	**2448.48**	**1872.58**
29.50	30.00	29.75	0.50	27.50	18.99	8.99	130.05	1.57	18.0	18.0	1.0	66.40	2100.49	28	1.0	44.0	3309.43	30.0	18.0	47	8.99	5.42	4.29	143.0	956.0	6366.0	324.1	5734.0	**2546.39**	**1911.34**
30.00	31.00	30.50	1.00	28.50	18.99	8.99	130.05	3.14	18.0	18.0	1.0	132.80	2233.29	47	1.0	147.7	3457.14	31.0	13.0	42	9.41	3.35	2.08	143.0	681.1	6371.5	335.9	6026.3	**2548.60**	**2008.77**
31.00	32.50	31.75	1.50	30.00	19.41	9.41	130.05	4.71	13.0	13.0	1.0	141.54	2374.83	42	1.0	198.0	3655.14	32.5	13.0	42	9.32	3.35	2.08	143.0	681.0	6711.0	353.6	6383.5	**2684.39**	**2127.85**
32.50	34.00	33.25	1.50	31.50	19.32	9.32	130.05	4.71	13.0	13.0	1.0	141.54	2516.38	42	1.0	198.0	3853.14	34.0	8.5	53	8.46	2.20	0.99	143.0	625.3	6994.8	371.3	6740.8	**2797.91**	**2246.92**
34.00	35.00	34.50	1.00	32.50	18.46	8.46	130.05	3.14	8.5	8.5	1.0	61.08	2577.46	53	1.0	166.6	4019.71	35.0	8.5	53	8.46	2.20	0.99	143.0	625.3	7222.4	383.0	6980.2	**2888.97**	**2326.74**
35.00	35.50	35.25	0.50	33.00	18.46	8.46	130.05	1.57	8.5	8.5	1.0	30.54	2608.00	53	1.0	83.3	4103.00	35.5	22.5	30	7.82	8.20	8.14	143.0	1158.5	7869.5	388.9	7099.9	**3147.79**	**2366.64**
35.50	37.00	36.25	1.50	34.50	17.82	7.82	130.05	4.71	22.5	22.5	1.0	253.95	2861.96	30	1.0	141.4	4244.43	37.0	22.5	30	8.29	8.20	8.14	143.0	1160.0	8266.3	406.6	7513.0	**3306.54**	**2504.33**
37.00	37.50	37.25	0.50	35.00	18.29	8.29	130.05	1.57	22.5	22.5	1.0	84.65	2946.61	30	1.0	47.1	4291.57	37.5	22.5	30	8.29	8.20	8.14	143.0	1160.0	8398.1	412.5	7650.7	**3359.26**	**2550.23**
37.50	38.50	38.00	1.00	36.00	18.29	8.29	130.05	3.14	22.5	22.5	1.0	169.30	3115.91	30	1.0	94.3	4385.86	38.5	18.5	38	9.36	5.64	4.57	143.0	919.4	8421.2	424.3	7926.0	**3368.48**	**2642.02**
38.50	40.00	39.25	1.50	37.50	19.36	9.36	130.05	4.71	18.5	18.5	1.0	205.14	3321.04	38	1.0	179.1	4565.00	40.0	18.5	38	9.36	5.64	4.57	143.0	919.4	8805.5	442.0	8328.0	**3522.19**	**2776.00**
BORE NO: P82, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	18.21	8.21	22.58	1.57	12.2	12.2	1.0	7.67	0	35	1.0	55.0	0	3.0	10.8	44	10.40	2.71	1.45	24.6	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	5.00	4.00	2.00	2.50	20.40	10.40	35.03	6.29	10.8	10.8	1.0	42.00	0	44	1.0	276.6	0	5.0	10.8	44	10.40	2.71	1.45	45.4	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.50	20.40	10.40	50.63	3.14	10.8	10.8	1.0	30.35	0	44	1.0	138.3	0	6.0	27.5	3	10.40	15.63	16.64	55.8	0	0.0	41.3	41.3	**0.00**	**13.75**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
6.00	7.00	6.50	1.00	4.50	20.40	10.40	61.03	3.14	27.5	27.5	1.0	99.85	0	3	1.0	9.4	0	7.0	27.5	3	8.60	15.63	16.64	66.2	0	0.0	53.0	53.0	**0.00**	**17.68**
7.00	8.00	7.50	1.00	5.50	18.60	8.60	70.53	3.14	27.5	27.5	1.0	115.39	0	3	1.0	9.4	0	8.0	15.9	29	8.60	4.38	3.14	74.8	473.4	473.4	64.8	64.8	**189.35**	**21.61**
8.00	9.00	8.50	1.00	6.50	18.60	8.60	79.13	3.14	15.9	15.9	1.0	70.84	70.84	29	1.0	91.1	91.14	9.0	15.9	29	8.60	4.38	3.14	83.4	503.0	665.0	76.6	238.6	**265.99**	**79.53**
9.00	10.00	9.50	1.00	7.50	18.60	8.60	87.73	3.14	15.9	15.9	1.0	78.54	149.38	29	1.0	91.1	182.29	10.0	18.0	55	8.60	5.42	4.29	92.0	795.1	1126.7	88.4	420.1	**450.69**	**140.02**
10.00	11.00	10.50	1.00	8.50	18.60	8.60	96.33	3.14	18.0	18.0	1.0	98.37	247.75	55	1.0	172.9	355.14	11.0	9.0	55	11.00	2.29	1.07	100.6	574.6	1177.5	100.2	703.1	**471.00**	**234.36**
11.00	12.00	11.50	1.00	9.50	21.00	11.00	106.13	3.14	9.0	9.0	1.0	52.83	300.58	55	1.0	172.9	528.00	12.0	9.0	55	11.00	2.29	1.07	111.6	594.4	1423.0	112.0	940.5	**569.19**	**313.52**
12.00	14.50	13.25	2.50	12.00	21.00	11.00	125.38	7.86	9.0	9.0	1.0	156.03	456.61	55	1.0	432.1	960.14	14.5	10.5	52	10.50	2.62	1.36	139.1	659.4	2076.2	141.4	1558.2	**830.47**	**519.39**
14.50	17.50	16.00	3.00	15.00	20.50	10.50	125.38	9.43	10.5	10.5	1.0	219.10	675.71	52	1.0	490.3	1450.43	17.5	10.6	51	10.80	2.65	1.39	139.1	655.8	2782.0	176.8	2302.9	**1112.79**	**767.64**
17.50	20.50	19.00	3.00	18.00	20.80	10.80	125.38	9.43	10.6	10.6	1.0	221.23	896.95	51	1.0	480.9	1931.29	20.5	10.5	51	10.80	2.62	1.36	139.1	652.5	3480.7	212.1	3040.4	**1392.30**	**1013.46**
20.50	22.00	21.25	1.50	19.50	20.80	10.80	125.38	4.71	10.5	10.5	1.0	109.55	1006.50	51	1.0	240.4	2171.71	22.0	24.5	12	10.70	9.64	10.33	139.1	1182.1	4360.3	229.8	3408.0	**1744.12**	**1136.01**
22.00	23.50	22.75	1.50	21.00	20.70	10.70	125.38	4.71	24.5	24.5	1.0	269.37	1275.87	12	1.0	56.6	2228.29	23.5	14.5	55	10.70	3.80	2.51	139.1	814.3	4318.5	247.5	3751.7	**1727.39**	**1250.55**
23.50	26.50	25.00	3.00	24.00	20.70	10.70	125.38	9.43	14.5	14.5	1.0	305.73	1581.59	55	1.0	518.6	2746.86	26.5	9.5	55	10.80	2.38	1.14	139.1	654.0	4982.4	282.9	4611.3	**1992.96**	**1537.10**
26.50	27.50	27.00	1.00	25.00	20.80	10.80	125.38	3.14	9.5	9.5	1.0	65.94	1647.53	55	1.0	172.9	2919.71	27.5	9.5	55	10.80	2.38	1.14	139.1	654.0	5221.2	294.6	4861.9	**2088.48**	**1620.63**
27.50	29.50	28.50	2.00	27.00	20.80	10.80	125.38	6.29	9.5	9.5	1.0	131.88	1779.42	55	1.0	345.7	3265.43	29.5	10.5	56	10.80	2.62	1.36	139.1	687.9	5732.7	318.2	5363.1	**2293.08**	**1787.69**
29.50	30.00	29.75	0.50	27.50	20.80	10.80	125.38	1.57	10.5	10.5	1.0	36.52	1815.93	56	1.0	88.0	3353.43	30.0	10.5	56	10.50	2.62	1.36	139.1	687.7	5857.1	324.1	5493.5	**2342.83**	**1831.16**
30.00	32.50	31.25	2.50	30.00	20.50	10.50	125.38	7.86	10.5	10.5	1.0	182.58	1998.52	56	1.0	440.0	3793.43	32.5	11.2	56	10.50	2.82	1.56	139.1	711.0	6503.0	353.6	6145.5	**2601.19**	**2048.51**
32.50	34.00	33.25	1.50	31.50	20.50	10.50	125.38	4.71	11.2	11.2	1.0	117.04	2115.55	56	1.0	264.0	4057.43	34.0	7.3	60	10.50	1.98	0.80	139.1	644.5	6817.5	371.3	6544.2	**2726.99**	**2181.41**
34.00	35.00	34.50	1.00	32.50	20.50	10.50	125.38	3.14	7.3	7.3	1.0	50.48	2166.03	60	1.0	188.6	4246.00	35.0	7.0	72	8.95	1.93	0.76	139.1	722.8	7134.8	383.0	6795.1	**2853.93**	**2265.02**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
35.00	35.50	35.25	0.50	33.00	18.95	8.95	125.38	1.57	7.0	7.0	1.0	24.19	2190.22	72	1.0	113.1	4359.14	35.5	7.0	72	10.68	1.93	0.76	139.1	723.3	7272.7	388.9	6938.3	**2909.07**	**2312.76**
35.50	37.50	36.50	2.00	35.00	20.68	10.68	125.38	6.29	7.0	7.0	1.0	96.77	2286.99	72	1.0	452.6	4811.71	37.5	7.0	72	10.68	1.93	0.76	139.1	723.3	7822.0	412.5	7511.2	**3128.80**	**2503.73**
37.50	38.50	38.00	1.00	36.00	20.68	10.68	125.38	3.14	7.0	7.0	1.0	48.38	2335.37	72	1.0	226.3	5038.00	38.5	7.0	72	10.12	1.93	0.76	139.1	723.1	8096.5	424.3	7797.7	**3238.60**	**2599.22**
38.50	40.00	39.25	1.50	37.50	20.12	10.12	125.38	4.71	7.0	7.0	1.0	72.58	2407.95	72	1.0	339.4	5377.43	40.0	11.2	42	10.12	2.82	1.56	139.1	611.8	8397.2	442.0	8227.3	**3358.87**	**2742.45**
BORE NO: P83, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.88	9.88	27.17	1.57	26.8	26.8	1.0	21.57	0	6	1.0	9.4	0	3.0	23.9	0	9.88	9.21	9.67	29.6	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.50	19.88	9.88	34.58	3.14	23.9	23.9	1.0	48.16	0	0	1.0	0.0	0	4.0	24.8	10	10.15	9.86	10.66	39.5	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	6.00	5.00	2.00	3.50	20.15	10.15	49.67	6.29	24.8	24.8	1.0	144.26	0	10	1.0	62.9	0	6.0	24.2	0	10.15	9.42	10.00	59.8	0	0.0	41.3	41.3	**0.00**	**13.75**
6.00	7.00	6.50	1.00	4.50	20.15	10.15	64.90	3.14	24.2	24.2	1.0	91.66	0	0	1.0	0.0	0	7.0	24.2	0	10.15	9.42	10.00	70.0	0	0.0	53.0	53.0	**0.00**	**17.68**
7.00	8.00	7.50	1.00	5.50	20.15	10.15	75.05	3.14	24.2	24.2	1.0	106.00	0	0	1.0	0.0	0	8.0	28.6	0	9.80	18.11	19.17	80.1	0	0.0	64.8	64.8	**0.00**	**21.61**
8.00	9.00	8.50	1.00	6.50	19.80	9.80	85.02	3.14	28.6	28.6	1.0	145.69	0	0	1.0	0.0	0	9.0	8.9	58	9.80	2.27	1.05	89.9	574.7	574.7	76.6	76.6	**229.88**	**25.54**
9.00	10.00	9.50	1.00	7.50	19.80	9.80	94.82	3.14	8.9	8.9	1.0	46.67	46.67	58	1.0	182.3	182.29	10.0	8.9	58	10.31	2.27	1.05	99.7	592.4	821.4	88.4	317.3	**328.55**	**105.78**
10.00	12.50	11.25	2.50	10.00	20.31	10.31	112.61	7.86	8.9	8.9	1.0	138.55	185.22	58	1.0	455.7	638.00	12.5	9.5	52	10.31	2.38	1.14	125.5	607.0	1430.2	117.9	941.1	**572.10**	**313.69**
12.50	14.00	13.25	1.50	11.50	20.31	10.31	133.23	4.71	9.5	9.5	1.0	105.10	290.32	52	1.0	245.1	883.14	14.0	9.5	52	10.13	2.38	1.14	141.0	635.9	1809.3	135.5	1309.0	**723.73**	**436.33**
14.00	15.50	14.75	1.50	13.00	20.13	10.13	148.56	4.71	9.5	9.5	1.0	117.20	407.52	52	1.0	245.1	1128.29	15.5	9.5	58	10.13	2.38	1.14	141.0	678.3	2214.1	153.2	1689.0	**885.64**	**563.01**
15.50	18.50	17.00	3.00	16.00	20.13	10.13	148.56	9.43	9.5	9.5	1.0	234.39	641.91	58	1.0	546.9	1675.14	18.5	10.2	58	9.79	2.53	1.28	141.0	695.1	3012.2	188.6	2505.6	**1204.87**	**835.21**
18.50	21.50	20.00	3.00	19.00	19.79	9.79	148.56	9.43	10.2	10.2	1.0	252.02	893.94	58	1.0	546.9	2222.00	21.5	10.2	48	9.79	2.53	1.28	141.0	624.4	3740.4	223.9	3339.9	**1496.14**	**1113.29**
21.50	23.00	22.25	1.50	20.50	19.79	9.79	148.56	4.71	10.2	10.2	1.0	126.01	1019.95	48	1.0	226.3	2448.29	23.0	9.6	55	8.40	2.40	1.16	141.0	658.3	4126.6	241.6	3709.8	**1650.63**	**1236.61**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
23.00	24.50	23.75	1.50	22.00	18.40	8.40	148.56	4.71	9.6	9.6	1.0	118.45	1138.40	55	1.0	259.3	2707.57	24.5	9.6	55	8.40	2.40	1.16	141.0	658.3	4504.3	259.3	4105.3	**1801.73**	**1368.42**
24.50	27.50	26.00	3.00	25.00	18.40	8.40	148.56	9.43	9.6	9.6	1.0	236.91	1375.31	55	1.0	518.6	3226.14	27.5	9.6	55	11.35	2.40	1.16	141.0	659.7	5261.1	294.6	4896.1	**2104.45**	**1632.03**
27.50	30.00	28.75	2.50	27.50	21.35	11.35	148.56	7.86	9.6	9.6	1.0	197.42	1572.73	55	1.0	432.1	3658.29	30.0	8.1	62	11.35	2.13	0.93	141.0	678.2	5909.3	324.1	5555.1	**2363.71**	**1851.71**
30.00	30.50	30.25	0.50	28.00	21.35	11.35	148.56	1.57	8.1	8.1	1.0	33.22	1605.96	62	1.0	97.4	3755.71	30.5	15.3	49	11.35	4.09	2.81	141.0	811.8	6173.4	330.0	5691.7	**2469.38**	**1897.22**
30.50	32.00	31.25	1.50	29.50	21.35	11.35	148.56	4.71	15.3	15.3	1.0	191.59	1797.55	49	1.0	231.0	3986.71	32.0	13.8	49	11.35	3.59	2.31	141.0	754.4	6538.7	347.7	6131.9	**2615.46**	**2043.98**
32.00	32.50	32.25	0.50	30.00	21.35	11.35	148.56	1.57	13.8	13.8	1.0	57.34	1854.89	49	1.0	77.0	4063.71	32.5	13.8	49	10.60	3.59	2.31	141.0	753.7	6672.3	353.6	6272.2	**2668.93**	**2090.73**
32.50	33.50	33.00	1.00	31.00	20.60	10.60	148.56	3.14	13.8	13.8	1.0	114.68	1969.57	49	1.0	154.0	4217.71	33.5	13.8	49	10.60	3.59	2.31	141.0	753.7	6941.0	365.4	6552.6	**2776.40**	**2184.21**
33.50	35.00	34.25	1.50	32.50	20.60	10.60	148.56	4.71	13.8	13.8	1.0	172.02	2141.59	49	1.0	231.0	4448.71	35.0	12.8	47	10.60	3.29	2.02	141.0	705.3	7295.6	383.0	6973.3	**2918.25**	**2324.45**
35.00	36.50	35.75	1.50	34.00	20.60	10.60	148.56	4.71	12.8	12.8	1.0	159.11	2300.70	47	1.0	221.6	4670.29	36.5	12.8	47	10.60	3.29	2.02	141.0	705.3	7676.3	400.7	7371.7	**3070.53**	**2457.23**
36.50	37.50	37.00	1.00	35.00	20.60	10.60	148.56	3.14	12.8	12.8	1.0	106.08	2406.78	47	1.0	147.7	4818.00	37.5	12.0	38	10.60	3.06	1.79	141.0	614.9	7839.6	412.5	7637.3	**3135.86**	**2545.76**
37.50	38.00	37.75	0.50	35.50	20.60	10.60	148.56	1.57	12.0	12.0	1.0	49.62	2456.40	38	1.0	59.7	4877.71	38.0	12.0	38	9.30	3.06	1.79	141.0	613.9	7948.1	418.4	7752.5	**3179.23**	**2584.17**
38.00	40.00	39.00	2.00	37.50	19.30	9.30	148.56	6.29	12.0	12.0	1.0	198.48	2654.88	38	1.0	238.9	5116.57	40.0	12.0	38	9.30	3.06	1.79	141.0	613.9	8385.4	442.0	8213.4	**3354.16**	**2737.81**
BORE NO: P84, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.99	9.99	27.47	1.57	26.5	26.5	1.0	21.52	21.52	8	1.0	12.6	12.57	3.0	25.0	10	9.99	10.00	10.88	30.0	348.9	383.0	5.9	40.0	**153.20**	**13.33**
3.00	4.00	3.50	1.00	1.50	19.99	9.99	34.97	3.14	25.0	25.0	1.0	51.24	72.77	10	1.0	31.4	44.00	4.0	25.0	10	9.99	10.00	10.88	40.0	427.4	544.2	17.7	134.4	**217.66**	**44.82**
4.00	5.00	4.50	1.00	2.50	19.99	9.99	44.96	3.14	25.0	25.0	1.0	65.88	138.65	10	1.0	31.4	75.43	5.0	25.0	10	9.91	10.00	10.88	50.0	505.5	719.6	29.5	243.5	**287.85**	**81.18**
5.00	6.00	5.50	1.00	3.50	19.91	9.91	54.91	3.14	25.0	25.0	1.0	80.47	219.12	10	1.0	31.4	106.86	6.0	25.0	10	9.91	10.00	10.88	59.9	583.4	909.4	41.3	367.2	**363.75**	**122.41**
6.00	7.00	6.50	1.00	4.50	19.91	9.91	64.82	3.14	25.0	25.0	1.0	94.99	314.10	10	1.0	31.4	138.29	7.0	10.2	45	10.13	2.53	1.28	69.8	461.9	914.3	53.0	505.4	**365.73**	**168.48**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
7.00	9.00	8.00	2.00	6.50	20.13	10.13	79.90	6.29	10.2	10.2	1.0	90.37	404.47	45	1.0	282.9	421.14	9.0	10.2	45	10.13	2.53	1.28	90.0	502.2	1327.8	76.6	902.2	**531.12**	**300.74**
9.00	10.00	9.50	1.00	7.50	20.13	10.13	95.10	3.14	10.2	10.2	1.0	53.78	458.24	45	1.0	141.4	562.57	10.0	10.2	45	10.13	2.53	1.28	100.2	522.3	1543.1	88.4	1109.2	**617.25**	**369.74**
10.00	11.00	10.50	1.00	8.50	20.13	10.13	105.23	3.14	10.2	10.2	1.0	59.50	517.75	45	1.0	141.4	704.00	11.0	27.0	0	9.90	14.50	15.49	110.3	1317.1	2538.8	100.2	1321.9	**1015.53**	**440.64**
11.00	12.50	11.75	1.50	10.00	19.90	9.90	117.72	4.71	27.0	27.0	1.0	282.76	800.51	0	1.0	0.0	704.00	12.5	27.0	0	10.09	14.50	15.49	125.1	1487.5	2992.0	117.9	1622.4	**1196.79**	**540.79**
12.50	15.50	14.00	3.00	13.00	20.09	10.09	140.28	9.43	27.0	27.0	1.0	673.89	1474.40	0	1.0	0.0	704.00	15.5	8.5	65	10.09	2.20	0.99	125.1	679.9	2858.3	153.2	2331.6	**1143.31**	**777.20**
15.50	17.00	16.25	1.50	14.50	20.09	10.09	140.28	4.71	8.5	8.5	1.0	98.83	1573.23	65	1.0	306.4	1010.43	17.0	26.7	0	8.11	13.83	14.80	125.1	1406.8	3990.5	170.9	2754.6	**1596.18**	**918.18**
17.00	18.50	17.75	1.50	16.00	18.11	8.11	140.28	4.71	26.7	26.7	1.0	332.60	1905.83	0	1.0	0.0	1010.43	18.5	26.7	0	8.11	13.83	14.80	125.1	1406.8	4323.1	188.6	3104.8	**1729.22**	**1034.94**
18.50	20.00	19.25	1.50	17.50	18.11	8.11	140.28	4.71	26.7	26.7	1.0	332.60	2238.43	0	1.0	0.0	1010.43	20.0	10.5	56	8.11	2.62	1.36	125.1	657.7	3906.5	206.3	3455.1	**1562.60**	**1151.70**
20.00	21.50	20.75	1.50	19.00	18.11	8.11	140.28	4.71	10.5	10.5	1.0	122.56	2360.99	56	1.0	264.0	1274.43	21.5	9.5	56	10.24	2.38	1.14	125.1	634.6	4270.0	223.9	3859.3	**1708.01**	**1286.45**
21.50	24.50	23.00	3.00	22.00	20.24	10.24	140.28	9.43	9.5	9.5	1.0	221.33	2582.32	56	1.0	528.0	1802.43	24.5	16.2	41	10.24	4.53	3.31	125.1	748.7	5133.4	259.3	4644.0	**2053.37**	**1548.01**
24.50	26.00	25.25	1.50	23.50	20.24	10.24	140.28	4.71	16.2	16.2	1.0	192.12	2774.44	41	1.0	193.3	1995.71	26.0	8.5	49	10.24	2.20	0.99	125.1	566.8	5336.9	277.0	5047.1	**2134.78**	**1682.37**
26.00	27.50	26.75	1.50	25.00	20.24	10.24	140.28	4.71	8.5	8.5	1.0	98.83	2873.27	49	1.0	231.0	2226.71	27.5	29.0	0	10.64	19.01	20.10	125.1	1952.9	7052.9	294.6	5394.6	**2821.16**	**1798.21**
27.50	29.00	28.25	1.50	26.50	20.64	10.64	140.28	4.71	29.0	29.0	1.0	366.56	3239.84	0	1.0	0.0	2226.71	29.0	29.0	0	10.64	19.01	20.10	125.1	1952.9	7419.5	312.3	5778.9	**2967.78**	**1926.29**
29.00	30.00	29.50	1.00	27.50	20.64	10.64	140.28	3.14	29.0	29.0	1.0	244.38	3484.21	0	1.0	0.0	2226.71	30.0	29.0	0	10.64	19.01	20.10	125.1	1952.9	7663.8	324.1	6035.0	**3065.53**	**2011.68**
30.00	30.50	30.25	0.50	28.00	20.64	10.64	140.28	1.57	29.0	29.0	1.0	122.19	3606.40	0	1.0	0.0	2226.71	30.5	29.0	0	10.64	19.01	20.10	125.1	1952.9	7786.0	330.0	6163.1	**3114.41**	**2054.37**
30.50	32.00	31.25	1.50	29.50	20.64	10.64	140.28	4.71	29.0	29.0	1.0	366.56	3972.96	0	1.0	0.0	2226.71	32.0	28.7	0	10.64	18.33	19.40	125.1	1883.6	8083.3	347.7	6547.4	**3233.31**	**2182.45**
32.00	32.50	32.25	0.50	30.00	20.64	10.64	140.28	1.57	28.7	28.7	1.0	120.68	4093.64	0	1.0	0.0	2226.71	32.5	28.7	0	10.43	18.33	19.40	125.1	1882.0	8202.4	353.6	6673.9	**3280.94**	**2224.64**
32.50	33.50	33.00	1.00	31.00	20.43	10.43	140.28	3.14	28.7	28.7	1.0	241.37	4335.01	0	1.0	0.0	2226.71	33.5	28.7	0	10.43	18.33	19.40	125.1	1882.0	8443.7	365.4	6927.1	**3377.49**	**2309.03**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
33.50	35.00	34.25	1.50	32.50	20.43	10.43	140.28	4.71	28.7	28.7	1.0	362.05	4697.06	0	1.0	0.0	2226.71	35.0	28.7	0	10.43	18.33	19.40	125.1	1882.0	8805.8	383.0	7306.8	**3522.31**	**2435.60**
35.00	36.50	35.75	1.50	34.00	20.43	10.43	140.28	4.71	28.7	28.7	1.0	362.05	5059.11	0	1.0	0.0	2226.71	36.5	28.7	0	10.43	18.33	19.40	125.1	1882.0	9167.8	400.7	7686.5	**3667.13**	**2562.18**
36.50	37.50	37.00	1.00	35.00	20.43	10.43	140.28	3.14	28.7	28.7	1.0	241.37	5300.47	0	1.0	0.0	2226.71	37.5	28.7	0	10.43	18.33	19.40	125.1	1882.0	9409.2	412.5	7939.7	**3763.67**	**2646.56**
37.50	40.00	38.75	2.50	37.50	20.43	10.43	140.28	7.86	28.7	28.7	1.0	603.42	5903.89	0	1.0	0.0	2226.71	40.0	28.7	0	10.43	18.33	19.40	125.1	1882.0	10012.6	442.0	8572.6	**4005.04**	**2857.52**
BORE NO: P85, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.45	9.45	25.99	1.57	13.3	13.3	1.0	9.65	0	27	1.0	42.4	0	3.0	13.3	27	9.45	3.44	2.16	28.4	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.50	19.45	9.45	33.08	3.14	13.3	13.3	1.0	24.57	0	27	1.0	84.9	0	4.0	12.4	46	9.45	3.17	1.91	37.8	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	5.00	4.50	1.00	2.50	19.45	9.45	42.53	3.14	12.4	12.4	1.0	29.38	0	46	1.0	144.6	0	5.0	14.3	22	9.00	3.74	2.45	47.3	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.50	19.00	9.00	51.75	3.14	14.3	14.3	1.0	41.46	0	22	1.0	69.1	0	6.0	14.3	22	9.00	3.74	2.45	56.3	0	0.0	41.3	41.3	**0.00**	**13.75**
6.00	7.00	6.50	1.00	4.50	19.00	9.00	60.75	3.14	14.3	14.3	1.0	48.67	0	22	1.0	69.1	0	7.0	28.5	3	9.00	17.88	18.94	65.3	0	0.0	53.0	53.0	**0.00**	**17.68**
7.00	8.00	7.50	1.00	5.50	19.00	9.00	69.75	3.14	28.5	28.5	1.0	119.02	0	3	1.0	9.4	0	8.0	24.5	13	9.00	9.64	10.33	74.3	690.8	690.8	64.8	64.8	**276.34**	**21.61**
8.00	9.00	8.50	1.00	6.50	19.00	9.00	78.75	3.14	24.5	24.5	1.0	112.79	112.79	13	1.0	40.9	40.86	9.0	24.5	13	9.00	9.64	10.33	83.3	759.0	912.7	76.6	230.3	**365.07**	**76.75**
9.00	10.00	9.50	1.00	7.50	19.00	9.00	87.75	3.14	24.5	24.5	1.0	125.68	238.48	13	1.0	40.9	81.71	10.0	24.5	13	9.90	9.64	10.33	92.3	830.8	1151.0	88.4	408.6	**460.41**	**136.19**
10.00	11.00	10.50	1.00	8.50	19.90	9.90	97.20	3.14	24.5	24.5	1.0	139.22	377.69	13	1.0	40.9	122.57	11.0	24.5	13	9.90	9.64	10.33	102.2	905.8	1406.1	100.2	600.4	**562.43**	**200.15**
11.00	12.00	11.50	1.00	9.50	19.90	9.90	107.10	3.14	24.5	24.5	1.0	153.40	531.09	13	1.0	40.9	163.43	12.0	26.5	15	9.70	13.38	14.34	112.1	1338.5	2033.0	112.0	806.5	**813.20**	**268.83**
12.00	14.50	13.25	2.50	12.00	19.70	9.70	124.18	7.86	26.5	26.5	1.0	486.45	1017.54	15	1.0	117.9	281.29	14.5	26.5	15	9.70	13.38	14.34	136.3	1593.4	2892.2	141.4	1440.3	**1156.88**	**480.08**
14.50	16.00	15.25	1.50	13.50	19.70	9.70	124.18	4.71	26.5	26.5	1.0	291.87	1309.40	15	1.0	70.7	352.00	16.0	10.2	46	10.90	2.53	1.28	136.3	601.6	2263.0	159.1	1820.5	**905.19**	**606.84**
16.00	17.50	16.75	1.50	15.00	20.90	10.90	124.18	4.71	10.2	10.2	1.0	105.33	1414.73	46	1.0	216.9	568.86	17.5	11.5	46	10.40	2.91	1.65	136.3	643.8	2627.4	176.8	2160.4	**1050.94**	**720.13**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
17.50	20.50	19.00	3.00	18.00	20.40	10.40	124.18	9.43	11.5	11.5	1.0	238.20	1652.93	46	1.0	433.7	1002.57	20.5	10.6	54	10.70	2.65	1.39	136.3	671.1	3326.6	212.1	2867.6	**1330.65**	**955.88**
20.50	23.50	22.00	3.00	21.00	20.70	10.70	124.18	9.43	10.6	10.6	1.0	219.11	1872.04	54	1.0	509.1	1511.71	23.5	10.6	54	9.80	2.65	1.39	136.3	670.6	4054.4	247.5	3631.3	**1621.75**	**1210.42**
23.50	26.50	25.00	3.00	24.00	19.80	9.80	124.18	9.43	10.6	10.6	1.0	219.11	2091.15	54	1.0	509.1	2020.86	26.5	18.0	40	9.80	5.42	4.29	136.3	879.4	4991.4	282.9	4394.9	**1996.56**	**1464.95**
26.50	27.50	27.00	1.00	25.00	19.80	9.80	124.18	3.14	18.0	18.0	1.0	126.80	2217.96	40	1.0	125.7	2146.57	27.5	18.0	40	9.80	5.42	4.29	136.3	879.4	5243.9	294.6	4659.2	**2097.57**	**1553.06**
27.50	28.00	27.75	0.50	25.50	19.80	9.80	124.18	1.57	18.0	18.0	1.0	63.40	2281.36	40	1.0	62.9	2209.43	28.0	8.5	60	11.02	2.20	0.99	136.3	664.2	5155.0	300.5	4791.3	**2061.98**	**1597.11**
28.00	29.50	28.75	1.50	27.00	21.02	11.02	124.18	4.71	8.5	8.5	1.0	87.49	2368.85	60	1.0	282.9	2492.29	29.5	8.5	60	11.02	2.20	0.99	136.3	664.2	5525.3	318.2	5179.3	**2210.12**	**1726.45**
29.50	30.00	29.75	0.50	27.50	21.02	11.02	124.18	1.57	8.5	8.5	1.0	29.16	2398.01	60	1.0	94.3	2586.57	30.0	8.5	60	11.02	2.20	0.99	136.3	664.2	5648.8	324.1	5308.7	**2259.50**	**1769.56**
30.00	31.00	30.50	1.00	28.50	21.02	11.02	124.18	3.14	8.5	8.5	1.0	58.33	2456.33	60	1.0	188.6	2775.14	31.0	9.0	40	11.02	2.29	1.07	136.3	532.7	5764.2	335.9	5567.4	**2305.68**	**1855.79**
31.00	32.50	31.75	1.50	30.00	21.02	11.02	124.18	4.71	9.0	9.0	1.0	92.72	2549.05	40	1.0	188.6	2963.71	32.5	9.1	44	9.90	2.31	1.08	136.3	562.5	6075.3	353.6	5866.3	**2430.11**	**1955.45**
32.50	35.00	33.75	2.50	32.50	19.90	9.90	124.18	7.86	9.1	9.1	1.0	156.28	2705.33	44	1.0	345.7	3309.43	35.0	9.1	44	9.90	2.31	1.08	136.3	562.5	6577.3	383.0	6397.8	**2630.91**	**2132.60**
35.00	35.50	35.25	0.50	33.00	19.90	9.90	124.18	1.57	9.1	9.1	1.0	31.26	2736.58	44	1.0	69.1	3378.57	35.5	21.0	26	9.90	7.12	6.49	136.3	971.6	7086.7	388.9	6504.1	**2834.70**	**2168.03**
35.50	37.00	36.25	1.50	34.50	19.90	9.90	124.18	4.71	21.0	21.0	1.0	224.71	2961.29	26	1.0	122.6	3501.14	37.0	11.5	44	9.90	2.91	1.65	136.3	629.3	7091.7	406.6	6869.0	**2836.70**	**2289.68**
37.00	37.50	37.25	0.50	35.00	19.90	9.90	124.18	1.57	11.5	11.5	1.0	39.70	3000.99	44	1.0	69.1	3570.29	37.5	11.5	44	8.60	2.91	1.65	136.3	628.5	7199.7	412.5	6983.8	**2879.90**	**2327.93**
37.50	38.50	38.00	1.00	36.00	18.60	8.60	124.18	3.14	11.5	11.5	1.0	79.40	3080.39	44	1.0	138.3	3708.57	38.5	9.5	56	9.43	2.38	1.14	136.3	655.1	7444.1	424.3	7213.3	**2977.63**	**2404.42**
38.50	40.00	39.25	1.50	37.50	19.43	9.43	124.18	4.71	9.5	9.5	1.0	97.96	3178.36	56	1.0	264.0	3972.57	40.0	9.5	56	9.43	2.38	1.14	136.3	655.1	7806.0	442.0	7592.9	**3122.42**	**2530.96**
BORE NO: P86, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.64	9.64	26.51	1.57	11.8	11.8	1.0	8.70	0	24	1.0	37.7	0	3.0	25.7	8	9.64	11.58	12.49	28.9	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.50	19.64	9.64	33.74	3.14	25.7	25.7	1.0	51.03	0	8	1.0	25.1	0	4.0	25.7	8	9.64	11.58	12.49	38.6	0	0.0	17.7	17.7	**0.00**	**5.89**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
4.00	6.00	5.00	2.00	3.50	19.64	9.64	48.20	6.29	25.7	25.7	1.0	145.81	0	8	1.0	50.3	0	6.0	25.5	10	9.64	11.13	12.03	57.8	621.9	621.9	41.3	41.3	**248.76**	**13.75**
6.00	7.00	6.50	1.00	4.50	19.64	9.64	62.66	3.14	25.5	25.5	1.0	93.93	93.93	10	1.0	31.4	31.43	7.0	25.5	10	9.64	11.13	12.03	67.5	706.2	831.5	53.0	178.4	**332.62**	**59.47**
7.00	8.00	7.50	1.00	5.50	19.64	9.64	72.30	3.14	25.5	25.5	1.0	108.38	202.31	10	1.0	31.4	62.86	8.0	25.5	10	9.68	11.13	12.03	77.1	790.6	1055.8	64.8	330.0	**422.32**	**110.00**
8.00	9.00	8.50	1.00	6.50	19.68	9.68	81.96	3.14	25.5	25.5	1.0	122.86	325.18	10	1.0	31.4	94.29	9.0	25.2	11	9.68	10.45	11.34	86.8	833.6	1253.1	76.6	496.1	**501.24**	**165.36**
9.00	10.00	9.50	1.00	7.50	19.68	9.68	91.64	3.14	25.2	25.2	1.0	135.53	460.71	11	1.0	34.6	128.86	10.0	25.5	10	9.68	11.13	12.03	96.5	959.9	1549.4	88.4	678.0	**619.78**	**225.99**
10.00	11.00	10.50	1.00	8.50	19.68	9.68	101.32	3.14	25.5	25.5	1.0	151.89	612.59	10	1.0	31.4	160.29	11.0	25.2	11	8.99	10.45	11.34	106.2	989.5	1762.4	100.2	873.1	**704.96**	**291.02**
11.00	12.50	11.75	1.50	10.00	18.99	8.99	112.90	4.71	25.2	25.2	1.0	250.46	863.05	11	1.0	51.9	212.14	12.5	10.5	51	10.19	2.62	1.36	119.6	612.1	1687.3	117.9	1193.1	**674.92**	**397.68**
12.50	15.50	14.00	3.00	13.00	20.19	10.19	134.93	9.43	10.5	10.5	1.0	235.79	1098.84	51	1.0	480.9	693.00	15.5	10.5	51	10.19	2.62	1.36	119.6	612.1	2404.0	153.2	1945.1	**961.58**	**648.35**
15.50	17.00	16.25	1.50	14.50	20.19	10.19	134.93	4.71	10.5	10.5	1.0	117.89	1216.73	51	1.0	240.4	933.43	17.0	27.0	5	9.65	14.50	15.49	119.6	1457.5	3607.7	170.9	2321.1	**1443.08**	**773.68**
17.00	18.50	17.75	1.50	16.00	19.65	9.65	134.93	4.71	27.0	27.0	1.0	324.11	1540.84	5	1.0	23.6	957.00	18.5	13.5	50	9.65	3.50	2.22	119.6	691.0	3188.9	188.6	2686.4	**1275.54**	**895.47**
18.50	21.50	20.00	3.00	19.00	19.65	9.65	134.93	9.43	13.5	13.5	1.0	305.43	1846.27	50	1.0	471.4	1428.43	21.5	13.5	50	10.09	3.50	2.22	119.6	691.4	3966.1	223.9	3498.6	**1586.44**	**1166.21**
21.50	24.50	23.00	3.00	22.00	20.09	10.09	134.93	9.43	13.5	13.5	1.0	305.43	2151.70	50	1.0	471.4	1899.86	24.5	9.4	53	10.09	2.36	1.13	119.6	601.3	4652.9	259.3	4310.8	**1861.14**	**1436.95**
24.50	26.00	25.25	1.50	23.50	20.09	10.09	134.93	4.71	9.4	9.4	1.0	105.31	2257.00	53	1.0	249.9	2149.71	26.0	27.1	0	8.89	14.73	15.72	119.6	1439.5	5846.2	277.0	4683.7	**2338.50**	**1561.23**
26.00	27.50	26.75	1.50	25.00	18.89	8.89	134.93	4.71	27.1	27.1	1.0	325.51	2582.51	0	1.0	0.0	2149.71	27.5	21.5	0	8.89	7.48	7.04	119.6	727.7	5460.0	294.6	5026.9	**2183.99**	**1675.62**
27.50	30.00	28.75	2.50	27.50	18.89	8.89	134.93	7.86	21.5	21.5	1.0	417.61	3000.12	0	1.0	0.0	2149.71	30.0	21.5	0	9.32	7.48	7.04	119.6	728.9	5878.8	324.1	5473.9	**2351.51**	**1824.65**
30.00	30.50	30.25	0.50	28.00	19.32	9.32	134.93	1.57	21.5	21.5	1.0	83.52	3083.64	0	1.0	0.0	2149.71	30.5	28.5	0	10.55	17.88	18.94	119.6	1759.5	6992.9	330.0	5563.4	**2797.15**	**1854.45**
30.50	32.00	31.25	1.50	29.50	20.55	10.55	134.93	4.71	28.5	28.5	1.0	345.37	3429.01	0	1.0	0.0	2149.71	32.0	14.5	54	10.55	3.80	2.51	119.6	749.0	6327.7	347.7	5926.4	**2531.09**	**1975.47**
32.00	32.50	32.25	0.50	30.00	20.55	10.55	134.93	1.57	14.5	14.5	1.0	54.84	3483.85	54	1.0	84.9	2234.57	32.5	14.5	54	10.55	3.80	2.51	119.6	749.0	6467.4	353.6	6072.0	**2586.97**	**2024.00**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
32.50	33.50	33.00	1.00	31.00	20.55	10.55	134.93	3.14	14.5	14.5	1.0	109.67	3593.52	54	1.0	169.7	2404.29	33.5	9.3	67	10.55	2.34	1.11	119.6	698.7	6696.6	365.4	6363.2	**2678.62**	**2121.05**
33.50	35.00	34.25	1.50	32.50	20.55	10.55	134.93	4.71	9.3	9.3	1.0	104.17	3697.69	67	1.0	315.9	2720.14	35.0	9.3	67	10.55	2.34	1.11	119.6	698.7	7116.6	383.0	6800.9	**2846.63**	**2266.95**
35.00	36.50	35.75	1.50	34.00	20.55	10.55	134.93	4.71	9.3	9.3	1.0	104.17	3801.85	67	1.0	315.9	3036.00	36.5	13.1	49	10.55	3.38	2.11	119.6	673.0	7510.8	400.7	7238.6	**3004.33**	**2412.86**
36.50	37.50	37.00	1.00	35.00	20.55	10.55	134.93	3.14	13.1	13.1	1.0	98.68	3900.53	49	1.0	154.0	3190.00	37.5	13.1	49	10.81	3.38	2.11	119.6	673.2	7763.7	412.5	7503.0	**3105.49**	**2501.01**
37.50	40.00	38.75	2.50	37.50	20.81	10.81	134.93	7.86	13.1	13.1	1.0	246.71	4147.24	49	1.0	385.0	3575.00	40.0	13.1	49	10.81	3.38	2.11	119.6	673.2	8395.4	442.0	8164.2	**3358.17**	**2721.40**
BORE NO: P87, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	20.05	10.05	27.64	1.57	12.5	12.5	1.0	9.63	0	51	1.0	80.1	0	3.0	13.5	12	10.05	3.50	2.22	30.2	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.50	20.05	10.05	35.18	3.14	13.5	13.5	1.0	26.54	0	12	1.0	37.7	0	4.0	27.5	4	9.59	15.63	16.64	40.2	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	5.00	4.50	1.00	2.50	19.59	9.59	45.00	3.14	27.5	27.5	1.0	73.61	0	4	1.0	12.6	0	5.0	29.0	0	9.59	19.01	20.10	49.8	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.50	19.59	9.59	54.59	3.14	29.0	29.0	1.0	95.09	0	0	1.0	0.0	0	6.0	29.0	0	9.88	19.01	20.10	59.4	0	0.0	41.3	41.3	**0.00**	**13.75**
6.00	8.00	7.00	2.00	5.50	19.88	9.88	69.26	6.29	29.0	29.0	1.0	241.32	0	0	1.0	0.0	0	8.0	17.5	68	9.88	5.17	4.02	79.1	817.9	817.9	64.8	64.8	**327.18**	**21.61**
8.00	9.00	8.50	1.00	6.50	19.88	9.88	84.08	3.14	17.5	17.5	1.0	83.32	83.32	68	1.0	213.7	213.71	9.0	15.0	30	9.88	3.94	2.65	89.0	498.0	795.0	76.6	373.6	**318.02**	**124.55**
9.00	10.00	9.50	1.00	7.50	19.88	9.88	93.96	3.14	15.0	15.0	1.0	79.13	162.44	30	1.0	94.3	308.00	10.0	25.6	0	9.88	11.35	12.26	98.9	929.7	1400.1	88.4	558.8	**560.04**	**186.28**
10.00	11.00	10.50	1.00	8.50	19.88	9.88	103.84	3.14	25.6	25.6	1.0	156.36	318.81	0	1.0	0.0	308.00	11.0	11.5	53	9.79	2.91	1.65	108.8	629.9	1256.7	100.2	727.0	**502.70**	**242.33**
11.00	12.00	11.50	1.00	9.50	19.79	9.79	113.68	3.14	11.5	11.5	1.0	72.69	391.49	53	1.0	166.6	474.57	12.0	9.0	72	9.79	2.29	1.07	118.6	726.6	1592.6	112.0	978.0	**637.06**	**326.01**
12.00	13.00	12.50	1.00	10.50	19.79	9.79	123.47	3.14	9.0	9.0	1.0	61.46	452.95	72	1.0	226.3	700.86	13.0	11.5	53	9.79	2.91	1.65	128.4	674.7	1828.5	123.8	1277.6	**731.41**	**425.85**
13.00	14.50	13.75	1.50	12.00	19.79	9.79	135.70	4.71	11.5	11.5	1.0	130.16	583.11	53	1.0	249.9	950.71	14.5	11.5	53	9.79	2.91	1.65	143.0	708.3	2242.1	141.4	1675.3	**896.85**	**558.42**
14.50	16.00	15.25	1.50	13.50	19.79	9.79	135.70	4.71	11.5	11.5	1.0	130.16	713.26	53	1.0	249.9	1200.57	16.0	26.8	0	9.46	14.05	15.03	143.0	1635.3	3549.2	159.1	2072.9	**1419.67**	**690.98**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
16.00	17.50	16.75	1.50	15.00	19.46	9.46	135.70	4.71	26.8	26.8	1.0	323.16	1036.42	0	1.0	0.0	1200.57	17.5	9.5	56	11.05	2.38	1.14	143.0	668.5	2905.4	176.8	2413.8	**1162.18**	**804.59**
17.50	20.50	19.00	3.00	18.00	21.05	11.05	135.70	9.43	9.5	9.5	1.0	214.11	1250.53	56	1.0	528.0	1728.57	20.5	9.5	56	11.05	2.38	1.14	143.0	668.5	3647.6	212.1	3191.2	**1459.02**	**1063.75**
20.50	22.00	21.25	1.50	19.50	21.05	11.05	135.70	4.71	9.5	9.5	1.0	107.06	1357.59	56	1.0	264.0	1992.57	22.0	11.5	42	10.00	2.91	1.65	143.0	630.7	3980.8	229.8	3580.0	**1592.33**	**1193.33**
22.00	23.50	22.75	1.50	21.00	20.00	10.00	135.70	4.71	11.5	11.5	1.0	130.16	1487.75	42	1.0	198.0	2190.57	23.5	11.0	68	10.00	2.76	1.51	143.0	797.4	4475.7	247.5	3925.8	**1790.30**	**1308.61**
23.50	25.00	24.25	1.50	22.50	20.00	10.00	135.70	4.71	11.0	11.0	1.0	124.35	1612.10	68	1.0	320.6	2511.14	25.0	26.5	0	9.48	13.38	14.34	143.0	1557.0	5680.2	265.2	4388.4	**2272.08**	**1462.81**
25.00	26.50	25.75	1.50	24.00	19.48	9.48	135.70	4.71	26.5	26.5	1.0	318.96	1931.06	0	1.0	0.0	2511.14	26.5	26.0	0	9.48	12.25	13.18	143.0	1426.1	5868.3	282.9	4725.1	**2347.33**	**1575.02**
26.50	27.50	27.00	1.00	25.00	19.48	9.48	135.70	3.14	26.0	26.0	1.0	208.01	2139.08	0	1.0	0.0	2511.14	27.5	26.0	0	9.48	12.25	13.18	143.0	1426.1	6076.3	294.6	4944.9	**2430.54**	**1648.29**
27.50	29.50	28.50	2.00	27.00	19.48	9.48	135.70	6.29	26.0	26.0	1.0	416.03	2555.11	0	1.0	0.0	2511.14	29.5	19.4	26	10.50	6.08	5.06	143.0	888.2	5954.4	318.2	5384.5	**2381.77**	**1794.82**
29.50	30.00	29.75	0.50	27.50	20.50	10.50	135.70	1.57	19.4	19.4	1.0	75.10	2630.20	26	1.0	40.9	2552.00	30.0	29.0	0	10.50	19.01	20.10	143.0	2219.2	7401.4	324.1	5506.3	**2960.56**	**1835.44**
30.00	32.50	31.25	2.50	30.00	20.50	10.50	135.70	7.86	29.0	29.0	1.0	591.02	3221.22	0	1.0	0.0	2552.00	32.5	29.0	0	10.50	19.01	20.10	143.0	2219.2	7992.4	353.6	6126.8	**3196.97**	**2042.27**
32.50	35.00	33.75	2.50	32.50	20.50	10.50	135.70	7.86	29.0	29.0	1.0	591.02	3812.25	0	1.0	0.0	2552.00	35.0	28.7	0	10.75	18.33	19.40	143.0	2142.3	8506.6	383.0	6747.3	**3402.63**	**2249.09**
35.00	35.50	35.25	0.50	33.00	20.75	10.75	135.70	1.57	28.7	28.7	1.0	116.75	3929.00	0	1.0	0.0	2552.00	35.5	28.7	0	10.75	18.33	19.40	143.0	2142.3	8623.3	388.9	6869.9	**3449.33**	**2289.98**
35.50	37.50	36.50	2.00	35.00	20.75	10.75	135.70	6.29	28.7	28.7	1.0	467.00	4395.99	0	1.0	0.0	2552.00	37.5	28.7	0	10.75	18.33	19.40	143.0	2142.3	9090.3	412.5	7360.5	**3636.13**	**2453.50**
37.50	38.50	38.00	1.00	36.00	20.75	10.75	135.70	3.14	28.7	28.7	1.0	233.50	4629.49	0	1.0	0.0	2552.00	38.5	28.7	0	10.75	18.33	19.40	143.0	2142.3	9323.8	424.3	7605.8	**3729.53**	**2535.26**
38.50	40.00	39.25	1.50	37.50	20.75	10.75	135.70	4.71	28.7	28.7	1.0	350.25	4979.74	0	1.0	0.0	2552.00	40.0	28.7	0	10.75	18.33	19.40	143.0	2142.3	9674.1	442.0	7973.7	**3869.63**	**2657.90**
BORE NO: P88, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.90	9.90	27.23	1.57	24.2	24.2	1.0	19.23	0	18	1.0	28.3	0	3.0	26.6	0	9.90	13.60	14.57	29.7	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.50	19.90	9.90	34.65	3.14	26.6	26.6	1.0	54.53	0	0	1.0	0.0	0	4.0	23.6	16	8.85	8.99	9.34	39.6	425.4	425.4	17.7	17.7	**170.16**	**5.89**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
4.00	6.00	5.00	2.00	3.50	18.85	8.85	48.45	6.29	23.6	23.6	1.0	133.05	133.05	16	1.0	100.6	100.57	6.0	23.6	16	8.85	8.99	9.34	57.3	550.5	784.1	41.3	274.9	**313.63**	**91.62**
6.00	7.00	6.50	1.00	4.50	18.85	8.85	61.73	3.14	23.6	23.6	1.0	84.75	217.80	16	1.0	50.3	150.86	7.0	9.8	58	8.85	2.43	1.19	66.2	540.8	909.4	53.0	421.7	**363.78**	**140.57**
7.00	9.00	8.00	2.00	6.50	18.85	8.85	75.00	6.29	9.8	9.8	1.0	81.43	299.23	58	1.0	364.6	515.43	9.0	27.9	0	10.70	16.53	17.56	83.9	1162.9	1977.6	76.6	891.3	**791.02**	**297.09**
9.00	10.00	9.50	1.00	7.50	20.70	10.70	89.20	3.14	27.9	27.9	1.0	148.43	447.67	0	1.0	0.0	515.43	10.0	27.9	0	10.70	16.53	17.56	94.6	1301.9	2265.0	88.4	1051.5	**905.98**	**350.50**
10.00	11.00	10.50	1.00	8.50	20.70	10.70	99.90	3.14	27.9	27.9	1.0	166.24	613.91	0	1.0	0.0	515.43	11.0	25.3	16	10.70	10.68	11.57	105.3	1044.6	2174.0	100.2	1229.5	**869.58**	**409.84**
11.00	12.50	11.75	1.50	10.00	20.70	10.70	113.28	4.71	25.3	25.3	1.0	252.43	866.33	16	1.0	75.4	590.86	12.5	25.3	16	10.80	10.68	11.57	121.3	1179.7	2636.9	117.9	1575.0	**1054.75**	**525.02**
12.50	15.50	14.00	3.00	13.00	20.80	10.80	137.50	9.43	25.3	25.3	1.0	612.82	1479.15	16	1.0	150.9	741.71	15.5	25.9	15	10.80	12.03	12.95	121.3	1307.3	3528.1	153.2	2374.1	**1411.25**	**791.36**
15.50	18.50	17.00	3.00	16.00	20.80	10.80	137.50	9.43	25.9	25.9	1.0	629.51	2108.66	15	1.0	141.4	883.14	18.5	25.9	15	10.85	12.03	12.95	121.3	1307.5	4299.3	188.6	3180.4	**1719.73**	**1060.13**
18.50	21.50	20.00	3.00	19.00	20.85	10.85	137.50	9.43	25.9	25.9	1.0	629.51	2738.18	15	1.0	141.4	1024.57	21.5	9.0	88	10.85	2.29	1.07	121.3	845.1	4607.8	223.9	3986.7	**1843.13**	**1328.89**
21.50	24.50	23.00	3.00	22.00	20.85	10.85	137.50	9.43	9.0	9.0	1.0	205.33	2943.51	88	1.0	829.7	1854.29	24.5	14.0	67	9.27	3.65	2.36	121.3	830.3	5628.1	259.3	5057.1	**2251.22**	**1685.69**
24.50	26.00	25.25	1.50	23.50	19.27	9.27	137.50	4.71	14.0	14.0	1.0	161.62	3105.13	67	1.0	315.9	2170.14	26.0	24.5	8	9.27	9.64	10.33	121.3	1013.0	6288.2	277.0	5552.2	**2515.29**	**1850.75**
26.00	27.50	26.75	1.50	25.00	19.27	9.27	137.50	4.71	24.5	24.5	1.0	295.41	3400.54	8	1.0	37.7	2207.86	27.5	13.8	38	9.27	3.59	2.31	121.3	619.3	6227.7	294.6	5903.0	**2491.06**	**1967.68**
27.50	29.00	28.25	1.50	26.50	19.27	9.27	137.50	4.71	13.8	13.8	1.0	159.22	3559.75	38	1.0	179.1	2387.00	29.0	13.8	38	10.40	3.59	2.31	121.3	620.3	6567.0	312.3	6259.1	**2626.82**	**2086.36**
29.00	30.00	29.50	1.00	27.50	20.40	10.40	137.50	3.14	13.8	13.8	1.0	106.14	3665.90	38	1.0	119.4	2506.43	30.0	13.8	39	10.40	3.59	2.31	121.3	627.4	6799.7	324.1	6496.4	**2719.88**	**2165.48**
30.00	30.50	30.25	0.50	28.00	20.40	10.40	137.50	1.57	13.8	13.8	1.0	53.07	3718.97	39	1.0	61.3	2567.71	30.5	13.4	39	10.40	3.47	2.19	121.3	615.5	6902.1	330.0	6616.7	**2760.86**	**2205.56**
30.50	32.00	31.25	1.50	29.50	20.40	10.40	137.50	4.71	13.4	13.4	1.0	154.43	3873.40	39	1.0	183.9	2751.57	32.0	13.4	40	10.45	3.47	2.19	121.3	622.6	7247.5	347.7	6972.6	**2899.02**	**2324.22**
32.00	32.50	32.25	0.50	30.00	20.45	10.45	137.50	1.57	13.4	13.4	1.0	51.48	3924.87	40	1.0	62.9	2814.43	32.5	13.4	40	10.45	3.47	2.19	121.3	622.6	7361.9	353.6	7092.9	**2944.75**	**2364.29**
32.50	33.50	33.00	1.00	31.00	20.45	10.45	137.50	3.14	13.4	13.4	1.0	102.95	4027.82	40	1.0	125.7	2940.14	33.5	16.7	39	10.45	4.78	3.58	121.3	745.7	7713.7	365.4	7333.3	**3085.47**	**2444.44**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
33.50	35.00	34.25	1.50	32.50	20.45	10.45	137.50	4.71	16.7	16.7	1.0	194.47	4222.30	39	1.0	183.9	3124.00	35.0	28.2	0	10.45	17.21	18.25	121.3	1714.8	9061.1	383.0	7729.3	**3624.44**	**2576.44**
35.00	36.50	35.75	1.50	34.00	20.45	10.45	137.50	4.71	28.2	28.2	1.0	347.57	4569.87	0	1.0	0.0	3124.00	36.5	28.7	0	8.93	18.33	19.40	121.3	1815.3	9509.1	400.7	8094.6	**3803.65**	**2698.19**
36.50	37.50	37.00	1.00	35.00	18.93	8.93	137.50	3.14	28.7	28.7	1.0	236.59	4806.46	0	1.0	0.0	3124.00	37.5	29.2	0	8.93	19.46	20.56	121.3	1926.6	9857.1	412.5	8343.0	**3942.82**	**2780.99**
37.50	40.00	38.75	2.50	37.50	18.93	8.93	137.50	7.86	29.2	29.2	1.0	603.79	5410.25	0	1.0	0.0	3124.00	40.0	12.3	38	8.93	3.15	1.88	121.3	575.1	9109.3	442.0	8976.2	**3643.74**	**2992.07**
BORE NO: P89, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	20.18	10.18	28.00	1.57	11.5	11.5	1.0	8.95	0	47	1.0	73.9	0	3.0	27.5	2	9.52	15.63	16.64	30.5	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	5.00	4.00	2.00	2.50	19.52	9.52	40.06	6.29	27.5	27.5	1.0	131.08	0	2	1.0	12.6	0	5.0	27.5	2	9.52	15.63	16.64	49.6	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.50	19.52	9.52	54.34	3.14	27.5	27.5	1.0	88.90	0	2	1.0	6.3	0	6.0	24.6	0	9.52	9.71	10.44	59.1	0	0.0	41.3	41.3	**0.00**	**13.75**
6.00	7.00	6.50	1.00	4.50	19.52	9.52	63.86	3.14	24.6	24.6	1.0	91.89	0	0	1.0	0.0	0	7.0	23.9	4	9.38	9.21	9.67	68.6	0	0.0	53.0	53.0	**0.00**	**17.68**
7.00	8.00	7.50	1.00	5.50	19.38	9.38	73.31	3.14	23.9	23.9	1.0	102.10	0	4	1.0	12.6	0	8.0	23.9	4	9.38	9.21	9.67	78.0	0	0.0	64.8	64.8	**0.00**	**21.61**
8.00	9.00	8.50	1.00	6.50	19.38	9.38	82.69	3.14	23.9	23.9	1.0	115.16	0	4	1.0	12.6	0	9.0	27.4	5	9.38	15.40	16.41	87.4	1153.4	1153.4	76.6	76.6	**461.38**	**25.54**
9.00	11.00	10.00	2.00	8.50	19.38	9.38	96.76	6.29	27.4	27.4	1.0	315.26	315.26	5	1.0	31.4	31.43	11.0	27.4	5	9.38	15.40	16.41	106.1	1380.5	1727.2	100.2	446.9	**690.88**	**148.96**
11.00	12.00	11.50	1.00	9.50	19.38	9.38	110.83	3.14	27.4	27.4	1.0	180.55	495.82	5	1.0	15.7	47.14	12.0	9.0	57	9.38	2.29	1.07	115.5	614.9	1157.8	112.0	654.9	**463.13**	**218.31**
12.00	14.50	13.25	2.50	12.00	19.38	9.38	127.25	7.86	9.0	9.0	1.0	158.35	654.17	57	1.0	447.9	495.00	14.5	9.0	57	9.31	2.29	1.07	139.0	657.0	1806.2	141.4	1290.6	**722.47**	**430.20**
14.50	16.00	15.25	1.50	13.50	19.31	9.31	127.25	4.71	9.0	9.0	1.0	95.01	749.18	57	1.0	268.7	763.71	16.0	28.2	0	9.31	17.21	18.25	139.0	1945.5	3458.4	159.1	1672.0	**1383.36**	**557.33**
16.00	17.50	16.75	1.50	15.00	19.31	9.31	127.25	4.71	28.2	28.2	1.0	321.65	1070.82	0	1.0	0.0	763.71	17.5	15.6	29	9.31	4.24	2.98	139.0	678.4	2512.9	176.8	2011.3	**1005.18**	**670.44**
17.50	19.00	18.25	1.50	16.50	19.31	9.31	127.25	4.71	15.6	15.6	1.0	167.49	1238.31	29	1.0	136.7	900.43	19.0	8.2	58	10.07	2.15	0.94	139.0	648.2	2786.9	194.5	2333.2	**1114.77**	**777.73**
19.00	20.50	19.75	1.50	18.00	20.07	10.07	127.25	4.71	8.2	8.2	1.0	86.44	1324.75	58	1.0	273.4	1173.86	20.5	8.2	59	10.34	2.15	0.94	139.0	655.4	3154.0	212.1	2710.8	**1261.59**	**903.58**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
20.50	23.50	22.00	3.00	21.00	20.34	10.34	127.25	9.43	8.2	8.2	1.0	172.88	1497.64	59	1.0	556.3	1730.14	23.5	9.5	59	10.34	2.38	1.14	139.0	681.7	3909.5	247.5	3475.3	**1563.80**	**1158.43**
23.50	25.00	24.25	1.50	22.50	20.34	10.34	127.25	4.71	9.5	9.5	1.0	100.38	1598.02	59	1.0	278.1	2008.29	25.0	28.1	0	9.65	16.98	18.02	139.0	1922.5	5528.8	265.2	3871.5	**2211.52**	**1290.50**
25.00	26.50	25.75	1.50	24.00	19.65	9.65	127.25	4.71	28.1	28.1	1.0	320.30	1918.32	0	1.0	0.0	2008.29	26.5	28.1	0	9.65	16.98	18.02	139.0	1922.5	5849.1	282.9	4209.5	**2339.64**	**1403.16**
26.50	27.50	27.00	1.00	25.00	19.65	9.65	127.25	3.14	28.1	28.1	1.0	213.53	2131.86	0	1.0	0.0	2008.29	27.5	28.1	0	9.65	16.98	18.02	139.0	1922.5	6062.6	294.6	4434.8	**2425.05**	**1478.26**
27.50	28.00	27.75	0.50	25.50	19.65	9.65	127.25	1.57	28.1	28.1	1.0	106.77	2238.62	0	1.0	0.0	2008.29	28.0	16.5	38	9.65	4.68	3.47	139.0	792.7	5039.6	300.5	4547.4	**2015.83**	**1515.81**
28.00	29.50	28.75	1.50	27.00	19.65	9.65	127.25	4.71	16.5	16.5	1.0	177.69	2416.31	38	1.0	179.1	2187.43	29.5	16.5	38	10.15	4.68	3.47	139.0	793.4	5397.1	318.2	4922.0	**2158.84**	**1640.65**
29.50	30.00	29.75	0.50	27.50	20.15	10.15	127.25	1.57	16.5	16.5	1.0	59.23	2475.54	38	1.0	59.7	2247.14	30.0	16.5	38	10.15	4.68	3.47	139.0	793.4	5516.0	324.1	5046.8	**2206.42**	**1682.26**
30.00	31.00	30.50	1.00	28.50	20.15	10.15	127.25	3.14	16.5	16.5	1.0	118.46	2594.00	38	1.0	119.4	2366.57	31.0	11.1	46	10.15	2.79	1.53	139.0	636.4	5597.0	335.9	5296.5	**2238.80**	**1765.49**
31.00	32.50	31.75	1.50	30.00	20.15	10.15	127.25	4.71	11.1	11.1	1.0	117.69	2711.69	46	1.0	216.9	2583.43	32.5	11.1	46	10.15	2.79	1.53	139.0	636.4	5931.5	353.6	5648.7	**2372.62**	**1882.90**
32.50	35.00	33.75	2.50	32.50	20.15	10.15	127.25	7.86	11.1	11.1	1.0	196.15	2907.84	46	1.0	361.4	2944.86	35.0	11.1	46	10.68	2.79	1.53	139.0	636.7	6489.4	383.0	6235.7	**2595.77**	**2078.58**
35.00	35.50	35.25	0.50	33.00	20.68	10.68	127.25	1.57	11.1	11.1	1.0	39.23	2947.07	46	1.0	72.3	3017.14	35.5	12.8	55	10.68	3.29	2.02	139.0	756.8	6721.0	388.9	6353.1	**2688.41**	**2117.71**
35.50	37.50	36.50	2.00	35.00	20.68	10.68	127.25	6.29	12.8	12.8	1.0	181.72	3128.79	55	1.0	345.7	3362.86	37.5	10.3	50	10.68	2.56	1.31	139.0	638.4	7130.0	412.5	6904.1	**2852.01**	**2301.38**
37.50	38.50	38.00	1.00	36.00	20.68	10.68	127.25	3.14	10.3	10.3	1.0	72.68	3201.46	50	1.0	157.1	3520.00	38.5	10.3	50	10.68	2.56	1.31	139.0	638.4	7359.8	424.3	7145.7	**2943.94**	**2381.92**
38.50	40.00	39.25	1.50	37.50	20.68	10.68	127.25	4.71	10.3	10.3	1.0	109.01	3310.48	50	1.0	235.7	3755.71	40.0	16.0	31	10.68	4.43	3.20	139.0	716.6	7782.8	442.0	7508.2	**3113.10**	**2502.72**
BORE NO: P90, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.89	9.89	27.20	1.57	8.2	8.2	1.0	6.16	0	58	1.0	91.1	0	3.0	23.4	11	9.89	8.85	9.12	29.7	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.50	19.89	9.89	34.62	3.14	23.4	23.4	1.0	47.08	0	11	1.0	34.6	0	4.0	29.2	0	9.60	19.46	20.56	39.6	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	5.00	4.50	1.00	2.50	19.60	9.60	44.36	3.14	29.2	29.2	1.0	77.92	0	0	1.0	0.0	0	5.0	29.2	0	9.60	19.46	20.56	49.2	829.1	829.1	29.5	29.5	**331.64**	**9.82**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
5.00	6.00	5.50	1.00	3.50	19.60	9.60	53.96	3.14	29.2	29.2	1.0	94.78	94.78	0	1.0	0.0	0.00	6.0	27.3	0	9.60	15.18	16.18	58.8	761.8	856.6	41.3	136.0	**342.64**	**45.34**
6.00	7.00	6.50	1.00	4.50	19.60	9.60	63.56	3.14	27.3	27.3	1.0	103.10	197.88	0	1.0	0.0	0.00	7.0	26.0	7	9.40	12.25	13.18	68.4	756.3	954.1	53.0	250.9	**381.66**	**83.64**
7.00	8.00	7.50	1.00	5.50	19.40	9.40	73.06	3.14	26.0	26.0	1.0	111.99	309.88	7	1.0	22.0	22.00	8.0	9.5	44	9.40	2.38	1.14	77.8	460.8	792.7	64.8	396.7	**317.06**	**132.23**
8.00	9.00	8.50	1.00	6.50	19.40	9.40	82.46	3.14	9.5	9.5	1.0	43.37	353.24	44	1.0	138.3	160.29	9.0	9.5	44	9.40	2.38	1.14	87.2	478.4	991.9	76.6	590.1	**396.75**	**196.71**
9.00	10.00	9.50	1.00	7.50	19.40	9.40	91.86	3.14	9.5	9.5	1.0	48.31	401.56	44	1.0	138.3	298.57	10.0	9.5	44	10.09	2.38	1.14	96.6	496.2	1196.4	88.4	788.5	**478.55**	**262.84**
10.00	11.00	10.50	1.00	8.50	20.09	10.09	101.61	3.14	9.5	9.5	1.0	53.44	454.99	44	1.0	138.3	436.86	11.0	10.5	42	10.09	2.62	1.36	106.7	521.7	1413.5	100.2	992.0	**565.42**	**330.68**
11.00	12.00	11.50	1.00	9.50	20.09	10.09	111.70	3.14	10.5	10.5	1.0	65.06	520.06	42	1.0	132.0	568.86	12.0	11.0	63	10.30	2.76	1.51	116.7	705.1	1794.0	112.0	1200.9	**717.61**	**400.29**
12.00	14.50	13.25	2.50	12.00	20.30	10.30	129.62	7.86	11.0	11.0	1.0	197.96	718.01	63	1.0	495.0	1063.86	14.5	8.1	63	10.30	2.13	0.93	142.5	687.5	2469.4	141.4	1923.3	**987.75**	**641.10**
14.50	16.00	15.25	1.50	13.50	20.30	10.30	129.62	4.71	8.1	8.1	1.0	86.96	804.98	63	1.0	297.0	1360.86	16.0	27.3	0	9.39	15.18	16.18	142.5	1759.1	3924.9	159.1	2324.9	**1569.98**	**774.98**
16.00	17.50	16.75	1.50	15.00	19.39	9.39	129.62	4.71	27.3	27.3	1.0	315.38	1120.36	0	1.0	0.0	1360.86	17.5	12.4	54	9.39	3.17	1.91	142.5	744.3	3225.5	176.8	2658.0	**1290.22**	**886.00**
17.50	19.00	18.25	1.50	16.50	19.39	9.39	129.62	4.71	12.4	12.4	1.0	134.35	1254.71	54	1.0	254.6	1615.43	19.0	11.0	42	10.27	2.76	1.51	142.5	612.5	3482.7	194.5	3064.6	**1393.06**	**1021.53**
19.00	20.50	19.75	1.50	18.00	20.27	10.27	129.62	4.71	11.0	11.0	1.0	118.77	1373.48	42	1.0	198.0	1813.43	20.5	11.0	42	10.27	2.76	1.51	142.5	612.5	3799.4	212.1	3399.1	**1519.77**	**1133.02**
20.50	22.00	21.25	1.50	19.50	20.27	10.27	129.62	4.71	11.0	11.0	1.0	118.77	1492.26	42	1.0	198.0	2011.43	22.0	9.2	55	10.36	2.33	1.10	142.5	653.8	4157.5	229.8	3733.5	**1662.99**	**1244.50**
22.00	23.50	22.75	1.50	21.00	20.36	10.36	129.62	4.71	9.2	9.2	1.0	98.97	1591.22	55	1.0	259.3	2270.71	23.5	13.0	50	10.36	3.35	2.08	142.5	737.1	4599.0	247.5	4109.4	**1839.61**	**1369.81**
23.50	25.00	24.25	1.50	22.50	20.36	10.36	129.62	4.71	13.0	13.0	1.0	141.07	1732.29	50	1.0	235.7	2506.43	25.0	29.3	0	9.12	19.68	20.79	142.5	2278.1	6516.9	265.2	4503.9	**2606.74**	**1501.30**
25.00	26.50	25.75	1.50	24.00	19.12	9.12	129.62	4.71	29.3	29.3	1.0	342.90	2075.19	0	1.0	0.0	2506.43	26.5	29.3	0	9.12	19.68	20.79	142.5	2278.1	6859.8	282.9	4864.5	**2743.90**	**1621.49**
26.50	27.50	27.00	1.00	25.00	19.12	9.12	129.62	3.14	29.3	29.3	1.0	228.60	2303.79	0	1.0	0.0	2506.43	27.5	26.3	0	9.12	12.93	13.88	142.5	1497.0	6307.2	294.6	5104.9	**2522.90**	**1701.62**
27.50	28.00	27.75	0.50	25.50	19.12	9.12	129.62	1.57	26.3	26.3	1.0	100.67	2404.46	0	1.0	0.0	2506.43	28.0	23.0	0	9.12	8.56	8.68	142.5	989.5	5900.3	300.5	5211.4	**2360.14**	**1737.14**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
28.00	29.50	28.75	1.50	27.00	19.12	9.12	129.62	4.71	23.0	23.0	1.0	259.37	2663.83	0	1.0	0.0	2506.43	29.5	9.0	48	9.31	2.29	1.07	142.5	599.7	5770.0	318.2	5488.5	**2307.99**	**1829.49**
29.50	30.00	29.75	0.50	27.50	19.31	9.31	129.62	1.57	9.0	9.0	1.0	32.26	2696.09	48	1.0	75.4	2581.86	30.0	9.0	48	10.48	2.29	1.07	142.5	600.2	5878.1	324.1	5602.1	**2351.26**	**1867.35**
30.00	31.00	30.50	1.00	28.50	20.48	10.48	129.62	3.14	9.0	9.0	1.0	64.52	2760.61	48	1.0	150.9	2732.71	31.0	8.3	48	10.48	2.16	0.96	142.5	585.6	6079.0	335.9	5829.2	**2431.59**	**1943.07**
31.00	32.50	31.75	1.50	30.00	20.48	10.48	129.62	4.71	8.3	8.3	1.0	89.14	2849.75	48	1.0	226.3	2959.00	32.5	12.1	40	10.48	3.09	1.82	142.5	636.0	6444.7	353.6	6162.3	**2577.89**	**2054.11**
32.50	35.00	33.75	2.50	32.50	20.48	10.48	129.62	7.86	12.1	12.1	1.0	218.33	3068.08	40	1.0	314.3	3273.29	35.0	12.1	40	10.48	3.09	1.82	142.5	636.0	6977.3	383.0	6724.4	**2790.94**	**2241.47**
35.00	35.50	35.25	0.50	33.00	20.48	10.48	129.62	1.57	12.1	12.1	1.0	43.67	3111.74	40	1.0	62.9	3336.14	35.5	12.1	40	10.48	3.09	1.82	142.5	636.0	7083.9	388.9	6836.8	**2833.55**	**2278.94**
35.50	37.50	36.50	2.00	35.00	20.48	10.48	129.62	6.29	12.1	12.1	1.0	174.66	3286.41	40	1.0	251.4	3587.57	37.5	29.1	5	10.32	19.23	20.33	142.5	2271.0	9145.0	412.5	7286.5	**3657.99**	**2428.83**
37.50	38.50	38.00	1.00	36.00	20.32	10.32	129.62	3.14	29.1	29.1	1.0	226.73	3513.14	5	1.0	15.7	3603.29	38.5	29.0	5	10.32	19.01	20.10	142.5	2244.9	9361.3	424.3	7540.7	**3744.51**	**2513.57**
38.50	40.00	39.25	1.50	37.50	20.32	10.32	129.62	4.71	29.0	29.0	1.0	338.71	3851.85	5	1.0	23.6	3626.86	40.0	17.1	89	10.32	4.97	3.80	142.5	1201.5	8680.3	442.0	7920.7	**3472.10**	**2640.22**
BORE NO: P91, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.48	9.48	26.07	1.57	26.6	26.6	1.0	20.51	0	3	1.0	4.7	0	3.0	26.6	3	9.68	13.60	14.57	28.4	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	5.00	4.00	2.00	2.50	19.68	9.68	38.12	6.29	26.6	26.6	1.0	119.99	0	3	1.0	18.9	0	5.0	26.6	3	9.68	13.60	14.57	47.8	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.50	19.68	9.68	52.64	3.14	26.6	26.6	1.0	82.85	0	3	1.0	9.4	0	6.0	14.6	23	9.68	3.82	2.54	57.5	0	0.0	41.3	41.3	**0.00**	**13.75**
6.00	7.00	6.50	1.00	4.50	19.68	9.68	62.32	3.14	14.6	14.6	1.0	51.02	0	23	1.0	72.3	0	7.0	12.4	48	9.68	3.17	1.91	67.2	514.2	514.2	53.0	53.0	**205.68**	**17.68**
7.00	8.00	7.50	1.00	5.50	19.68	9.68	72.00	3.14	12.4	12.4	1.0	49.75	49.75	48	1.0	150.9	150.86	8.0	11.5	44	10.60	2.91	1.65	76.8	493.8	694.4	64.8	265.4	**277.75**	**88.48**
8.00	9.00	8.50	1.00	6.50	20.60	10.60	82.14	3.14	11.5	11.5	1.0	52.52	102.27	44	1.0	138.3	289.14	9.0	11.5	44	10.60	2.91	1.65	87.4	518.0	909.4	76.6	468.0	**363.77**	**156.01**
9.00	11.00	10.00	2.00	8.50	20.60	10.60	98.04	6.29	11.5	11.5	1.0	125.38	227.65	44	1.0	276.6	565.71	11.0	11.5	44	10.60	2.91	1.65	108.6	566.5	1359.9	100.2	893.5	**543.94**	**297.85**
11.00	12.00	11.50	1.00	9.50	20.60	10.60	113.94	3.14	11.5	11.5	1.0	72.86	300.51	44	1.0	138.3	704.00	12.0	10.0	53	11.00	2.47	1.22	119.2	611.5	1616.0	112.0	1116.5	**646.39**	**372.16**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
12.00	14.50	13.25	2.50	12.00	21.00	11.00	132.99	7.86	10.0	10.0	1.0	184.25	484.76	53	1.0	416.4	1120.43	14.5	10.5	57	10.80	2.62	1.36	146.7	710.6	2315.8	141.4	1746.6	**926.31**	**582.20**
14.50	17.50	16.00	3.00	15.00	20.80	10.80	132.99	9.43	10.5	10.5	1.0	232.40	717.15	57	1.0	537.4	1657.86	17.5	9.5	55	11.90	2.38	1.14	146.7	668.7	3043.7	176.8	2551.8	**1217.47**	**850.60**
17.50	20.50	19.00	3.00	18.00	21.90	11.90	132.99	9.43	9.5	9.5	1.0	209.83	926.99	55	1.0	518.6	2176.43	20.5	9.5	55	9.79	2.38	1.14	146.7	667.7	3771.1	212.1	3315.6	**1508.46**	**1105.19**
20.50	23.50	22.00	3.00	21.00	19.79	9.79	132.99	9.43	9.5	9.5	1.0	209.83	1136.82	55	1.0	518.6	2695.00	23.5	23.0	16	9.79	8.56	8.68	146.7	1133.5	4965.3	247.5	4079.3	**1986.12**	**1359.77**
23.50	26.50	25.00	3.00	24.00	19.79	9.79	132.99	9.43	23.0	23.0	1.0	532.25	1669.07	16	1.0	150.9	2845.86	26.5	17.6	16	10.20	5.22	4.07	146.7	731.2	5246.1	282.9	4797.8	**2098.46**	**1599.26**
26.50	27.50	27.00	1.00	25.00	20.20	10.20	132.99	3.14	17.6	17.6	1.0	132.59	1801.66	16	1.0	50.3	2896.14	27.5	17.6	36	10.20	5.22	4.07	146.7	872.7	5570.4	294.6	4992.4	**2228.18**	**1664.15**
27.50	28.00	27.75	0.50	25.50	20.20	10.20	132.99	1.57	17.6	17.6	1.0	66.29	1867.95	36	1.0	56.6	2952.71	28.0	8.5	61	10.20	2.20	0.99	146.7	689.0	5509.6	300.5	5121.2	**2203.85**	**1707.07**
28.00	29.50	28.75	1.50	27.00	20.20	10.20	132.99	4.71	8.5	8.5	1.0	93.70	1961.65	61	1.0	287.6	3240.29	29.5	18.0	35	10.20	5.42	4.29	146.7	889.1	6091.1	318.2	5520.1	**2436.43**	**1840.05**
29.50	30.00	29.75	0.50	27.50	20.20	10.20	132.99	1.57	18.0	18.0	1.0	67.90	2029.55	35	1.0	55.0	3295.29	30.0	18.0	35	10.20	5.42	4.29	146.7	889.1	6214.0	324.1	5648.9	**2485.59**	**1882.98**
30.00	31.00	30.50	1.00	28.50	20.20	10.20	132.99	3.14	18.0	18.0	1.0	135.81	2165.36	35	1.0	110.0	3405.29	31.0	18.5	46	10.20	5.64	4.57	146.7	994.1	6564.7	335.9	5906.5	**2625.89**	**1968.85**
31.00	32.50	31.75	1.50	30.00	20.20	10.20	132.99	4.71	18.5	18.5	1.0	209.78	2375.13	46	1.0	216.9	3622.14	32.5	10.2	58	10.20	2.53	1.28	146.7	706.8	6704.1	353.6	6350.8	**2681.64**	**2116.95**
32.50	35.00	33.75	2.50	32.50	20.20	10.20	132.99	7.86	10.2	10.2	1.0	188.01	2563.14	58	1.0	455.7	4077.86	35.0	10.2	58	10.20	2.53	1.28	146.7	706.8	7347.8	383.0	7024.0	**2939.13**	**2341.35**
35.00	35.50	35.25	0.50	33.00	20.20	10.20	132.99	1.57	10.2	10.2	1.0	37.60	2600.75	58	1.0	91.1	4169.00	35.5	10.2	58	10.20	2.53	1.28	146.7	706.8	7476.6	388.9	7158.7	**2990.63**	**2386.22**
35.50	37.50	36.50	2.00	35.00	20.20	10.20	132.99	6.29	10.2	10.2	1.0	150.41	2751.16	58	1.0	364.6	4533.57	37.5	17.0	60	8.78	4.92	3.75	146.7	1004.9	8289.6	412.5	7697.2	**3315.86**	**2565.74**
37.50	38.50	38.00	1.00	36.00	18.78	8.78	132.99	3.14	17.0	17.0	1.0	127.79	2878.94	60	1.0	188.6	4722.14	38.5	17.0	50	8.83	4.92	3.75	146.7	934.3	8535.4	424.3	8025.4	**3414.15**	**2675.12**
38.50	40.00	39.25	1.50	37.50	18.83	8.83	132.99	4.71	17.0	17.0	1.0	191.68	3070.62	50	1.0	235.7	4957.86	40.0	17.0	50	8.83	4.92	3.75	146.7	934.3	8962.8	442.0	8470.4	**3585.10**	**2823.48**
BORE NO: P92, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.60	9.60	26.40	1.57	12.4	12.4	1.0	9.12	0	23	1.0	36.1	0	3.0	23.3	0	9.60	8.78	9.01	28.8	0	0.0	5.9	5.9	**0.00**	**1.96**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
3.00	4.00	3.50	1.00	1.50	19.60	9.60	33.60	3.14	23.3	23.3	1.0	45.48	0	0	1.0	0.0	0	4.0	26.5	9	9.60	13.38	14.34	38.4	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	5.00	4.50	1.00	2.50	19.60	9.60	43.20	3.14	26.5	26.5	1.0	67.69	0	9	1.0	28.3	0	5.0	26.5	9	9.60	13.38	14.34	48.0	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.50	19.60	9.60	52.80	3.14	26.5	26.5	1.0	82.74	0	9	1.0	28.3	0	6.0	25.5	13	9.60	11.13	12.03	57.6	0	0.0	41.3	41.3	**0.00**	**13.75**
6.00	7.00	6.50	1.00	4.50	19.60	9.60	62.40	3.14	25.5	25.5	1.0	93.54	0	13	1.0	40.9	0	7.0	25.5	13	9.57	11.13	12.03	67.2	724.6	724.6	53.0	53.0	**289.85**	**17.68**
7.00	8.00	7.50	1.00	5.50	19.57	9.57	71.99	3.14	25.5	25.5	1.0	107.91	107.91	13	1.0	40.9	40.86	8.0	25.5	13	9.57	11.13	12.03	76.8	808.3	957.0	64.8	213.6	**382.82**	**71.20**
8.00	9.00	8.50	1.00	6.50	19.57	9.57	81.56	3.14	25.5	25.5	1.0	122.26	230.17	13	1.0	40.9	81.71	9.0	12.2	42	10.70	3.12	1.85	86.3	516.2	828.1	76.6	388.5	**331.23**	**129.50**
9.00	11.00	10.00	2.00	8.50	20.70	10.70	97.04	6.29	12.2	12.2	1.0	131.88	362.05	42	1.0	264.0	345.71	11.0	12.2	42	10.70	3.12	1.85	107.7	568.6	1276.3	100.2	807.9	**510.54**	**269.31**
11.00	12.00	11.50	1.00	9.50	20.70	10.70	113.09	3.14	12.2	12.2	1.0	76.85	438.89	42	1.0	132.0	477.71	12.0	11.5	50	10.40	2.91	1.65	118.4	631.2	1547.8	112.0	1028.6	**619.12**	**342.86**
12.00	14.50	13.25	2.50	12.00	20.40	10.40	131.44	7.86	11.5	11.5	1.0	210.11	649.01	50	1.0	392.9	870.57	14.5	9.5	53	10.55	2.38	1.14	144.4	649.6	2169.2	141.4	1661.0	**867.68**	**553.67**
14.50	17.50	16.00	3.00	15.00	20.55	10.55	131.44	9.43	9.5	9.5	1.0	207.39	856.39	53	1.0	499.7	1370.29	17.5	10.2	50	10.55	2.53	1.28	144.4	645.9	2872.5	176.8	2403.5	**1149.01**	**801.15**
17.50	19.00	18.25	1.50	16.50	20.55	10.55	131.44	4.71	10.2	10.2	1.0	111.49	967.88	50	1.0	235.7	1606.00	19.0	11.0	55	10.30	2.76	1.51	144.4	708.7	3282.6	194.5	2768.3	**1313.04**	**922.78**
19.00	20.50	19.75	1.50	18.00	20.30	10.30	131.44	4.71	11.0	11.0	1.0	120.45	1088.33	55	1.0	259.3	1865.29	20.5	11.5	59	10.10	2.91	1.65	144.4	754.1	3707.7	212.1	3165.8	**1483.10**	**1055.25**
20.50	23.50	22.00	3.00	21.00	20.10	10.10	131.44	9.43	11.5	11.5	1.0	252.14	1340.47	59	1.0	556.3	2421.57	23.5	10.3	53	10.42	2.56	1.31	144.4	670.5	4432.5	247.5	4009.5	**1773.00**	**1336.51**
23.50	26.50	25.00	3.00	24.00	20.42	10.42	131.44	9.43	10.3	10.3	1.0	225.22	1565.68	53	1.0	499.7	2921.29	26.5	10.3	53	10.42	2.56	1.31	144.4	670.5	5157.4	282.9	4769.8	**2062.97**	**1589.94**
26.50	27.50	27.00	1.00	25.00	20.42	10.42	131.44	3.14	10.3	10.3	1.0	75.07	1640.76	53	1.0	166.6	3087.86	27.5	10.3	53	10.42	2.56	1.31	144.4	670.5	5399.1	294.6	5023.3	**2159.63**	**1674.42**
27.50	29.50	28.50	2.00	27.00	20.42	10.42	131.44	6.29	10.3	10.3	1.0	150.14	1790.90	53	1.0	333.1	3421.00	29.5	10.5	53	8.69	2.62	1.36	144.4	676.4	5888.3	318.2	5530.1	**2355.34**	**1843.37**
29.50	30.00	29.75	0.50	27.50	18.69	8.69	131.44	1.57	10.5	10.5	1.0	38.28	1829.18	53	1.0	83.3	3504.29	30.0	10.0	50	10.52	2.47	1.22	144.4	638.9	5972.4	324.1	5657.6	**2388.96**	**1885.86**
30.00	32.50	31.25	2.50	30.00	20.52	10.52	131.44	7.86	10.0	10.0	1.0	182.10	2011.28	50	1.0	392.9	3897.14	32.5	10.8	45	10.52	2.71	1.45	144.4	631.2	6539.6	353.6	6262.0	**2615.86**	**2087.33**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
32.50	35.00	33.75	2.50	32.50	20.52	10.52	131.44	7.86	10.8	10.8	1.0	197.01	2208.29	45	1.0	353.6	4250.71	35.0	10.8	45	10.52	2.71	1.45	144.4	631.2	7090.2	383.0	6842.0	**2836.09**	**2280.68**
35.00	35.50	35.25	0.50	33.00	20.52	10.52	131.44	1.57	10.8	10.8	1.0	39.40	2247.69	45	1.0	70.7	4321.43	35.5	10.1	65	10.52	2.50	1.25	144.4	748.5	7317.6	388.9	6958.0	**2927.03**	**2319.35**
35.50	37.50	36.50	2.00	35.00	20.52	10.52	131.44	6.29	10.1	10.1	1.0	147.17	2394.86	65	1.0	408.6	4730.00	37.5	10.1	65	9.61	2.50	1.25	144.4	748.0	7872.9	412.5	7537.4	**3149.15**	**2512.45**
37.50	38.50	38.00	1.00	36.00	19.61	9.61	131.44	3.14	10.1	10.1	1.0	73.58	2468.44	65	1.0	204.3	4934.29	38.5	10.1	65	8.74	2.50	1.25	144.4	747.6	8150.3	424.3	7827.0	**3260.12**	**2609.00**
38.50	40.00	39.25	1.50	37.50	18.74	8.74	131.44	4.71	10.1	10.1	1.0	110.38	2578.82	65	1.0	306.4	5240.71	40.0	26.3	0	8.74	12.93	13.88	144.4	1514.8	9334.3	442.0	8261.5	**3733.72**	**2753.83**
BORE NO: P93, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.36	9.36	25.74	1.57	23.4	23.4	1.0	17.50	0	0	1.0	0.0	0	3.0	23.7	0	9.36	9.06	9.45	28.1	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.50	19.36	9.36	32.76	3.14	23.7	23.7	1.0	45.20	0	0	1.0	0.0	0	4.0	25.8	6	9.69	11.80	12.72	37.4	438.0	438.0	17.7	17.7	**175.21**	**5.89**
4.00	5.00	4.50	1.00	2.50	19.69	9.69	42.29	3.14	25.8	25.8	1.0	64.24	64.24	6	1.0	18.9	18.86	5.0	25.8	6	9.69	11.80	12.72	47.1	527.9	611.0	29.5	112.6	**244.39**	**37.52**
5.00	6.00	5.50	1.00	3.50	19.69	9.69	51.98	3.14	25.8	25.8	1.0	78.97	143.21	6	1.0	18.9	37.71	6.0	25.8	6	9.69	11.80	12.72	56.8	617.7	798.7	41.3	222.2	**319.46**	**74.06**
6.00	8.00	7.00	2.00	5.50	19.69	9.69	66.51	6.29	25.8	25.8	1.0	202.10	345.31	6	1.0	37.7	75.43	8.0	26.7	0	10.43	13.83	14.80	76.2	888.5	1309.3	64.8	485.6	**523.71**	**161.85**
8.00	9.00	8.50	1.00	6.50	20.43	10.43	81.42	3.14	26.7	26.7	1.0	128.69	474.00	0	1.0	0.0	75.43	9.0	26.5	7	10.43	13.38	14.34	86.6	1018.8	1568.3	76.6	626.0	**627.30**	**208.68**
9.00	11.00	10.00	2.00	8.50	20.43	10.43	97.06	6.29	26.5	26.5	1.0	304.18	778.18	7	1.0	44.0	119.43	11.0	23.0	10	10.43	8.56	8.68	107.5	829.2	1726.9	100.2	997.8	**690.74**	**332.60**
11.00	12.00	11.50	1.00	9.50	20.43	10.43	112.71	3.14	23.0	23.0	1.0	150.36	928.54	10	1.0	31.4	150.86	12.0	9.5	52	10.08	2.38	1.14	117.9	592.8	1672.1	112.0	1191.4	**668.86**	**397.12**
12.00	14.50	13.25	2.50	12.00	20.08	10.08	130.52	7.86	9.5	9.5	1.0	171.61	1100.15	52	1.0	408.6	559.43	14.5	11.5	56	10.17	2.91	1.65	143.1	729.9	2389.5	141.4	1801.0	**955.81**	**600.34**
14.50	17.50	16.00	3.00	15.00	20.17	10.17	130.52	9.43	11.5	11.5	1.0	250.37	1350.52	56	1.0	528.0	1087.43	17.5	11.5	56	10.17	2.91	1.65	143.1	729.9	3167.9	176.8	2614.7	**1267.15**	**871.58**
17.50	19.00	18.25	1.50	16.50	20.17	10.17	130.52	4.71	11.5	11.5	1.0	125.19	1475.71	56	1.0	264.0	1351.43	19.0	8.7	55	8.61	2.24	1.02	143.1	643.8	3471.0	194.5	3021.6	**1388.38**	**1007.20**
19.00	20.50	19.75	1.50	18.00	18.61	8.61	130.52	4.71	8.7	8.7	1.0	94.16	1569.86	55	1.0	259.3	1610.71	20.5	8.7	55	9.70	2.24	1.02	143.1	644.3	3824.8	212.1	3392.7	**1529.93**	**1130.91**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
20.50	23.50	22.00	3.00	21.00	19.70	9.70	130.52	9.43	8.7	8.7	1.0	188.31	1758.17	55	1.0	518.6	2129.29	23.5	8.5	57	9.70	2.20	0.99	143.1	654.2	4541.7	247.5	4135.0	**1816.68**	**1378.32**
23.50	25.00	24.25	1.50	22.50	19.70	9.70	130.52	4.71	8.5	8.5	1.0	91.96	1850.13	57	1.0	268.7	2398.00	25.0	28.8	0	10.84	18.56	19.64	143.1	2170.4	6418.5	265.2	4513.3	**2567.42**	**1504.44**
25.00	26.50	25.75	1.50	24.00	20.84	10.84	130.52	4.71	28.8	28.8	1.0	338.27	2188.40	0	1.0	0.0	2398.00	26.5	28.0	0	10.84	16.76	17.79	143.1	1960.0	6546.4	282.9	4869.3	**2618.55**	**1623.09**
26.50	27.50	27.00	1.00	25.00	20.84	10.84	130.52	3.14	28.0	28.0	1.0	218.11	2406.51	0	1.0	0.0	2398.00	27.5	30.4	0	10.84	23.27	24.45	143.1	2721.4	7525.9	294.6	5099.2	**3010.35**	**1699.72**
27.50	28.00	27.75	0.50	25.50	20.84	10.84	130.52	1.57	30.4	30.4	1.0	122.74	2529.25	0	1.0	0.0	2398.00	28.0	29.8	0	10.84	20.81	21.94	143.1	2433.4	7360.7	300.5	5227.8	**2944.28**	**1742.60**
28.00	29.50	28.75	1.50	27.00	20.84	10.84	130.52	4.71	29.8	29.8	1.0	352.39	2881.64	0	1.0	0.0	2398.00	29.5	11.5	50	8.61	2.91	1.65	143.1	686.5	5966.1	318.2	5597.9	**2386.46**	**1865.95**
29.50	30.00	29.75	0.50	27.50	18.61	8.61	130.52	1.57	11.5	11.5	1.0	41.73	2923.37	50	1.0	78.6	2476.57	30.0	11.5	50	8.61	2.91	1.65	143.1	686.5	6086.4	324.1	5724.0	**2434.58**	**1908.02**
30.00	31.00	30.50	1.00	28.50	18.61	8.61	130.52	3.14	11.5	11.5	1.0	83.46	3006.83	50	1.0	157.1	2633.71	31.0	11.5	50	8.56	2.91	1.65	143.1	686.5	6327.0	335.9	5976.4	**2530.80**	**1992.15**
31.00	32.50	31.75	1.50	30.00	18.56	8.56	130.52	4.71	11.5	11.5	1.0	125.19	3132.01	50	1.0	235.7	2869.43	32.5	11.5	50	8.83	2.91	1.65	143.1	686.6	6688.1	353.6	6355.0	**2675.23**	**2118.34**
32.50	34.00	33.25	1.50	31.50	18.83	8.83	130.52	4.71	11.5	11.5	1.0	125.19	3257.20	50	1.0	235.7	3105.14	34.0	12.3	56	8.63	3.15	1.88	143.1	756.1	7118.4	371.3	6733.6	**2847.37**	**2244.53**
34.00	35.00	34.50	1.00	32.50	18.63	8.63	130.52	3.14	12.3	12.3	1.0	89.44	3346.64	56	1.0	176.0	3281.14	35.0	12.3	56	8.63	3.15	1.88	143.1	756.1	7383.9	383.0	7010.8	**2953.55**	**2336.94**
35.00	35.50	35.25	0.50	33.00	18.63	8.63	130.52	1.57	12.3	12.3	1.0	44.72	3391.36	56	1.0	88.0	3369.14	35.5	12.3	56	8.93	3.15	1.88	143.1	756.3	7516.8	388.9	7149.4	**3006.73**	**2383.14**
35.50	37.00	36.25	1.50	34.50	18.93	8.93	130.52	4.71	12.3	12.3	1.0	134.16	3525.52	56	1.0	264.0	3633.14	37.0	12.3	56	8.84	3.15	1.88	143.1	756.2	7914.9	406.6	7565.3	**3165.96**	**2521.76**
37.00	37.50	37.25	0.50	35.00	18.84	8.84	130.52	1.57	12.3	12.3	1.0	44.72	3570.24	56	1.0	88.0	3721.14	37.5	12.3	63	8.84	3.15	1.88	143.1	805.7	8097.1	412.5	7703.9	**3238.85**	**2567.96**
37.50	38.50	38.00	1.00	36.00	18.84	8.84	130.52	3.14	12.3	12.3	1.0	89.44	3659.68	63	1.0	198.0	3919.14	38.5	12.3	63	8.93	3.15	1.88	143.1	805.8	8384.6	424.3	8003.1	**3353.85**	**2667.70**
38.50	40.00	39.25	1.50	37.50	18.93	8.93	130.52	4.71	12.3	12.3	1.0	134.16	3793.84	63	1.0	297.0	4216.14	40.0	12.3	63	8.93	3.15	1.88	143.1	805.8	8815.8	442.0	8451.9	**3526.32**	**2817.31**
BORE NO: P94, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	20.40	10.40	28.60	1.57	11.2	11.2	1.0	8.90	0	14	1.0	22.0	0	3.0	25.0	13	10.40	10.00	10.88	31.2	0	0.0	5.9	5.9	**0.00**	**1.96**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
3.00	4.00	3.50	1.00	1.50	20.40	10.40	36.40	3.14	25.0	25.0	1.0	53.35	0	13	1.0	40.9	0	4.0	25.0	13	10.40	10.00	10.88	41.6	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	5.00	4.50	1.00	2.50	20.40	10.40	46.80	3.14	25.0	25.0	1.0	68.59	0	13	1.0	40.9	0	5.0	25.0	13	9.52	10.00	10.88	52.0	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.50	19.52	9.52	56.76	3.14	25.0	25.0	1.0	83.18	0	13	1.0	40.9	0	6.0	23.5	17	9.52	8.92	9.23	61.5	585.9	585.9	41.3	41.3	**234.37**	**13.75**
6.00	7.00	6.50	1.00	4.50	19.52	9.52	66.28	3.14	23.5	23.5	1.0	90.58	90.58	17	1.0	53.4	53.43	7.0	23.5	17	10.30	8.92	9.23	71.0	655.5	799.5	53.0	197.0	**319.79**	**65.68**
7.00	9.00	8.00	2.00	6.50	20.30	10.30	81.34	6.29	23.5	23.5	1.0	222.31	312.89	17	1.0	106.9	160.29	9.0	23.5	17	10.30	8.92	9.23	91.6	799.8	1273.0	76.6	549.8	**509.20**	**183.26**
9.00	10.00	9.50	1.00	7.50	20.30	10.30	96.79	3.14	23.5	23.5	1.0	132.27	445.15	17	1.0	53.4	213.71	10.0	12.0	54	10.30	3.06	1.79	101.9	634.0	1292.9	88.4	747.3	**517.16**	**249.09**
10.00	11.00	10.50	1.00	8.50	20.30	10.30	107.09	3.14	12.0	12.0	1.0	71.54	516.69	54	1.0	169.7	383.43	11.0	11.5	56	10.30	2.91	1.65	112.2	659.4	1559.5	100.2	1000.3	**623.81**	**333.43**
11.00	12.50	11.75	1.50	10.00	20.30	10.30	119.97	4.71	11.5	11.5	1.0	115.06	631.76	56	1.0	264.0	647.43	12.5	11.5	56	9.90	2.91	1.65	127.7	694.5	1973.7	117.9	1397.0	**789.46**	**465.68**
12.50	14.00	13.25	1.50	11.50	19.90	9.90	135.12	4.71	11.5	11.5	1.0	129.59	761.35	56	1.0	264.0	911.43	14.0	11.2	47	9.90	2.82	1.56	142.5	654.6	2327.4	135.5	1808.3	**930.94**	**602.77**
14.00	15.50	14.75	1.50	13.00	19.90	9.90	149.97	4.71	11.2	11.2	1.0	139.99	901.34	47	1.0	221.6	1133.00	15.5	11.2	47	10.70	2.82	1.56	142.5	655.1	2689.4	153.2	2187.5	**1075.76**	**729.18**
15.50	18.50	17.00	3.00	16.00	20.70	10.70	149.97	9.43	11.2	11.2	1.0	279.97	1181.31	47	1.0	443.1	1576.14	18.5	13.0	45	10.70	3.35	2.08	142.5	702.1	3459.6	188.6	2946.0	**1383.83**	**982.01**
18.50	20.00	19.25	1.50	17.50	20.70	10.70	149.97	4.71	13.0	13.0	1.0	163.22	1344.52	45	1.0	212.1	1788.29	20.0	24.0	16	11.59	9.28	9.78	142.5	1197.0	4329.8	206.3	3339.1	**1731.93**	**1113.02**
20.00	21.50	20.75	1.50	19.00	21.59	11.59	149.97	4.71	24.0	24.0	1.0	314.77	1659.29	16	1.0	75.4	1863.71	21.5	11.5	49	9.80	2.91	1.65	142.5	678.9	4201.9	223.9	3746.9	**1680.75**	**1248.98**
21.50	24.50	23.00	3.00	22.00	19.80	9.80	149.97	9.43	11.5	11.5	1.0	287.67	1946.96	49	1.0	462.0	2325.71	24.5	13.5	51	10.59	3.50	2.22	142.5	761.9	5034.5	259.3	4532.0	**2013.82**	**1510.65**
24.50	27.50	26.00	3.00	25.00	20.59	10.59	149.97	9.43	13.5	13.5	1.0	339.46	2286.42	51	1.0	480.9	2806.57	27.5	14.5	51	10.59	3.80	2.51	142.5	796.1	5889.1	294.6	5387.6	**2355.64**	**1795.88**
27.50	30.00	28.75	2.50	27.50	20.59	10.59	149.97	7.86	14.5	14.5	1.0	304.73	2591.15	51	1.0	400.7	3207.29	30.0	9.5	51	10.70	2.38	1.14	142.5	632.0	6430.4	324.1	6122.5	**2572.17**	**2040.85**
30.00	30.50	30.25	0.50	28.00	20.70	10.70	149.97	1.57	9.5	9.5	1.0	39.44	2630.59	51	1.0	80.1	3287.43	30.5	18.8	37	10.70	5.78	4.73	142.5	928.6	6846.6	330.0	6248.0	**2738.65**	**2082.67**
30.50	32.50	31.50	2.00	30.00	20.70	10.70	149.97	6.29	18.8	18.8	1.0	320.90	2951.49	37	1.0	232.6	3520.00	32.5	23.5	48	11.05	8.92	9.23	142.5	1378.5	7850.0	353.6	6825.1	**3140.00**	**2275.02**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
32.50	33.50	33.00	1.00	31.00	21.05	11.05	149.97	3.14	23.5	23.5	1.0	204.94	3156.42	48	1.0	150.9	3670.86	33.5	10.0	50	11.05	2.47	1.22	142.5	635.5	7462.8	365.4	7192.6	**2985.11**	**2397.55**
33.50	35.00	34.25	1.50	32.50	21.05	11.05	149.97	4.71	10.0	10.0	1.0	124.66	3281.08	50	1.0	235.7	3906.57	35.0	23.0	8	11.05	8.56	8.68	142.5	1053.0	8240.6	383.0	7570.7	**3296.24**	**2523.56**
35.00	36.50	35.75	1.50	34.00	21.05	11.05	149.97	4.71	28.9	28.9	1.0	390.27	3671.36	8	1.0	37.7	3944.29	36.5	9.0	68	11.05	2.29	1.07	142.5	742.0	8357.6	400.7	8016.4	**3343.04**	**2672.12**
36.50	37.50	37.00	1.00	35.00	21.05	11.05	149.97	3.14	9.0	9.0	1.0	74.65	3746.01	68	1.0	213.7	4158.00	37.5	9.0	68	11.05	2.29	1.07	142.5	742.0	8646.0	412.5	8316.5	**3458.38**	**2772.17**
37.50	40.00	38.75	2.50	37.50	21.05	11.05	149.97	7.86	9.0	9.0	1.0	186.62	3932.63	68	1.0	534.3	4692.29	40.0	6.0	125	11.05	1.75	0.60	142.5	1082.5	9707.5	442.0	9066.9	**3882.98**	**3022.29**
BORE NO: P95, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.43	9.43	25.93	1.57	28.0	28.0	1.0	21.67	0	3	1.0	4.7	0	3.0	23.4	0	9.43	8.85	9.12	28.3	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.50	19.43	9.43	33.01	3.14	23.4	23.4	1.0	44.89	0	0	1.0	0.0	0	4.0	24.2	0	9.43	9.42	10.00	37.7	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	5.00	4.50	1.00	2.50	19.43	9.43	42.44	3.14	24.2	24.2	1.0	59.94	0	0	1.0	0.0	0	5.0	27.5	4	9.64	15.63	16.64	47.2	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.50	19.64	9.64	51.97	3.14	27.5	27.5	1.0	85.03	0	4	1.0	12.6	0	6.0	24.2	0	9.64	9.42	10.00	56.8	0	0.0	41.3	41.3	**0.00**	**13.75**
6.00	7.00	6.50	1.00	4.50	19.64	9.64	61.61	3.14	24.2	24.2	1.0	87.02	0	0	1.0	0.0	0	7.0	24.2	0	9.64	9.42	10.00	66.4	0	0.0	53.0	53.0	**0.00**	**17.68**
7.00	8.00	7.50	1.00	5.50	19.64	9.64	71.25	3.14	24.2	24.2	1.0	100.64	0	0	1.0	0.0	0	8.0	10.7	45	10.20	2.68	1.42	76.1	483.8	483.8	64.8	64.8	**193.53**	**21.61**
8.00	9.00	8.50	1.00	6.50	20.20	10.20	81.17	3.14	10.7	10.7	1.0	48.20	48.20	45	1.0	141.4	141.43	9.0	9.5	52	10.20	2.38	1.14	86.3	533.6	723.3	76.6	266.2	**289.30**	**88.75**
9.00	10.00	9.50	1.00	7.50	20.20	10.20	91.37	3.14	9.5	9.5	1.0	48.05	96.26	52	1.0	163.4	304.86	10.0	9.5	52	10.31	2.38	1.14	96.5	552.7	953.9	88.4	489.5	**381.54**	**163.17**
10.00	12.50	11.25	2.50	10.00	20.31	10.31	109.36	7.86	9.5	9.5	1.0	143.79	240.04	52	1.0	408.6	713.43	12.5	9.5	52	9.43	2.38	1.14	122.2	600.5	1554.0	117.9	1071.3	**621.61**	**357.11**
12.50	15.50	14.00	3.00	13.00	19.43	9.43	136.39	9.43	9.5	9.5	1.0	215.20	455.24	52	1.0	490.3	1203.71	15.5	9.0	53	9.43	2.29	1.07	122.2	598.7	2257.6	153.2	1812.2	**903.06**	**604.06**
15.50	18.50	17.00	3.00	16.00	19.43	9.43	136.39	9.43	9.0	9.0	1.0	203.68	658.92	53	1.0	499.7	1703.43	18.5	9.0	53	9.69	2.29	1.07	122.2	598.8	2961.1	188.6	2550.9	**1184.46**	**850.31**
18.50	20.00	19.25	1.50	17.50	19.69	9.69	136.39	4.71	9.0	9.0	1.0	101.84	760.76	53	1.0	249.9	1953.29	20.0	10.2	49	9.69	2.53	1.28	122.2	594.3	3308.3	206.3	2920.3	**1323.32**	**973.43**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
20.00	21.50	20.75	1.50	19.00	19.69	9.69	136.39	4.71	10.2	10.2	1.0	115.69	876.45	49	1.0	231.0	2184.29	21.5	10.2	49	9.69	2.53	1.28	122.2	594.3	3655.0	223.9	3284.7	**1461.99**	**1094.89**
21.50	23.00	22.25	1.50	20.50	19.69	9.69	136.39	4.71	10.2	10.2	1.0	115.69	992.14	49	1.0	231.0	2415.29	23.0	9.4	40	10.82	2.36	1.13	122.2	514.5	3921.9	241.6	3649.0	**1568.78**	**1216.34**
23.00	24.50	23.75	1.50	22.00	20.82	10.82	136.39	4.71	9.4	9.4	1.0	106.44	1098.58	40	1.0	188.6	2603.86	24.5	9.4	44	10.82	2.36	1.13	122.2	542.8	4245.2	259.3	3961.7	**1698.10**	**1320.57**
24.50	27.50	26.00	3.00	25.00	20.82	10.82	136.39	9.43	9.4	9.4	1.0	212.89	1311.47	44	1.0	414.9	3018.71	27.5	9.5	26	10.10	2.38	1.14	122.2	417.0	4747.2	294.6	4624.8	**1898.87**	**1541.61**
27.50	30.00	28.75	2.50	27.50	20.10	10.10	136.39	7.86	9.5	9.5	1.0	179.33	1490.80	26	1.0	204.3	3223.00	30.0	26.7	0	10.10	13.83	14.80	122.2	1386.9	6100.7	324.1	5037.9	**2440.28**	**1679.30**
30.00	30.50	30.25	0.50	28.00	20.10	10.10	136.39	1.57	26.7	26.7	1.0	107.80	1598.60	0	1.0	0.0	3223.00	30.5	26.7	0	10.10	13.83	14.80	122.2	1386.9	6208.5	330.0	5151.6	**2483.40**	**1717.20**
30.50	32.00	31.25	1.50	29.50	20.10	10.10	136.39	4.71	26.7	26.7	1.0	323.39	1921.98	0	1.0	0.0	3223.00	32.0	10.5	63	10.10	2.62	1.36	122.2	702.3	5847.3	347.7	5492.7	**2338.90**	**1830.89**
32.00	32.50	32.25	0.50	30.00	20.10	10.10	136.39	1.57	10.5	10.5	1.0	39.72	1961.71	63	1.0	99.0	3322.00	32.5	10.5	63	8.97	2.62	1.36	122.2	701.7	5985.4	353.6	5637.3	**2394.15**	**1879.09**
32.50	33.50	33.00	1.00	31.00	18.97	8.97	136.39	3.14	10.5	10.5	1.0	79.45	2041.15	63	1.0	198.0	3520.00	33.5	10.5	63	8.97	2.62	1.36	122.2	701.7	6262.8	365.4	5926.5	**2505.13**	**1975.50**
33.50	35.00	34.25	1.50	32.50	18.97	8.97	136.39	4.71	10.5	10.5	1.0	119.17	2160.32	63	1.0	297.0	3817.00	35.0	26.1	0	9.42	12.48	13.41	122.2	1248.1	7225.4	383.0	6360.4	**2890.15**	**2120.12**
35.00	36.50	35.75	1.50	34.00	19.42	9.42	136.39	4.71	26.1	26.1	1.0	314.99	2475.32	0	1.0	0.0	3817.00	36.5	13.2	56	9.57	3.41	2.14	122.2	731.6	7023.9	400.7	6693.0	**2809.55**	**2231.01**
36.50	37.50	37.00	1.00	35.00	19.57	9.57	136.39	3.14	13.2	13.2	1.0	100.54	2575.86	56	1.0	176.0	3993.00	37.5	13.2	56	9.57	3.41	2.14	122.2	731.6	7300.4	412.5	6981.4	**2920.16**	**2327.12**
37.50	38.00	37.75	0.50	35.50	19.57	9.57	136.39	1.57	13.2	13.2	1.0	50.27	2626.13	56	1.0	88.0	4081.00	38.0	10.0	55	9.51	2.47	1.22	122.2	630.7	7337.9	418.4	7125.5	**2935.14**	**2375.17**
38.00	40.00	39.00	2.00	37.50	19.51	9.51	136.39	6.29	10.0	10.0	1.0	151.17	2777.29	55	1.0	345.7	4426.71	40.0	10.0	55	9.51	2.47	1.22	122.2	630.7	7834.7	442.0	7646.0	**3133.89**	**2548.66**
BORE NO: P96, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	20.19	10.19	28.02	1.57	27.5	27.5	1.0	22.92	0	3	1.0	4.7	0	3.0	25.5	0	10.19	11.13	12.03	30.6	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.50	20.19	10.19	35.67	3.14	25.5	25.5	1.0	53.46	0	0	1.0	0.0	0	4.0	24.3	5	9.41	9.50	10.11	40.8	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	6.00	5.00	2.00	3.50	19.41	9.41	50.17	6.29	24.3	24.3	1.0	142.39	0	5	1.0	31.4	0	6.0	24.7	0	9.41	9.78	10.55	59.6	0	0.0	41.3	41.3	**0.00**	**13.75**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
6.00	7.00	6.50	1.00	4.50	19.41	9.41	64.29	3.14	24.7	24.7	1.0	92.93	0	0	1.0	0.0	0	7.0	24.7	0	9.41	9.78	10.55	69.0	0	0.0	53.0	53.0	**0.00**	**17.68**
7.00	8.00	7.50	1.00	5.50	19.41	9.41	73.70	3.14	24.7	24.7	1.0	106.53	0	0	1.0	0.0	0	8.0	10.5	42	9.41	2.62	1.36	78.4	463.2	463.2	64.8	64.8	**185.30**	**21.61**
8.00	9.00	8.50	1.00	6.50	19.41	9.41	83.11	3.14	10.5	10.5	1.0	48.41	48.41	42	1.0	132.0	132.00	9.0	10.5	42	10.20	2.62	1.36	87.8	483.0	663.4	76.6	257.0	**265.37**	**85.67**
9.00	10.00	9.50	1.00	7.50	20.20	10.20	92.91	3.14	10.5	10.5	1.0	54.12	102.53	42	1.0	132.0	264.00	10.0	10.5	42	10.20	2.62	1.36	98.0	504.0	870.5	88.4	454.9	**348.21**	**151.64**
10.00	12.50	11.25	2.50	10.00	20.20	10.20	110.76	7.86	10.5	10.5	1.0	161.29	263.82	42	1.0	330.0	594.00	12.5	11.2	54	10.20	2.82	1.56	123.5	662.1	1519.9	117.9	975.7	**607.95**	**325.23**
12.50	14.00	13.25	1.50	11.50	20.20	10.20	131.16	4.71	11.2	11.2	1.0	122.43	386.25	54	1.0	254.6	848.57	14.0	11.2	40	10.07	2.82	1.56	138.8	596.9	1831.7	135.5	1370.4	**732.69**	**456.79**
14.00	15.50	14.75	1.50	13.00	20.07	10.07	146.36	4.71	11.2	11.2	1.0	136.62	522.87	40	1.0	188.6	1037.14	15.5	11.2	40	10.07	2.82	1.56	138.8	596.9	2156.9	153.2	1713.2	**862.77**	**571.08**
15.50	17.00	16.25	1.50	14.50	20.07	10.07	146.36	4.71	11.2	11.2	1.0	136.62	659.50	40	1.0	188.6	1225.71	17.0	28.0	0	10.25	16.76	17.79	138.8	1899.1	3784.3	170.9	2056.1	**1513.73**	**685.37**
17.00	18.50	17.75	1.50	16.00	20.25	10.25	146.36	4.71	28.0	28.0	1.0	366.88	1026.37	0	1.0	0.0	1225.71	18.5	28.0	0	10.25	16.76	17.79	138.8	1899.1	4151.2	188.6	2440.7	**1660.48**	**813.55**
18.50	20.00	19.25	1.50	17.50	20.25	10.25	146.36	4.71	28.0	28.0	1.0	366.88	1393.25	0	1.0	0.0	1225.71	20.0	15.5	32	10.25	4.19	2.92	138.8	694.6	3313.6	206.3	2825.2	**1325.43**	**941.74**
20.00	21.50	20.75	1.50	19.00	20.25	10.25	146.36	4.71	15.5	15.5	1.0	191.35	1584.60	32	1.0	150.9	1376.57	21.5	15.5	32	9.88	4.19	2.92	138.8	694.2	3655.4	223.9	3185.1	**1462.14**	**1061.70**
21.50	23.00	22.25	1.50	20.50	19.88	9.88	146.36	4.71	15.5	15.5	1.0	191.35	1775.96	32	1.0	150.9	1527.43	23.0	9.4	49	9.88	2.36	1.13	138.8	608.5	3911.9	241.6	3545.0	**1564.75**	**1181.66**
23.00	24.50	23.75	1.50	22.00	19.88	9.88	146.36	4.71	9.4	9.4	1.0	114.23	1890.18	49	1.0	231.0	1758.43	24.5	9.4	49	9.88	2.36	1.13	138.8	608.5	4257.1	259.3	3907.9	**1702.84**	**1302.63**
24.50	26.00	25.25	1.50	23.50	19.88	9.88	146.36	4.71	9.4	9.4	1.0	114.23	2004.41	49	1.0	231.0	1989.43	26.0	29.8	0	9.88	20.81	21.94	138.8	2354.7	6348.5	277.0	4270.8	**2539.42**	**1423.60**
26.00	27.50	26.75	1.50	25.00	19.88	9.88	146.36	4.71	29.8	29.8	1.0	395.16	2399.57	0	1.0	0.0	1989.43	27.5	29.8	0	11.32	20.81	21.94	138.8	2367.1	6756.1	294.6	4683.6	**2702.45**	**1561.22**
27.50	29.00	28.25	1.50	26.50	21.32	11.32	146.36	4.71	29.8	29.8	1.0	395.16	2794.74	0	1.0	0.0	1989.43	29.0	12.1	42	11.32	3.09	1.82	138.8	641.8	5426.0	312.3	5096.5	**2170.39**	**1698.83**
29.00	30.00	29.50	1.00	27.50	21.32	11.32	146.36	3.14	12.1	12.1	1.0	98.61	2893.35	42	1.0	132.0	2121.43	30.0	12.1	42	11.32	3.09	1.82	138.8	641.8	5656.6	324.1	5338.9	**2262.63**	**1779.63**
30.00	30.50	30.25	0.50	28.00	21.32	11.32	146.36	1.57	12.1	12.1	1.0	49.31	2942.66	42	1.0	66.0	2187.43	30.5	12.1	42	11.32	3.09	1.82	138.8	641.8	5771.9	330.0	5460.1	**2308.76**	**1820.03**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
30.50	32.00	31.25	1.50	29.50	21.32	11.32	146.36	4.71	12.1	12.1	1.0	147.92	3090.58	42	1.0	198.0	2385.43	32.0	29.1	0	11.32	19.23	20.33	138.8	2188.0	7664.0	347.7	5823.7	**3065.61**	**1941.23**
32.00	32.50	32.25	0.50	30.00	21.32	11.32	146.36	1.57	29.1	29.1	1.0	128.02	3218.60	0	1.0	0.0	2385.43	32.5	27.6	0	10.88	15.85	16.87	138.8	1801.3	7405.4	353.6	5957.6	**2962.14**	**1985.87**
32.50	33.50	33.00	1.00	31.00	20.88	10.88	146.36	3.14	27.6	27.6	1.0	240.48	3459.08	0	1.0	0.0	2385.43	33.5	18.0	39	10.88	5.42	4.29	138.8	884.8	6729.3	365.4	6209.9	**2691.74**	**2069.95**
33.50	35.00	34.25	1.50	32.50	20.88	10.88	146.36	4.71	18.0	18.0	1.0	224.19	3683.27	39	1.0	183.9	2569.29	35.0	29.3	5	10.88	19.68	20.79	138.8	2271.0	8523.5	383.0	6635.6	**3409.40**	**2211.86**
35.00	36.50	35.75	1.50	34.00	20.88	10.88	146.36	4.71	29.3	29.3	1.0	387.21	4070.48	5	1.0	23.6	2592.86	36.5	12.6	48	10.88	3.23	1.96	138.8	700.5	7363.8	400.7	7064.0	**2945.51**	**2354.68**
36.50	37.50	37.00	1.00	35.00	20.88	10.88	146.36	3.14	12.6	12.6	1.0	102.82	4173.30	48	1.0	150.9	2743.71	37.5	12.6	48	10.88	3.23	1.96	138.8	700.5	7617.5	412.5	7329.5	**3046.99**	**2443.17**
37.50	38.00	37.75	0.50	35.50	20.88	10.88	146.36	1.57	12.6	12.6	1.0	51.41	4224.71	48	1.0	75.4	2819.14	38.0	10.0	45	8.03	2.47	1.22	138.8	591.5	7635.3	418.4	7462.2	**3054.12**	**2487.42**
38.00	40.00	39.00	2.00	37.50	18.03	8.03	146.36	6.29	10.0	10.0	1.0	162.22	4386.93	45	1.0	282.9	3102.00	40.0	10.0	45	8.03	2.47	1.22	138.8	591.5	8080.4	442.0	7930.9	**3232.15**	**2643.63**
BORE NO: P97, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.91	9.91	27.25	1.57	15.0	15.0	1.0	11.48	0	32	1.0	50.3	0	3.0	12.9	16	9.91	3.32	2.05	29.7	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.50	19.91	9.91	34.69	3.14	12.9	12.9	1.0	24.97	0	16	1.0	50.3	0	4.0	27.0	7	9.91	14.50	15.49	39.6	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	5.00	4.50	1.00	2.50	19.91	9.91	44.60	3.14	27.0	27.0	1.0	71.41	0	7	1.0	22.0	0	5.0	27.0	7	9.91	14.50	15.49	49.6	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.50	19.91	9.91	54.51	3.14	27.0	27.0	1.0	87.28	0	7	1.0	22.0	0	6.0	25.8	0	9.91	11.80	12.72	59.5	0	0.0	41.3	41.3	**0.00**	**13.75**
6.00	7.00	6.50	1.00	4.50	19.91	9.91	64.42	3.14	25.8	25.8	1.0	97.87	0	0	1.0	0.0	0	7.0	26.0	10	10.07	12.25	13.18	69.4	0	0.0	53.0	53.0	**0.00**	**17.68**
7.00	8.00	7.50	1.00	5.50	20.07	10.07	74.41	3.14	26.0	26.0	1.0	114.05	0	10	1.0	31.4	0	8.0	11.5	44	10.07	2.91	1.65	79.4	499.4	499.4	64.8	64.8	**199.75**	**21.61**
8.00	9.00	8.50	1.00	6.50	20.07	10.07	84.48	3.14	11.5	11.5	1.0	54.02	54.02	44	1.0	138.3	138.29	9.0	11.5	44	10.35	2.91	1.65	89.5	522.6	714.9	76.6	268.9	**285.95**	**89.64**
9.00	11.00	10.00	2.00	8.50	20.35	10.35	99.86	6.29	11.5	11.5	1.0	127.71	181.72	44	1.0	276.6	414.86	11.0	9.5	51	10.35	2.38	1.14	110.2	571.4	1168.0	100.2	696.8	**467.18**	**232.25**
11.00	12.00	11.50	1.00	9.50	20.35	10.35	115.39	3.14	9.5	9.5	1.0	60.68	242.41	51	1.0	160.3	575.14	12.0	9.0	51	10.56	2.29	1.07	120.6	582.0	1399.5	112.0	929.5	**559.81**	**309.84**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
12.00	14.50	13.25	2.50	12.00	20.56	10.56	133.76	7.86	9.0	9.0	1.0	166.46	408.86	51	1.0	400.7	975.86	14.5	9.0	50	9.81	2.29	1.07	147.0	622.1	2006.8	141.4	1526.1	**802.73**	**508.72**
14.50	17.50	16.00	3.00	15.00	19.81	9.81	133.76	9.43	9.0	9.0	1.0	199.75	608.61	50	1.0	471.4	1447.29	17.5	11.0	44	9.81	2.76	1.51	147.0	636.1	2692.0	176.8	2232.7	**1076.80**	**744.23**
17.50	20.50	19.00	3.00	18.00	19.81	9.81	133.76	9.43	11.0	11.0	1.0	245.15	853.76	44	1.0	414.9	1862.14	20.5	11.3	44	10.96	2.85	1.59	147.0	647.3	3363.2	212.1	2928.0	**1345.29**	**976.01**
20.50	23.50	22.00	3.00	21.00	20.96	10.96	133.76	9.43	11.3	11.3	1.0	252.01	1105.76	44	1.0	414.9	2277.00	23.5	12.6	44	10.96	3.23	1.96	147.0	692.9	4075.7	247.5	3630.3	**1630.28**	**1210.09**
23.50	26.50	25.00	3.00	24.00	20.96	10.96	133.76	9.43	12.6	12.6	1.0	281.90	1387.67	44	1.0	414.9	2691.86	26.5	15.5	39	9.65	4.19	2.92	147.0	770.2	4849.7	282.9	4362.4	**1939.90**	**1454.13**
26.50	27.50	27.00	1.00	25.00	19.65	9.65	133.76	3.14	15.5	15.5	1.0	116.58	1504.25	39	1.0	122.6	2814.43	27.5	15.5	39	10.33	4.19	2.92	147.0	771.0	5089.7	294.6	4613.3	**2035.87**	**1537.77**
27.50	29.50	28.50	2.00	27.00	20.33	10.33	133.76	6.29	15.5	15.5	1.0	233.17	1737.42	39	1.0	245.1	3059.57	29.5	26.8	0	10.33	14.05	15.03	147.0	1683.7	6480.7	318.2	5115.2	**2592.28**	**1705.07**
29.50	30.00	29.75	0.50	27.50	20.33	10.33	133.76	1.57	26.8	26.8	1.0	106.18	1843.60	0	1.0	0.0	3059.57	30.0	26.8	0	10.33	14.05	15.03	147.0	1683.7	6586.9	324.1	5227.3	**2634.75**	**1742.42**
30.00	32.50	31.25	2.50	30.00	20.33	10.33	133.76	7.86	26.8	26.8	1.0	530.88	2374.48	0	1.0	0.0	3059.57	32.5	23.5	10	10.33	8.92	9.23	147.0	1138.2	6572.2	353.6	5787.6	**2628.89**	**1929.21**
32.50	35.00	33.75	2.50	32.50	20.33	10.33	133.76	7.86	23.5	23.5	1.0	456.98	2831.46	10	1.0	78.6	3138.14	35.0	23.5	10	11.77	8.92	9.23	147.0	1143.4	7113.0	383.0	6352.6	**2845.19**	**2117.54**
35.00	35.50	35.25	0.50	33.00	21.77	11.77	133.76	1.57	23.5	23.5	1.0	91.40	2922.85	10	1.0	15.7	3153.86	35.5	23.0	10	11.77	8.56	8.68	147.0	1099.3	7176.0	388.9	6465.6	**2870.39**	**2155.21**
35.50	37.50	36.50	2.00	35.00	21.77	11.77	133.76	6.29	23.0	23.0	1.0	356.89	3279.74	10	1.0	62.9	3216.71	37.5	26.5	10	11.77	13.38	14.34	147.0	1681.7	8178.2	412.5	6909.0	**3271.27**	**2302.98**
37.50	38.50	38.00	1.00	36.00	21.77	11.77	133.76	3.14	26.5	26.5	1.0	209.60	3489.34	10	1.0	31.4	3248.14	38.5	26.0	10	11.77	12.25	13.18	147.0	1546.4	8283.9	424.3	7161.8	**3313.55**	**2387.26**
38.50	40.00	39.25	1.50	37.50	21.77	11.77	133.76	4.71	26.0	26.0	1.0	307.56	3796.89	10	1.0	47.1	3295.29	40.0	18.0	47	11.77	5.42	4.29	147.0	977.6	8069.8	442.0	7534.1	**3227.91**	**2511.38**
BORE NO: P98, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.20	9.20	25.30	1.57	27.3	27.3	1.0	20.52	0	2	1.0	3.1	0	3.0	27.3	2	9.48	15.18	16.18	27.6	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	5.00	4.00	2.00	2.50	19.48	9.48	37.08	6.29	27.3	27.3	1.0	120.30	0	2	1.0	12.6	0	5.0	25.7	8	9.48	11.58	12.49	46.6	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.50	19.48	9.48	51.30	3.14	25.7	25.7	1.0	77.59	0	8	1.0	25.1	0	6.0	25.7	8	9.48	11.58	12.49	56.0	0	0.0	41.3	41.3	**0.00**	**13.75**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
6.00	7.00	6.50	1.00	4.50	19.48	9.48	60.78	3.14	25.7	25.7	1.0	91.93	0	8	1.0	25.1	0	7.0	25.7	8	9.84	11.58	12.49	65.5	700.8	700.8	53.0	53.0	**280.33**	**17.68**
7.00	8.00	7.50	1.00	5.50	19.84	9.84	70.44	3.14	25.7	25.7	1.0	106.54	106.54	8	1.0	25.1	25.14	8.0	9.5	47	9.84	2.38	1.14	75.4	477.7	609.4	64.8	196.5	**243.75**	**65.50**
8.00	9.00	8.50	1.00	6.50	19.84	9.84	80.28	3.14	9.5	9.5	1.0	42.22	148.77	47	1.0	147.7	172.86	9.0	9.5	47	9.61	2.38	1.14	85.2	496.0	817.6	76.6	398.2	**327.05**	**132.74**
9.00	11.00	10.00	2.00	8.50	19.61	9.61	94.81	6.29	9.5	9.5	1.0	99.73	248.49	47	1.0	295.4	468.29	11.0	9.2	53	9.61	2.33	1.10	104.4	569.8	1286.5	100.2	817.0	**514.62**	**272.32**
11.00	12.00	11.50	1.00	9.50	19.61	9.61	109.23	3.14	9.2	9.2	1.0	55.60	304.09	53	1.0	166.6	634.86	12.0	9.2	53	10.15	2.33	1.10	114.0	587.6	1526.5	112.0	1050.9	**610.60**	**350.30**
12.00	14.50	13.25	2.50	12.00	20.15	10.15	126.72	7.86	9.2	9.2	1.0	161.26	465.35	53	1.0	416.4	1051.29	14.5	10.3	43	10.47	2.56	1.31	139.4	589.6	2106.3	141.4	1658.1	**842.51**	**552.69**
14.50	17.50	16.00	3.00	15.00	20.47	10.47	126.72	9.43	10.3	10.3	1.0	217.13	682.48	43	1.0	405.4	1456.71	17.5	10.3	43	10.47	2.56	1.31	139.4	589.6	2728.8	176.8	2316.0	**1091.54**	**771.99**
17.50	19.00	18.25	1.50	16.50	20.47	10.47	126.72	4.71	10.3	10.3	1.0	108.56	791.04	43	1.0	202.7	1659.43	19.0	28.4	0	9.49	17.66	18.71	139.4	2003.7	4454.2	194.5	2644.9	**1781.68**	**881.64**
19.00	20.50	19.75	1.50	18.00	19.49	9.49	126.72	4.71	28.4	28.4	1.0	323.00	1114.04	0	1.0	0.0	1659.43	20.5	12.8	34	9.49	3.29	2.02	139.4	608.5	3382.0	212.1	2985.6	**1352.79**	**995.20**
20.50	22.00	21.25	1.50	19.50	19.49	9.49	126.72	4.71	12.8	12.8	1.0	135.72	1249.76	34	1.0	160.3	1819.71	22.0	20.7	39	9.49	6.90	6.16	139.4	1055.0	4124.4	229.8	3299.3	**1649.78**	**1099.77**
22.00	23.50	22.75	1.50	21.00	19.49	9.49	126.72	4.71	20.7	20.7	1.0	225.73	1475.50	39	1.0	183.9	2003.57	23.5	11.5	40	9.47	2.91	1.65	139.4	607.8	4086.9	247.5	3726.6	**1634.76**	**1242.19**
23.50	26.50	25.00	3.00	24.00	19.47	9.47	126.72	9.43	11.5	11.5	1.0	243.08	1718.57	40	1.0	377.1	2380.71	26.5	11.5	40	9.47	2.91	1.65	139.4	607.8	4707.1	282.9	4382.1	**1882.85**	**1460.72**
26.50	27.50	27.00	1.00	25.00	19.47	9.47	126.72	3.14	11.5	11.5	1.0	81.03	1799.60	40	1.0	125.7	2506.43	27.5	14.4	40	9.47	3.77	2.48	139.4	704.6	5010.6	294.6	4600.7	**2004.24**	**1533.56**
27.50	28.00	27.75	0.50	25.50	19.47	9.47	126.72	1.57	14.4	14.4	1.0	51.13	1850.73	40	1.0	62.9	2569.29	28.0	28.5	4	9.78	17.88	18.94	139.4	2059.7	6479.7	300.5	4720.5	**2591.88**	**1573.52**
28.00	29.50	28.75	1.50	27.00	19.78	9.78	126.72	4.71	28.5	28.5	1.0	324.35	2175.08	4	1.0	18.9	2588.14	29.5	30.2	0	9.78	22.27	23.43	139.4	2529.0	7292.2	318.2	5081.4	**2916.87**	**1693.81**
29.50	30.00	29.75	0.50	27.50	19.78	9.78	126.72	1.57	30.2	30.2	1.0	117.05	2292.13	0	1.0	0.0	2588.14	30.0	30.6	0	9.78	24.28	25.48	139.4	2757.5	7637.8	324.1	5204.4	**3055.13**	**1734.79**
30.00	31.00	30.50	1.00	28.50	19.78	9.78	126.72	3.14	30.6	30.6	1.0	242.59	2534.73	0	1.0	0.0	2588.14	31.0	32.8	0	9.78	35.36	36.75	139.4	4014.8	9137.6	335.9	5458.8	**3655.05**	**1819.59**
31.00	32.50	31.75	1.50	30.00	19.78	9.78	126.72	4.71	32.8	32.8	1.1	438.88	2973.61	0	1.0	0.0	2588.14	32.5	32.8	0	11.12	35.36	36.75	139.4	4034.1	9595.9	353.6	5915.3	**3838.34**	**1971.78**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
32.50	35.00	33.75	2.50	32.50	21.12	11.12	126.72	7.86	32.8	32.8	1.1	731.47	3705.09	0	1.0	0.0	2588.14	35.0	32.0	0	11.12	31.33	32.65	139.4	3574.8	9868.0	383.0	6676.3	**3947.20**	**2225.42**
35.00	35.50	35.25	0.50	33.00	21.12	11.12	126.72	1.57	32.0	32.0	1.1	136.87	3841.96	0	1.0	0.0	2588.14	35.5	31.3	0	11.12	27.81	29.06	139.4	3172.9	9603.0	388.9	6819.0	**3841.19**	**2273.01**
35.50	37.50	36.50	2.00	35.00	21.12	11.12	126.72	6.29	31.3	31.3	1.1	515.76	4357.72	0	1.0	0.0	2588.14	37.5	31.3	0	8.46	27.81	29.06	139.4	3142.5	10088.4	412.5	7358.4	**4035.34**	**2452.79**
37.50	38.50	38.00	1.00	36.00	18.46	8.46	126.72	3.14	31.3	31.3	1.1	257.88	4615.60	0	1.0	0.0	2588.14	38.5	30.3	0	8.68	22.77	23.94	139.4	2575.8	9779.5	424.3	7628.0	**3911.81**	**2542.68**
38.50	40.00	39.25	1.50	37.50	18.68	8.68	126.72	4.71	30.3	30.3	1.0	354.32	4969.92	0	1.0	0.0	2588.14	40.0	30.3	0	8.68	22.77	23.94	139.4	2575.8	10133.8	442.0	8000.0	**4053.53**	**2666.68**
BORE NO: P99, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	20.67	10.67	29.34	1.57	27.5	27.5	1.0	24.00	0	11	1.0	17.3	0	3.0	26.1	0	10.67	12.48	13.41	32.0	370.0	370.0	5.9	5.9	**148.02**	**1.96**
3.00	4.00	3.50	1.00	1.50	20.67	10.67	37.35	3.14	26.1	26.1	1.0	57.50	57.50	0	1.0	0.0	0.00	4.0	26.0	11	9.83	12.25	13.18	42.7	539.6	597.1	17.7	75.2	**238.82**	**25.06**
4.00	5.00	4.50	1.00	2.50	19.83	9.83	47.60	3.14	26.0	26.0	1.0	72.96	130.46	11	1.0	34.6	34.57	5.0	26.0	11	9.83	12.25	13.18	52.5	634.2	799.2	29.5	194.5	**319.69**	**64.83**
5.00	6.00	5.50	1.00	3.50	19.83	9.83	57.43	3.14	26.0	26.0	1.0	88.03	218.48	11	1.0	34.6	69.14	6.0	26.5	0	9.83	13.38	14.34	62.3	710.6	998.3	41.3	328.9	**399.30**	**109.62**
6.00	7.00	6.50	1.00	4.50	19.83	9.83	67.26	3.14	26.5	26.5	1.0	105.39	323.87	0	1.0	0.0	69.14	7.0	23.0	15	9.83	8.56	8.68	72.2	625.0	1018.0	53.0	446.0	**407.21**	**148.68**
7.00	8.00	7.50	1.00	5.50	19.83	9.83	77.09	3.14	23.0	23.0	1.0	102.84	426.70	15	1.0	47.1	116.29	8.0	9.6	47	10.52	2.40	1.16	82.0	491.6	1034.6	64.8	607.8	**413.85**	**202.60**
8.00	9.00	8.50	1.00	6.50	20.52	10.52	87.26	3.14	9.6	9.6	1.0	46.39	473.09	47	1.0	147.7	264.00	9.0	9.6	47	10.52	2.40	1.16	92.5	511.5	1248.6	76.6	813.7	**499.42**	**271.23**
9.00	11.00	10.00	2.00	8.50	20.52	10.52	103.04	6.29	9.6	9.6	1.0	109.55	582.64	47	1.0	295.4	559.43	11.0	9.6	46	10.52	2.40	1.16	113.6	544.0	1686.1	100.2	1242.2	**674.44**	**414.08**
11.00	12.00	11.50	1.00	9.50	20.52	10.52	118.82	3.14	9.6	9.6	1.0	63.16	645.80	46	1.0	144.6	704.00	12.0	11.0	50	10.17	2.76	1.51	124.1	629.1	1978.9	112.0	1461.8	**791.54**	**487.25**
12.00	14.50	13.25	2.50	12.00	20.17	10.17	136.79	7.86	11.0	11.0	1.0	208.92	854.72	50	1.0	392.9	1096.86	14.5	11.0	55	9.76	2.76	1.51	149.5	719.4	2671.0	141.4	2093.0	**1068.38**	**697.67**
14.50	17.50	16.00	3.00	15.00	19.76	9.76	136.79	9.43	11.0	11.0	1.0	250.70	1105.42	55	1.0	518.6	1615.43	17.5	27.5	7	9.76	15.63	16.64	149.5	1949.3	4670.2	176.8	2897.6	**1868.06**	**965.88**
17.50	19.00	18.25	1.50	16.50	19.76	9.76	136.79	4.71	27.5	27.5	1.0	335.70	1441.12	7	1.0	33.0	1648.43	19.0	24.8	0	9.93	9.86	10.66	149.5	1199.4	4288.9	194.5	3284.0	**1715.56**	**1094.67**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
19.00	20.50	19.75	1.50	18.00	19.93	9.93	136.79	4.71	24.8	24.8	1.0	297.98	1739.10	0	1.0	0.0	1648.43	20.5	24.8	0	9.93	9.86	10.66	149.5	1199.4	4586.9	212.1	3599.7	**1834.75**	**1199.89**
20.50	22.00	21.25	1.50	19.50	19.93	9.93	136.79	4.71	24.8	24.8	1.0	297.98	2037.08	0	1.0	0.0	1648.43	22.0	26.5	12	10.16	13.38	14.34	149.5	1713.6	5399.1	229.8	3915.3	**2159.62**	**1305.11**
22.00	23.50	22.75	1.50	21.00	20.16	10.16	136.79	4.71	26.5	26.5	1.0	321.52	2358.60	12	1.0	56.6	1705.00	23.5	26.0	12	10.16	12.25	13.18	149.5	1576.7	5640.3	247.5	4311.1	**2256.12**	**1437.03**
23.50	25.00	24.25	1.50	22.50	20.16	10.16	136.79	4.71	26.0	26.0	1.0	314.53	2673.13	12	1.0	56.6	1761.57	25.0	27.0	0	10.16	14.50	15.49	149.5	1765.6	6200.3	265.2	4699.9	**2480.10**	**1566.63**
25.00	26.50	25.75	1.50	24.00	20.16	10.16	136.79	4.71	27.0	27.0	1.0	328.58	3001.71	0	1.0	0.0	1761.57	26.5	27.0	0	10.06	14.50	15.49	149.5	1764.9	6528.2	282.9	5046.1	**2611.29**	**1682.05**
26.50	27.50	27.00	1.00	25.00	20.06	10.06	136.79	3.14	27.0	27.0	1.0	219.05	3220.77	0	1.0	0.0	1761.57	27.5	27.0	0	10.06	14.50	15.49	149.5	1764.9	6747.3	294.6	5277.0	**2698.91**	**1758.99**
27.50	28.00	27.75	0.50	25.50	20.06	10.06	136.79	1.57	27.0	27.0	1.0	109.53	3330.29	0	1.0	0.0	1761.57	28.0	25.5	13	10.06	11.13	12.03	149.5	1446.4	6538.3	300.5	5392.4	**2615.32**	**1797.47**
28.00	29.50	28.75	1.50	27.00	20.06	10.06	136.79	4.71	25.5	25.5	1.0	307.59	3637.88	13	1.0	61.3	1822.86	29.5	25.0	13	10.06	10.00	10.88	149.5	1309.6	6770.4	318.2	5779.0	**2708.14**	**1926.32**
29.50	30.00	29.75	0.50	27.50	20.06	10.06	136.79	1.57	25.0	25.0	1.0	100.24	3738.12	13	1.0	20.4	1843.29	30.0	25.4	5	10.06	10.90	11.80	149.5	1362.5	6943.9	324.1	5905.5	**2777.56**	**1968.51**
30.00	31.00	30.50	1.00	28.50	20.06	10.06	136.79	3.14	25.4	25.4	1.0	204.14	3942.26	5	1.0	15.7	1859.00	31.0	25.4	5	10.06	10.90	11.80	149.5	1362.5	7163.8	335.9	6137.2	**2865.50**	**2045.72**
31.00	32.50	31.75	1.50	30.00	20.06	10.06	136.79	4.71	25.4	25.4	1.0	306.21	4248.47	5	1.0	23.6	1882.57	32.5	25.4	5	10.39	10.90	11.80	149.5	1364.0	7495.1	353.6	6484.6	**2998.03**	**2161.54**
32.50	35.00	33.75	2.50	32.50	20.39	10.39	136.79	7.86	25.4	25.4	1.0	510.35	4758.83	5	1.0	39.3	1921.86	35.0	25.4	5	10.39	10.90	11.80	149.5	1364.0	8044.7	383.0	7063.7	**3217.88**	**2354.57**
35.00	35.50	35.25	0.50	33.00	20.39	10.39	136.79	1.57	25.4	25.4	1.0	102.07	4860.90	5	1.0	7.9	1929.71	35.5	25.6	5	10.39	11.35	12.26	149.5	1418.8	8209.4	388.9	7179.5	**3283.77**	**2393.18**
35.50	37.00	36.25	1.50	34.50	20.39	10.39	136.79	4.71	25.6	25.6	1.0	308.97	5169.87	5	1.0	23.6	1953.29	37.0	27.7	0	10.39	16.08	17.10	149.5	1958.7	9081.9	406.6	7529.8	**3632.75**	**2509.92**
37.00	37.50	37.25	0.50	35.00	20.39	10.39	136.79	1.57	27.7	27.7	1.0	112.86	5282.73	0	1.0	0.0	1953.29	37.5	27.7	0	9.43	16.08	17.10	149.5	1952.3	9188.3	412.5	7648.5	**3675.31**	**2549.50**
37.50	38.50	38.00	1.00	36.00	19.43	9.43	136.79	3.14	27.7	27.7	1.0	225.71	5508.44	0	1.0	0.0	1953.29	38.5	28.2	0	8.89	17.21	18.25	149.5	2084.9	9546.6	424.3	7886.0	**3818.66**	**2628.67**
38.50	40.00	39.25	1.50	37.50	18.89	8.89	136.79	4.71	28.2	28.2	1.0	345.78	5854.22	0	1.0	0.0	1953.29	40.0	28.2	0	8.89	17.21	18.25	149.5	2084.9	9892.4	442.0	8249.5	**3956.97**	**2749.82**

BORE NO: P100, CUT OFF LENGTH: 2.50 m, Nc= 9

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
2.50	3.00	2.75	0.50	0.50	20.10	10.10	27.78	1.57	28.5	28.5	1.0	23.70	0	0	1.0	0.0	0	3.0	24.5	6	8.73	9.64	10.33	30.3	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	5.00	4.00	2.00	2.50	18.73	8.73	39.03	6.29	24.5	24.5	1.0	111.80	0	6	1.0	37.7	0	5.0	24.5	6	8.73	9.64	10.33	47.8	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.50	18.73	8.73	52.13	3.14	24.5	24.5	1.0	74.66	0	6	1.0	18.9	0	6.0	28.9	0	10.01	18.78	19.87	56.5	911.8	911.8	41.3	41.3	**364.71**	**13.75**
6.00	8.00	7.00	2.00	5.50	20.01	10.01	66.50	6.29	28.9	28.9	1.0	230.75	230.75	0	1.0	0.0	0.00	8.0	11.5	43	10.01	2.91	1.65	76.5	485.6	716.3	64.8	295.6	**286.52**	**98.52**
8.00	9.00	8.50	1.00	6.50	20.01	10.01	81.52	3.14	11.5	11.5	1.0	52.12	282.87	43	1.0	135.1	135.14	9.0	11.5	43	10.01	2.91	1.65	86.5	508.4	926.5	76.6	494.6	**370.58**	**164.87**
9.00	10.00	9.50	1.00	7.50	20.01	10.01	91.53	3.14	11.5	11.5	1.0	58.52	341.39	43	1.0	135.1	270.29	10.0	11.5	43	9.76	2.91	1.65	96.5	531.2	1142.9	88.4	700.1	**457.14**	**233.36**
10.00	11.00	10.50	1.00	8.50	19.76	9.76	101.41	3.14	11.5	11.5	1.0	64.84	406.24	43	1.0	135.1	405.43	11.0	11.5	43	9.76	2.91	1.65	106.3	553.5	1365.2	100.2	911.8	**546.07**	**303.95**
11.00	12.00	11.50	1.00	9.50	19.76	9.76	111.17	3.14	11.5	11.5	1.0	71.08	477.32	43	1.0	135.1	540.57	12.0	11.5	43	9.76	2.91	1.65	116.1	575.8	1593.7	112.0	1129.9	**637.49**	**376.62**
12.00	14.50	13.25	2.50	12.00	19.76	9.76	128.25	7.86	11.5	11.5	1.0	205.01	682.34	43	1.0	337.9	878.43	14.5	9.6	54	10.10	2.40	1.16	140.5	651.1	2211.8	141.4	1702.2	**884.74**	**567.40**
14.50	16.00	15.25	1.50	13.50	20.10	10.10	128.25	4.71	9.6	9.6	1.0	102.26	784.60	54	1.0	254.6	1133.00	16.0	15.1	49	10.10	3.99	2.70	140.5	797.5	2715.1	159.1	2076.7	**1086.02**	**692.24**
16.00	17.50	16.75	1.50	15.00	20.10	10.10	128.25	4.71	15.1	15.1	1.0	163.14	947.73	49	1.0	231.0	1364.00	17.5	15.1	49	10.10	3.99	2.70	140.5	797.5	3109.2	176.8	2488.5	**1243.68**	**829.51**
17.50	19.00	18.25	1.50	16.50	20.10	10.10	128.25	4.71	15.1	15.1	1.0	163.14	1110.87	49	1.0	231.0	1595.00	19.0	28.8	0	10.00	18.56	19.64	140.5	2125.0	4830.9	194.5	2900.3	**1932.35**	**966.78**
19.00	20.50	19.75	1.50	18.00	20.00	10.00	128.25	4.71	28.8	28.8	1.0	332.39	1443.25	0	1.0	0.0	1595.00	20.5	21.2	41	10.00	7.26	6.71	140.5	1117.9	4156.1	212.1	3250.4	**1662.46**	**1083.47**
20.50	22.00	21.25	1.50	19.50	20.00	10.00	128.25	4.71	21.2	21.2	1.0	234.51	1677.77	41	1.0	193.3	1788.29	22.0	10.5	57	9.55	2.62	1.36	140.5	697.0	4163.0	229.8	3695.9	**1665.21**	**1231.96**
22.00	23.50	22.75	1.50	21.00	19.55	9.55	128.25	4.71	10.5	10.5	1.0	112.06	1789.82	57	1.0	268.7	2057.00	23.5	10.5	57	9.55	2.62	1.36	140.5	697.0	4543.8	247.5	4094.3	**1817.52**	**1364.77**
23.50	25.00	24.25	1.50	22.50	19.55	9.55	128.25	4.71	10.5	10.5	1.0	112.06	1901.88	57	1.0	268.7	2325.71	25.0	27.3	0	9.50	15.18	16.18	140.5	1735.5	5963.1	265.2	4492.8	**2385.23**	**1497.59**
25.00	26.50	25.75	1.50	24.00	19.50	9.50	128.25	4.71	27.3	27.3	1.0	312.06	2213.94	0	1.0	0.0	2325.71	26.5	27.3	0	9.50	15.18	16.18	140.5	1735.5	6275.1	282.9	4822.5	**2510.06**	**1607.50**
26.50	27.50	27.00	1.00	25.00	19.50	9.50	128.25	3.14	27.3	27.3	1.0	208.04	2421.98	0	1.0	0.0	2325.71	27.5	28.4	0	9.50	17.66	18.71	140.5	2018.3	6766.0	294.6	5042.3	**2706.40**	**1680.78**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
27.50	29.50	28.50	2.00	27.00	19.50	9.50	128.25	6.29	28.4	28.4	1.0	435.88	2857.86	0	1.0	0.0	2325.71	29.5	28.4	0	10.70	17.66	18.71	140.5	2027.1	7210.7	318.2	5501.8	**2884.28**	**1833.93**
29.50	30.00	29.75	0.50	27.50	20.70	10.70	128.25	1.57	28.4	28.4	1.0	108.97	2966.83	0	1.0	0.0	2325.71	30.0	28.4	0	10.70	17.66	18.71	140.5	2027.1	7319.7	324.1	5616.7	**2927.87**	**1872.22**
30.00	31.00	30.50	1.00	28.50	20.70	10.70	128.25	3.14	28.4	28.4	1.0	217.94	3184.77	0	1.0	0.0	2325.71	31.0	27.8	2	10.70	16.31	17.33	140.5	1886.3	7396.8	335.9	5846.4	**2958.73**	**1948.79**
31.00	32.50	31.75	1.50	30.00	20.70	10.70	128.25	4.71	27.8	27.8	1.0	318.77	3503.55	2	1.0	9.4	2335.14	32.5	27.8	0	10.70	16.31	17.33	140.5	1872.2	7710.9	353.6	6192.3	**3084.36**	**2064.09**
32.50	34.00	33.25	1.50	31.50	20.70	10.70	128.25	4.71	27.8	27.8	1.0	318.77	3822.32	0	1.0	0.0	2335.14	34.0	28.5	0	10.70	17.88	18.94	140.5	2052.9	8210.4	371.3	6528.7	**3284.16**	**2176.24**
34.00	35.00	34.50	1.00	32.50	20.70	10.70	128.25	3.14	28.5	28.5	1.0	218.85	4041.17	0	1.0	0.0	2335.14	35.0	28.5	0	10.62	17.88	18.94	140.5	2052.3	8428.7	383.0	6759.3	**3371.46**	**2253.12**
35.00	35.50	35.25	0.50	33.00	20.62	10.62	128.25	1.57	28.5	28.5	1.0	109.42	4150.59	0	1.0	0.0	2335.14	35.5	28.5	0	10.62	17.88	18.94	140.5	2052.3	8538.1	388.9	6874.7	**3415.23**	**2291.56**
35.50	37.50	36.50	2.00	35.00	20.62	10.62	128.25	6.29	28.5	28.5	1.0	437.70	4588.29	0	1.0	0.0	2335.14	37.5	28.8	0	10.62	18.56	19.64	140.5	2129.8	9053.2	412.5	7335.9	**3621.29**	**2445.31**
37.50	38.50	38.00	1.00	36.00	20.62	10.62	128.25	3.14	28.8	28.8	1.0	221.59	4809.88	0	1.0	0.0	2335.14	38.5	28.6	0	10.62	18.11	19.17	140.5	2078.2	9223.2	424.3	7569.3	**3689.27**	**2523.10**
38.50	40.00	39.25	1.50	37.50	20.62	10.62	128.25	4.71	28.6	28.6	1.0	329.64	5139.53	0	1.0	0.0	2335.14	40.0	28.6	0	10.62	18.11	19.17	140.5	2078.2	9552.8	442.0	7916.6	**3821.13**	**2638.88**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
BORE NO: P81, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	18.85	8.85	24.34	1.89	26.3	26.3	1.0	22.68	0	3	1.0	5.7	0	3.0	23.6	0	8.85	8.99	9.34	26.6	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.50	18.85	8.85	30.98	3.77	23.6	23.6	1.0	51.04	0	0	1.0	0.0	0	4.0	11.5	44	10.17	2.91	1.65	35.4	0	0.0	25.5	25.5	**0.00**	**8.49**
4.00	5.00	4.50	1.00	2.50	20.17	10.17	40.49	3.77	11.5	11.5	1.0	31.06	0	44	1.0	165.9	0	5.0	12.7	48	10.17	3.26	1.99	45.6	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.50	20.17	10.17	50.66	3.77	12.7	12.7	1.0	43.05	0	48	1.0	181.0	0	6.0	12.7	48	10.17	3.26	1.99	55.7	708.3	708.3	59.4	59.4	**283.31**	**19.80**
6.00	7.00	6.50	1.00	4.50	20.17	10.17	60.83	3.77	12.7	12.7	1.0	51.70	51.70	48	1.0	181.0	181.03	7.0	12.7	48	10.27	3.26	1.99	65.9	746.0	978.7	76.4	309.1	**391.47**	**103.03**
7.00	8.00	7.50	1.00	5.50	20.27	10.27	71.05	3.77	12.7	12.7	1.0	60.38	112.08	48	1.0	181.0	362.06	8.0	11.0	45	10.27	2.76	1.51	76.2	707.0	1181.1	93.3	567.5	**472.44**	**189.16**
8.00	9.00	8.50	1.00	6.50	20.27	10.27	81.32	3.77	11.0	11.0	1.0	59.61	171.69	45	1.0	169.7	531.77	9.0	11.0	45	10.27	2.76	1.51	86.5	739.1	1442.5	110.3	813.8	**577.02**	**271.26**
9.00	10.00	9.50	1.00	7.50	20.27	10.27	91.59	3.77	11.0	11.0	1.0	67.14	238.83	45	1.0	169.7	701.49	10.0	11.0	45	10.19	2.76	1.51	96.7	771.1	1711.4	127.3	1067.6	**684.57**	**355.87**
10.00	11.00	10.50	1.00	8.50	20.19	10.19	101.82	3.77	11.0	11.0	1.0	74.64	313.47	45	1.0	169.7	871.20	11.0	11.0	45	10.19	2.76	1.51	106.9	803.0	1987.7	144.3	1328.9	**795.06**	**442.98**
11.00	12.00	11.50	1.00	9.50	20.19	10.19	112.01	3.77	11.0	11.0	1.0	82.11	395.58	45	1.0	169.7	1040.91	12.0	9.5	55	10.36	2.38	1.14	117.1	883.4	2319.9	161.2	1597.7	**927.97**	**532.57**
12.00	14.50	13.25	2.50	12.00	20.36	10.36	130.05	9.43	9.5	9.5	1.0	205.19	600.77	55	1.0	518.6	1559.49	14.5	9.5	53	10.36	2.38	1.14	143.0	932.8	3093.1	203.7	2363.9	**1237.22**	**787.97**
14.50	16.00	15.25	1.50	13.50	20.36	10.36	150.77	5.66	9.5	9.5	1.0	142.73	743.51	53	1.0	299.8	1859.31	16.0	27.5	0	9.82	15.63	16.64	158.5	2914.5	5517.4	229.1	2831.9	**2206.95**	**943.98**
16.00	17.50	16.75	1.50	15.00	19.82	9.82	165.91	5.66	27.5	27.5	1.0	488.58	1232.08	0	1.0	0.0	1859.31	17.5	11.4	64	9.82	2.88	1.62	173.3	1227.4	4318.8	254.6	3346.0	**1727.53**	**1115.32**
17.50	19.00	18.25	1.50	16.50	19.82	9.82	165.91	5.66	11.4	11.4	1.0	189.24	1421.33	64	1.0	362.1	2221.37	19.0	12.2	44	10.40	3.12	1.85	173.3	1072.0	4714.7	280.0	3922.7	**1885.90**	**1307.58**
19.00	20.50	19.75	1.50	18.00	20.40	10.40	165.91	5.66	12.2	12.2	1.0	202.92	1624.25	44	1.0	248.9	2470.29	20.5	12.2	44	10.40	3.12	1.85	173.3	1072.0	5166.6	305.5	4400.0	**2066.63**	**1466.67**
20.50	23.50	22.00	3.00	21.00	20.40	10.40	165.91	11.31	12.2	12.2	1.0	405.84	2030.09	44	1.0	497.8	2968.11	23.5	10.0	44	9.50	2.47	1.22	173.3	940.1	5938.3	356.4	5354.6	**2375.34**	**1784.87**
23.50	25.00	24.25	1.50	22.50	19.50	9.50	165.91	5.66	10.0	10.0	1.0	165.49	2195.58	44	1.0	248.9	3217.03	25.0	13.0	48	9.87	3.35	2.08	173.3	1159.4	6572.1	381.9	5794.5	**2628.82**	**1931.49**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
25.00	26.50	25.75	1.50	24.00	19.87	9.87	165.91	5.66	13.0	13.0	1.0	216.68	2412.26	48	1.0	271.5	3488.57	26.5	13.0	48	8.83	3.35	2.08	173.3	1158.0	7058.8	407.3	6308.1	**2823.52**	**2102.72**
26.50	27.50	27.00	1.00	25.00	18.83	8.83	165.91	3.77	13.0	13.0	1.0	144.45	2556.72	48	1.0	181.0	3669.60	27.5	13.0	48	8.83	3.35	2.08	173.3	1158.0	7384.3	424.3	6650.6	**2953.72**	**2216.87**
27.50	28.00	27.75	0.50	25.50	18.83	8.83	165.91	1.89	13.0	13.0	1.0	72.23	2628.94	48	1.0	90.5	3760.11	28.0	18.0	28	9.79	5.42	4.29	173.3	1375.4	7764.5	432.8	6821.8	**3105.79**	**2273.94**
28.00	29.50	28.75	1.50	27.00	19.79	9.79	165.91	5.66	18.0	18.0	1.0	304.95	2933.90	28	1.0	158.4	3918.51	29.5	18.0	28	8.99	5.42	4.29	173.3	1373.1	8225.5	458.2	7310.6	**3290.20**	**2436.88**
29.50	30.00	29.75	0.50	27.50	18.99	8.99	165.91	1.89	18.0	18.0	1.0	101.65	3035.55	28	1.0	52.8	3971.31	30.0	18.0	47	8.99	5.42	4.29	173.3	1566.6	8573.4	466.7	7473.6	**3429.37**	**2491.19**
30.00	31.00	30.50	1.00	28.50	18.99	8.99	165.91	3.77	18.0	18.0	1.0	203.30	3238.85	47	1.0	177.3	4148.57	31.0	13.0	42	9.41	3.35	2.08	173.3	1097.7	8485.1	483.7	7871.1	**3394.05**	**2623.70**
31.00	32.50	31.75	1.50	30.00	19.41	9.41	165.91	5.66	13.0	13.0	1.0	216.68	3455.53	42	1.0	237.6	4386.17	32.5	13.0	42	9.32	3.35	2.08	173.3	1097.6	8939.3	509.1	8350.8	**3575.71**	**2783.62**
32.50	34.00	33.25	1.50	31.50	19.32	9.32	165.91	5.66	13.0	13.0	1.0	216.68	3672.21	42	1.0	237.6	4623.77	34.0	8.5	53	8.46	2.20	0.99	173.3	976.7	9272.6	534.6	8830.6	**3709.06**	**2943.53**
34.00	35.00	34.50	1.00	32.50	18.46	8.46	165.91	3.77	8.5	8.5	1.0	93.51	3765.72	53	1.0	199.9	4823.66	35.0	8.5	53	8.46	2.20	0.99	173.3	976.7	9566.0	551.6	9141.0	**3826.42**	**3046.98**
35.00	35.50	35.25	0.50	33.00	18.46	8.46	165.91	1.89	8.5	8.5	1.0	46.76	3812.48	53	1.0	99.9	4923.60	35.5	22.5	30	7.82	8.20	8.14	173.3	1956.2	10692.3	560.1	9296.1	**4276.92**	**3098.71**
35.50	37.00	36.25	1.50	34.50	17.82	7.82	165.91	5.66	22.5	22.5	1.0	388.76	4201.24	30	1.0	169.7	5093.31	37.0	22.5	30	8.29	8.20	8.14	173.3	1958.8	11253.4	585.5	9880.1	**4501.35**	**3293.36**
37.00	37.50	37.25	0.50	35.00	18.29	8.29	165.91	1.89	22.5	22.5	1.0	129.59	4330.82	30	1.0	56.6	5149.89	37.5	22.5	30	8.29	8.20	8.14	173.3	1958.8	11439.5	594.0	10074.7	**4575.81**	**3358.24**
37.50	38.50	38.00	1.00	36.00	18.29	8.29	165.91	3.77	22.5	22.5	1.0	259.17	4590.00	30	1.0	113.1	5263.03	38.5	18.5	38	9.36	5.64	4.57	173.3	1522.0	11375.1	611.0	10464.0	**4550.03**	**3488.00**
38.50	40.00	39.25	1.50	37.50	19.36	9.36	165.91	5.66	18.5	18.5	1.0	314.03	4904.03	38	1.0	215.0	5478.00	40.0	18.5	38	9.36	5.64	4.57	173.3	1522.0	11904.1	636.4	11018.5	**4761.63**	**3672.82**
BORE NO: P82, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	18.21	8.21	22.58	1.89	12.2	12.2	1.0	9.20	0	35	1.0	66.0	0	3.0	10.8	44	10.40	2.71	1.45	24.6	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	5.00	4.00	2.00	2.50	20.40	10.40	35.03	7.54	10.8	10.8	1.0	50.40	0	44	1.0	331.9	0	5.0	10.8	44	10.40	2.71	1.45	45.4	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.50	20.40	10.40	50.63	3.77	10.8	10.8	1.0	36.43	0	44	1.0	165.9	0	6.0	27.5	3	10.40	15.63	16.64	55.8	0	0.0	59.4	59.4	**0.00**	**19.80**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
6.00	7.00	6.50	1.00	4.50	20.40	10.40	61.03	3.77	27.5	27.5	1.0	119.82	0	3	1.0	11.3	0	7.0	27.5	3	8.60	15.63	16.64	66.2	0	0.0	76.4	76.4	**0.00**	**25.46**
7.00	8.00	7.50	1.00	5.50	18.60	8.60	70.53	3.77	27.5	27.5	1.0	138.47	0	3	1.0	11.3	0	8.0	15.9	29	8.60	4.38	3.14	74.8	684.7	684.7	93.3	93.3	**273.89**	**31.11**
8.00	9.00	8.50	1.00	6.50	18.60	8.60	79.13	3.77	15.9	15.9	1.0	85.01	85.01	29	1.0	109.4	109.37	9.0	15.9	29	8.60	4.38	3.14	83.4	727.4	921.8	110.3	304.7	**368.70**	**101.57**
9.00	10.00	9.50	1.00	7.50	18.60	8.60	87.73	3.77	15.9	15.9	1.0	94.25	179.26	29	1.0	109.4	218.74	10.0	18.0	55	8.60	5.42	4.29	92.0	1149.1	1547.1	127.3	525.3	**618.83**	**175.10**
10.00	11.00	10.50	1.00	8.50	18.60	8.60	96.33	3.77	18.0	18.0	1.0	118.04	297.30	55	1.0	207.4	426.17	11.0	9.0	55	11.00	2.29	1.07	100.6	828.7	1552.2	144.3	867.7	**620.89**	**289.24**
11.00	12.00	11.50	1.00	9.50	21.00	11.00	106.13	3.77	9.0	9.0	1.0	63.40	360.70	55	1.0	207.4	633.60	12.0	9.0	55	11.00	2.29	1.07	111.6	857.2	1851.5	161.2	1155.5	**740.62**	**385.18**
12.00	14.50	13.25	2.50	12.00	21.00	11.00	125.38	9.43	9.0	9.0	1.0	187.23	547.93	55	1.0	518.6	1152.17	14.5	10.5	52	10.50	2.62	1.36	139.1	951.2	2651.3	203.7	1903.8	**1060.51**	**634.59**
14.50	17.50	16.00	3.00	15.00	20.50	10.50	154.88	11.31	10.5	10.5	1.0	324.78	872.72	52	1.0	588.3	1740.51	17.5	10.6	51	10.80	2.65	1.39	170.6	1040.4	3653.7	254.6	2867.8	**1461.46**	**955.93**
17.50	20.50	19.00	3.00	18.00	20.80	10.80	154.88	11.31	10.6	10.6	1.0	327.94	1200.66	51	1.0	577.0	2317.54	20.5	10.5	51	10.80	2.62	1.36	170.6	1034.5	4552.7	305.5	3823.7	**1821.10**	**1274.56**
20.50	22.00	21.25	1.50	19.50	20.80	10.80	154.88	5.66	10.5	10.5	1.0	162.39	1363.05	51	1.0	288.5	2606.06	22.0	24.5	12	10.70	9.64	10.33	170.6	2058.3	6027.4	330.9	4300.0	**2410.96**	**1433.35**
22.00	23.50	22.75	1.50	21.00	20.70	10.70	154.88	5.66	24.5	24.5	1.0	399.30	1762.35	12	1.0	67.9	2673.94	23.5	14.5	55	10.70	3.80	2.51	170.6	1310.9	5747.2	356.4	4792.7	**2298.88**	**1597.56**
23.50	26.50	25.00	3.00	24.00	20.70	10.70	154.88	11.31	14.5	14.5	1.0	453.19	2215.54	55	1.0	622.3	3296.23	26.5	9.5	55	10.80	2.38	1.14	170.6	1027.9	6539.7	407.3	5919.1	**2615.87**	**1973.03**
26.50	27.50	27.00	1.00	25.00	20.80	10.80	154.88	3.77	9.5	9.5	1.0	97.75	2313.29	55	1.0	207.4	3503.66	27.5	9.5	55	10.80	2.38	1.14	170.6	1027.9	6844.9	424.3	6241.2	**2737.94**	**2080.41**
27.50	29.50	28.50	2.00	27.00	20.80	10.80	154.88	7.54	9.5	9.5	1.0	195.50	2508.78	55	1.0	414.9	3918.51	29.5	10.5	56	10.80	2.62	1.36	170.6	1085.5	7512.8	458.2	6885.5	**3005.10**	**2295.17**
29.50	30.00	29.75	0.50	27.50	20.80	10.80	154.88	1.89	10.5	10.5	1.0	54.13	2562.91	56	1.0	105.6	4024.11	30.0	10.5	56	10.50	2.62	1.36	170.6	1085.2	7672.2	466.7	7053.7	**3068.88**	**2351.25**
30.00	32.50	31.25	2.50	30.00	20.50	10.50	154.88	9.43	10.5	10.5	1.0	270.65	2833.56	56	1.0	528.0	4552.11	32.5	11.2	56	10.50	2.82	1.56	170.6	1126.3	8512.0	509.1	7894.8	**3404.81**	**2631.61**
32.50	34.00	33.25	1.50	31.50	20.50	10.50	154.88	5.66	11.2	11.2	1.0	173.49	3007.05	56	1.0	316.8	4868.91	34.0	7.3	60	10.50	1.98	0.80	170.6	999.7	8875.7	534.6	8410.6	**3550.28**	**2803.52**
34.00	35.00	34.50	1.00	32.50	20.50	10.50	154.88	3.77	7.3	7.3	1.0	74.83	3081.88	60	1.0	226.3	5095.20	35.0	7.0	72	8.95	1.93	0.76	170.6	1110.4	9287.4	551.6	8728.6	**3714.98**	**2909.55**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
35.00	35.50	35.25	0.50	33.00	18.95	8.95	154.88	1.89	7.0	7.0	1.0	35.86	3117.74	72	1.0	135.8	5230.97	35.5	7.0	72	10.68	1.93	0.76	170.6	1111.3	9460.0	560.1	8908.8	**3783.99**	**2969.59**
35.50	37.50	36.50	2.00	35.00	20.68	10.68	154.88	7.54	7.0	7.0	1.0	143.44	3261.18	72	1.0	543.1	5774.06	37.5	7.0	72	10.68	1.93	0.76	170.6	1111.3	10146.5	594.0	9629.2	**4058.60**	**3209.75**
37.50	38.50	38.00	1.00	36.00	20.68	10.68	154.88	3.77	7.0	7.0	1.0	71.72	3332.90	72	1.0	271.5	6045.60	38.5	7.0	72	10.12	1.93	0.76	170.6	1111.0	10489.5	611.0	9989.5	**4195.79**	**3329.82**
38.50	40.00	39.25	1.50	37.50	20.12	10.12	154.88	5.66	7.0	7.0	1.0	107.58	3440.48	72	1.0	407.3	6452.91	40.0	11.2	42	10.12	2.82	1.56	170.6	983.4	10876.8	636.4	10529.8	**4350.71**	**3509.94**
BORE NO: P83, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.88	9.88	27.17	1.89	26.8	26.8	1.0	25.88	0	6	1.0	11.3	0	3.0	23.9	0	9.88	9.21	9.67	29.6	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.50	19.88	9.88	34.58	3.77	23.9	23.9	1.0	57.79	0	0	1.0	0.0	0	4.0	24.8	10	10.15	9.86	10.66	39.5	0	0.0	25.5	25.5	**0.00**	**8.49**
4.00	6.00	5.00	2.00	3.50	20.15	10.15	49.67	7.54	24.8	24.8	1.0	173.11	0	10	1.0	75.4	0	6.0	24.2	0	10.15	9.42	10.00	59.8	0	0.0	59.4	59.4	**0.00**	**19.80**
6.00	7.00	6.50	1.00	4.50	20.15	10.15	64.90	3.77	24.2	24.2	1.0	109.99	0	0	1.0	0.0	0	7.0	24.2	0	10.15	9.42	10.00	70.0	0	0.0	76.4	76.4	**0.00**	**25.46**
7.00	8.00	7.50	1.00	5.50	20.15	10.15	75.05	3.77	24.2	24.2	1.0	127.20	0	0	1.0	0.0	0	8.0	28.6	0	9.80	18.11	19.17	80.1	0	0.0	93.3	93.3	**0.00**	**31.11**
8.00	9.00	8.50	1.00	6.50	19.80	9.80	85.02	3.77	28.6	28.6	1.0	174.82	0	0	1.0	0.0	0	9.0	8.9	58	9.80	2.27	1.05	89.9	828.7	828.7	110.3	110.3	**331.50**	**36.77**
9.00	10.00	9.50	1.00	7.50	19.80	9.80	94.82	3.77	8.9	8.9	1.0	56.00	56.00	58	1.0	218.7	218.74	10.0	8.9	58	10.31	2.27	1.05	99.7	854.3	1129.0	127.3	402.0	**451.62**	**134.01**
10.00	12.50	11.25	2.50	10.00	20.31	10.31	112.61	9.43	8.9	8.9	1.0	166.26	222.26	58	1.0	546.9	765.60	12.5	9.5	52	10.31	2.38	1.14	125.5	875.4	1863.3	169.7	1157.6	**745.32**	**385.86**
12.50	14.00	13.25	1.50	11.50	20.31	10.31	133.23	5.66	9.5	9.5	1.0	126.12	348.39	52	1.0	294.2	1059.77	14.0	9.5	52	10.13	2.38	1.14	141.0	916.9	2325.1	195.2	1603.3	**930.04**	**534.44**
14.00	15.50	14.75	1.50	13.00	20.13	10.13	148.56	5.66	9.5	9.5	1.0	140.64	489.02	52	1.0	294.2	1353.94	15.5	9.5	58	10.13	2.38	1.14	156.2	1019.0	2861.9	220.6	2063.6	**1144.77**	**687.86**
15.50	18.50	17.00	3.00	16.00	20.13	10.13	171.35	11.31	9.5	9.5	1.0	324.43	813.45	58	1.0	656.2	2010.17	18.5	10.2	58	9.79	2.53	1.28	156.2	1045.9	3869.5	271.5	3095.2	**1547.80**	**1031.72**
18.50	21.50	20.00	3.00	19.00	19.79	9.79	171.35	11.31	10.2	10.2	1.0	348.83	1162.28	58	1.0	656.2	2666.40	21.5	10.2	48	9.79	2.53	1.28	156.2	944.0	4772.7	322.5	4151.1	**1909.09**	**1383.71**
21.50	23.00	22.25	1.50	20.50	19.79	9.79	171.35	5.66	10.2	10.2	1.0	174.41	1336.69	48	1.0	271.5	2937.94	23.0	9.6	55	8.40	2.40	1.16	156.2	990.3	5265.0	347.9	4622.5	**2105.99**	**1540.85**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
23.00	24.50	23.75	1.50	22.00	18.40	8.40	171.35	5.66	9.6	9.6	1.0	163.95	1500.65	55	1.0	311.1	3249.09	24.5	9.6	55	8.40	2.40	1.16	156.2	990.3	5740.1	373.4	5123.1	**2296.03**	**1707.70**
24.50	27.50	26.00	3.00	25.00	18.40	8.40	171.35	11.31	9.6	9.6	1.0	327.91	1828.55	55	1.0	622.3	3871.37	27.5	9.6	55	11.35	2.40	1.16	156.2	992.7	6692.6	424.3	6124.2	**2677.03**	**2041.40**
27.50	30.00	28.75	2.50	27.50	21.35	11.35	171.35	9.43	9.6	9.6	1.0	273.26	2101.81	55	1.0	518.6	4389.94	30.0	8.1	62	11.35	2.13	0.93	156.2	1014.5	7506.2	466.7	6958.5	**3002.48**	**2319.49**
30.00	30.50	30.25	0.50	28.00	21.35	11.35	171.35	1.89	8.1	8.1	1.0	45.99	2147.79	62	1.0	116.9	4506.86	30.5	15.3	49	11.35	4.09	2.81	156.2	1242.8	7897.5	475.2	7129.9	**3158.99**	**2376.62**
30.50	32.00	31.25	1.50	29.50	21.35	11.35	171.35	5.66	15.3	15.3	1.0	265.18	2412.98	49	1.0	277.2	4784.06	32.0	13.8	49	11.35	3.59	2.31	156.2	1151.0	8348.0	500.7	7697.7	**3339.22**	**2565.90**
32.00	32.50	32.25	0.50	30.00	21.35	11.35	171.35	1.89	13.8	13.8	1.0	79.37	2492.34	49	1.0	92.4	4876.46	32.5	13.8	49	10.60	3.59	2.31	156.2	1149.8	8518.6	509.1	7877.9	**3407.45**	**2625.98**
32.50	33.50	33.00	1.00	31.00	20.60	10.60	171.35	3.77	13.8	13.8	1.0	158.73	2651.07	49	1.0	184.8	5061.26	33.5	13.8	49	10.60	3.59	2.31	156.2	1149.8	8862.2	526.1	8238.4	**3544.87**	**2746.15**
33.50	35.00	34.25	1.50	32.50	20.60	10.60	171.35	5.66	13.8	13.8	1.0	238.10	2889.17	49	1.0	277.2	5338.46	35.0	12.8	47	10.60	3.29	2.02	156.2	1074.7	9302.3	551.6	8779.2	**3720.93**	**2926.40**
35.00	36.50	35.75	1.50	34.00	20.60	10.60	171.35	5.66	12.8	12.8	1.0	220.23	3109.40	47	1.0	265.9	5604.34	36.5	12.8	47	10.60	3.29	2.02	156.2	1074.7	9788.4	577.0	9290.8	**3915.37**	**3096.92**
36.50	37.50	37.00	1.00	35.00	20.60	10.60	171.35	3.77	12.8	12.8	1.0	146.82	3256.22	47	1.0	177.3	5781.60	37.5	12.0	38	10.60	3.06	1.79	156.2	940.1	9977.9	594.0	9631.8	**3991.18**	**3210.61**
37.50	38.00	37.75	0.50	35.50	20.60	10.60	171.35	1.89	12.0	12.0	1.0	68.68	3324.90	38	1.0	71.7	5853.26	38.0	12.0	38	9.30	3.06	1.79	156.2	938.5	10116.7	602.5	9780.6	**4046.68**	**3260.22**
38.00	40.00	39.00	2.00	37.50	19.30	9.30	171.35	7.54	12.0	12.0	1.0	274.72	3599.63	38	1.0	286.6	6139.89	40.0	12.0	38	9.30	3.06	1.79	156.2	938.5	10678.1	636.4	10375.9	**4271.22**	**3458.65**
BORE NO: P84, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.99	9.99	27.47	1.89	26.5	26.5	1.0	25.83	25.83	8	1.0	15.1	15.09	3.0	25.0	10	9.99	10.00	10.88	30.0	514.7	555.6	8.5	49.4	**222.25**	**16.47**
3.00	4.00	3.50	1.00	1.50	19.99	9.99	34.97	3.77	25.0	25.0	1.0	61.49	87.32	10	1.0	37.7	52.80	4.0	25.0	10	9.99	10.00	10.88	40.0	627.7	767.9	25.5	165.6	**307.14**	**55.19**
4.00	5.00	4.50	1.00	2.50	19.99	9.99	44.96	3.77	25.0	25.0	1.0	79.06	166.38	10	1.0	37.7	90.51	5.0	25.0	10	9.91	10.00	10.88	50.0	740.2	997.1	42.4	299.3	**398.83**	**99.77**
5.00	6.00	5.50	1.00	3.50	19.91	9.91	54.91	3.77	25.0	25.0	1.0	96.56	262.94	10	1.0	37.7	128.23	6.0	25.0	10	9.91	10.00	10.88	59.9	852.3	1243.5	59.4	450.6	**497.39**	**150.19**
6.00	7.00	6.50	1.00	4.50	19.91	9.91	64.82	3.77	25.0	25.0	1.0	113.99	376.93	10	1.0	37.7	165.94	7.0	10.2	45	10.13	2.53	1.28	69.8	666.6	1209.5	76.4	619.2	**483.80**	**206.41**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
7.00	9.00	8.00	2.00	6.50	20.13	10.13	79.90	7.54	10.2	10.2	1.0	108.44	485.36	45	1.0	339.4	505.37	9.0	10.2	45	10.13	2.53	1.28	90.0	724.6	1715.3	110.3	1101.0	**686.13**	**367.02**
9.00	10.00	9.50	1.00	7.50	20.13	10.13	95.10	3.77	10.2	10.2	1.0	64.53	549.89	45	1.0	169.7	675.09	10.0	10.2	45	10.13	2.53	1.28	100.2	753.6	1978.6	127.3	1352.3	**791.43**	**450.76**
10.00	11.00	10.50	1.00	8.50	20.13	10.13	105.23	3.77	10.2	10.2	1.0	71.40	621.30	45	1.0	169.7	844.80	11.0	27.0	0	9.90	14.50	15.49	110.3	1914.0	3380.0	144.3	1610.4	**1352.02**	**536.79**
11.00	12.50	11.75	1.50	10.00	19.90	9.90	117.72	5.66	27.0	27.0	1.0	339.31	960.61	0	1.0	0.0	844.80	12.5	27.0	0	10.09	14.50	15.49	125.1	2159.6	3965.0	169.7	1975.1	**1586.02**	**658.37**
12.50	15.50	14.00	3.00	13.00	20.09	10.09	140.28	11.31	27.0	27.0	1.0	808.67	1769.28	0	1.0	0.0	844.80	15.5	8.5	65	10.09	2.20	0.99	155.4	1055.5	3669.6	220.6	2834.7	**1467.83**	**944.90**
15.50	17.00	16.25	1.50	14.50	20.09	10.09	162.98	5.66	8.5	8.5	1.0	137.79	1907.07	65	1.0	367.7	1212.51	17.0	26.7	0	8.11	13.83	14.80	170.5	2749.8	5869.3	246.1	3365.7	**2347.74**	**1121.89**
17.00	18.50	17.75	1.50	16.00	18.11	8.11	176.63	5.66	26.7	26.7	1.0	502.55	2409.62	0	1.0	0.0	1212.51	18.5	26.7	0	8.11	13.83	14.80	170.5	2749.8	6371.9	271.5	3893.7	**2548.76**	**1297.89**
18.50	20.00	19.25	1.50	17.50	18.11	8.11	176.63	5.66	26.7	26.7	1.0	502.55	2912.17	0	1.0	0.0	1212.51	20.0	10.5	56	8.11	2.62	1.36	170.5	1082.7	5207.4	297.0	4421.7	**2082.96**	**1473.89**
20.00	21.50	20.75	1.50	19.00	18.11	8.11	176.63	5.66	10.5	10.5	1.0	185.19	3097.36	56	1.0	316.8	1529.31	21.5	9.5	56	10.24	2.38	1.14	170.5	1037.4	5664.1	322.5	4949.1	**2265.64**	**1649.71**
21.50	24.50	23.00	3.00	22.00	20.24	10.24	176.63	11.31	9.5	9.5	1.0	334.42	3431.78	56	1.0	633.6	2162.91	24.5	16.2	41	10.24	4.53	3.31	170.5	1314.7	6909.4	373.4	5968.1	**2763.75**	**1989.36**
24.50	26.00	25.25	1.50	23.50	20.24	10.24	176.63	5.66	16.2	16.2	1.0	290.30	3722.08	41	1.0	231.9	2394.86	26.0	8.5	49	10.24	2.20	0.99	170.5	930.3	7047.3	398.8	6515.8	**2818.91**	**2171.92**
26.00	27.50	26.75	1.50	25.00	20.24	10.24	176.63	5.66	8.5	8.5	1.0	149.33	3871.41	49	1.0	277.2	2672.06	27.5	29.0	0	10.64	19.01	20.10	170.5	3812.9	10356.3	424.3	6967.8	**4142.53**	**2322.58**
27.50	29.00	28.25	1.50	26.50	20.64	10.64	176.63	5.66	29.0	29.0	1.0	553.87	4425.28	0	1.0	0.0	2672.06	29.0	29.0	0	10.64	19.01	20.10	170.5	3812.9	10910.2	449.7	7547.1	**4364.08**	**2515.69**
29.00	30.00	29.50	1.00	27.50	20.64	10.64	176.63	3.77	29.0	29.0	1.0	369.25	4794.53	0	1.0	0.0	2672.06	30.0	29.0	0	10.64	19.01	20.10	170.5	3812.9	11279.4	466.7	7933.3	**4511.78**	**2644.43**
30.00	30.50	30.25	0.50	28.00	20.64	10.64	176.63	1.89	29.0	29.0	1.0	184.62	4979.15	0	1.0	0.0	2672.06	30.5	29.0	0	10.64	19.01	20.10	170.5	3812.9	11464.1	475.2	8126.4	**4585.62**	**2708.80**
30.50	32.00	31.25	1.50	29.50	20.64	10.64	176.63	5.66	29.0	29.0	1.0	553.87	5533.02	0	1.0	0.0	2672.06	32.0	28.7	0	10.64	18.33	19.40	170.5	3677.5	11882.6	500.7	8705.7	**4753.03**	**2901.91**
32.00	32.50	32.25	0.50	30.00	20.64	10.64	176.63	1.89	28.7	28.7	1.0	182.35	5715.37	0	1.0	0.0	2672.06	32.5	28.7	0	10.43	18.33	19.40	170.5	3674.7	12062.2	509.1	8896.6	**4824.87**	**2965.52**
32.50	33.50	33.00	1.00	31.00	20.43	10.43	176.63	3.77	28.7	28.7	1.0	364.70	6080.07	0	1.0	0.0	2672.06	33.5	28.7	0	10.43	18.33	19.40	170.5	3674.7	12426.9	526.1	9278.2	**4970.75**	**3092.75**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
33.50	35.00	34.25	1.50	32.50	20.43	10.43	176.63	5.66	28.7	28.7	1.0	547.05	6627.12	0	1.0	0.0	2672.06	35.0	28.7	0	10.43	18.33	19.40	170.5	3674.7	12973.9	551.6	9850.7	**5189.57**	**3283.58**
35.00	36.50	35.75	1.50	34.00	20.43	10.43	176.63	5.66	28.7	28.7	1.0	547.05	7174.17	0	1.0	0.0	2672.06	36.5	28.7	0	10.43	18.33	19.40	170.5	3674.7	13521.0	577.0	10423.3	**5408.39**	**3474.42**
36.50	37.50	37.00	1.00	35.00	20.43	10.43	176.63	3.77	28.7	28.7	1.0	364.70	7538.87	0	1.0	0.0	2672.06	37.5	28.7	0	10.43	18.33	19.40	170.5	3674.7	13885.7	594.0	10804.9	**5554.27**	**3601.64**
37.50	40.00	38.75	2.50	37.50	20.43	10.43	176.63	9.43	28.7	28.7	1.0	911.75	8450.62	0	1.0	0.0	2672.06	40.0	28.7	0	10.43	18.33	19.40	170.5	3674.7	14797.4	636.4	11759.1	**5918.97**	**3919.70**
BORE NO: P85, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.45	9.45	25.99	1.89	13.3	13.3	1.0	11.58	0	27	1.0	50.9	0	3.0	13.3	27	9.45	3.44	2.16	28.4	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.50	19.45	9.45	33.08	3.77	13.3	13.3	1.0	29.49	0	27	1.0	101.8	0	4.0	12.4	46	9.45	3.17	1.91	37.8	0	0.0	25.5	25.5	**0.00**	**8.49**
4.00	5.00	4.50	1.00	2.50	19.45	9.45	42.53	3.77	12.4	12.4	1.0	35.26	0	46	1.0	173.5	0	5.0	14.3	22	9.00	3.74	2.45	47.3	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.50	19.00	9.00	51.75	3.77	14.3	14.3	1.0	49.75	0	22	1.0	83.0	0	6.0	14.3	22	9.00	3.74	2.45	56.3	0	0.0	59.4	59.4	**0.00**	**19.80**
6.00	7.00	6.50	1.00	4.50	19.00	9.00	60.75	3.77	14.3	14.3	1.0	58.40	0	22	1.0	83.0	0	7.0	28.5	3	9.00	17.88	18.94	65.3	0	0.0	76.4	76.4	**0.00**	**25.46**
7.00	8.00	7.50	1.00	5.50	19.00	9.00	69.75	3.77	28.5	28.5	1.0	142.83	0	3	1.0	11.3	0	8.0	24.5	13	9.00	9.64	10.33	74.3	1005.3	1005.3	93.3	93.3	**402.14**	**31.11**
8.00	9.00	8.50	1.00	6.50	19.00	9.00	78.75	3.77	24.5	24.5	1.0	135.35	135.35	13	1.0	49.0	49.03	9.0	24.5	13	9.00	9.64	10.33	83.3	1103.5	1287.9	110.3	294.7	**515.15**	**98.23**
9.00	10.00	9.50	1.00	7.50	19.00	9.00	87.75	3.77	24.5	24.5	1.0	150.82	286.17	13	1.0	49.0	98.06	10.0	24.5	13	9.90	9.64	10.33	92.3	1208.0	1592.2	127.3	511.5	**636.88**	**170.50**
10.00	11.00	10.50	1.00	8.50	19.90	9.90	97.20	3.77	24.5	24.5	1.0	167.06	453.23	13	1.0	49.0	147.09	11.0	24.5	13	9.90	9.64	10.33	102.2	1316.0	1916.3	144.3	744.6	**766.51**	**248.19**
11.00	12.00	11.50	1.00	9.50	19.90	9.90	107.10	3.77	24.5	24.5	1.0	184.08	637.31	13	1.0	49.0	196.11	12.0	26.5	15	9.70	13.38	14.34	112.1	1943.1	2776.6	161.2	994.7	**1110.63**	**331.55**
12.00	14.50	13.25	2.50	12.00	19.70	9.70	124.18	9.43	26.5	26.5	1.0	583.74	1221.04	15	1.0	141.4	337.54	14.5	26.5	15	9.70	13.38	14.34	136.3	2310.2	3868.8	203.7	1762.2	**1547.51**	**587.41**
14.50	16.00	15.25	1.50	13.50	19.70	9.70	143.58	5.66	26.5	26.5	1.0	404.96	1626.00	15	1.0	84.9	422.40	16.0	10.2	46	10.90	2.53	1.28	150.9	909.5	2957.9	229.1	2277.5	**1183.15**	**759.17**
16.00	17.50	16.75	1.50	15.00	20.90	10.90	159.03	5.66	10.2	10.2	1.0	161.87	1787.87	46	1.0	260.2	682.63	17.5	11.5	46	10.40	2.91	1.65	167.2	1030.7	3501.2	254.6	2725.1	**1400.50**	**908.36**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	N_γ	q	Qb					
17.50	20.50	19.00	3.00	18.00	20.40	10.40	159.03	11.31	11.5	11.5	1.0	366.06	2153.94	46	1.0	520.5	1203.09	20.5	10.6	54	10.70	2.65	1.39	167.2	1060.6	4417.6	305.5	3662.5	**1767.05**	**1220.84**
20.50	23.50	22.00	3.00	21.00	20.70	10.70	159.03	11.31	10.6	10.6	1.0	336.72	2490.66	54	1.0	611.0	1814.06	23.5	10.6	54	9.80	2.65	1.39	167.2	1059.8	5364.5	356.4	4661.1	**2145.79**	**1553.70**
23.50	26.50	25.00	3.00	24.00	19.80	9.80	159.03	11.31	10.6	10.6	1.0	336.72	2827.38	54	1.0	611.0	2425.03	26.5	18.0	40	9.80	5.42	4.29	167.2	1460.5	6712.9	407.3	5659.7	**2685.14**	**1886.57**
26.50	27.50	27.00	1.00	25.00	19.80	9.80	159.03	3.77	18.0	18.0	1.0	194.87	3022.25	40	1.0	150.9	2575.89	27.5	18.0	40	9.80	5.42	4.29	167.2	1460.5	7058.6	424.3	6022.4	**2823.43**	**2007.47**
27.50	28.00	27.75	0.50	25.50	19.80	9.80	159.03	1.89	18.0	18.0	1.0	97.44	3119.68	40	1.0	75.4	2651.31	28.0	8.5	60	11.02	2.20	0.99	167.2	1034.6	6805.6	432.8	6203.8	**2722.22**	**2067.92**
28.00	29.50	28.75	1.50	27.00	21.02	11.02	159.03	5.66	8.5	8.5	1.0	134.45	3254.13	60	1.0	339.4	2990.74	29.5	8.5	60	11.02	2.20	0.99	167.2	1034.6	7279.4	458.2	6703.1	**2911.77**	**2234.37**
29.50	30.00	29.75	0.50	27.50	21.02	11.02	159.03	1.89	8.5	8.5	1.0	44.82	3298.95	60	1.0	113.1	3103.89	30.0	8.5	60	11.02	2.20	0.99	167.2	1034.6	7437.4	466.7	6869.6	**2974.96**	**2289.85**
30.00	31.00	30.50	1.00	28.50	21.02	11.02	159.03	3.77	8.5	8.5	1.0	89.63	3388.58	60	1.0	226.3	3330.17	31.0	9.0	40	11.02	2.29	1.07	167.2	848.5	7567.3	483.7	7202.4	**3026.90**	**2400.81**
31.00	32.50	31.75	1.50	30.00	21.02	11.02	159.03	5.66	9.0	9.0	1.0	142.49	3531.07	40	1.0	226.3	3556.46	32.5	9.1	44	9.90	2.31	1.08	167.2	891.9	7979.5	509.1	7596.7	**3191.78**	**2532.22**
32.50	35.00	33.75	2.50	32.50	19.90	9.90	159.03	9.43	9.1	9.1	1.0	240.16	3771.23	44	1.0	414.9	3971.31	35.0	9.1	44	9.90	2.31	1.08	167.2	891.9	8634.5	551.6	8294.1	**3453.79**	**2764.71**
35.00	35.50	35.25	0.50	33.00	19.90	9.90	159.03	1.89	9.1	9.1	1.0	48.03	3819.27	44	1.0	83.0	4054.29	35.5	21.0	26	9.90	7.12	6.49	167.2	1655.3	9528.8	560.1	8433.6	**3811.53**	**2811.20**
35.50	37.00	36.25	1.50	34.50	19.90	9.90	159.03	5.66	21.0	21.0	1.0	345.33	4164.60	26	1.0	147.1	4201.37	37.0	11.5	44	9.90	2.91	1.65	167.2	1009.8	9375.8	585.5	8951.5	**3750.32**	**2983.83**
37.00	37.50	37.25	0.50	35.00	19.90	9.90	159.03	1.89	11.5	11.5	1.0	61.01	4225.61	44	1.0	83.0	4284.34	37.5	11.5	44	8.60	2.91	1.65	167.2	1008.4	9518.3	594.0	9104.0	**3807.33**	**3034.65**
37.50	38.50	38.00	1.00	36.00	18.60	8.60	159.03	3.77	11.5	11.5	1.0	122.02	4347.63	44	1.0	165.9	4450.29	38.5	9.5	56	9.43	2.38	1.14	167.2	1027.8	9825.7	611.0	9408.9	**3930.28**	**3136.30**
38.50	40.00	39.25	1.50	37.50	19.43	9.43	159.03	5.66	9.5	9.5	1.0	150.55	4498.18	56	1.0	316.8	4767.09	40.0	9.5	56	9.43	2.38	1.14	167.2	1027.8	10293.1	636.4	9901.7	**4117.22**	**3300.56**
BORE NO: P86, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.64	9.64	26.51	1.89	11.8	11.8	1.0	10.44	0	24	1.0	45.3	0	3.0	25.7	8	9.64	11.58	12.49	28.9	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.50	19.64	9.64	33.74	3.77	25.7	25.7	1.0	61.24	0	8	1.0	30.2	0	4.0	25.7	8	9.64	11.58	12.49	38.6	0	0.0	25.5	25.5	**0.00**	**8.49**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
4.00	6.00	5.00	2.00	3.50	19.64	9.64	48.20	7.54	25.7	25.7	1.0	174.97	0	8	1.0	60.3	0	6.0	25.5	10	9.64	11.13	12.03	57.8	908.7	908.7	59.4	59.4	**363.47**	**19.80**
6.00	7.00	6.50	1.00	4.50	19.64	9.64	62.66	3.77	25.5	25.5	1.0	112.72	112.72	10	1.0	37.7	37.71	7.0	25.5	10	9.64	11.13	12.03	67.5	1030.0	1180.5	76.4	226.8	**472.18**	**75.60**
7.00	8.00	7.50	1.00	5.50	19.64	9.64	72.30	3.77	25.5	25.5	1.0	130.06	242.78	10	1.0	37.7	75.43	8.0	25.5	10	9.68	11.13	12.03	77.1	1151.7	1469.9	93.3	411.5	**587.96**	**137.18**
8.00	9.00	8.50	1.00	6.50	19.68	9.68	81.96	3.77	25.5	25.5	1.0	147.44	390.21	10	1.0	37.7	113.14	9.0	25.2	11	9.68	10.45	11.34	86.8	1212.8	1716.2	110.3	613.7	**686.48**	**204.56**
9.00	10.00	9.50	1.00	7.50	19.68	9.68	91.64	3.77	25.2	25.2	1.0	162.63	552.85	11	1.0	41.5	154.63	10.0	25.5	10	9.68	11.13	12.03	96.5	1395.4	2102.9	127.3	834.8	**841.15**	**278.25**
10.00	11.00	10.50	1.00	8.50	19.68	9.68	101.32	3.77	25.5	25.5	1.0	182.26	735.11	10	1.0	37.7	192.34	11.0	25.2	11	8.99	10.45	11.34	106.2	1436.4	2363.9	144.3	1071.7	**945.56**	**357.24**
11.00	12.50	11.75	1.50	10.00	18.99	8.99	112.90	5.66	25.2	25.2	1.0	300.55	1035.66	11	1.0	62.2	254.57	12.5	10.5	51	10.19	2.62	1.36	119.6	883.0	2173.2	169.7	1459.9	**869.30**	**486.65**
12.50	15.50	14.00	3.00	13.00	20.19	10.19	134.93	11.31	10.5	10.5	1.0	282.95	1318.61	51	1.0	577.0	831.60	15.5	10.5	51	10.19	2.62	1.36	150.2	973.5	3123.7	220.6	2370.8	**1249.50**	**790.28**
15.50	17.00	16.25	1.50	14.50	20.19	10.19	157.86	5.66	10.5	10.5	1.0	165.51	1484.12	51	1.0	288.5	1120.11	17.0	27.0	5	9.65	14.50	15.49	165.5	2868.2	5472.5	246.1	2850.3	**2188.99**	**950.11**
17.00	18.50	17.75	1.50	16.00	19.65	9.65	172.74	5.66	27.0	27.0	1.0	497.91	1982.03	5	1.0	28.3	1148.40	18.5	13.5	50	9.65	3.50	2.22	165.5	1179.1	4309.5	271.5	3402.0	**1723.80**	**1133.99**
18.50	21.50	20.00	3.00	19.00	19.65	9.65	172.74	11.31	13.5	13.5	1.0	469.21	2451.24	50	1.0	565.7	1714.11	21.5	13.5	50	10.09	3.50	2.22	165.5	1179.7	5345.1	322.5	4487.8	**2138.03**	**1495.94**
21.50	24.50	23.00	3.00	22.00	20.09	10.09	172.74	11.31	13.5	13.5	1.0	469.21	2920.45	50	1.0	565.7	2279.83	24.5	9.4	53	10.09	2.36	1.13	165.5	989.7	6190.0	373.4	5573.6	**2475.99**	**1857.88**
24.50	26.00	25.25	1.50	23.50	20.09	10.09	172.74	5.66	9.4	9.4	1.0	161.77	3082.22	53	1.0	299.8	2579.66	26.0	27.1	0	8.89	14.73	15.72	165.5	2852.9	8514.8	398.8	6060.7	**3405.91**	**2020.24**
26.00	27.50	26.75	1.50	25.00	18.89	8.89	172.74	5.66	27.1	27.1	1.0	500.06	3582.28	0	1.0	0.0	2579.66	27.5	21.5	0	8.89	7.48	7.04	165.5	1443.1	7605.0	424.3	6586.2	**3042.02**	**2195.41**
27.50	30.00	28.75	2.50	27.50	18.89	8.89	172.74	9.43	21.5	21.5	1.0	641.55	4223.83	0	1.0	0.0	2579.66	30.0	21.5	0	9.32	7.48	7.04	165.5	1445.2	8248.7	466.7	7270.2	**3299.46**	**2423.40**
30.00	30.50	30.25	0.50	28.00	19.32	9.32	172.74	1.89	21.5	21.5	1.0	128.31	4352.14	0	1.0	0.0	2579.66	30.5	28.5	0	10.55	17.88	18.94	165.5	3484.0	10415.8	475.2	7407.0	**4166.34**	**2469.00**
30.50	32.00	31.25	1.50	29.50	20.55	10.55	172.74	5.66	28.5	28.5	1.0	530.58	4882.72	0	1.0	0.0	2579.66	32.0	14.5	54	10.55	3.80	2.51	165.5	1278.4	8740.8	500.7	7963.0	**3496.33**	**2654.34**
32.00	32.50	32.25	0.50	30.00	20.55	10.55	172.74	1.89	14.5	14.5	1.0	84.24	4966.96	54	1.0	101.8	2681.49	32.5	14.5	54	10.55	3.80	2.51	165.5	1278.4	8926.9	509.1	8157.6	**3570.76**	**2719.20**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	N_γ	q	Qb					
32.50	33.50	33.00	1.00	31.00	20.55	10.55	172.74	3.77	14.5	14.5	1.0	168.48	5135.44	54	1.0	203.7	2885.14	33.5	9.3	67	10.55	2.34	1.11	165.5	1129.1	9149.7	526.1	8546.7	**3659.89**	**2848.90**
33.50	35.00	34.25	1.50	32.50	20.55	10.55	172.74	5.66	9.3	9.3	1.0	160.02	5295.46	67	1.0	379.0	3264.17	35.0	9.3	67	10.55	2.34	1.11	165.5	1129.1	9688.8	551.6	9111.2	**3875.51**	**3037.07**
35.00	36.50	35.75	1.50	34.00	20.55	10.55	172.74	5.66	9.3	9.3	1.0	160.02	5455.48	67	1.0	379.0	3643.20	36.5	13.1	49	10.55	3.38	2.11	165.5	1147.0	10245.6	577.0	9675.7	**4098.26**	**3225.24**
36.50	37.50	37.00	1.00	35.00	20.55	10.55	172.74	3.77	13.1	13.1	1.0	151.60	5607.08	49	1.0	184.8	3828.00	37.5	13.1	49	10.81	3.38	2.11	165.5	1147.3	10582.4	594.0	10029.1	**4232.97**	**3343.03**
37.50	40.00	38.75	2.50	37.50	20.81	10.81	172.74	9.43	13.1	13.1	1.0	379.00	5986.09	49	1.0	462.0	4290.00	40.0	13.1	49	10.81	3.38	2.11	165.5	1147.3	11423.4	636.4	10912.5	**4569.37**	**3637.51**
BORE NO: P87, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	20.05	10.05	27.64	1.89	12.5	12.5	1.0	11.55	0	51	1.0	96.2	0	3.0	13.5	12	10.05	3.50	2.22	30.2	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.50	20.05	10.05	35.18	3.77	13.5	13.5	1.0	31.85	0	12	1.0	45.3	0	4.0	27.5	4	9.59	15.63	16.64	40.2	0	0.0	25.5	25.5	**0.00**	**8.49**
4.00	5.00	4.50	1.00	2.50	19.59	9.59	45.00	3.77	27.5	27.5	1.0	88.34	0	4	1.0	15.1	0	5.0	29.0	0	9.59	19.01	20.10	49.8	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.50	19.59	9.59	54.59	3.77	29.0	29.0	1.0	114.11	0	0	1.0	0.0	0	6.0	29.0	0	9.88	19.01	20.10	59.4	0	0.0	59.4	59.4	**0.00**	**19.80**
6.00	8.00	7.00	2.00	5.50	19.88	9.88	69.26	7.54	29.0	29.0	1.0	289.58	0	0	1.0	0.0	0	8.0	17.5	68	9.88	5.17	4.02	79.1	1182.3	1182.3	93.3	93.3	**472.93**	**31.11**
8.00	9.00	8.50	1.00	6.50	19.88	9.88	84.08	3.77	17.5	17.5	1.0	99.98	99.98	68	1.0	256.5	256.46	9.0	15.0	30	9.88	3.94	2.65	89.0	720.1	1076.5	110.3	466.8	**430.61**	**155.58**
9.00	10.00	9.50	1.00	7.50	19.88	9.88	93.96	3.77	15.0	15.0	1.0	94.95	194.93	30	1.0	113.1	369.60	10.0	25.6	0	9.88	11.35	12.26	98.9	1352.4	1917.0	127.3	691.8	**766.78**	**230.61**
10.00	11.00	10.50	1.00	8.50	19.88	9.88	103.84	3.77	25.6	25.6	1.0	187.64	382.57	0	1.0	0.0	369.60	11.0	11.5	53	9.79	2.91	1.65	108.8	908.9	1661.1	144.3	896.4	**664.44**	**298.81**
11.00	12.00	11.50	1.00	9.50	19.79	9.79	113.68	3.77	11.5	11.5	1.0	87.22	469.79	53	1.0	199.9	569.49	12.0	9.0	72	9.79	2.29	1.07	118.6	1047.5	2086.7	161.2	1200.5	**834.70**	**400.17**
12.00	13.00	12.50	1.00	10.50	19.79	9.79	123.47	3.77	9.0	9.0	1.0	73.75	543.54	72	1.0	271.5	841.03	13.0	11.5	53	9.79	2.91	1.65	128.4	973.4	2358.0	178.2	1562.8	**943.19**	**520.92**
13.00	14.50	13.75	1.50	12.00	19.79	9.79	135.70	5.66	11.5	11.5	1.0	156.19	699.73	53	1.0	299.8	1140.86	14.5	11.5	53	9.79	2.91	1.65	143.0	1021.8	2862.4	203.7	2044.2	**1144.95**	**681.41**
14.50	16.00	15.25	1.50	13.50	19.79	9.79	150.39	5.66	11.5	11.5	1.0	173.09	872.82	53	1.0	299.8	1440.69	16.0	26.8	0	9.46	14.05	15.03	157.7	2604.5	4918.0	229.1	2542.6	**1967.20**	**847.54**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
16.00	17.50	16.75	1.50	15.00	19.46	9.46	164.83	5.66	26.8	26.8	1.0	471.01	1343.83	0	1.0	0.0	1440.69	17.5	9.5	56	11.05	2.38	1.14	171.9	1041.8	3826.3	254.6	3039.1	**1530.51**	**1013.03**
17.50	20.50	19.00	3.00	18.00	21.05	11.05	164.83	11.31	9.5	9.5	1.0	312.07	1655.90	56	1.0	633.6	2074.29	20.5	9.5	56	11.05	2.38	1.14	171.9	1041.8	4771.9	305.5	4035.7	**1908.78**	**1345.22**
20.50	22.00	21.25	1.50	19.50	21.05	11.05	164.83	5.66	9.5	9.5	1.0	156.04	1811.94	56	1.0	316.8	2391.09	22.0	11.5	42	10.00	2.91	1.65	171.9	1005.1	5208.1	330.9	4534.0	**2083.25**	**1511.32**
22.00	23.50	22.75	1.50	21.00	20.00	10.00	164.83	5.66	11.5	11.5	1.0	189.71	2001.65	42	1.0	237.6	2628.69	23.5	11.0	68	10.00	2.76	1.51	171.9	1240.3	5870.6	356.4	4986.7	**2348.25**	**1662.24**
23.50	25.00	24.25	1.50	22.50	20.00	10.00	164.83	5.66	11.0	11.0	1.0	181.25	2182.89	68	1.0	384.7	3013.37	25.0	26.5	0	9.48	13.38	14.34	171.9	2694.5	7890.7	381.9	5578.1	**3156.29**	**1859.37**
25.00	26.50	25.75	1.50	24.00	19.48	9.48	164.83	5.66	26.5	26.5	1.0	464.90	2647.79	0	1.0	0.0	3013.37	26.5	26.0	0	9.48	12.25	13.18	171.9	2468.0	8129.2	407.3	6068.5	**3251.68**	**2022.83**
26.50	27.50	27.00	1.00	25.00	19.48	9.48	164.83	3.77	26.0	26.0	1.0	303.19	2950.98	0	1.0	0.0	3013.37	27.5	26.0	0	9.48	12.25	13.18	171.9	2468.0	8432.4	424.3	6388.6	**3372.95**	**2129.54**
27.50	29.50	28.50	2.00	27.00	19.48	9.48	164.83	7.54	26.0	26.0	1.0	606.37	3557.35	0	1.0	0.0	3013.37	29.5	19.4	26	10.50	6.08	5.06	171.9	1483.6	8054.4	458.2	7029.0	**3221.74**	**2342.98**
29.50	30.00	29.75	0.50	27.50	20.50	10.50	164.83	1.89	19.4	19.4	1.0	109.45	3666.81	26	1.0	49.0	3062.40	30.0	29.0	0	10.50	19.01	20.10	171.9	3840.5	10569.7	466.7	7195.9	**4227.89**	**2398.64**
30.00	32.50	31.25	2.50	30.00	20.50	10.50	164.83	9.43	29.0	29.0	1.0	861.43	4528.24	0	1.0	0.0	3062.40	32.5	29.0	0	10.50	19.01	20.10	171.9	3840.5	11431.2	509.1	8099.8	**4572.46**	**2699.93**
32.50	35.00	33.75	2.50	32.50	20.50	10.50	164.83	9.43	29.0	29.0	1.0	861.43	5389.67	0	1.0	0.0	3062.40	35.0	28.7	0	10.75	18.33	19.40	171.9	3707.5	12159.5	551.6	9003.6	**4863.82**	**3001.21**
35.00	35.50	35.25	0.50	33.00	20.75	10.75	164.83	1.89	28.7	28.7	1.0	170.17	5559.83	0	1.0	0.0	3062.40	35.5	28.7	0	10.75	18.33	19.40	171.9	3707.5	12329.7	560.1	9182.3	**4931.88**	**3060.76**
35.50	37.50	36.50	2.00	35.00	20.75	10.75	164.83	7.54	28.7	28.7	1.0	680.66	6240.49	0	1.0	0.0	3062.40	37.5	28.7	0	10.75	18.33	19.40	171.9	3707.5	13010.4	594.0	9896.9	**5204.15**	**3298.96**
37.50	38.50	38.00	1.00	36.00	20.75	10.75	164.83	3.77	28.7	28.7	1.0	340.33	6580.82	0	1.0	0.0	3062.40	38.5	28.7	0	10.75	18.33	19.40	171.9	3707.5	13350.7	611.0	10254.2	**5340.28**	**3418.07**
38.50	40.00	39.25	1.50	37.50	20.75	10.75	164.83	5.66	28.7	28.7	1.0	510.50	7091.32	0	1.0	0.0	3062.40	40.0	28.7	0	10.75	18.33	19.40	171.9	3707.5	13861.2	636.4	10790.1	**5544.48**	**3596.72**
BORE NO: P88, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.90	9.90	27.23	1.89	24.2	24.2	1.0	23.07	0	18	1.0	33.9	0	3.0	26.6	0	9.90	13.60	14.57	29.7	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.50	19.90	9.90	34.65	3.77	26.6	26.6	1.0	65.44	0	0	1.0	0.0	0	4.0	23.6	16	8.85	8.99	9.34	39.6	621.9	621.9	25.5	25.5	**248.78**	**8.49**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
4.00	6.00	5.00	2.00	3.50	18.85	8.85	48.45	7.54	23.6	23.6	1.0	159.66	159.66	16	1.0	120.7	120.69	6.0	23.6	16	8.85	8.99	9.34	57.3	802.0	1082.4	59.4	339.7	**432.95**	**113.25**
6.00	7.00	6.50	1.00	4.50	18.85	8.85	61.73	3.77	23.6	23.6	1.0	101.70	261.37	16	1.0	60.3	181.03	7.0	9.8	58	8.85	2.43	1.19	66.2	779.9	1222.3	76.4	518.8	**488.93**	**172.92**
7.00	9.00	8.00	2.00	6.50	18.85	8.85	75.00	7.54	9.8	9.8	1.0	97.72	359.08	58	1.0	437.5	618.51	9.0	27.9	0	10.70	16.53	17.56	83.9	1695.8	2673.4	110.3	1087.9	**1069.37**	**362.64**
9.00	10.00	9.50	1.00	7.50	20.70	10.70	89.20	3.77	27.9	27.9	1.0	178.12	537.20	0	1.0	0.0	618.51	10.0	27.9	0	10.70	16.53	17.56	94.6	1895.9	3051.7	127.3	1283.0	**1220.66**	**427.67**
10.00	11.00	10.50	1.00	8.50	20.70	10.70	99.90	3.77	27.9	27.9	1.0	199.49	736.69	0	1.0	0.0	618.51	11.0	25.3	16	10.70	10.68	11.57	105.3	1518.3	2873.5	144.3	1499.5	**1149.38**	**499.82**
11.00	12.50	11.75	1.50	10.00	20.70	10.70	113.28	5.66	25.3	25.3	1.0	302.91	1039.60	16	1.0	90.5	709.03	12.5	25.3	16	10.80	10.68	11.57	121.3	1712.9	3461.5	169.7	1918.3	**1384.61**	**639.45**
12.50	15.50	14.00	3.00	13.00	20.80	10.80	137.50	11.31	25.3	25.3	1.0	735.38	1774.98	16	1.0	181.0	890.06	15.5	25.9	15	10.80	12.03	12.95	153.7	2339.2	5004.2	220.6	2885.7	**2001.68**	**961.89**
15.50	18.50	17.00	3.00	16.00	20.80	10.80	169.90	11.31	25.9	25.9	1.0	933.42	2708.40	15	1.0	169.7	1059.77	18.5	25.9	15	10.85	12.03	12.95	153.7	2339.6	6107.8	271.5	4039.7	**2443.11**	**1346.57**
18.50	21.50	20.00	3.00	19.00	20.85	10.85	169.90	11.31	25.9	25.9	1.0	933.42	3641.82	15	1.0	169.7	1229.49	21.5	9.0	88	10.85	2.29	1.07	153.7	1302.2	6173.5	322.5	5193.8	**2469.39**	**1731.25**
21.50	24.50	23.00	3.00	22.00	20.85	10.85	169.90	11.31	9.0	9.0	1.0	304.46	3946.28	88	1.0	995.7	2225.14	24.5	14.0	67	9.27	3.65	2.36	153.7	1331.9	7503.3	373.4	6544.8	**3001.32**	**2181.60**
24.50	26.00	25.25	1.50	23.50	19.27	9.27	169.90	5.66	14.0	14.0	1.0	239.64	4185.92	67	1.0	379.0	2604.17	26.0	24.5	8	9.27	9.64	10.33	153.7	1822.9	8613.0	398.8	7188.9	**3445.19**	**2396.31**
26.00	27.50	26.75	1.50	25.00	19.27	9.27	169.90	5.66	24.5	24.5	1.0	438.02	4623.94	8	1.0	45.3	2649.43	27.5	13.8	38	9.27	3.59	2.31	153.7	1025.8	8299.1	424.3	7697.7	**3319.66**	**2565.89**
27.50	29.00	28.25	1.50	26.50	19.27	9.27	169.90	5.66	13.8	13.8	1.0	236.08	4860.02	38	1.0	215.0	2864.40	29.0	13.8	38	10.40	3.59	2.31	153.7	1027.5	8752.0	449.7	8174.2	**3500.78**	**2724.72**
29.00	30.00	29.50	1.00	27.50	20.40	10.40	169.90	3.77	13.8	13.8	1.0	157.39	5017.41	38	1.0	143.3	3007.71	30.0	13.8	39	10.40	3.59	2.31	153.7	1037.7	9062.8	466.7	8491.8	**3625.14**	**2830.61**
30.00	30.50	30.25	0.50	28.00	20.40	10.40	169.90	1.89	13.8	13.8	1.0	78.69	5096.10	39	1.0	73.5	3081.26	30.5	13.4	39	10.40	3.47	2.19	153.7	1016.0	9193.4	475.2	8652.6	**3677.36**	**2884.19**
30.50	32.00	31.25	1.50	29.50	20.40	10.40	169.90	5.66	13.4	13.4	1.0	228.98	5325.08	39	1.0	220.6	3301.89	32.0	13.4	40	10.45	3.47	2.19	153.7	1026.3	9653.3	500.7	9127.6	**3861.31**	**3042.54**
32.00	32.50	32.25	0.50	30.00	20.45	10.45	169.90	1.89	13.4	13.4	1.0	76.33	5401.41	40	1.0	75.4	3377.31	32.5	13.4	40	10.45	3.47	2.19	153.7	1026.3	9805.0	509.1	9287.9	**3922.01**	**3095.95**
32.50	33.50	33.00	1.00	31.00	20.45	10.45	169.90	3.77	13.4	13.4	1.0	152.65	5554.06	40	1.0	150.9	3528.17	33.5	16.7	39	10.45	4.78	3.58	153.7	1253.2	10335.4	526.1	9608.3	**4134.16**	**3202.78**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
33.50	35.00	34.25	1.50	32.50	20.45	10.45	169.90	5.66	16.7	16.7	1.0	288.36	5842.42	39	1.0	220.6	3748.80	35.0	28.2	0	10.45	17.21	18.25	153.7	3121.6	12712.9	551.6	10142.8	**5085.14**	**3380.93**
35.00	36.50	35.75	1.50	34.00	20.45	10.45	169.90	5.66	28.2	28.2	1.0	515.36	6357.78	0	1.0	0.0	3748.80	36.5	28.7	0	8.93	18.33	19.40	153.7	3305.6	13412.2	577.0	10683.6	**5364.87**	**3561.20**
36.50	37.50	37.00	1.00	35.00	18.93	8.93	169.90	3.77	28.7	28.7	1.0	350.81	6708.59	0	1.0	0.0	3748.80	37.5	29.2	0	8.93	19.46	20.56	153.7	3508.4	13965.8	594.0	11051.4	**5586.31**	**3683.80**
37.50	40.00	38.75	2.50	37.50	18.93	8.93	169.90	9.43	29.2	29.2	1.0	895.28	7603.87	0	1.0	0.0	3748.80	40.0	12.3	38	8.93	3.15	1.88	153.7	945.4	12298.0	636.4	11989.1	**4919.21**	**3996.37**
BORE NO: P89, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	20.18	10.18	28.00	1.89	11.5	11.5	1.0	10.74	0	47	1.0	88.6	0	3.0	27.5	2	9.52	15.63	16.64	30.5	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	5.00	4.00	2.00	2.50	19.52	9.52	40.06	7.54	27.5	27.5	1.0	157.30	0	2	1.0	15.1	0	5.0	27.5	2	9.52	15.63	16.64	49.6	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.50	19.52	9.52	54.34	3.77	27.5	27.5	1.0	106.68	0	2	1.0	7.5	0	6.0	24.6	0	9.52	9.71	10.44	59.1	0	0.0	59.4	59.4	**0.00**	**19.80**
6.00	7.00	6.50	1.00	4.50	19.52	9.52	63.86	3.77	24.6	24.6	1.0	110.27	0	0	1.0	0.0	0	7.0	23.9	4	9.38	9.21	9.67	68.6	0	0.0	76.4	76.4	**0.00**	**25.46**
7.00	8.00	7.50	1.00	5.50	19.38	9.38	73.31	3.77	23.9	23.9	1.0	122.52	0	4	1.0	15.1	0	8.0	23.9	4	9.38	9.21	9.67	78.0	0	0.0	93.3	93.3	**0.00**	**31.11**
8.00	9.00	8.50	1.00	6.50	19.38	9.38	82.69	3.77	23.9	23.9	1.0	138.20	0	4	1.0	15.1	0	9.0	27.4	5	9.38	15.40	16.41	87.4	1678.4	1678.4	110.3	110.3	**671.35**	**36.77**
9.00	11.00	10.00	2.00	8.50	19.38	9.38	96.76	7.54	27.4	27.4	1.0	378.32	378.32	5	1.0	37.7	37.71	11.0	27.4	5	9.38	15.40	16.41	106.1	2005.3	2421.4	144.3	560.3	**968.55**	**186.76**
11.00	12.00	11.50	1.00	9.50	19.38	9.38	110.83	3.77	27.4	27.4	1.0	216.66	594.98	5	1.0	18.9	56.57	12.0	9.0	57	9.38	2.29	1.07	115.5	886.5	1538.1	161.2	812.8	**615.23**	**270.93**
12.00	14.50	13.25	2.50	12.00	19.38	9.38	127.25	9.43	9.0	9.0	1.0	190.02	785.00	57	1.0	537.4	594.00	14.5	9.0	57	9.31	2.29	1.07	139.0	947.2	2326.2	203.7	1582.7	**930.49**	**527.55**
14.50	16.00	15.25	1.50	13.50	19.31	9.31	145.95	5.66	9.0	9.0	1.0	130.77	915.77	57	1.0	322.5	916.46	16.0	28.2	0	9.31	17.21	18.25	152.9	3092.6	4924.8	229.1	2061.3	**1969.94**	**687.12**
16.00	17.50	16.75	1.50	15.00	19.31	9.31	159.92	5.66	28.2	28.2	1.0	485.08	1400.86	0	1.0	0.0	916.46	17.5	15.6	29	9.31	4.24	2.98	166.9	1113.9	3431.2	254.6	2571.9	**1372.48**	**857.30**
17.50	19.00	18.25	1.50	16.50	19.31	9.31	159.92	5.66	15.6	15.6	1.0	252.59	1653.45	29	1.0	164.1	1080.51	19.0	8.2	58	10.07	2.15	0.94	166.9	1002.3	3736.3	280.0	3014.0	**1494.50**	**1004.66**
19.00	20.50	19.75	1.50	18.00	20.07	10.07	159.92	5.66	8.2	8.2	1.0	130.37	1783.81	58	1.0	328.1	1408.63	20.5	8.2	59	10.34	2.15	0.94	166.9	1012.6	4205.1	305.5	3497.9	**1682.04**	**1165.98**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
20.50	23.50	22.00	3.00	21.00	20.34	10.34	159.92	11.31	8.2	8.2	1.0	260.73	2044.55	59	1.0	667.5	2076.17	23.5	9.5	59	10.34	2.38	1.14	166.9	1058.2	5179.0	356.4	4477.1	**2071.58**	**1492.37**
23.50	25.00	24.25	1.50	22.50	20.34	10.34	159.92	5.66	9.5	9.5	1.0	151.39	2195.94	59	1.0	333.8	2409.94	25.0	28.1	0	9.65	16.98	18.02	166.9	3324.7	7930.5	381.9	4987.7	**3172.22**	**1662.58**
25.00	26.50	25.75	1.50	24.00	19.65	9.65	159.92	5.66	28.1	28.1	1.0	483.05	2678.99	0	1.0	0.0	2409.94	26.5	28.1	0	9.65	16.98	18.02	166.9	3324.7	8413.6	407.3	5496.2	**3365.44**	**1832.08**
26.50	27.50	27.00	1.00	25.00	19.65	9.65	159.92	3.77	28.1	28.1	1.0	322.03	3001.02	0	1.0	0.0	2409.94	27.5	28.1	0	9.65	16.98	18.02	166.9	3324.7	8735.6	424.3	5835.3	**3494.25**	**1945.08**
27.50	28.00	27.75	0.50	25.50	19.65	9.65	159.92	1.89	28.1	28.1	1.0	161.02	3162.04	0	1.0	0.0	2409.94	28.0	16.5	38	9.65	4.68	3.47	166.9	1293.1	6865.0	432.8	6004.8	**2746.02**	**2001.58**
28.00	29.50	28.75	1.50	27.00	19.65	9.65	159.92	5.66	16.5	16.5	1.0	267.98	3430.02	38	1.0	215.0	2624.91	29.5	16.5	38	10.15	4.68	3.47	166.9	1294.2	7349.2	458.2	6513.2	**2939.67**	**2171.05**
29.50	30.00	29.75	0.50	27.50	20.15	10.15	159.92	1.89	16.5	16.5	1.0	89.33	3519.34	38	1.0	71.7	2696.57	30.0	16.5	38	10.15	4.68	3.47	166.9	1294.2	7510.2	466.7	6682.6	**3004.06**	**2227.54**
30.00	31.00	30.50	1.00	28.50	20.15	10.15	159.92	3.77	16.5	16.5	1.0	178.65	3697.99	38	1.0	143.3	2839.89	31.0	11.1	46	10.15	2.79	1.53	166.9	1006.5	7544.4	483.7	7021.6	**3017.74**	**2340.52**
31.00	32.50	31.75	1.50	30.00	20.15	10.15	159.92	5.66	11.1	11.1	1.0	177.49	3875.49	46	1.0	260.2	3100.11	32.5	11.1	46	10.15	2.79	1.53	166.9	1006.5	7982.1	509.1	7484.7	**3192.83**	**2494.91**
32.50	35.00	33.75	2.50	32.50	20.15	10.15	159.92	9.43	11.1	11.1	1.0	295.82	4171.30	46	1.0	433.7	3533.83	35.0	11.1	46	10.68	2.79	1.53	166.9	1007.0	8712.2	551.6	8256.7	**3484.86**	**2752.23**
35.00	35.50	35.25	0.50	33.00	20.68	10.68	159.92	1.89	11.1	11.1	1.0	59.16	4230.47	46	1.0	86.7	3620.57	35.5	12.8	55	10.68	3.29	2.02	166.9	1196.3	9047.3	560.1	8411.1	**3618.93**	**2803.70**
35.50	37.50	36.50	2.00	35.00	20.68	10.68	159.92	7.54	12.8	12.8	1.0	274.05	4504.52	55	1.0	414.9	4035.43	37.5	10.3	50	10.68	2.56	1.31	166.9	1001.7	9541.6	594.0	9133.9	**3816.65**	**3044.65**
37.50	38.50	38.00	1.00	36.00	20.68	10.68	159.92	3.77	10.3	10.3	1.0	109.61	4614.12	50	1.0	188.6	4224.00	38.5	10.3	50	10.68	2.56	1.31	166.9	1001.7	9839.8	611.0	9449.1	**3935.92**	**3149.70**
38.50	40.00	39.25	1.50	37.50	20.68	10.68	159.92	5.66	10.3	10.3	1.0	164.41	4778.53	50	1.0	282.9	4506.86	40.0	16.0	31	10.68	4.43	3.20	166.9	1175.8	10461.2	636.4	9921.8	**4184.46**	**3307.27**
BORE NO: P90, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.89	9.89	27.20	1.89	8.2	8.2	1.0	7.39	0	58	1.0	109.4	0	3.0	23.4	11	9.89	8.85	9.12	29.7	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.50	19.89	9.89	34.62	3.77	23.4	23.4	1.0	56.49	0	11	1.0	41.5	0	4.0	29.2	0	9.60	19.46	20.56	39.6	0	0.0	25.5	25.5	**0.00**	**8.49**
4.00	5.00	4.50	1.00	2.50	19.60	9.60	44.36	3.77	29.2	29.2	1.0	93.50	0	0	1.0	0.0	0	5.0	29.2	0	9.60	19.46	20.56	49.2	1216.2	1216.2	42.4	42.4	**486.50**	**14.14**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
5.00	6.00	5.50	1.00	3.50	19.60	9.60	53.96	3.77	29.2	29.2	1.0	113.74	113.74	0	1.0	0.0	0.00	6.0	27.3	0	9.60	15.18	16.18	58.8	1114.6	1228.3	59.4	173.1	**491.34**	**57.71**
6.00	7.00	6.50	1.00	4.50	19.60	9.60	63.56	3.77	27.3	27.3	1.0	123.72	237.46	0	1.0	0.0	0.00	7.0	26.0	7	9.40	12.25	13.18	68.4	1103.0	1340.5	76.4	313.8	**536.20**	**104.61**
7.00	8.00	7.50	1.00	5.50	19.40	9.40	73.06	3.77	26.0	26.0	1.0	134.39	371.85	7	1.0	26.4	26.40	8.0	9.5	44	9.40	2.38	1.14	77.8	664.7	1063.0	93.3	491.6	**425.19**	**163.86**
8.00	9.00	8.50	1.00	6.50	19.40	9.40	82.46	3.77	9.5	9.5	1.0	52.04	423.89	44	1.0	165.9	192.34	9.0	9.5	44	9.40	2.38	1.14	87.2	690.0	1306.3	110.3	726.5	**522.51**	**242.18**
9.00	10.00	9.50	1.00	7.50	19.40	9.40	91.86	3.77	9.5	9.5	1.0	57.97	481.87	44	1.0	165.9	358.29	10.0	9.5	44	10.09	2.38	1.14	96.6	715.9	1556.0	127.3	967.4	**622.42**	**322.48**
10.00	11.00	10.50	1.00	8.50	20.09	10.09	101.61	3.77	9.5	9.5	1.0	64.13	545.99	44	1.0	165.9	524.23	11.0	10.5	42	10.09	2.62	1.36	106.7	752.8	1823.0	144.3	1214.5	**729.21**	**404.83**
11.00	12.00	11.50	1.00	9.50	20.09	10.09	111.70	3.77	10.5	10.5	1.0	78.07	624.07	42	1.0	158.4	682.63	12.0	11.0	63	10.30	2.76	1.51	116.7	1017.1	2323.8	161.2	1467.9	**929.53**	**489.31**
12.00	14.50	13.25	2.50	12.00	20.30	10.30	129.62	9.43	11.0	11.0	1.0	237.55	861.62	63	1.0	594.0	1276.63	14.5	8.1	63	10.30	2.13	0.93	142.5	991.1	3129.3	203.7	2341.9	**1251.73**	**780.63**
14.50	16.00	15.25	1.50	13.50	20.30	10.30	150.22	5.66	8.1	8.1	1.0	120.94	982.56	63	1.0	356.4	1633.03	16.0	27.3	0	9.39	15.18	16.18	157.9	2815.7	5431.2	229.1	2844.7	**2172.50**	**948.23**
16.00	17.50	16.75	1.50	15.00	19.39	9.39	164.98	5.66	27.3	27.3	1.0	481.73	1464.29	0	1.0	0.0	1633.03	17.5	12.4	54	9.39	3.17	1.91	172.0	1180.0	4277.3	254.6	3351.9	**1710.91**	**1117.30**
17.50	19.00	18.25	1.50	16.50	19.39	9.39	164.98	5.66	12.4	12.4	1.0	205.21	1669.49	54	1.0	305.5	1938.51	19.0	11.0	42	10.27	2.76	1.51	172.0	976.1	4584.2	280.0	3888.0	**1833.66**	**1296.01**
19.00	20.50	19.75	1.50	18.00	20.27	10.27	164.98	5.66	11.0	11.0	1.0	181.42	1850.91	42	1.0	237.6	2176.11	20.5	11.0	42	10.27	2.76	1.51	172.0	976.1	5003.2	305.5	4332.5	**2001.27**	**1444.17**
20.50	22.00	21.25	1.50	19.50	20.27	10.27	164.98	5.66	11.0	11.0	1.0	181.42	2032.33	42	1.0	237.6	2413.71	22.0	9.2	55	10.36	2.33	1.10	172.0	1020.5	5466.5	330.9	4777.0	**2186.61**	**1592.33**
22.00	23.50	22.75	1.50	21.00	20.36	10.36	164.98	5.66	9.2	9.2	1.0	151.17	2183.50	55	1.0	311.1	2724.86	23.5	13.0	50	10.36	3.35	2.08	172.0	1175.8	6084.1	356.4	5264.8	**2433.66**	**1754.92**
23.50	25.00	24.25	1.50	22.50	20.36	10.36	164.98	5.66	13.0	13.0	1.0	215.48	2398.98	50	1.0	282.9	3007.71	25.0	29.3	0	9.12	19.68	20.79	172.0	3959.7	9366.4	381.9	5788.5	**3746.56**	**1929.52**
25.00	26.50	25.75	1.50	24.00	19.12	9.12	164.98	5.66	29.3	29.3	1.0	523.76	2922.74	0	1.0	0.0	3007.71	26.5	29.3	0	9.12	19.68	20.79	172.0	3959.7	9890.2	407.3	6337.8	**3956.07**	**2112.59**
26.50	27.50	27.00	1.00	25.00	19.12	9.12	164.98	3.77	29.3	29.3	1.0	349.17	3271.91	0	1.0	0.0	3007.71	27.5	26.3	0	9.12	12.93	13.88	172.0	2602.0	8881.7	424.3	6703.9	**3552.66**	**2234.64**
27.50	28.00	27.75	0.50	25.50	19.12	9.12	164.98	1.89	26.3	26.3	1.0	153.76	3425.67	0	1.0	0.0	3007.71	28.0	23.0	0	9.12	8.56	8.68	172.0	1719.8	8153.2	432.8	6866.2	**3261.29**	**2288.72**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
28.00	29.50	28.75	1.50	27.00	19.12	9.12	164.98	5.66	23.0	23.0	1.0	396.17	3821.84	0	1.0	0.0	3007.71	29.5	9.0	48	9.31	2.29	1.07	172.0	941.2	7770.8	458.2	7287.8	**3108.31**	**2429.26**
29.50	30.00	29.75	0.50	27.50	19.31	9.31	164.98	1.89	9.0	9.0	1.0	49.27	3871.12	48	1.0	90.5	3098.23	30.0	9.0	48	10.48	2.29	1.07	172.0	942.1	7911.4	466.7	7436.1	**3164.57**	**2478.69**
30.00	31.00	30.50	1.00	28.50	20.48	10.48	164.98	3.77	9.0	9.0	1.0	98.55	3969.67	48	1.0	181.0	3279.26	31.0	8.3	48	10.48	2.16	0.96	172.0	916.8	8165.7	483.7	7732.6	**3266.28**	**2577.54**
31.00	32.50	31.75	1.50	30.00	20.48	10.48	164.98	5.66	8.3	8.3	1.0	136.16	4105.83	48	1.0	271.5	3550.80	32.5	12.1	40	10.48	3.09	1.82	172.0	1021.1	8677.8	509.1	8165.8	**3471.11**	**2721.92**
32.50	35.00	33.75	2.50	32.50	20.48	10.48	164.98	9.43	12.1	12.1	1.0	333.48	4439.31	40	1.0	377.1	3927.94	35.0	12.1	40	10.48	3.09	1.82	172.0	1021.1	9388.4	551.6	8918.8	**3755.36**	**2972.94**
35.00	35.50	35.25	0.50	33.00	20.48	10.48	164.98	1.89	12.1	12.1	1.0	66.70	4506.00	40	1.0	75.4	4003.37	35.5	12.1	40	10.48	3.09	1.82	172.0	1021.1	9530.5	560.1	9069.4	**3812.21**	**3023.14**
35.50	37.50	36.50	2.00	35.00	20.48	10.48	164.98	7.54	12.1	12.1	1.0	266.78	4772.79	40	1.0	301.7	4305.09	37.5	29.1	5	10.32	19.23	20.33	172.0	3936.7	13014.6	594.0	9671.9	**5205.82**	**3223.96**
37.50	38.50	38.00	1.00	36.00	20.32	10.32	164.98	3.77	29.1	29.1	1.0	346.32	5119.11	5	1.0	18.9	4323.94	38.5	29.0	5	10.32	19.01	20.10	172.0	3891.2	13334.3	611.0	10054.0	**5333.71**	**3351.34**
38.50	40.00	39.25	1.50	37.50	20.32	10.32	164.98	5.66	29.0	29.0	1.0	517.35	5636.47	5	1.0	28.3	4352.23	40.0	17.1	89	10.32	4.97	3.80	172.0	1900.9	11889.5	636.4	10625.1	**4755.82**	**3541.71**
BORE NO: P91, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.48	9.48	26.07	1.89	26.6	26.6	1.0	24.62	0	3	1.0	5.7	0	3.0	26.6	3	9.68	13.60	14.57	28.4	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	5.00	4.00	2.00	2.50	19.68	9.68	38.12	7.54	26.6	26.6	1.0	143.99	0	3	1.0	22.6	0	5.0	26.6	3	9.68	13.60	14.57	47.8	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.50	19.68	9.68	52.64	3.77	26.6	26.6	1.0	99.42	0	3	1.0	11.3	0	6.0	14.6	23	9.68	3.82	2.54	57.5	0	0.0	59.4	59.4	**0.00**	**19.80**
6.00	7.00	6.50	1.00	4.50	19.68	9.68	62.32	3.77	14.6	14.6	1.0	61.22	0	23	1.0	86.7	0	7.0	12.4	48	9.68	3.17	1.91	67.2	742.5	742.5	76.4	76.4	**297.02**	**25.46**
7.00	8.00	7.50	1.00	5.50	19.68	9.68	72.00	3.77	12.4	12.4	1.0	59.70	59.70	48	1.0	181.0	181.03	8.0	11.5	44	10.60	2.91	1.65	76.8	713.0	953.7	93.3	334.1	**381.49**	**111.36**
8.00	9.00	8.50	1.00	6.50	20.60	10.60	82.14	3.77	11.5	11.5	1.0	63.03	122.73	44	1.0	165.9	346.97	9.0	11.5	44	10.60	2.91	1.65	87.4	747.9	1217.6	110.3	580.0	**487.04**	**193.34**
9.00	11.00	10.00	2.00	8.50	20.60	10.60	98.04	7.54	11.5	11.5	1.0	150.45	273.18	44	1.0	331.9	678.86	11.0	11.5	44	10.60	2.91	1.65	108.6	817.7	1769.8	144.3	1096.3	**707.91**	**365.43**
11.00	12.00	11.50	1.00	9.50	20.60	10.60	113.94	3.77	11.5	11.5	1.0	87.43	360.61	44	1.0	165.9	844.80	12.0	10.0	53	11.00	2.47	1.22	119.2	882.0	2087.4	161.2	1366.6	**834.98**	**455.55**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
12.00	14.50	13.25	2.50	12.00	21.00	11.00	132.99	9.43	10.0	10.0	1.0	221.10	581.71	53	1.0	499.7	1344.51	14.5	10.5	57	10.80	2.62	1.36	146.7	1024.9	2951.1	203.7	2129.9	**1180.45**	**709.96**
14.50	17.50	16.00	3.00	15.00	20.80	10.80	162.94	11.31	10.5	10.5	1.0	341.68	923.39	57	1.0	644.9	1989.43	17.5	9.5	55	11.90	2.38	1.14	179.1	1051.7	3964.5	254.6	3167.4	**1585.80**	**1055.80**
17.50	20.50	19.00	3.00	18.00	21.90	11.90	162.94	11.31	9.5	9.5	1.0	308.50	1231.89	55	1.0	622.3	2611.71	20.5	9.5	55	9.79	2.38	1.14	179.1	1050.0	4893.6	305.5	4149.1	**1957.46**	**1383.03**
20.50	23.50	22.00	3.00	21.00	19.79	9.79	162.94	11.31	9.5	9.5	1.0	308.50	1540.40	55	1.0	622.3	3234.00	23.5	23.0	16	9.79	8.56	8.68	179.1	1955.6	6730.0	356.4	5130.8	**2692.01**	**1710.27**
23.50	26.50	25.00	3.00	24.00	19.79	9.79	162.94	11.31	23.0	23.0	1.0	782.54	2322.94	16	1.0	181.0	3415.03	26.5	17.6	16	10.20	5.22	4.07	179.1	1249.0	6987.0	407.3	6145.3	**2794.78**	**2048.43**
26.50	27.50	27.00	1.00	25.00	20.20	10.20	162.94	3.77	17.6	17.6	1.0	194.94	2517.87	16	1.0	60.3	3475.37	27.5	17.6	36	10.20	5.22	4.07	179.1	1452.6	7445.9	424.3	6417.5	**2978.36**	**2139.18**
27.50	28.00	27.75	0.50	25.50	20.20	10.20	162.94	1.89	17.6	17.6	1.0	97.47	2615.34	36	1.0	67.9	3543.26	28.0	8.5	61	10.20	2.20	0.99	179.1	1073.9	7232.5	432.8	6591.4	**2893.00**	**2197.12**
28.00	29.50	28.75	1.50	27.00	20.20	10.20	162.94	5.66	8.5	8.5	1.0	137.76	2753.10	61	1.0	345.1	3888.34	29.5	18.0	35	10.20	5.42	4.29	179.1	1483.9	8125.3	458.2	7099.7	**3250.13**	**2366.56**
29.50	30.00	29.75	0.50	27.50	20.20	10.20	162.94	1.89	18.0	18.0	1.0	99.83	2852.94	35	1.0	66.0	3954.34	30.0	18.0	35	10.20	5.42	4.29	179.1	1483.9	8291.1	466.7	7274.0	**3316.46**	**2424.66**
30.00	31.00	30.50	1.00	28.50	20.20	10.20	162.94	3.77	18.0	18.0	1.0	199.67	3052.60	35	1.0	132.0	4086.34	31.0	18.5	46	10.20	5.64	4.57	179.1	1643.6	8782.5	483.7	7622.6	**3513.01**	**2540.88**
31.00	32.50	31.75	1.50	30.00	20.20	10.20	162.94	5.66	18.5	18.5	1.0	308.42	3361.03	46	1.0	260.2	4346.57	32.5	10.2	58	10.20	2.53	1.28	179.1	1112.0	8819.6	509.1	8216.7	**3527.84**	**2738.91**
32.50	35.00	33.75	2.50	32.50	20.20	10.20	162.94	9.43	10.2	10.2	1.0	276.42	3637.45	58	1.0	546.9	4893.43	35.0	10.2	58	10.20	2.53	1.28	179.1	1112.0	9642.9	551.6	9082.4	**3857.15**	**3027.48**
35.00	35.50	35.25	0.50	33.00	20.20	10.20	162.94	1.89	10.2	10.2	1.0	55.28	3692.73	58	1.0	109.4	5002.80	35.5	10.2	58	10.20	2.53	1.28	179.1	1112.0	9807.5	560.1	9255.6	**3923.01**	**3085.20**
35.50	37.50	36.50	2.00	35.00	20.20	10.20	162.94	7.54	10.2	10.2	1.0	221.14	3913.87	58	1.0	437.5	5440.29	37.5	17.0	60	8.78	4.92	3.75	179.1	1631.3	10985.5	594.0	9948.2	**4394.19**	**3316.05**
37.50	38.50	38.00	1.00	36.00	18.78	8.78	162.94	3.77	17.0	17.0	1.0	187.88	4101.75	60	1.0	226.3	5666.57	38.5	17.0	50	8.83	4.92	3.75	179.1	1529.6	11297.9	611.0	10379.3	**4519.17**	**3459.76**
38.50	40.00	39.25	1.50	37.50	18.83	8.83	162.94	5.66	17.0	17.0	1.0	281.81	4383.56	50	1.0	282.9	5949.43	40.0	17.0	50	8.83	4.92	3.75	179.1	1529.6	11862.6	636.4	10969.4	**4745.04**	**3656.47**
BORE NO: P92, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.60	9.60	26.40	1.89	12.4	12.4	1.0	10.95	0	23	1.0	43.4	0	3.0	23.3	0	9.60	8.78	9.01	28.8	0	0.0	8.5	8.5	**0.00**	**2.83**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
3.00	4.00	3.50	1.00	1.50	19.60	9.60	33.60	3.77	23.3	23.3	1.0	54.57	0	0	1.0	0.0	0	4.0	26.5	9	9.60	13.38	14.34	38.4	0	0.0	25.5	25.5	**0.00**	**8.49**
4.00	5.00	4.50	1.00	2.50	19.60	9.60	43.20	3.77	26.5	26.5	1.0	81.23	0	9	1.0	33.9	0	5.0	26.5	9	9.60	13.38	14.34	48.0	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.50	19.60	9.60	52.80	3.77	26.5	26.5	1.0	99.28	0	9	1.0	33.9	0	6.0	25.5	13	9.60	11.13	12.03	57.6	0	0.0	59.4	59.4	**0.00**	**19.80**
6.00	7.00	6.50	1.00	4.50	19.60	9.60	62.40	3.77	25.5	25.5	1.0	112.25	0	13	1.0	49.0	0	7.0	25.5	13	9.57	11.13	12.03	67.2	1056.5	1056.5	76.4	76.4	**422.59**	**25.46**
7.00	8.00	7.50	1.00	5.50	19.57	9.57	71.99	3.77	25.5	25.5	1.0	129.49	129.49	13	1.0	49.0	49.03	8.0	25.5	13	9.57	11.13	12.03	76.8	1176.9	1355.5	93.3	271.9	**542.19**	**90.62**
8.00	9.00	8.50	1.00	6.50	19.57	9.57	81.56	3.77	25.5	25.5	1.0	146.71	276.20	13	1.0	49.0	98.06	9.0	12.2	42	10.70	3.12	1.85	86.3	745.5	1119.8	110.3	484.6	**447.92**	**161.52**
9.00	11.00	10.00	2.00	8.50	20.70	10.70	97.04	7.54	12.2	12.2	1.0	158.26	434.46	42	1.0	316.8	414.86	11.0	12.2	42	10.70	3.12	1.85	107.7	821.0	1670.3	144.3	993.6	**668.13**	**331.19**
11.00	12.00	11.50	1.00	9.50	20.70	10.70	113.09	3.77	12.2	12.2	1.0	92.21	526.67	42	1.0	158.4	573.26	12.0	11.5	50	10.40	2.91	1.65	118.4	910.9	2010.8	161.2	1261.2	**804.32**	**420.39**
12.00	14.50	13.25	2.50	12.00	20.40	10.40	131.44	9.43	11.5	11.5	1.0	252.14	778.81	50	1.0	471.4	1044.69	14.5	9.5	53	10.55	2.38	1.14	144.4	936.8	2760.3	203.7	2027.1	**1104.13**	**675.72**
14.50	17.50	16.00	3.00	15.00	20.55	10.55	160.27	11.31	9.5	9.5	1.0	303.44	1082.25	53	1.0	599.7	1644.34	17.5	10.2	50	10.55	2.53	1.28	176.1	1022.1	3748.7	254.6	2981.2	**1499.48**	**993.72**
17.50	19.00	18.25	1.50	16.50	20.55	10.55	160.27	5.66	10.2	10.2	1.0	163.13	1245.38	50	1.0	282.9	1927.20	19.0	11.0	55	10.30	2.76	1.51	176.1	1121.3	4293.8	280.0	3452.6	**1717.54**	**1150.87**
19.00	20.50	19.75	1.50	18.00	20.30	10.30	160.27	5.66	11.0	11.0	1.0	176.23	1421.61	55	1.0	311.1	2238.34	20.5	11.5	59	10.10	2.91	1.65	176.1	1192.1	4852.0	305.5	3965.4	**1940.81**	**1321.81**
20.50	23.50	22.00	3.00	21.00	20.10	10.10	160.27	11.31	11.5	11.5	1.0	368.92	1790.53	59	1.0	667.5	2905.89	23.5	10.3	53	10.42	2.56	1.31	176.1	1058.6	5755.0	356.4	5052.8	**2302.01**	**1684.27**
23.50	26.50	25.00	3.00	24.00	20.42	10.42	160.27	11.31	10.3	10.3	1.0	329.53	2120.06	53	1.0	599.7	3505.54	26.5	10.3	53	10.42	2.56	1.31	176.1	1058.6	6684.2	407.3	6032.9	**2673.68**	**2010.97**
26.50	27.50	27.00	1.00	25.00	20.42	10.42	160.27	3.77	10.3	10.3	1.0	109.84	2229.90	53	1.0	199.9	3705.43	27.5	10.3	53	10.42	2.56	1.31	176.1	1058.6	6993.9	424.3	6359.6	**2797.57**	**2119.87**
27.50	29.50	28.50	2.00	27.00	20.42	10.42	160.27	7.54	10.3	10.3	1.0	219.69	2449.59	53	1.0	399.8	4105.20	29.5	10.5	53	8.69	2.62	1.36	176.1	1069.1	7623.9	458.2	7013.0	**3049.56**	**2337.67**
29.50	30.00	29.75	0.50	27.50	18.69	8.69	160.27	1.89	10.5	10.5	1.0	56.01	2505.60	53	1.0	99.9	4205.14	30.0	10.0	50	10.52	2.47	1.22	176.1	1010.0	7720.7	466.7	7177.5	**3088.28**	**2392.49**
30.00	32.50	31.25	2.50	30.00	20.52	10.52	160.27	9.43	10.0	10.0	1.0	266.44	2772.04	50	1.0	471.4	4676.57	32.5	10.8	45	10.52	2.71	1.45	176.1	1007.5	8456.2	509.1	7957.8	**3382.46**	**2652.58**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
32.50	35.00	33.75	2.50	32.50	20.52	10.52	160.27	9.43	10.8	10.8	1.0	288.25	3060.29	45	1.0	424.3	5100.86	35.0	10.8	45	10.52	2.71	1.45	176.1	1007.5	9168.7	551.6	8712.7	**3667.48**	**2904.24**
35.00	35.50	35.25	0.50	33.00	20.52	10.52	160.27	1.89	10.8	10.8	1.0	57.65	3117.94	45	1.0	84.9	5185.71	35.5	10.1	65	10.52	2.50	1.25	176.1	1168.8	9472.4	560.1	8863.7	**3788.97**	**2954.57**
35.50	37.50	36.50	2.00	35.00	20.52	10.52	160.27	7.54	10.1	10.1	1.0	215.33	3333.27	65	1.0	490.3	5676.00	37.5	10.1	65	9.61	2.50	1.25	176.1	1168.0	10177.3	594.0	9603.3	**4070.91**	**3201.09**
37.50	38.50	38.00	1.00	36.00	19.61	9.61	160.27	3.77	10.1	10.1	1.0	107.67	3440.94	65	1.0	245.1	5921.14	38.5	10.1	65	8.74	2.50	1.25	176.1	1167.3	10529.3	611.0	9973.1	**4211.74**	**3324.35**
38.50	40.00	39.25	1.50	37.50	18.74	8.74	160.27	5.66	10.1	10.1	1.0	161.50	3602.44	65	1.0	367.7	6288.86	40.0	26.3	0	8.74	12.93	13.88	176.1	2657.9	12549.2	636.4	10527.7	**5019.68**	**3509.24**
BORE NO: P93, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.36	9.36	25.74	1.89	23.4	23.4	1.0	21.00	0	0	1.0	0.0	0	3.0	23.7	0	9.36	9.06	9.45	28.1	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.50	19.36	9.36	32.76	3.77	23.7	23.7	1.0	54.24	0	0	1.0	0.0	0	4.0	25.8	6	9.69	11.80	12.72	37.4	644.7	644.7	25.5	25.5	**257.89**	**8.49**
4.00	5.00	4.50	1.00	2.50	19.69	9.69	42.29	3.77	25.8	25.8	1.0	77.09	77.09	6	1.0	22.6	22.63	5.0	25.8	6	9.69	11.80	12.72	47.1	774.1	873.8	42.4	142.2	**349.53**	**47.38**
5.00	6.00	5.50	1.00	3.50	19.69	9.69	51.98	3.77	25.8	25.8	1.0	94.76	171.85	6	1.0	22.6	45.26	6.0	25.8	6	9.69	11.80	12.72	56.8	903.5	1120.6	59.4	276.5	**448.24**	**92.17**
6.00	8.00	7.00	2.00	5.50	19.69	9.69	66.51	7.54	25.8	25.8	1.0	242.52	414.37	6	1.0	45.3	90.51	8.0	26.7	0	10.43	13.83	14.80	76.2	1297.0	1801.9	93.3	598.2	**720.74**	**199.41**
8.00	9.00	8.50	1.00	6.50	20.43	10.43	81.42	3.77	26.7	26.7	1.0	154.43	568.80	0	1.0	0.0	90.51	9.0	26.5	7	10.43	13.38	14.34	86.6	1484.0	2143.3	110.3	769.6	**857.34**	**256.54**
9.00	11.00	10.00	2.00	8.50	20.43	10.43	97.06	7.54	26.5	26.5	1.0	365.02	933.82	7	1.0	52.8	143.31	11.0	23.0	10	10.43	8.56	8.68	107.5	1204.4	2281.5	144.3	1221.4	**912.60**	**407.13**
11.00	12.00	11.50	1.00	9.50	20.43	10.43	112.71	3.77	23.0	23.0	1.0	180.43	1114.25	10	1.0	37.7	181.03	12.0	9.5	52	10.08	2.38	1.14	117.9	854.9	2150.1	161.2	1456.5	**860.06**	**485.50**
12.00	14.50	13.25	2.50	12.00	20.08	10.08	130.52	9.43	9.5	9.5	1.0	205.93	1320.18	52	1.0	490.3	671.31	14.5	11.5	56	10.17	2.91	1.65	143.1	1053.0	3044.5	203.7	2195.2	**1217.80**	**731.72**
14.50	17.50	16.00	3.00	15.00	20.17	10.17	158.38	11.31	11.5	11.5	1.0	364.57	1684.75	56	1.0	633.6	1304.91	17.5	11.5	56	10.17	2.91	1.65	173.6	1153.5	4143.2	254.6	3244.2	**1657.26**	**1081.41**
17.50	19.00	18.25	1.50	16.50	20.17	10.17	158.38	5.66	11.5	11.5	1.0	182.28	1867.03	56	1.0	316.8	1621.71	19.0	8.7	55	8.61	2.24	1.02	173.6	1005.3	4494.0	280.0	3768.8	**1797.61**	**1256.26**
19.00	20.50	19.75	1.50	18.00	18.61	8.61	158.38	5.66	8.7	8.7	1.0	137.10	2004.13	55	1.0	311.1	1932.86	20.5	8.7	55	9.70	2.24	1.02	173.6	1006.0	4943.0	305.5	4242.5	**1977.21**	**1414.16**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
20.50	23.50	22.00	3.00	21.00	19.70	9.70	158.38	11.31	8.7	8.7	1.0	274.20	2278.33	55	1.0	622.3	2555.14	23.5	8.5	57	9.70	2.20	0.99	173.6	1019.1	5852.6	356.4	5189.9	**2341.04**	**1729.96**
23.50	25.00	24.25	1.50	22.50	19.70	9.70	158.38	5.66	8.5	8.5	1.0	133.90	2412.23	57	1.0	322.5	2877.60	25.0	28.8	0	10.84	18.56	19.64	173.6	3790.1	9079.9	381.9	5671.7	**3631.96**	**1890.56**
25.00	26.50	25.75	1.50	24.00	20.84	10.84	158.38	5.66	28.8	28.8	1.0	492.55	2904.78	0	1.0	0.0	2877.60	26.5	28.0	0	10.84	16.76	17.79	173.6	3422.6	9205.0	407.3	6189.7	**3681.99**	**2063.23**
26.50	27.50	27.00	1.00	25.00	20.84	10.84	158.38	3.77	28.0	28.0	1.0	317.59	3222.37	0	1.0	0.0	2877.60	27.5	30.4	0	10.84	23.27	24.45	173.6	4752.2	10852.2	424.3	6524.3	**4340.87**	**2174.75**
27.50	28.00	27.75	0.50	25.50	20.84	10.84	158.38	1.89	30.4	30.4	1.0	178.72	3401.09	0	1.0	0.0	2877.60	28.0	29.8	0	10.84	20.81	21.94	173.6	4249.4	10528.1	432.8	6711.5	**4211.24**	**2237.15**
28.00	29.50	28.75	1.50	27.00	20.84	10.84	158.38	5.66	29.8	29.8	1.0	513.12	3914.21	0	1.0	0.0	2877.60	29.5	11.5	50	8.61	2.91	1.65	173.6	1090.6	7882.5	458.2	7250.0	**3152.98**	**2416.68**
29.50	30.00	29.75	0.50	27.50	18.61	8.61	158.38	1.89	11.5	11.5	1.0	60.76	3974.97	50	1.0	94.3	2971.89	30.0	11.5	50	8.61	2.91	1.65	173.6	1090.6	8037.5	466.7	7413.6	**3215.00**	**2471.19**
30.00	31.00	30.50	1.00	28.50	18.61	8.61	158.38	3.77	11.5	11.5	1.0	121.52	4096.49	50	1.0	188.6	3160.46	31.0	11.5	50	8.56	2.91	1.65	173.6	1090.6	8347.5	483.7	7740.6	**3339.02**	**2580.21**
31.00	32.50	31.75	1.50	30.00	18.56	8.56	158.38	5.66	11.5	11.5	1.0	182.28	4278.77	50	1.0	282.9	3443.31	32.5	11.5	50	8.83	2.91	1.65	173.6	1090.9	8813.0	509.1	8231.2	**3525.19**	**2743.74**
32.50	34.00	33.25	1.50	31.50	18.83	8.83	158.38	5.66	11.5	11.5	1.0	182.28	4461.06	50	1.0	282.9	3726.17	34.0	12.3	56	8.63	3.15	1.88	173.6	1199.2	9386.4	534.6	8721.8	**3754.57**	**2907.28**
34.00	35.00	34.50	1.00	32.50	18.63	8.63	158.38	3.77	12.3	12.3	1.0	130.23	4591.29	56	1.0	211.2	3937.37	35.0	12.3	56	8.63	3.15	1.88	173.6	1199.2	9727.9	551.6	9080.2	**3891.14**	**3026.74**
35.00	35.50	35.25	0.50	33.00	18.63	8.63	158.38	1.89	12.3	12.3	1.0	65.12	4656.41	56	1.0	105.6	4042.97	35.5	12.3	56	8.93	3.15	1.88	173.6	1199.6	9899.0	560.1	9259.4	**3959.58**	**3086.48**
35.50	37.00	36.25	1.50	34.50	18.93	8.93	158.38	5.66	12.3	12.3	1.0	195.35	4851.76	56	1.0	316.8	4359.77	37.0	12.3	56	8.84	3.15	1.88	173.6	1199.5	10411.0	585.5	9797.0	**4164.40**	**3265.68**
37.00	37.50	37.25	0.50	35.00	18.84	8.84	158.38	1.89	12.3	12.3	1.0	65.12	4916.87	56	1.0	105.6	4465.37	37.5	12.3	63	8.84	3.15	1.88	173.6	1270.7	10653.0	594.0	9976.2	**4261.19**	**3325.41**
37.50	38.50	38.00	1.00	36.00	18.84	8.84	158.38	3.77	12.3	12.3	1.0	130.23	5047.10	63	1.0	237.6	4702.97	38.5	12.3	63	8.93	3.15	1.88	173.6	1270.9	11020.9	611.0	10361.0	**4408.37**	**3453.68**
38.50	40.00	39.25	1.50	37.50	18.93	8.93	158.38	5.66	12.3	12.3	1.0	195.35	5242.45	63	1.0	356.4	5059.37	40.0	12.3	63	8.93	3.15	1.88	173.6	1270.9	11572.7	636.4	10938.3	**4629.07**	**3646.08**
BORE NO: P94, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	20.40	10.40	28.60	1.89	11.2	11.2	1.0	10.68	0	14	1.0	26.4	0	3.0	25.0	13	10.40	10.00	10.88	31.2	0	0.0	8.5	8.5	**0.00**	**2.83**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
3.00	4.00	3.50	1.00	1.50	20.40	10.40	36.40	3.77	25.0	25.0	1.0	64.01	0	13	1.0	49.0	0	4.0	25.0	13	10.40	10.00	10.88	41.6	0	0.0	25.5	25.5	**0.00**	**8.49**
4.00	5.00	4.50	1.00	2.50	20.40	10.40	46.80	3.77	25.0	25.0	1.0	82.30	0	13	1.0	49.0	0	5.0	25.0	13	9.52	10.00	10.88	52.0	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.50	19.52	9.52	56.76	3.77	25.0	25.0	1.0	99.82	0	13	1.0	49.0	0	6.0	23.5	17	9.52	8.92	9.23	61.5	853.7	853.7	59.4	59.4	**341.46**	**19.80**
6.00	7.00	6.50	1.00	4.50	19.52	9.52	66.28	3.77	23.5	23.5	1.0	108.69	108.69	17	1.0	64.1	64.11	7.0	23.5	17	10.30	8.92	9.23	71.0	954.6	1127.4	76.4	249.2	**450.97**	**83.06**
7.00	9.00	8.00	2.00	6.50	20.30	10.30	81.34	7.54	23.5	23.5	1.0	266.77	375.46	17	1.0	128.2	192.34	9.0	23.5	17	10.30	8.92	9.23	91.6	1162.5	1730.3	110.3	678.1	**692.13**	**226.04**
9.00	10.00	9.50	1.00	7.50	20.30	10.30	96.79	3.77	23.5	23.5	1.0	158.72	534.19	17	1.0	64.1	256.46	10.0	12.0	54	10.30	3.06	1.79	101.9	915.1	1705.8	127.3	917.9	**682.30**	**305.98**
10.00	11.00	10.50	1.00	8.50	20.30	10.30	107.09	3.77	12.0	12.0	1.0	85.85	620.03	54	1.0	203.7	460.11	11.0	11.5	56	10.30	2.91	1.65	112.2	951.4	2031.6	144.3	1224.4	**812.64**	**408.13**
11.00	12.50	11.75	1.50	10.00	20.30	10.30	119.97	5.66	11.5	11.5	1.0	138.07	758.11	56	1.0	316.8	776.91	12.5	11.5	56	9.90	2.91	1.65	127.7	1001.9	2536.9	169.7	1704.7	**1014.76**	**568.25**
12.50	14.00	13.25	1.50	11.50	19.90	9.90	135.12	5.66	11.5	11.5	1.0	155.51	913.62	56	1.0	316.8	1093.71	14.0	11.2	47	9.90	2.82	1.56	142.5	944.3	2951.7	195.2	2202.5	**1180.67**	**734.17**
14.00	15.50	14.75	1.50	13.00	19.90	9.90	149.97	5.66	11.2	11.2	1.0	167.98	1081.60	47	1.0	265.9	1359.60	15.5	11.2	47	10.70	2.82	1.56	157.4	992.6	3433.8	220.6	2661.8	**1373.53**	**887.28**
15.50	18.50	17.00	3.00	16.00	20.70	10.70	173.44	11.31	11.2	11.2	1.0	388.56	1470.16	47	1.0	531.8	1891.37	18.5	13.0	45	10.70	3.35	2.08	157.4	1069.9	4431.4	271.5	3633.1	**1772.56**	**1211.02**
18.50	20.00	19.25	1.50	17.50	20.70	10.70	173.44	5.66	13.0	13.0	1.0	226.52	1696.68	45	1.0	254.6	2145.94	20.0	24.0	16	11.59	9.28	9.78	157.4	1892.4	5735.1	297.0	4139.6	**2294.02**	**1379.87**
20.00	21.50	20.75	1.50	19.00	21.59	11.59	173.44	5.66	24.0	24.0	1.0	436.85	2133.53	16	1.0	90.5	2236.46	21.5	11.5	49	9.80	2.91	1.65	157.4	1028.3	5398.3	322.5	4692.4	**2159.32**	**1564.15**
21.50	24.50	23.00	3.00	22.00	19.80	9.80	173.44	11.31	11.5	11.5	1.0	399.24	2532.77	49	1.0	554.4	2790.86	24.5	13.5	51	10.59	3.50	2.22	157.4	1158.6	6482.2	373.4	5697.0	**2592.87**	**1899.00**
24.50	27.50	26.00	3.00	25.00	20.59	10.59	173.44	11.31	13.5	13.5	1.0	471.12	3003.89	51	1.0	577.0	3367.89	27.5	14.5	51	10.59	3.80	2.51	157.4	1213.1	7584.9	424.3	6796.1	**3033.97**	**2265.35**
27.50	30.00	28.75	2.50	27.50	20.59	10.59	173.44	9.43	14.5	14.5	1.0	422.92	3426.81	51	1.0	480.9	3848.74	30.0	9.5	51	10.70	2.38	1.14	157.4	951.4	8227.0	466.7	7742.3	**3290.80**	**2580.75**
30.00	30.50	30.25	0.50	28.00	20.70	10.70	173.44	1.89	9.5	9.5	1.0	54.73	3481.54	51	1.0	96.2	3944.91	30.5	18.8	37	10.70	5.78	4.73	157.4	1440.0	8866.4	475.2	7901.7	**3546.58**	**2633.88**
30.50	32.50	31.50	2.00	30.00	20.70	10.70	173.44	7.54	18.8	18.8	1.0	445.36	3926.90	37	1.0	279.1	4224.00	32.5	23.5	48	11.05	8.92	9.23	157.4	2146.5	10297.4	509.1	8660.0	**4118.95**	**2886.68**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
32.50	33.50	33.00	1.00	31.00	21.05	11.05	173.44	3.77	23.5	23.5	1.0	284.42	4211.31	48	1.0	181.0	4405.03	33.5	10.0	50	11.05	2.47	1.22	157.4	958.1	9574.5	526.1	9142.5	**3829.79**	**3047.49**
33.50	35.00	34.25	1.50	32.50	21.05	11.05	173.44	5.66	10.0	10.0	1.0	173.01	4384.32	50	1.0	282.9	4687.89	35.0	23.0	8	11.05	8.56	8.68	157.4	1670.9	10743.1	551.6	9623.8	**4297.26**	**3207.93**
35.00	36.50	35.75	1.50	34.00	21.05	11.05	173.44	5.66	28.9	28.9	1.0	541.64	4925.96	8	1.0	45.3	4733.14	36.5	9.0	68	11.05	2.29	1.07	157.4	1108.2	10767.3	577.0	10236.1	**4306.93**	**3412.04**
36.50	37.50	37.00	1.00	35.00	21.05	11.05	173.44	3.77	9.0	9.0	1.0	103.60	5029.56	68	1.0	256.5	4989.60	37.5	9.0	68	11.05	2.29	1.07	157.4	1108.2	11127.4	594.0	10613.2	**4450.95**	**3537.72**
37.50	40.00	38.75	2.50	37.50	21.05	11.05	173.44	9.43	9.0	9.0	1.0	259.00	5288.57	68	1.0	641.1	5630.74	40.0	6.0	125	11.05	1.75	0.60	157.4	1589.0	12508.3	636.4	11555.7	**5003.33**	**3851.91**
BORE NO: P95, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.43	9.43	25.93	1.89	28.0	28.0	1.0	26.00	0	3	1.0	5.7	0	3.0	23.4	0	9.43	8.85	9.12	28.3	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.50	19.43	9.43	33.01	3.77	23.4	23.4	1.0	53.87	0	0	1.0	0.0	0	4.0	24.2	0	9.43	9.42	10.00	37.7	0	0.0	25.5	25.5	**0.00**	**8.49**
4.00	5.00	4.50	1.00	2.50	19.43	9.43	42.44	3.77	24.2	24.2	1.0	71.93	0	0	1.0	0.0	0	5.0	27.5	4	9.64	15.63	16.64	47.2	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.50	19.64	9.64	51.97	3.77	27.5	27.5	1.0	102.03	0	4	1.0	15.1	0	6.0	24.2	0	9.64	9.42	10.00	56.8	0	0.0	59.4	59.4	**0.00**	**19.80**
6.00	7.00	6.50	1.00	4.50	19.64	9.64	61.61	3.77	24.2	24.2	1.0	104.43	0	0	1.0	0.0	0	7.0	24.2	0	9.64	9.42	10.00	66.4	0	0.0	76.4	76.4	**0.00**	**25.46**
7.00	8.00	7.50	1.00	5.50	19.64	9.64	71.25	3.77	24.2	24.2	1.0	120.76	0	0	1.0	0.0	0	8.0	10.7	45	10.20	2.68	1.42	76.1	698.4	698.4	93.3	93.3	**279.35**	**31.11**
8.00	9.00	8.50	1.00	6.50	20.20	10.20	81.17	3.77	10.7	10.7	1.0	57.84	57.84	45	1.0	169.7	169.71	9.0	9.5	52	10.20	2.38	1.14	86.3	769.7	997.3	110.3	337.9	**398.92**	**112.62**
9.00	10.00	9.50	1.00	7.50	20.20	10.20	91.37	3.77	9.5	9.5	1.0	57.67	115.51	52	1.0	196.1	365.83	10.0	9.5	52	10.31	2.38	1.14	96.5	797.3	1278.6	127.3	608.6	**511.45**	**202.87**
10.00	12.50	11.25	2.50	10.00	20.31	10.31	109.36	9.43	9.5	9.5	1.0	172.54	288.05	52	1.0	490.3	856.11	12.5	9.5	52	9.43	2.38	1.14	122.2	866.0	2010.2	169.7	1313.9	**804.07**	**437.96**
12.50	15.50	14.00	3.00	13.00	19.43	9.43	136.39	11.31	9.5	9.5	1.0	258.24	546.29	52	1.0	588.3	1444.46	15.5	9.0	53	9.43	2.29	1.07	150.5	936.5	2927.3	220.6	2211.4	**1170.92**	**737.12**
15.50	18.50	17.00	3.00	16.00	19.43	9.43	164.68	11.31	9.0	9.0	1.0	295.11	841.40	53	1.0	599.7	2044.11	18.5	9.0	53	9.69	2.29	1.07	150.5	936.7	3822.2	271.5	3157.1	**1528.90**	**1052.35**
18.50	20.00	19.25	1.50	17.50	19.69	9.69	164.68	5.66	9.0	9.0	1.0	147.55	988.95	53	1.0	299.8	2343.94	20.0	10.2	49	9.69	2.53	1.28	150.5	938.1	4271.0	297.0	3629.9	**1708.38**	**1209.96**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
20.00	21.50	20.75	1.50	19.00	19.69	9.69	164.68	5.66	10.2	10.2	1.0	167.62	1156.57	49	1.0	277.2	2621.14	21.5	10.2	49	9.69	2.53	1.28	150.5	938.1	4715.8	322.5	4100.2	**1886.31**	**1366.72**
21.50	23.00	22.25	1.50	20.50	19.69	9.69	164.68	5.66	10.2	10.2	1.0	167.62	1324.20	49	1.0	277.2	2898.34	23.0	9.4	40	10.82	2.36	1.13	150.5	817.9	5040.4	347.9	4570.5	**2016.17**	**1523.49**
23.00	24.50	23.75	1.50	22.00	20.82	10.82	164.68	5.66	9.4	9.4	1.0	154.23	1478.43	40	1.0	226.3	3124.63	24.5	9.4	44	10.82	2.36	1.13	150.5	858.6	5461.7	373.4	4976.4	**2184.67**	**1658.81**
24.50	27.50	26.00	3.00	25.00	20.82	10.82	164.68	11.31	9.4	9.4	1.0	308.46	1786.88	44	1.0	497.8	3622.46	27.5	9.5	26	10.10	2.38	1.14	150.5	678.0	6087.3	424.3	5833.6	**2434.92**	**1944.54**
27.50	30.00	28.75	2.50	27.50	20.10	10.10	164.68	9.43	9.5	9.5	1.0	259.83	2046.72	26	1.0	245.1	3867.60	30.0	26.7	0	10.10	13.83	14.80	150.5	2456.7	8371.0	466.7	6381.0	**3348.40**	**2127.01**
30.00	30.50	30.25	0.50	28.00	20.10	10.10	164.68	1.89	26.7	26.7	1.0	156.19	2202.90	0	1.0	0.0	3867.60	30.5	26.7	0	10.10	13.83	14.80	150.5	2456.7	8527.2	475.2	6545.7	**3410.87**	**2181.90**
30.50	32.00	31.25	1.50	29.50	20.10	10.10	164.68	5.66	26.7	26.7	1.0	468.56	2671.46	0	1.0	0.0	3867.60	32.0	10.5	63	10.10	2.62	1.36	150.5	1096.6	7635.6	500.7	7039.7	**3054.26**	**2346.57**
32.00	32.50	32.25	0.50	30.00	20.10	10.10	164.68	1.89	10.5	10.5	1.0	57.56	2729.01	63	1.0	118.8	3986.40	32.5	10.5	63	8.97	2.62	1.36	150.5	1095.5	7811.0	509.1	7224.6	**3124.38**	**2408.19**
32.50	33.50	33.00	1.00	31.00	18.97	8.97	164.68	3.77	10.5	10.5	1.0	115.11	2844.12	63	1.0	237.6	4224.00	33.5	10.5	63	8.97	2.62	1.36	150.5	1095.5	8163.7	526.1	7594.2	**3265.47**	**2531.41**
33.50	35.00	34.25	1.50	32.50	18.97	8.97	164.68	5.66	10.5	10.5	1.0	172.67	3016.79	63	1.0	356.4	4580.40	35.0	26.1	0	9.42	12.48	13.41	150.5	2210.9	9808.1	551.6	8148.8	**3923.23**	**2716.25**
35.00	36.50	35.75	1.50	34.00	19.42	9.42	164.68	5.66	26.1	26.1	1.0	456.40	3473.18	0	1.0	0.0	4580.40	36.5	13.2	56	9.57	3.41	2.14	150.5	1164.9	9218.5	577.0	8630.6	**3687.39**	**2876.87**
36.50	37.50	37.00	1.00	35.00	19.57	9.57	164.68	3.77	13.2	13.2	1.0	145.67	3618.86	56	1.0	211.2	4791.60	37.5	13.2	56	9.57	3.41	2.14	150.5	1164.9	9575.4	594.0	9004.5	**3830.14**	**3001.49**
37.50	38.00	37.75	0.50	35.50	19.57	9.57	164.68	1.89	13.2	13.2	1.0	72.84	3691.69	56	1.0	105.6	4897.20	38.0	10.0	55	9.51	2.47	1.22	150.5	988.6	9577.5	602.5	9191.4	**3831.01**	**3063.79**
38.00	40.00	39.00	2.00	37.50	19.51	9.51	164.68	7.54	10.0	10.0	1.0	219.03	3910.72	55	1.0	414.9	5312.06	40.0	10.0	55	9.51	2.47	1.22	150.5	988.6	10211.4	636.4	9859.2	**4084.56**	**3286.40**
BORE NO: P96, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	20.19	10.19	28.02	1.89	27.5	27.5	1.0	27.51	0	3	1.0	5.7	0	3.0	25.5	0	10.19	11.13	12.03	30.6	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.50	20.19	10.19	35.67	3.77	25.5	25.5	1.0	64.16	0	0	1.0	0.0	0	4.0	24.3	5	9.41	9.50	10.11	40.8	0	0.0	25.5	25.5	**0.00**	**8.49**
4.00	6.00	5.00	2.00	3.50	19.41	9.41	50.17	7.54	24.3	24.3	1.0	170.87	0	5	1.0	37.7	0	6.0	24.7	0	9.41	9.78	10.55	59.6	0	0.0	59.4	59.4	**0.00**	**19.80**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
6.00	7.00	6.50	1.00	4.50	19.41	9.41	64.29	3.77	24.7	24.7	1.0	111.51	0	0	1.0	0.0	0	7.0	24.7	0	9.41	9.78	10.55	69.0	0	0.0	76.4	76.4	**0.00**	**25.46**
7.00	8.00	7.50	1.00	5.50	19.41	9.41	73.70	3.77	24.7	24.7	1.0	127.84	0	0	1.0	0.0	0	8.0	10.5	42	9.41	2.62	1.36	78.4	668.5	668.5	93.3	93.3	**267.41**	**31.11**
8.00	9.00	8.50	1.00	6.50	19.41	9.41	83.11	3.77	10.5	10.5	1.0	58.09	58.09	42	1.0	158.4	158.40	9.0	10.5	42	10.20	2.62	1.36	87.8	697.1	913.6	110.3	326.8	**365.44**	**108.93**
9.00	10.00	9.50	1.00	7.50	20.20	10.20	92.91	3.77	10.5	10.5	1.0	64.94	123.03	42	1.0	158.4	316.80	10.0	10.5	42	10.20	2.62	1.36	98.0	727.3	1167.2	127.3	567.1	**466.86**	**189.04**
10.00	12.50	11.25	2.50	10.00	20.20	10.20	110.76	9.43	10.5	10.5	1.0	193.55	316.58	42	1.0	396.0	712.80	12.5	11.2	54	10.20	2.82	1.56	123.5	955.2	1984.5	169.7	1199.1	**793.82**	**399.70**
12.50	14.00	13.25	1.50	11.50	20.20	10.20	131.16	5.66	11.2	11.2	1.0	146.92	463.50	54	1.0	305.5	1018.29	14.0	11.2	40	10.07	2.82	1.56	138.8	861.3	2343.1	195.2	1677.0	**937.25**	**558.99**
14.00	15.50	14.75	1.50	13.00	20.07	10.07	146.36	5.66	11.2	11.2	1.0	163.95	627.45	40	1.0	226.3	1244.57	15.5	11.2	40	10.07	2.82	1.56	153.9	909.6	2781.6	220.6	2092.6	**1112.64**	**697.55**
15.50	17.00	16.25	1.50	14.50	20.07	10.07	161.47	5.66	11.2	11.2	1.0	180.87	808.32	40	1.0	226.3	1470.86	17.0	28.0	0	10.25	16.76	17.79	169.0	3328.1	5607.2	246.1	2525.3	**2242.90**	**841.75**
17.00	18.50	17.75	1.50	16.00	20.25	10.25	176.71	5.66	28.0	28.0	1.0	531.53	1339.85	0	1.0	0.0	1470.86	18.5	28.0	0	10.25	16.76	17.79	169.0	3328.1	6138.8	271.5	3082.2	**2455.51**	**1027.42**
18.50	20.00	19.25	1.50	17.50	20.25	10.25	176.71	5.66	28.0	28.0	1.0	531.53	1871.37	0	1.0	0.0	1470.86	20.0	15.5	32	10.25	4.19	2.92	169.0	1146.7	4488.9	297.0	3639.2	**1795.57**	**1213.08**
20.00	21.50	20.75	1.50	19.00	20.25	10.25	176.71	5.66	15.5	15.5	1.0	277.23	2148.60	32	1.0	181.0	1651.89	21.5	15.5	32	9.88	4.19	2.92	169.0	1146.0	4946.5	322.5	4122.9	**1978.58**	**1374.32**
21.50	23.00	22.25	1.50	20.50	19.88	9.88	176.71	5.66	15.5	15.5	1.0	277.23	2425.83	32	1.0	181.0	1832.91	23.0	9.4	49	9.88	2.36	1.13	169.0	958.2	5217.0	347.9	4606.7	**2086.79**	**1535.55**
23.00	24.50	23.75	1.50	22.00	19.88	9.88	176.71	5.66	9.4	9.4	1.0	165.49	2591.33	49	1.0	277.2	2110.11	24.5	9.4	49	9.88	2.36	1.13	169.0	958.2	5659.7	373.4	5074.8	**2263.86**	**1691.60**
24.50	26.00	25.25	1.50	23.50	19.88	9.88	176.71	5.66	9.4	9.4	1.0	165.49	2756.82	49	1.0	277.2	2387.31	26.0	29.8	0	9.88	20.81	21.94	169.0	4126.6	9270.7	398.8	5543.0	**3708.28**	**1847.65**
26.00	27.50	26.75	1.50	25.00	19.88	9.88	176.71	5.66	29.8	29.8	1.0	572.51	3329.33	0	1.0	0.0	2387.31	27.5	29.8	0	11.32	20.81	21.94	169.0	4148.0	9864.7	424.3	6140.9	**3945.86**	**2046.98**
27.50	29.00	28.25	1.50	26.50	21.32	11.32	176.71	5.66	29.8	29.8	1.0	572.51	3901.84	0	1.0	0.0	2387.31	29.0	12.1	42	11.32	3.09	1.82	169.0	1032.0	7321.2	449.7	6738.9	**2928.48**	**2246.30**
29.00	30.00	29.50	1.00	27.50	21.32	11.32	176.71	3.77	12.1	12.1	1.0	142.87	4044.71	42	1.0	158.4	2545.71	30.0	12.1	42	11.32	3.09	1.82	169.0	1032.0	7622.5	466.7	7057.1	**3048.99**	**2352.38**
30.00	30.50	30.25	0.50	28.00	21.32	11.32	176.71	1.89	12.1	12.1	1.0	71.44	4116.15	42	1.0	79.2	2624.91	30.5	12.1	42	11.32	3.09	1.82	169.0	1032.0	7773.1	475.2	7216.3	**3109.24**	**2405.42**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	N_γ	q	Qb					
30.50	32.00	31.25	1.50	29.50	21.32	11.32	176.71	5.66	12.1	12.1	1.0	214.31	4330.46	42	1.0	237.6	2862.51	32.0	29.1	0	11.32	19.23	20.33	169.0	3834.2	11027.1	500.7	7693.6	**4410.86**	**2564.54**
32.00	32.50	32.25	0.50	30.00	21.32	11.32	176.71	1.89	29.1	29.1	1.0	185.47	4515.92	0	1.0	0.0	2862.51	32.5	27.6	0	10.88	15.85	16.87	169.0	3156.6	10535.1	509.1	7887.6	**4214.02**	**2629.19**
32.50	33.50	33.00	1.00	31.00	20.88	10.88	176.71	3.77	27.6	27.6	1.0	348.41	4864.33	0	1.0	0.0	2862.51	33.5	18.0	39	10.88	5.42	4.29	169.0	1464.6	9191.4	526.1	8253.0	**3676.57**	**2750.99**
33.50	35.00	34.25	1.50	32.50	20.88	10.88	176.71	5.66	18.0	18.0	1.0	324.81	5189.14	39	1.0	220.6	3083.14	35.0	29.3	5	10.88	19.68	20.79	169.0	3968.5	12240.8	551.6	8823.9	**4896.33**	**2941.28**
35.00	36.50	35.75	1.50	34.00	20.88	10.88	176.71	5.66	29.3	29.3	1.0	560.98	5750.12	5	1.0	28.3	3111.43	36.5	12.6	48	10.88	3.23	1.96	169.0	1121.6	9983.1	577.0	9438.6	**3993.25**	**3146.19**
36.50	37.50	37.00	1.00	35.00	20.88	10.88	176.71	3.77	12.6	12.6	1.0	148.97	5899.09	48	1.0	181.0	3292.46	37.5	12.6	48	10.88	3.23	1.96	169.0	1121.6	10313.1	594.0	9785.5	**4125.25**	**3261.85**
37.50	38.00	37.75	0.50	35.50	20.88	10.88	176.71	1.89	12.6	12.6	1.0	74.48	5973.57	48	1.0	90.5	3382.97	38.0	10.0	45	8.03	2.47	1.22	169.0	937.2	10293.8	602.5	9959.0	**4117.51**	**3319.68**
38.00	40.00	39.00	2.00	37.50	18.03	8.03	176.71	7.54	10.0	10.0	1.0	235.02	6208.60	45	1.0	339.4	3722.40	40.0	10.0	45	8.03	2.47	1.22	169.0	937.2	10868.2	636.4	10567.4	**4347.29**	**3522.47**
BORE NO: P97, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.91	9.91	27.25	1.89	15.0	15.0	1.0	13.77	0	32	1.0	60.3	0	3.0	12.9	16	9.91	3.32	2.05	29.7	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.50	19.91	9.91	34.69	3.77	12.9	12.9	1.0	29.96	0	16	1.0	60.3	0	4.0	27.0	7	9.91	14.50	15.49	39.6	0	0.0	25.5	25.5	**0.00**	**8.49**
4.00	5.00	4.50	1.00	2.50	19.91	9.91	44.60	3.77	27.0	27.0	1.0	85.70	0	7	1.0	26.4	0	5.0	27.0	7	9.91	14.50	15.49	49.6	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.50	19.91	9.91	54.51	3.77	27.0	27.0	1.0	104.74	0	7	1.0	26.4	0	6.0	25.8	0	9.91	11.80	12.72	59.5	0	0.0	59.4	59.4	**0.00**	**19.80**
6.00	7.00	6.50	1.00	4.50	19.91	9.91	64.42	3.77	25.8	25.8	1.0	117.44	0	0	1.0	0.0	0	7.0	26.0	10	10.07	12.25	13.18	69.4	0	0.0	76.4	76.4	**0.00**	**25.46**
7.00	8.00	7.50	1.00	5.50	20.07	10.07	74.41	3.77	26.0	26.0	1.0	136.86	0	10	1.0	37.7	0	8.0	11.5	44	10.07	2.91	1.65	79.4	721.0	721.0	93.3	93.3	**288.38**	**31.11**
8.00	9.00	8.50	1.00	6.50	20.07	10.07	84.48	3.77	11.5	11.5	1.0	64.82	64.82	44	1.0	165.9	165.94	9.0	11.5	44	10.35	2.91	1.65	89.5	754.4	985.2	110.3	341.1	**394.08**	**113.69**
9.00	11.00	10.00	2.00	8.50	20.35	10.35	99.86	7.54	11.5	11.5	1.0	153.25	218.06	44	1.0	331.9	497.83	11.0	9.5	51	10.35	2.38	1.14	110.2	824.1	1540.0	144.3	860.2	**616.01**	**286.72**
11.00	12.00	11.50	1.00	9.50	20.35	10.35	115.39	3.77	9.5	9.5	1.0	72.82	290.89	51	1.0	192.3	690.17	12.0	9.0	51	10.56	2.29	1.07	120.6	839.3	1820.4	161.2	1142.3	**728.16**	**380.76**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	N_γ	q	Qb					
12.00	14.50	13.25	2.50	12.00	20.56	10.56	133.76	9.43	9.0	9.0	1.0	199.75	490.64	51	1.0	480.9	1171.03	14.5	9.0	50	9.81	2.29	1.07	147.0	897.0	2558.7	203.7	1865.3	**1023.47**	**621.77**
14.50	17.50	16.00	3.00	15.00	19.81	9.81	161.68	11.31	9.0	9.0	1.0	289.72	780.36	50	1.0	565.7	1736.74	17.5	11.0	44	9.81	2.76	1.51	176.4	1009.7	3526.8	254.6	2771.7	**1410.72**	**923.89**
17.50	20.50	19.00	3.00	18.00	19.81	9.81	161.68	11.31	11.0	11.0	1.0	355.57	1135.93	44	1.0	497.8	2234.57	20.5	11.3	44	10.96	2.85	1.59	176.4	1029.1	4399.6	305.5	3676.0	**1759.84**	**1225.33**
20.50	23.50	22.00	3.00	21.00	20.96	10.96	161.68	11.31	11.3	11.3	1.0	365.52	1501.44	44	1.0	497.8	2732.40	23.5	12.6	44	10.96	3.23	1.96	176.4	1107.9	5341.8	356.4	4590.2	**2136.70**	**1530.08**
23.50	26.50	25.00	3.00	24.00	20.96	10.96	161.68	11.31	12.6	12.6	1.0	408.88	1910.33	44	1.0	497.8	3230.23	26.5	15.5	39	9.65	4.19	2.92	176.4	1251.7	6392.3	407.3	5547.9	**2556.90**	**1849.29**
26.50	27.50	27.00	1.00	25.00	19.65	9.65	161.68	3.77	15.5	15.5	1.0	169.10	2079.42	39	1.0	147.1	3377.31	27.5	15.5	39	10.33	4.19	2.92	176.4	1253.0	6709.8	424.3	5881.0	**2683.91**	**1960.34**
27.50	29.50	28.50	2.00	27.00	20.33	10.33	161.68	7.54	15.5	15.5	1.0	338.19	2417.62	39	1.0	294.2	3671.49	29.5	26.8	0	10.33	14.05	15.03	176.4	2910.1	8999.2	458.2	6547.3	**3599.67**	**2182.44**
29.50	30.00	29.75	0.50	27.50	20.33	10.33	161.68	1.89	26.8	26.8	1.0	154.00	2571.62	0	1.0	0.0	3671.49	30.0	26.8	0	10.33	14.05	15.03	176.4	2910.1	9153.2	466.7	6709.8	**3661.27**	**2236.61**
30.00	32.50	31.25	2.50	30.00	20.33	10.33	161.68	9.43	26.8	26.8	1.0	770.01	3341.63	0	1.0	0.0	3671.49	32.5	23.5	10	10.33	8.92	9.23	176.4	1946.8	8959.9	509.1	7522.3	**3583.95**	**2507.42**
32.50	35.00	33.75	2.50	32.50	20.33	10.33	161.68	9.43	23.5	23.5	1.0	662.81	4004.45	10	1.0	94.3	3765.77	35.0	23.5	10	11.77	8.92	9.23	176.4	1955.8	9726.0	551.6	8321.8	**3890.40**	**2773.93**
35.00	35.50	35.25	0.50	33.00	21.77	11.77	161.68	1.89	23.5	23.5	1.0	132.56	4137.01	10	1.0	18.9	3784.63	35.5	23.0	10	11.77	8.56	8.68	176.4	1879.6	9801.2	560.1	8481.7	**3920.48**	**2827.23**
35.50	37.50	36.50	2.00	35.00	21.77	11.77	161.68	7.54	23.0	23.0	1.0	517.64	4654.65	10	1.0	75.4	3860.06	37.5	26.5	10	11.77	13.38	14.34	176.4	2886.2	11400.9	594.0	9108.7	**4560.38**	**3036.24**
37.50	38.50	38.00	1.00	36.00	21.77	11.77	161.68	3.77	26.5	26.5	1.0	304.01	4958.66	10	1.0	37.7	3897.77	38.5	26.0	10	11.77	12.25	13.18	176.4	2652.3	11508.7	611.0	9467.4	**4603.50**	**3155.80**
38.50	40.00	39.25	1.50	37.50	21.77	11.77	161.68	5.66	26.0	26.0	1.0	446.09	5404.75	10	1.0	56.6	3954.34	40.0	18.0	47	11.77	5.42	4.29	176.4	1593.8	10952.9	636.4	9995.5	**4381.15**	**3331.84**
BORE NO: P98, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.20	9.20	25.30	1.89	27.3	27.3	1.0	24.62	0	2	1.0	3.8	0	3.0	27.3	2	9.48	15.18	16.18	27.6	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	5.00	4.00	2.00	2.50	19.48	9.48	37.08	7.54	27.3	27.3	1.0	144.36	0	2	1.0	15.1	0	5.0	25.7	8	9.48	11.58	12.49	46.6	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.50	19.48	9.48	51.30	3.77	25.7	25.7	1.0	93.11	0	8	1.0	30.2	0	6.0	25.7	8	9.48	11.58	12.49	56.0	0	0.0	59.4	59.4	**0.00**	**19.80**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
6.00	7.00	6.50	1.00	4.50	19.48	9.48	60.78	3.77	25.7	25.7	1.0	110.32	0	8	1.0	30.2	0	7.0	25.7	8	9.84	11.58	12.49	65.5	1023.1	1023.1	76.4	76.4	**409.23**	**25.46**
7.00	8.00	7.50	1.00	5.50	19.84	9.84	70.44	3.77	25.7	25.7	1.0	127.85	127.85	8	1.0	30.2	30.17	8.0	9.5	47	9.84	2.38	1.14	75.4	689.2	847.2	93.3	251.4	**338.87**	**83.79**
8.00	9.00	8.50	1.00	6.50	19.84	9.84	80.28	3.77	9.5	9.5	1.0	50.67	178.52	47	1.0	177.3	207.43	9.0	9.5	47	9.61	2.38	1.14	85.2	715.5	1101.4	110.3	496.3	**440.57**	**165.42**
9.00	11.00	10.00	2.00	8.50	19.61	9.61	94.81	7.54	9.5	9.5	1.0	119.67	298.19	47	1.0	354.5	561.94	11.0	9.2	53	9.61	2.33	1.10	104.4	821.6	1681.8	144.3	1004.4	**672.71**	**334.80**
11.00	12.00	11.50	1.00	9.50	19.61	9.61	109.23	3.77	9.2	9.2	1.0	66.72	364.91	53	1.0	199.9	761.83	12.0	9.2	53	10.15	2.33	1.10	114.0	847.3	1974.1	161.2	1288.0	**789.63**	**429.32**
12.00	14.50	13.25	2.50	12.00	20.15	10.15	126.72	9.43	9.2	9.2	1.0	193.51	558.42	53	1.0	499.7	1261.54	14.5	10.3	43	10.47	2.56	1.31	139.4	850.6	2670.6	203.7	2023.6	**1068.24**	**674.54**
14.50	17.50	16.00	3.00	15.00	20.47	10.47	155.11	11.31	10.3	10.3	1.0	318.93	877.35	43	1.0	486.5	1748.06	17.5	10.3	43	10.47	2.56	1.31	170.8	941.6	3567.0	254.6	2880.0	**1426.79**	**959.99**
17.50	19.00	18.25	1.50	16.50	20.47	10.47	155.11	5.66	10.3	10.3	1.0	159.47	1036.82	43	1.0	243.3	1991.31	19.0	28.4	0	9.49	17.66	18.71	170.8	3532.9	6561.1	280.0	3308.2	**2624.43**	**1102.72**
19.00	20.50	19.75	1.50	18.00	19.49	9.49	155.11	5.66	28.4	28.4	1.0	474.45	1511.27	0	1.0	0.0	1991.31	20.5	12.8	34	9.49	3.29	2.02	170.8	995.4	4498.0	305.5	3808.1	**1799.19**	**1269.36**
20.50	22.00	21.25	1.50	19.50	19.49	9.49	155.11	5.66	12.8	12.8	1.0	199.36	1710.63	34	1.0	192.3	2183.66	22.0	20.7	39	9.49	6.90	6.16	170.8	1771.1	5665.4	330.9	4225.2	**2266.16**	**1408.41**
22.00	23.50	22.75	1.50	21.00	19.49	9.49	155.11	5.66	20.7	20.7	1.0	331.57	2042.20	39	1.0	220.6	2404.29	23.5	11.5	40	9.47	2.91	1.65	170.8	980.5	5427.0	356.4	4802.9	**2170.80**	**1600.96**
23.50	26.50	25.00	3.00	24.00	19.47	9.47	155.11	11.31	11.5	11.5	1.0	357.05	2399.25	40	1.0	452.6	2856.86	26.5	11.5	40	9.47	2.91	1.65	170.8	980.5	6236.6	407.3	5663.4	**2494.65**	**1887.81**
26.50	27.50	27.00	1.00	25.00	19.47	9.47	155.11	3.77	11.5	11.5	1.0	119.02	2518.27	40	1.0	150.9	3007.71	27.5	14.4	40	9.47	3.77	2.48	170.8	1151.1	6677.1	424.3	5950.3	**2670.83**	**1983.42**
27.50	28.00	27.75	0.50	25.50	19.47	9.47	155.11	1.89	14.4	14.4	1.0	75.10	2593.36	40	1.0	75.4	3083.14	28.0	28.5	4	9.78	17.88	18.94	170.8	3622.4	9298.9	432.8	6109.3	**3719.57**	**2036.43**
28.00	29.50	28.75	1.50	27.00	19.78	9.78	155.11	5.66	28.5	28.5	1.0	476.43	3069.80	4	1.0	22.6	3105.77	29.5	30.2	0	9.78	22.27	23.43	170.8	4459.0	10634.5	458.2	6633.8	**4253.81**	**2211.27**
29.50	30.00	29.75	0.50	27.50	19.78	9.78	155.11	1.89	30.2	30.2	1.0	171.94	3241.73	0	1.0	0.0	3105.77	30.0	30.6	0	9.78	24.28	25.48	170.8	4862.0	11209.5	466.7	6814.2	**4483.80**	**2271.41**
30.00	31.00	30.50	1.00	28.50	19.78	9.78	155.11	3.77	30.6	30.6	1.0	356.34	3598.07	0	1.0	0.0	3105.77	31.0	32.8	0	9.78	35.36	36.75	170.8	7078.7	13782.5	483.7	7187.5	**5513.02**	**2395.84**
31.00	32.50	31.75	1.50	30.00	19.78	9.78	155.11	5.66	32.8	32.8	1.1	644.67	4242.74	0	1.0	0.0	3105.77	32.5	32.8	0	11.12	35.36	36.75	170.8	7112.1	14460.6	509.1	7857.7	**5784.26**	**2619.22**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
32.50	35.00	33.75	2.50	32.50	21.12	11.12	155.11	9.43	32.8	32.8	1.1	1074.44	5317.18	0	1.0	0.0	3105.77	35.0	32.0	0	11.12	31.33	32.65	170.8	6302.3	14725.3	551.6	8974.5	**5890.11**	**2991.51**
35.00	35.50	35.25	0.50	33.00	21.12	11.12	155.11	1.89	32.0	32.0	1.1	201.05	5518.23	0	1.0	0.0	3105.77	35.5	31.3	0	11.12	27.81	29.06	170.8	5593.7	14217.8	560.1	9184.1	**5687.10**	**3061.35**
35.50	37.50	36.50	2.00	35.00	21.12	11.12	155.11	7.54	31.3	31.3	1.1	757.59	6275.82	0	1.0	0.0	3105.77	37.5	31.3	0	8.46	27.81	29.06	170.8	5541.3	14922.9	594.0	9975.6	**5969.14**	**3325.20**
37.50	38.50	38.00	1.00	36.00	18.46	8.46	155.11	3.77	31.3	31.3	1.1	378.80	6654.62	0	1.0	0.0	3105.77	38.5	30.3	0	8.68	22.77	23.94	170.8	4541.8	14302.2	611.0	10371.4	**5720.89**	**3457.12**
38.50	40.00	39.25	1.50	37.50	18.68	8.68	155.11	5.66	30.3	30.3	1.0	520.45	7175.07	0	1.0	0.0	3105.77	40.0	30.3	0	8.68	22.77	23.94	170.8	4541.8	14822.7	636.4	10917.3	**5929.07**	**3639.09**
BORE NO: P99, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	20.67	10.67	29.34	1.89	27.5	27.5	1.0	28.80	0	11	1.0	20.7	0	3.0	26.1	0	10.67	12.48	13.41	32.0	549.0	549.0	8.5	8.5	**219.62**	**2.83**
3.00	4.00	3.50	1.00	1.50	20.67	10.67	37.35	3.77	26.1	26.1	1.0	69.00	69.00	0	1.0	0.0	0.00	4.0	26.0	11	9.83	12.25	13.18	42.7	791.6	860.6	25.5	94.5	**344.25**	**31.49**
4.00	5.00	4.50	1.00	2.50	19.83	9.83	47.60	3.77	26.0	26.0	1.0	87.55	156.55	11	1.0	41.5	41.49	5.0	26.0	11	9.83	12.25	13.18	52.5	927.9	1125.9	42.4	240.5	**450.37**	**80.15**
5.00	6.00	5.50	1.00	3.50	19.83	9.83	57.43	3.77	26.0	26.0	1.0	105.63	262.18	11	1.0	41.5	82.97	6.0	26.5	0	9.83	13.38	14.34	62.3	1039.3	1384.4	59.4	404.5	**553.76**	**134.85**
6.00	7.00	6.50	1.00	4.50	19.83	9.83	67.26	3.77	26.5	26.5	1.0	126.46	388.64	0	1.0	0.0	82.97	7.0	23.0	15	9.83	8.56	8.68	72.2	909.7	1381.3	76.4	548.0	**552.51**	**182.66**
7.00	8.00	7.50	1.00	5.50	19.83	9.83	77.09	3.77	23.0	23.0	1.0	123.40	512.05	15	1.0	56.6	139.54	8.0	9.6	47	10.52	2.40	1.16	82.0	709.3	1360.9	93.3	744.9	**544.37**	**248.31**
8.00	9.00	8.50	1.00	6.50	20.52	10.52	87.26	3.77	9.6	9.6	1.0	55.66	567.71	47	1.0	177.3	316.80	9.0	9.6	47	10.52	2.40	1.16	92.5	737.9	1622.4	110.3	994.8	**648.96**	**331.61**
9.00	11.00	10.00	2.00	8.50	20.52	10.52	103.04	7.54	9.6	9.6	1.0	131.46	699.16	47	1.0	354.5	671.31	11.0	9.6	46	10.52	2.40	1.16	113.6	784.8	2155.3	144.3	1514.7	**862.11**	**504.91**
11.00	12.00	11.50	1.00	9.50	20.52	10.52	118.82	3.77	9.6	9.6	1.0	75.79	774.96	46	1.0	173.5	844.80	12.0	11.0	50	10.17	2.76	1.51	124.1	907.6	2527.3	161.2	1781.0	**1010.93**	**593.66**
12.00	14.50	13.25	2.50	12.00	20.17	10.17	136.79	9.43	11.0	11.0	1.0	250.70	1025.66	50	1.0	471.4	1316.23	14.5	11.0	55	9.76	2.76	1.51	149.5	1037.6	3379.5	203.7	2545.5	**1351.79**	**848.52**
14.50	17.50	16.00	3.00	15.00	19.76	9.76	164.15	11.31	11.0	11.0	1.0	361.00	1386.66	55	1.0	622.3	1938.51	17.5	27.5	7	9.76	15.63	16.64	178.8	3343.2	6668.3	254.6	3579.7	**2667.33**	**1193.25**
17.50	19.00	18.25	1.50	16.50	19.76	9.76	164.15	5.66	27.5	27.5	1.0	483.39	1870.06	7	1.0	39.6	1978.11	19.0	24.8	0	9.93	9.86	10.66	178.8	2065.6	5913.7	280.0	4128.2	**2365.49**	**1376.07**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
19.00	20.50	19.75	1.50	18.00	19.93	9.93	164.15	5.66	24.8	24.8	1.0	429.07	2299.12	0	1.0	0.0	1978.11	20.5	24.8	0	9.93	9.86	10.66	178.8	2065.6	6342.8	305.5	4582.7	**2537.12**	**1527.57**
20.50	22.00	21.25	1.50	19.50	19.93	9.93	164.15	5.66	24.8	24.8	1.0	429.07	2728.19	0	1.0	0.0	1978.11	22.0	26.5	12	10.16	13.38	14.34	178.8	2927.2	7633.5	330.9	5037.3	**3053.39**	**1679.08**
22.00	23.50	22.75	1.50	21.00	20.16	10.16	164.15	5.66	26.5	26.5	1.0	462.98	3191.17	12	1.0	67.9	2046.00	23.5	26.0	12	10.16	12.25	13.18	178.8	2691.5	7928.6	356.4	5593.6	**3171.46**	**1864.52**
23.50	25.00	24.25	1.50	22.50	20.16	10.16	164.15	5.66	26.0	26.0	1.0	452.90	3644.08	12	1.0	67.9	2113.89	25.0	27.0	0	10.16	14.50	15.49	178.8	3040.7	8798.7	381.9	6139.8	**3519.46**	**2046.61**
25.00	26.50	25.75	1.50	24.00	20.16	10.16	164.15	5.66	27.0	27.0	1.0	473.14	4117.22	0	1.0	0.0	2113.89	26.5	27.0	0	10.06	14.50	15.49	178.8	3039.6	9270.7	407.3	6638.4	**3708.30**	**2212.81**
26.50	27.50	27.00	1.00	25.00	20.06	10.06	164.15	3.77	27.0	27.0	1.0	315.43	4432.65	0	1.0	0.0	2113.89	27.5	27.0	0	10.06	14.50	15.49	178.8	3039.6	9586.2	424.3	6970.8	**3834.47**	**2323.61**
27.50	28.00	27.75	0.50	25.50	20.06	10.06	164.15	1.89	27.0	27.0	1.0	157.71	4590.36	0	1.0	0.0	2113.89	28.0	25.5	13	10.06	11.13	12.03	178.8	2465.1	9169.4	432.8	7137.0	**3667.75**	**2379.01**
28.00	29.50	28.75	1.50	27.00	20.06	10.06	164.15	5.66	25.5	25.5	1.0	442.92	5033.28	13	1.0	73.5	2187.43	29.5	25.0	13	10.06	10.00	10.88	178.8	2229.5	9450.2	458.2	7678.9	**3780.08**	**2559.64**
29.50	30.00	29.75	0.50	27.50	20.06	10.06	164.15	1.89	25.0	25.0	1.0	144.34	5177.61	13	1.0	24.5	2211.94	30.0	25.4	5	10.06	10.90	11.80	178.8	2336.5	9726.1	466.7	7856.3	**3890.44**	**2618.76**
30.00	31.00	30.50	1.00	28.50	20.06	10.06	164.15	3.77	25.4	25.4	1.0	293.95	5471.56	5	1.0	18.9	2230.80	31.0	25.4	5	10.06	10.90	11.80	178.8	2336.5	10038.9	483.7	8186.0	**4015.56**	**2728.68**
31.00	32.50	31.75	1.50	30.00	20.06	10.06	164.15	5.66	25.4	25.4	1.0	440.93	5912.49	5	1.0	28.3	2259.09	32.5	25.4	5	10.39	10.90	11.80	178.8	2339.2	10510.8	509.1	8680.7	**4204.31**	**2893.57**
32.50	35.00	33.75	2.50	32.50	20.39	10.39	164.15	9.43	25.4	25.4	1.0	734.88	6647.37	5	1.0	47.1	2306.23	35.0	25.4	5	10.39	10.90	11.80	178.8	2339.2	11292.8	551.6	9505.2	**4517.12**	**3168.39**
35.00	35.50	35.25	0.50	33.00	20.39	10.39	164.15	1.89	25.4	25.4	1.0	146.98	6794.35	5	1.0	9.4	2315.66	35.5	25.6	5	10.39	11.35	12.26	178.8	2433.5	11543.5	560.1	9670.1	**4617.42**	**3223.35**
35.50	37.00	36.25	1.50	34.50	20.39	10.39	164.15	5.66	25.6	25.6	1.0	444.91	7239.25	5	1.0	28.3	2343.94	37.0	27.7	0	10.39	16.08	17.10	178.8	3373.3	12956.5	585.5	10168.7	**5182.62**	**3389.57**
37.00	37.50	37.25	0.50	35.00	20.39	10.39	164.15	1.89	27.7	27.7	1.0	162.51	7401.76	0	1.0	0.0	2343.94	37.5	27.7	0	9.43	16.08	17.10	178.8	3362.2	13107.9	594.0	10339.7	**5243.16**	**3446.57**
37.50	38.50	38.00	1.00	36.00	19.43	9.43	164.15	3.77	27.7	27.7	1.0	325.01	7726.78	0	1.0	0.0	2343.94	38.5	28.2	0	8.89	17.21	18.25	178.8	3590.6	13661.4	611.0	10681.7	**5464.55**	**3560.56**
38.50	40.00	39.25	1.50	37.50	18.89	8.89	164.15	5.66	28.2	28.2	1.0	497.91	8224.68	0	1.0	0.0	2343.94	40.0	28.2	0	8.89	17.21	18.25	178.8	3590.6	14159.3	636.4	11205.1	**5663.71**	**3735.02**

BORE NO: P100, CUT OFF LENGTH: 2.50 m, Nc= 9

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)		Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To								ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb					
2.50	3.00	2.75	0.50	0.50	20.10	10.10	27.78	1.89	28.5	28.5	1.0	28.44	0	0	1.0	0.0	0	3.0	24.5	6	8.73	9.64	10.33	30.3	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	5.00	4.00	2.00	2.50	18.73	8.73	39.03	7.54	24.5	24.5	1.0	134.16	0	6	1.0	45.3	0	5.0	24.5	6	8.73	9.64	10.33	47.8	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.50	18.73	8.73	52.13	3.77	24.5	24.5	1.0	89.59	0	6	1.0	22.6	0	6.0	28.9	0	10.01	18.78	19.87	56.5	1335.5	1335.5	59.4	59.4	**534.18**	**19.80**
6.00	8.00	7.00	2.00	5.50	20.01	10.01	66.50	7.54	28.9	28.9	1.0	276.90	276.90	0	1.0	0.0	0.00	8.0	11.5	43	10.01	2.91	1.65	76.5	701.1	978.0	93.3	370.2	**391.18**	**123.41**
8.00	9.00	8.50	1.00	6.50	20.01	10.01	81.52	3.77	11.5	11.5	1.0	62.55	339.45	43	1.0	162.2	162.17	9.0	11.5	43	10.01	2.91	1.65	86.5	734.0	1235.6	110.3	611.9	**494.26**	**203.98**
9.00	10.00	9.50	1.00	7.50	20.01	10.01	91.53	3.77	11.5	11.5	1.0	70.23	409.67	43	1.0	162.2	324.34	10.0	11.5	43	9.76	2.91	1.65	96.5	766.7	1500.7	127.3	861.3	**600.29**	**287.10**
10.00	11.00	10.50	1.00	8.50	19.76	9.76	101.41	3.77	11.5	11.5	1.0	77.81	487.49	43	1.0	162.2	486.51	11.0	11.5	43	9.76	2.91	1.65	106.3	798.9	1772.9	144.3	1118.3	**709.15**	**372.75**
11.00	12.00	11.50	1.00	9.50	19.76	9.76	111.17	3.77	11.5	11.5	1.0	85.30	572.79	43	1.0	162.2	648.69	12.0	11.5	43	9.76	2.91	1.65	116.1	831.0	2052.5	161.2	1382.7	**820.99**	**460.90**
12.00	14.50	13.25	2.50	12.00	19.76	9.76	128.25	9.43	11.5	11.5	1.0	246.02	818.80	43	1.0	405.4	1054.11	14.5	9.6	54	10.10	2.40	1.16	140.5	938.9	2811.8	203.7	2076.6	**1124.72**	**692.19**
14.50	16.00	15.25	1.50	13.50	20.10	10.10	148.03	5.66	9.6	9.6	1.0	141.64	960.44	54	1.0	305.5	1359.60	16.0	15.1	49	10.10	3.99	2.70	155.6	1219.8	3539.8	229.1	2549.2	**1415.94**	**849.72**
16.00	17.50	16.75	1.50	15.00	20.10	10.10	163.18	5.66	15.1	15.1	1.0	249.07	1209.51	49	1.0	277.2	1636.80	17.5	15.1	49	10.10	3.99	2.70	170.8	1288.2	4134.5	254.6	3100.9	**1653.80**	**1033.63**
17.50	19.00	18.25	1.50	16.50	20.10	10.10	163.18	5.66	15.1	15.1	1.0	249.07	1458.58	49	1.0	277.2	1914.00	19.0	28.8	0	10.00	18.56	19.64	170.8	3718.4	7091.0	280.0	3652.6	**2836.39**	**1217.54**
19.00	20.50	19.75	1.50	18.00	20.00	10.00	163.18	5.66	28.8	28.8	1.0	507.48	1966.07	0	1.0	0.0	1914.00	20.5	21.2	41	10.00	7.26	6.71	170.8	1866.4	5746.4	305.5	4185.6	**2298.58**	**1395.18**
20.50	22.00	21.25	1.50	19.50	20.00	10.00	163.18	5.66	21.2	21.2	1.0	358.05	2324.11	41	1.0	231.9	2145.94	22.0	10.5	57	9.55	2.62	1.36	170.8	1094.8	5564.9	330.9	4801.0	**2225.96**	**1600.33**
22.00	23.50	22.75	1.50	21.00	19.55	9.55	163.18	5.66	10.5	10.5	1.0	171.09	2495.20	57	1.0	322.5	2468.40	23.5	10.5	57	9.55	2.62	1.36	170.8	1094.8	6058.4	356.4	5320.0	**2423.38**	**1773.33**
23.50	25.00	24.25	1.50	22.50	19.55	9.55	163.18	5.66	10.5	10.5	1.0	171.09	2666.29	57	1.0	322.5	2790.86	25.0	27.3	0	9.50	15.18	16.18	170.8	3036.9	8494.0	381.9	5839.0	**3397.61**	**1946.33**
25.00	26.50	25.75	1.50	24.00	19.50	9.50	163.18	5.66	27.3	27.3	1.0	476.45	3142.74	0	1.0	0.0	2790.86	26.5	27.3	0	9.50	15.18	16.18	170.8	3036.9	8970.5	407.3	6340.9	**3588.19**	**2113.64**
26.50	27.50	27.00	1.00	25.00	19.50	9.50	163.18	3.77	27.3	27.3	1.0	317.63	3460.37	0	1.0	0.0	2790.86	27.5	28.4	0	9.50	17.66	18.71	170.8	3531.8	9783.0	424.3	6675.5	**3913.20**	**2225.17**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
27.50	29.50	28.50	2.00	27.00	19.50	9.50	163.18	7.54	28.4	28.4	1.0	665.49	4125.87	0	1.0	0.0	2790.86	29.5	28.4	0	10.70	17.66	18.71	170.8	3547.0	10463.7	458.2	7375.0	**4185.49**	**2458.32**
29.50	30.00	29.75	0.50	27.50	20.70	10.70	163.18	1.89	28.4	28.4	1.0	166.37	4292.24	0	1.0	0.0	2790.86	30.0	28.4	0	10.70	17.66	18.71	170.8	3547.0	10630.1	466.7	7549.8	**4252.04**	**2516.60**
30.00	31.00	30.50	1.00	28.50	20.70	10.70	163.18	3.77	28.4	28.4	1.0	332.75	4624.99	0	1.0	0.0	2790.86	31.0	27.8	2	10.70	16.31	17.33	170.8	3296.3	10712.1	483.7	7899.5	**4284.86**	**2633.18**
31.00	32.50	31.75	1.50	30.00	20.70	10.70	163.18	5.66	27.8	27.8	1.0	486.70	5111.68	2	1.0	11.3	2802.17	32.5	27.8	0	10.70	16.31	17.33	170.8	3275.9	11189.8	509.1	8423.0	**4475.92**	**2807.67**
32.50	34.00	33.25	1.50	31.50	20.70	10.70	163.18	5.66	27.8	27.8	1.0	486.70	5598.38	0	1.0	0.0	2802.17	34.0	28.5	0	10.70	17.88	18.94	170.8	3592.2	11992.7	534.6	8935.2	**4797.10**	**2978.38**
34.00	35.00	34.50	1.00	32.50	20.70	10.70	163.18	3.77	28.5	28.5	1.0	334.14	5932.52	0	1.0	0.0	2802.17	35.0	28.5	0	10.62	17.88	18.94	170.8	3591.2	12325.9	551.6	9286.3	**4930.34**	**3095.42**
35.00	35.50	35.25	0.50	33.00	20.62	10.62	163.18	1.89	28.5	28.5	1.0	167.07	6099.59	0	1.0	0.0	2802.17	35.5	28.5	0	10.62	17.88	18.94	170.8	3591.2	12492.9	560.1	9461.8	**4997.17**	**3153.94**
35.50	37.50	36.50	2.00	35.00	20.62	10.62	163.18	7.54	28.5	28.5	1.0	668.27	6767.86	0	1.0	0.0	2802.17	37.5	28.8	0	10.62	18.56	19.64	170.8	3726.7	13296.7	594.0	10164.0	**5318.68**	**3388.01**
37.50	38.50	38.00	1.00	36.00	20.62	10.62	163.18	3.77	28.8	28.8	1.0	338.32	7106.18	0	1.0	0.0	2802.17	38.5	28.6	0	10.62	18.11	19.17	170.8	3636.3	13544.7	611.0	10519.3	**5417.87**	**3506.44**
38.50	40.00	39.25	1.50	37.50	20.62	10.62	163.18	5.66	28.6	28.6	1.0	503.29	7609.47	0	1.0	0.0	2802.17	40.0	28.6	0	10.62	18.11	19.17	170.8	3636.3	14048.0	636.4	11048.1	**5619.19**	**3682.69**

APPENDIX-H

TABLE 3: COMPUTATION OF LATERAL PILE LOAD CAPACITY (Dia. 1000 mm)

Bore No.	Dia. of pile (m)	Cut-off length (m)	Scour depth (m)	Concrete Grade	Young's Modulus (kN/m^2)	Moment of Inertia (m^4)	Average SPT	Modulus of sub grade (k_1)	Stiffness Factor (T)	Cantilever length	L_1/T	L_f/T	Permissible deflection (m)	Depth of Fixity (m)	Allowable Load capacity of pile(kN)
P81	1.00	2.50	0.00	35	29580399	0.0491	18	2552	3.56	3.50	0.98	2.08	0.005	7.41	67
P82	1.00	2.50	0.00	35	29580399	0.0491	21	2984	3.45	5.50	1.60	1.99	0.005	6.86	46
P83	1.00	2.50	0.00	35	29580399	0.0491	23	3272	3.38	6.50	1.92	1.94	0.005	6.57	39
P84	1.00	2.50	0.00	35	29580399	0.0491	15	2120	3.69	0.00	0.00	2.23	0.005	8.23	156
P85	1.00	2.50	0.00	35	29580399	0.0491	16	2264	3.64	5.50	1.51	2.00	0.005	7.30	42
P86	1.00	2.50	0.00	35	29580399	0.0491	21	2984	3.45	3.50	1.02	2.08	0.005	7.16	72
P87	1.00	2.50	0.00	35	29580399	0.0491	18	2552	3.56	5.50	1.55	2.00	0.005	7.11	43
P88	1.00	2.50	0.00	35	29580399	0.0491	15	2120	3.69	1.50	0.41	2.17	0.005	8.01	101
P89	1.00	2.50	0.00	35	29580399	0.0491	20	2840	3.48	6.50	1.87	1.95	0.005	6.79	37
P90	1.00	2.50	0.00	35	29580399	0.0491	15	2120	3.69	2.50	0.68	2.13	0.005	7.86	78
P91	1.00	2.50	0.00	35	29580399	0.0491	21	2984	3.45	4.50	1.31	2.03	0.005	7.01	57
P92	1.00	2.50	0.00	35	29580399	0.0491	14	1976	3.74	4.50	1.20	2.05	0.005	7.67	48
P93	1.00	2.50	0.00	35	29580399	0.0491	16	2264	3.64	1.50	0.41	2.17	0.005	7.90	105
P94	1.00	2.50	0.00	35	29580399	0.0491	12	1688	3.86	3.50	0.91	2.09	0.005	8.09	56
P95	1.00	2.50	0.00	35	29580399	0.0491	20	2840	3.48	5.50	1.58	1.99	0.005	6.94	45
P96	1.00	2.50	0.00	35	29580399	0.0491	15	2120	3.69	5.50	1.49	2.01	0.005	7.41	41
P97	1.00	2.50	0.00	35	29580399	0.0491	14	1976	3.74	5.50	1.47	2.01	0.005	7.52	39
P98	1.00	2.50	0.00	35	29580399	0.0491	16	2264	3.64	4.50	1.24	2.04	0.005	7.45	51
P99	1.00	2.50	0.00	35	29580399	0.0491	21	2984	3.45	0.50	0.15	2.21	0.005	7.61	163
P100	1.00	2.50	0.00	35	29580399	0.0491	18	2552	3.56	3.50	0.98	2.08	0.005	7.41	67

APPENDIX-H

TABLE 4: COMPUTATION OF LATERAL PILE LOAD CAPACITY (Dia. 1200 mm)

Bore No.	Dia. of pile (m)	Cut-off length (m)	Scour depth (m)	Concrete Grade	Young's Modulus (kN/m^2)	Moment of Inertia (m^4)	Average SPT	Modulus of sub grade (k_1)	Stiffness Factor (T)	Cantilever length	L_1/T	L_f/T	Permissible deflection (m)	Depth of Fixity (m)	Allowable Load capacity of pile(kN)
P81	1.20	2.50	0.00	35	29580399	0.1018	18	2552	4.11	3.50	0.85	2.10	0.005	8.65	101
P82	1.20	2.50	0.00	35	29580399	0.1018	23	3272	3.92	5.50	1.40	2.02	0.005	7.91	75
P83	1.20	2.50	0.00	35	29580399	0.1018	26	3704	3.82	6.50	1.70	1.97	0.005	7.54	65
P84	1.20	2.50	0.00	35	29580399	0.1018	16	2264	4.21	0.00	0.00	2.23	0.005	9.40	218
P85	1.20	2.50	0.00	35	29580399	0.1018	17	2408	4.16	5.50	1.32	2.03	0.005	8.46	66
P86	1.20	2.50	0.00	35	29580399	0.1018	21	2984	3.99	3.50	0.88	2.10	0.005	8.37	108
P87	1.20	2.50	0.00	35	29580399	0.1018	20	2840	4.03	5.50	1.37	2.03	0.005	8.16	71
P88	1.20	2.50	0.00	35	29580399	0.1018	15	2120	4.27	1.50	0.35	2.18	0.005	9.30	143
P89	1.20	2.50	0.00	35	29580399	0.1018	20	2840	4.03	6.50	1.61	1.99	0.005	8.01	59
P90	1.20	2.50	0.00	35	29580399	0.1018	15	2120	4.27	2.50	0.59	2.14	0.005	9.15	114
P91	1.20	2.50	0.00	35	29580399	0.1018	21	2984	3.99	4.50	1.13	2.06	0.005	8.22	88
P92	1.20	2.50	0.00	35	29580399	0.1018	14	1976	4.33	4.50	1.04	2.07	0.005	8.98	74
P93	1.20	2.50	0.00	35	29580399	0.1018	16	2264	4.21	1.50	0.36	2.18	0.005	9.17	149
P94	1.20	2.50	0.00	35	29580399	0.1018	13	1832	4.40	3.50	0.80	2.11	0.005	9.28	87
P95	1.20	2.50	0.00	35	29580399	0.1018	21	2984	3.99	5.50	1.38	2.02	0.005	8.07	72
P96	1.20	2.50	0.00	35	29580399	0.1018	16	2264	4.21	5.50	1.30	2.03	0.005	8.57	65
P97	1.20	2.50	0.00	35	29580399	0.1018	15	2120	4.27	5.50	1.29	2.04	0.005	8.70	63
P98	1.20	2.50	0.00	35	29580399	0.1018	16	2264	4.21	4.50	1.07	2.07	0.005	8.72	78
P99	1.20	2.50	0.00	35	29580399	0.1018	21	2984	3.99	0.50	0.13	2.21	0.005	8.82	223
P100	1.20	2.50	0.00	35	29580399	0.1018	18	2552	4.11	3.50	0.85	2.10	0.005	8.65	101

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
P81	0.50	SM	46	2	9.40	5.00	4.40	1.00	0.332	1.70	3.40	5.00	1.20	9.08	0.11	1.00	0.125	0.378	Liquefiable
	1.00	SM-SC	47	2	18.80	10.00	8.80	0.99	0.331	1.70	3.40	5.00	1.20	9.08	0.11	1.00	0.125	0.379	Liquefiable
	2.00	SM-SC	47	2	37.60	20.00	17.60	0.98	0.328	1.70	3.40	5.00	1.20	9.08	0.11	1.00	0.125	0.382	Liquefiable
	3.00	ML	55	7	56.40	30.00	26.40	0.98	0.326	1.70	11.90	5.00	1.20	19.28	0.21	1.00	0.246	0.757	Liquefiable
	4.00	CL-ML	67	7	75.20	40.00	35.20	0.97	0.323	1.69	11.80	5.00	1.20	19.16	0.21	1.00	-	-	Non-liquefiable
	5.00	ML	65	8	101.00	50.00	51.00	0.96	0.297	1.40	11.20	5.00	1.20	18.44	0.20	1.00	0.235	0.790	Liquefiable
	6.00	ML	51	14	121.20	60.00	61.20	0.95	0.295	1.28	17.90	5.00	1.20	26.48	0.32	1.00	0.387	1.313	Non-liquefiable
	7.00	CL-ML	68	14	141.40	70.00	71.40	0.95	0.292	1.18	16.57	5.00	1.20	24.88	0.29	1.00	-	-	Non-liquefiable
	8.00	CL	85	16	162.40	80.00	82.40	0.94	0.289	1.10	17.63	5.00	1.20	26.15	0.32	1.00	-	-	Non-liquefiable
	9.00	CL	85	19	182.70	90.00	92.70	0.93	0.286	1.04	19.73	5.00	1.20	28.68	0.40	1.00	-	-	Non-liquefiable
	10.00	ML	88	19	203.00	100.00	103.00	0.91	0.279	0.99	18.72	5.00	1.20	27.47	0.35	1.00	0.420	1.505	Non-liquefiable
	11.00	ML	88	21	222.20	110.00	112.20	0.88	0.272	0.94	19.83	5.00	1.20	28.79	0.40	1.00	0.478	1.757	Non-liquefiable
	12.00	CL	90	24	242.40	120.00	122.40	0.85	0.264	0.90	21.69	5.00	1.20	31.03	0.52	1.00	-	-	Non-liquefiable
	14.50	CL	74	29	292.90	145.00	147.90	0.79	0.243	0.82	23.85	5.00	1.20	33.62	0.52	1.00	-	-	Non-liquefiable
	16.00	SC	48	29	326.40	160.00	166.40	0.75	0.229	0.78	22.48	5.00	1.20	31.98	0.52	0.85	0.527	2.306	Non-liquefiable
	17.50	CL	76	28	346.50	175.00	171.50	0.71	0.223	0.76	21.38	5.00	1.20	30.66	0.52	0.84	-	-	Non-liquefiable
	19.00	CL-ML	64	28	376.20	190.00	186.20	0.67	0.210	0.73	20.52	5.00	1.20	29.62	0.44	0.77	-	-	Non-liquefiable
	20.50	CL-ML	64	78	418.20	205.00	213.20	0.63	0.192	0.68	53.42	5.00	1.20	69.10	0.52	0.73	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	23.50	CL-ML	80	102	479.40	235.00	244.40	0.56	0.171	0.64	65.25	5.00	1.20	83.29	0.52	0.69	-	-	Non-liquefiable
	25.00	ML	90	72	510.00	250.00	260.00	0.56	0.171	0.62	44.65	5.00	1.20	58.58	0.52	0.67	0.415	2.423	Non-liquefiable
	26.50	CL-ML	74	55	540.60	265.00	275.60	0.56	0.171	0.60	33.13	5.00	1.20	44.76	0.52	0.65	-	-	Non-liquefiable
	28.00	ML	73	67	571.20	280.00	291.20	0.56	0.171	0.59	39.26	5.00	1.20	52.12	0.52	0.64	0.396	2.311	Non-liquefiable
	29.50	ML	64	95	601.80	295.00	306.80	0.56	0.171	0.57	54.24	5.00	1.20	70.08	0.52	0.62	0.387	2.261	Non-liquefiable
	31.00	CL-ML	74	52	632.40	310.00	322.40	0.56	0.171	0.56	28.96	5.00	1.20	39.75	0.52	0.61	-	-	Non-liquefiable
	32.50	CL-ML	74	60	663.00	325.00	338.00	0.56	0.171	0.54	32.64	5.00	1.20	44.16	0.52	0.60	-	-	Non-liquefiable
	34.00	CL	83	63	693.60	340.00	353.60	0.56	0.171	0.53	33.50	5.00	1.20	45.20	0.52	0.59	-	-	Non-liquefiable
	35.50	CL-ML	55	64	724.20	355.00	369.20	0.56	0.171	0.52	33.31	5.00	1.20	44.97	0.52	0.58	-	-	Non-liquefiable
	37.00	CL-ML	55	77	754.80	370.00	384.80	0.56	0.171	0.51	39.25	5.00	1.20	52.10	0.52	0.57	-	-	Non-liquefiable
	38.50	CL-ML	63	85	785.40	385.00	400.40	0.56	0.171	0.50	42.48	5.00	1.20	55.97	0.52	0.56	-	-	Non-liquefiable
	40.00	CL-ML	63	92	816.00	400.00	416.00	0.56	0.171	0.49	45.11	5.00	1.20	59.13	0.52	0.55	-	-	Non-liquefiable
P82	0.50	ML	57	3.00	9.10	5.00	4.10	1.00	0.345	1.70	5.10	5.00	1.20	11.12	0.12	1.00	0.147	0.426	Liquefiable
	1.00	CL-ML	64	3.00	18.20	10.00	8.20	0.99	0.344	1.70	5.10	5.00	1.20	11.12	0.12	1.00	-	-	Non-liquefiable
	2.00	CL-ML	64	3.00	36.40	20.00	16.40	0.98	0.341	1.70	5.10	5.00	1.20	11.12	0.12	1.00	-	-	Non-liquefiable
	3.00	CL-ML	64	5.00	54.60	30.00	24.60	0.98	0.338	1.70	8.50	5.00	1.20	15.20	0.16	1.00	-	-	Non-liquefiable
	5.00	CL-ML	73	8.00	102.00	50.00	52.00	0.96	0.294	1.39	11.09	5.00	1.20	18.31	0.20	1.00	-	-	Non-liquefiable

APPENDIX-H
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Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	6.00	CL-ML	73	11.00	122.40	60.00	62.40	0.95	0.292	1.27	13.93	5.00	1.20	21.71	0.24	1.00	-	-	Non-liquefiable
	7.00	ML	51	11.00	130.20	70.00	60.20	0.95	0.319	1.29	14.18	5.00	1.20	22.01	0.24	1.00	0.289	0.905	Liquefiable
	8.00	ML	51	17.00	148.80	80.00	68.80	0.94	0.317	1.21	20.50	5.00	1.20	29.59	0.44	1.00	0.527	1.663	Non-liquefiable
	9.00	ML	51	18.00	167.40	90.00	77.40	0.93	0.314	1.14	20.46	5.00	1.20	29.55	0.44	1.00	0.524	1.667	Non-liquefiable
	10.00	CL-ML	64	18.00	186.00	100.00	86.00	0.91	0.306	1.08	19.41	5.00	1.20	28.29	0.38	1.00	-	-	Non-liquefiable
	11.00	CL	77	24.00	204.60	110.00	94.60	0.88	0.297	1.03	24.68	5.00	1.20	34.61	0.52	1.00	-	-	Non-liquefiable
	12.00	CL	83	29.00	223.20	120.00	103.20	0.85	0.288	0.98	28.55	5.00	1.20	39.26	0.52	1.00	-	-	Non-liquefiable
	14.50	CL	73	33.00	304.50	145.00	159.50	0.79	0.234	0.79	26.13	5.00	1.20	36.36	0.52	1.00	-	-	Non-liquefiable
	17.50	CL	77	37.00	358.75	175.00	183.75	0.71	0.215	0.74	27.30	5.00	1.20	37.75	0.52	0.85	-	-	Non-liquefiable
	20.50	CL	79	41.00	426.40	205.00	221.40	0.63	0.188	0.67	27.55	5.00	1.20	38.07	0.52	0.81	-	-	Non-liquefiable
	22.00	CL-ML	63	41.00	455.40	220.00	235.40	0.59	0.177	0.65	26.72	5.00	1.20	37.07	0.52	0.77	-	-	Non-liquefiable
	23.50	CL	85	48.00	486.45	235.00	251.45	0.56	0.169	0.63	30.27	5.00	1.20	41.32	0.52	0.74	-	-	Non-liquefiable
	26.50	CL	85	51.00	548.55	265.00	283.55	0.56	0.169	0.59	30.29	5.00	1.20	41.34	0.52	0.71	-	-	Non-liquefiable
	29.50	CL	85	55.00	613.60	295.00	318.60	0.56	0.168	0.56	30.81	5.00	1.20	41.98	0.52	0.67	-	-	Non-liquefiable
	32.50	CL	72	60.00	666.25	325.00	341.25	0.56	0.171	0.54	32.48	5.00	1.20	43.98	0.52	0.64	-	-	Non-liquefiable
	34.00	MI	92	60.00	697.00	340.00	357.00	0.56	0.171	0.53	31.76	5.00	1.20	43.11	0.52	0.63	-	-	Non-liquefiable
	35.50	MI	93	71.00	727.75	355.00	372.75	0.56	0.171	0.52	36.77	5.00	1.20	49.13	0.52	0.61	-	-	Non-liquefiable
	38.50	MI	91	75.00	789.25	385.00	404.25	0.56	0.171	0.50	37.30	5.00	1.20	49.76	0.52	0.59	-	-	Non-liquefiable

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BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	40.00	CL	64	81.00	820.00	400.00	420.00	0.56	0.171	0.49	39.52	5.00	1.20	52.43	0.52	0.59	-	-	Non-liquefiable
P83	0.50	SM	47	5	9.95	5.00	4.95	1.00	0.312	1.70	8.50	5.00	1.20	15.20	0.16	1.00	0.193	0.619	Liquefiable
	1.00	SM	47	5	19.90	10.00	9.90	0.99	0.311	1.70	8.50	5.00	1.20	15.20	0.16	1.00	0.193	0.621	Liquefiable
	3.00	SM	46	6	59.70	30.00	29.70	0.98	0.306	1.70	10.20	5.00	1.20	17.24	0.18	1.00	0.219	0.714	Liquefiable
	4.00	ML	58	7	79.60	40.00	39.60	0.97	0.304	1.59	11.12	5.00	1.20	18.35	0.20	1.00	0.233	0.768	Liquefiable
	6.00	SM	44	39	119.40	60.00	59.40	0.95	0.299	1.30	50.60	5.00	1.20	65.72	0.52	1.00	0.620	2.073	Non-liquefiable
	7.00	SM	44	8	140.70	70.00	70.70	0.95	0.294	1.19	9.51	5.00	1.20	16.42	0.17	1.00	0.208	0.709	Liquefiable
	8.00	ML	51	8	160.80	80.00	80.80	0.94	0.291	1.11	8.90	5.00	1.20	15.68	0.17	1.00	0.199	0.683	Liquefiable
	9.00	ML	51	32	178.20	90.00	88.20	0.93	0.293	1.06	34.07	5.00	1.20	45.89	0.52	1.00	0.620	2.113	Non-liquefiable
	10.00	CL	90	34	198.00	100.00	98.00	0.91	0.286	1.01	34.35	5.00	1.20	46.21	0.52	1.00	-	-	Non-liquefiable
	12.50	CL-ML	74	32	247.50	125.00	122.50	0.84	0.265	0.90	28.91	5.00	1.20	39.69	0.52	1.00	-	-	Non-liquefiable
	14.00	CL	67	32	284.20	140.00	144.20	0.80	0.246	0.83	26.65	5.00	1.20	36.98	0.52	1.00	-	-	Non-liquefiable
	15.50	CL	67	38	311.55	155.00	156.55	0.76	0.236	0.80	30.37	5.00	1.20	41.45	0.52	0.87	-	-	Non-liquefiable
	18.50	CL	73	41	371.85	185.00	186.85	0.68	0.211	0.73	29.99	5.00	1.20	40.99	0.52	0.82	-	-	Non-liquefiable
	21.50	CL	92	49	432.15	215.00	217.15	0.60	0.186	0.68	33.25	5.00	1.20	44.90	0.52	0.82	-	-	Non-liquefiable
	23.00	ML	73	49	455.40	230.00	225.40	0.56	0.176	0.67	32.64	5.00	1.20	44.17	0.52	0.88	0.545	3.089	Non-liquefiable
	24.50	CL-ML	73	50	450.80	245.00	205.80	0.56	0.191	0.70	34.85	5.00	1.20	46.82	0.52	0.89	-	-	Non-liquefiable

APPENDIX-H
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BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden (N_1)$_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content (N_1)$_{60CS}$	Cyclic Resistance Ratio (CRR$_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	27.50	MI	92	47	506.00	275.00	231.00	0.56	0.191	0.66	30.92	5.00	1.20	42.11	0.52	0.88	-	-	Non-liquefiable
	30.50	CL-ML	66	47	561.20	305.00	256.20	0.56	0.191	0.62	29.36	5.00	1.20	40.24	0.52	0.76	-	-	Non-liquefiable
	32.00	CL	71	47	684.80	320.00	364.80	0.56	0.164	0.52	24.61	5.00	1.20	34.53	0.52	0.68	-	-	Non-liquefiable
	33.50	CL	71	50	716.90	335.00	381.90	0.56	0.164	0.51	25.59	5.00	1.20	35.70	0.52	0.67	-	-	Non-liquefiable
	36.50	CL	76	55	781.10	365.00	416.10	0.56	0.164	0.49	26.96	5.00	1.20	37.36	0.52	0.60	-	-	Non-liquefiable
	38.00	CL-ML	77	58	782.80	380.00	402.80	0.56	0.170	0.50	28.90	5.00	1.20	39.68	0.52	0.61	-	-	Non-liquefiable
	40.00	CL-ML	77	61	824.00	400.00	424.00	0.56	0.170	0.49	29.62	5.00	1.20	40.55	0.52	0.60	-	-	Non-liquefiable
P84	0.50	ML	52	7	10.00	5.00	5.00	1.00	0.311	1.70	11.90	5.00	1.20	19.28	0.21	1.00	0.246	0.793	Liquefiable
	1.00	CL	61	7	20.00	10.00	10.00	0.99	0.310	1.70	11.90	5.00	1.20	19.28	0.21	1.00	-	-	Non-liquefiable
	2.00	CL-ML	51	7	40.00	20.00	20.00	0.98	0.307	1.70	11.90	5.00	1.20	19.28	0.21	1.00	-	-	Non-liquefiable
	3.00	ML	52	9	60.00	30.00	30.00	0.98	0.305	1.70	15.30	5.00	1.20	23.36	0.26	1.00	0.313	1.028	Non-liquefiable
	4.00	ML	52	14	80.00	40.00	40.00	0.97	0.302	1.58	22.14	5.00	1.20	31.56	0.52	1.00	0.620	2.051	Non-liquefiable
	5.00	CL-ML	64	14	100.00	50.00	50.00	0.96	0.300	1.41	19.80	5.00	1.20	28.76	0.40	1.00	-	-	Non-liquefiable
	6.00	CL-ML	64	22	119.40	60.00	59.40	0.95	0.299	1.30	28.54	5.00	1.20	39.25	0.52	1.00	-	-	Non-liquefiable
	7.00	ML	53	24	139.30	70.00	69.30	0.95	0.297	1.20	28.83	5.00	1.20	39.60	0.52	1.00	0.620	2.090	Non-liquefiable
	9.00	ML	88	19	179.10	90.00	89.10	0.93	0.292	1.06	20.13	5.00	1.20	29.15	0.42	1.00	0.498	1.707	Non-liquefiable
	10.00	ML	88	28	201.00	100.00	101.00	0.91	0.282	1.00	27.86	5.00	1.20	38.43	0.52	1.00	0.620	2.203	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	11.00	CL-ML	60	28	221.10	110.00	111.10	0.88	0.273	0.95	26.56	5.00	1.20	36.88	0.52	1.00	-	-	Non-liquefiable
	12.50	CL-ML	73	27	248.75	125.00	123.75	0.84	0.263	0.90	24.27	5.00	1.20	34.13	0.52	1.00	-	-	Non-liquefiable
	15.50	CL	83	30	308.45	155.00	153.45	0.76	0.238	0.81	24.22	5.00	1.20	34.06	0.52	0.87	-	-	Non-liquefiable
	17.00	CL-ML	71	30	341.70	170.00	171.70	0.72	0.224	0.76	22.89	5.00	1.20	32.47	0.52	0.96	-	-	Non-liquefiable
	18.50	CL-ML	71	31	334.85	185.00	149.85	0.68	0.237	0.82	25.32	5.00	1.20	35.39	0.52	0.97	-	-	Non-liquefiable
	20.00	CL	78	31	362.00	200.00	162.00	0.64	0.223	0.79	24.36	5.00	1.20	34.23	0.52	0.97	-	-	Non-liquefiable
	21.50	CL	78	37	389.15	215.00	174.15	0.60	0.209	0.76	28.04	5.00	1.20	38.65	0.52	0.96	-	-	Non-liquefiable
	24.50	ML	64	40	443.45	245.00	198.45	0.56	0.195	0.71	28.39	5.00	1.20	39.07	0.52	0.80	0.495	2.537	Non-liquefiable
	26.00	CL	85	40	525.20	260.00	265.20	0.56	0.173	0.61	24.56	5.00	1.20	34.48	0.52	0.73	-	-	Non-liquefiable
	27.50	SM	45	48	555.50	275.00	280.50	0.56	0.173	0.60	28.66	5.00	1.20	39.39	0.52	0.71	0.442	2.555	Non-liquefiable
	29.00	ML	51	48	585.80	290.00	295.80	0.56	0.173	0.58	27.91	5.00	1.20	38.49	0.52	0.67	0.414	2.394	Non-liquefiable
	30.50	SM	49	42	628.30	305.00	323.30	0.56	0.170	0.56	23.36	5.00	1.20	33.03	0.52	0.65	0.401	2.360	Non-liquefiable
	32.00	ML	51	42	659.20	320.00	339.20	0.56	0.170	0.54	22.80	5.00	1.20	32.37	0.52	0.63	0.394	2.318	Non-liquefiable
	33.50	ML	51	42	690.10	335.00	355.10	0.56	0.170	0.53	22.29	5.00	1.20	31.75	0.52	0.62	0.387	2.279	Non-liquefiable
	36.50	ML	53	46	751.90	365.00	386.90	0.56	0.170	0.51	23.39	5.00	1.20	33.06	0.52	0.60	0.375	2.207	Non-liquefiable
	40.00	ML	53	52	816.00	400.00	416.00	0.56	0.171	0.49	25.50	5.00	1.20	35.59	0.52	0.59	0.365	2.129	Non-liquefiable
P85	0.50	CL	78	4.00	9.70	5.00	4.70	1.00	0.321	1.70	6.80	5.00	1.20	13.16	0.14	1.00	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	1.00	ML	67	4.00	19.40	10.00	9.40	0.99	0.319	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.530	Liquefiable
	2.00	CL-ML	62	4.00	38.80	20.00	18.80	0.98	0.317	1.70	6.80	5.00	1.20	13.16	0.14	1.00	-	-	Non-liquefiable
	3.00	CL-ML	62	6.00	58.20	30.00	28.20	0.98	0.315	1.70	10.20	5.00	1.20	17.24	0.18	1.00	-	-	Non-liquefiable
	4.00	CL	67	6.00	77.60	40.00	37.60	0.97	0.312	1.63	9.78	5.00	1.20	16.74	0.18	1.00	-	-	Non-liquefiable
	5.00	ML	62	11.00	97.00	50.00	47.00	0.96	0.310	1.46	16.05	5.00	1.20	24.25	0.28	1.00	0.331	1.070	Non-liquefiable
	6.00	ML	62	11.00	116.40	60.00	56.40	0.95	0.307	1.33	14.65	5.00	1.20	22.58	0.25	1.00	0.299	0.972	Liquefiable
	7.00	SM	28	11.00	133.00	70.00	63.00	0.95	0.312	1.26	13.86	4.56	1.14	20.33	0.22	1.00	0.262	0.840	Liquefiable
	8.00	ML	81	14.00	152.00	80.00	72.00	0.94	0.309	1.18	16.50	5.00	1.20	24.80	0.29	1.00	0.343	1.111	Non-liquefiable
	9.00	ML	81	17.00	171.00	90.00	81.00	0.93	0.307	1.11	18.89	5.00	1.20	27.67	0.36	1.00	0.427	1.394	Non-liquefiable
	10.00	CL-ML	92	17.00	199.00	100.00	99.00	0.91	0.284	1.01	17.09	5.00	1.20	25.50	0.30	1.00	-	-	Non-liquefiable
	11.00	CL-ML	92	28.00	218.90	110.00	108.90	0.88	0.276	0.96	26.83	5.00	1.20	37.20	0.52	1.00	-	-	Non-liquefiable
	12.00	CL-ML	92	20.00	238.80	120.00	118.80	0.85	0.268	0.92	18.35	5.00	1.20	27.02	0.34	1.00	-	-	Non-liquefiable
	14.50	CL-ML	64	22.00	285.65	145.00	140.65	0.79	0.249	0.84	18.55	5.00	1.20	27.26	0.35	1.00	-	-	Non-liquefiable
	16.00	CL	87	22.00	334.40	160.00	174.40	0.75	0.223	0.76	16.66	5.00	1.20	24.99	0.29	0.89	-	-	Non-liquefiable
	17.50	CL	87	37.00	365.75	175.00	190.75	0.71	0.211	0.72	26.79	5.00	1.20	37.15	0.52	0.86	-	-	Non-liquefiable
	20.50	CL	80	43.00	418.20	205.00	213.20	0.63	0.192	0.68	29.45	5.00	1.20	40.34	0.52	0.79	-	-	Non-liquefiable
	23.50	CL	78	27.00	486.45	235.00	251.45	0.56	0.169	0.63	17.03	5.00	1.20	25.43	0.30	0.73	-	-	Non-liquefiable
	26.50	ML	60	47.00	524.70	265.00	259.70	0.56	0.176	0.62	29.16	5.00	1.20	40.00	0.52	0.72	0.447	2.531	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	28.00	MI	90	47.00	588.00	280.00	308.00	0.56	0.167	0.57	26.78	5.00	1.20	37.14	0.52	0.87	-	-	Non-liquefiable
	29.50	MI	90	66.00	619.50	295.00	324.50	0.56	0.167	0.56	36.64	5.00	1.20	48.97	0.52	0.86	-	-	Non-liquefiable
	31.00	CL-ML	64	66.00	651.00	310.00	341.00	0.56	0.167	0.54	35.74	5.00	1.20	47.89	0.52	0.86	-	-	Non-liquefiable
	32.50	CL	87	60.00	682.50	325.00	357.50	0.56	0.167	0.53	31.73	5.00	1.20	43.08	0.52	0.85	-	-	Non-liquefiable
	35.50	ML	58	64.00	706.45	355.00	351.45	0.56	0.176	0.53	34.14	5.00	1.20	45.97	0.52	0.62	0.385	2.190	Non-liquefiable
	37.00	CL	77	64.00	736.30	370.00	366.30	0.56	0.176	0.52	33.44	5.00	1.20	45.13	0.52	0.61	-	-	Non-liquefiable
	38.50	CL	81	68.00	766.15	385.00	381.15	0.56	0.176	0.51	34.83	5.00	1.20	46.80	0.52	0.60	-	-	Non-liquefiable
	40.00	CL	81	72.00	796.00	400.00	396.00	0.56	0.176	0.50	36.18	5.00	1.20	48.42	0.52	0.60	-	-	Non-liquefiable
P86	0.50	CL-ML	61	7	9.80	5.00	4.80	1.00	0.317	1.70	11.90	5.00	1.20	19.28	0.21	1.00	-	-	Non-liquefiable
	1.00	CL	57	7	19.60	10.00	9.60	0.99	0.316	1.70	11.90	5.00	1.20	19.28	0.21	1.00	-	-	Non-liquefiable
	3.00	ML	53	6	58.80	30.00	28.80	0.98	0.311	1.70	10.20	5.00	1.20	17.24	0.18	1.00	0.219	0.703	Liquefiable
	4.00	ML	53	8	78.40	40.00	38.40	0.97	0.309	1.61	12.91	5.00	1.20	20.49	0.22	1.00	0.264	0.856	Liquefiable
	6.00	ML	59	13	117.60	60.00	57.60	0.95	0.304	1.32	17.13	5.00	1.20	25.55	0.30	1.00	0.362	1.190	Non-liquefiable
	7.00	CL	81	36	137.20	70.00	67.20	0.95	0.301	1.22	43.92	5.00	1.20	57.70	0.52	1.00	-	-	Non-liquefiable
	8.00	CL-ML	72	36	156.80	80.00	76.80	0.94	0.299	1.14	41.08	5.00	1.20	54.30	0.52	1.00	-	-	Non-liquefiable
	9.00	CL-ML	72	31	177.30	90.00	87.30	0.93	0.295	1.07	33.18	5.00	1.20	44.81	0.52	1.00	-	-	Non-liquefiable
	10.00	CL-ML	72	27	197.00	100.00	97.00	0.91	0.287	1.02	27.41	5.00	1.20	37.90	0.52	1.00	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	11.00	ML	90	27	216.70	110.00	106.70	0.88	0.279	0.97	26.14	5.00	1.20	36.37	0.52	1.00	0.620	2.224	Non-liquefiable
	12.50	CL	84	23	237.50	125.00	112.50	0.84	0.277	0.94	21.68	5.00	1.20	31.02	0.52	1.00	-	-	Non-liquefiable
	15.50	CL	77	19	294.50	155.00	139.50	0.76	0.250	0.85	16.09	5.00	1.20	24.30	0.28	0.89	-	-	Non-liquefiable
	17.00	ML	60	19	343.40	170.00	173.40	0.72	0.222	0.76	14.43	5.00	1.20	22.31	0.25	0.85	0.249	1.118	Non-liquefiable
	18.50	CL	63	30	364.45	185.00	179.45	0.68	0.215	0.75	22.39	5.00	1.20	31.87	0.52	0.84	-	-	Non-liquefiable
	21.50	CL	73	49	423.55	215.00	208.55	0.60	0.190	0.69	33.93	5.00	1.20	45.72	0.52	0.80	-	-	Non-liquefiable
	24.50	CL	80	44	482.65	245.00	237.65	0.56	0.177	0.65	28.54	5.00	1.20	39.25	0.52	0.73	-	-	Non-liquefiable
	26.00	CL-ML	64	44	522.60	260.00	262.60	0.56	0.174	0.62	27.15	5.00	1.20	37.58	0.52	0.75	-	-	Non-liquefiable
	27.50	ML	90	49	519.75	275.00	244.75	0.56	0.185	0.64	31.32	5.00	1.20	42.59	0.52	0.76	0.473	2.548	Non-liquefiable
	30.50	SM	48	52	576.45	305.00	271.45	0.56	0.185	0.61	31.56	5.00	1.20	42.87	0.52	0.74	0.458	2.469	Non-liquefiable
	32.00	CL	71	51	604.80	320.00	284.80	0.56	0.185	0.59	30.22	5.00	1.20	41.26	0.52	0.73	-	-	Non-liquefiable
	33.50	CL	87	48	633.15	335.00	298.15	0.56	0.185	0.58	27.80	5.00	1.20	38.36	0.52	0.72	-	-	Non-liquefiable
	36.50	CL	65	47	689.85	365.00	324.85	0.56	0.185	0.55	26.08	5.00	1.20	36.29	0.52	0.66	-	-	Non-liquefiable
	40.00	CL	65	54	824.00	400.00	424.00	0.56	0.170	0.49	26.22	5.00	1.20	36.47	0.52	0.60	-	-	Non-liquefiable
P87	0.50	CL-ML	72	6	10.05	5.00	5.05	1.00	0.309	1.70	10.20	5.00	1.20	17.24	0.18	1.00	-	-	Non-liquefiable
	1.00	CL	58	6	20.10	10.00	10.10	0.99	0.308	1.70	10.20	5.00	1.20	17.24	0.18	1.00	-	-	Non-liquefiable
	2.00	CL	58	6	40.20	20.00	20.20	0.98	0.306	1.70	10.20	5.00	1.20	17.24	0.18	1.00	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	3.00	ML	51	6	60.30	30.00	30.30	0.98	0.303	1.70	10.20	5.00	1.20	17.24	0.18	1.00	0.219	0.721	Liquefiable
	4.00	SM	49	6	80.40	40.00	40.40	0.97	0.301	1.57	9.44	5.00	1.20	16.33	0.17	1.00	0.207	0.688	Liquefiable
	5.00	SM	49	9	98.00	50.00	48.00	0.96	0.306	1.44	12.99	5.00	1.20	20.59	0.22	1.00	0.266	0.868	Liquefiable
	6.00	SM	49	9	117.60	60.00	57.60	0.95	0.304	1.32	11.86	5.00	1.20	19.23	0.21	1.00	0.246	0.809	Liquefiable
	8.00	CL	65	10	156.80	80.00	76.80	0.94	0.299	1.14	11.41	5.00	1.20	18.69	0.20	1.00	-	-	Non-liquefiable
	9.00	CL-ML	70	31	179.10	90.00	89.10	0.93	0.292	1.06	32.84	5.00	1.20	44.41	0.52	1.00	-	-	Non-liquefiable
	10.00	SM	47	31	199.00	100.00	99.00	0.91	0.284	1.01	31.16	5.00	1.20	42.39	0.52	1.00	0.620	2.181	Non-liquefiable
	11.00	CL-ML	81	20	218.90	110.00	108.90	0.88	0.276	0.96	19.17	5.00	1.20	28.00	0.37	1.00	-	-	Non-liquefiable
	12.00	CL-ML	81	26	238.80	120.00	118.80	0.85	0.268	0.92	23.85	5.00	1.20	33.63	0.52	1.00	-	-	Non-liquefiable
	13.00	CL	72	26	258.70	130.00	128.70	0.83	0.259	0.88	22.92	5.00	1.20	32.50	0.52	1.00	-	-	Non-liquefiable
	14.50	CL	72	33	287.10	145.00	142.10	0.79	0.248	0.84	27.68	5.00	1.20	38.22	0.52	1.00	-	-	Non-liquefiable
	16.00	CL-ML	56	33	316.80	160.00	156.80	0.75	0.235	0.80	26.35	5.00	1.20	36.62	0.52	0.88	-	-	Non-liquefiable
	17.50	CL	85	28	341.25	175.00	166.25	0.71	0.226	0.78	21.72	5.00	1.20	31.06	0.52	0.87	-	-	Non-liquefiable
	20.50	CL	82	38	399.75	205.00	194.75	0.63	0.201	0.72	27.23	5.00	1.20	37.68	0.52	0.77	-	-	Non-liquefiable
	22.00	ML	74	38	464.20	220.00	244.20	0.59	0.174	0.64	24.32	5.00	1.20	34.18	0.52	0.75	0.466	2.679	Non-liquefiable
	23.50	CL	78	33	470.00	235.00	235.00	0.56	0.175	0.65	21.53	5.00	1.20	30.83	0.52	0.76	-	-	Non-liquefiable
	25.00	ML	63	33	500.00	250.00	250.00	0.56	0.175	0.63	20.87	5.00	1.20	30.05	0.47	0.76	0.429	2.453	Non-liquefiable
	26.50	ML	51	42	516.75	265.00	251.75	0.56	0.179	0.63	26.47	5.00	1.20	36.76	0.52	0.76	0.472	2.635	Non-liquefiable

APPENDIX-H

TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	29.50	ML	75	49	575.25	295.00	280.25	0.56	0.179	0.60	29.27	5.00	1.20	40.12	0.52	0.74	0.458	2.553	Non-liquefiable
	32.50	ML	57	45	633.75	325.00	308.75	0.56	0.179	0.57	25.61	5.00	1.20	35.73	0.52	0.66	0.408	2.273	Non-liquefiable
	35.50	ML	53	48	727.75	355.00	372.75	0.56	0.171	0.52	24.86	5.00	1.20	34.83	0.52	0.61	0.380	2.228	Non-liquefiable
	38.50	ML	52	53	789.25	385.00	404.25	0.56	0.171	0.50	26.36	5.00	1.20	36.63	0.52	0.59	0.369	2.162	Non-liquefiable
	40.00	ML	52	57	828.00	400.00	428.00	0.56	0.169	0.48	27.55	5.00	1.20	38.06	0.52	0.58	0.361	2.136	Non-liquefiable
P88	0.50	ML	64	5.00	9.95	5.00	4.95	1.00	0.312	1.70	8.50	5.00	1.20	15.20	0.16	1.00	0.193	0.619	Liquefiable
	1.00	CL	76	5.00	19.90	10.00	9.90	0.99	0.311	1.70	8.50	5.00	1.20	15.20	0.16	1.00	-	-	Non-liquefiable
	3.00	SM	33	7.00	59.70	30.00	29.70	0.98	0.306	1.70	11.90	4.88	1.18	18.92	0.20	1.00	0.241	0.788	Liquefiable
	4.00	CL-ML	65	9.00	79.60	40.00	39.60	0.97	0.304	1.59	14.30	5.00	1.20	22.16	0.24	1.00	-	-	Non-liquefiable
	6.00	CL-ML	60	13.00	113.40	60.00	53.40	0.95	0.316	1.37	17.79	5.00	1.20	26.35	0.32	1.00	-	-	Non-liquefiable
	7.00	CL	77	17.00	132.30	70.00	62.30	0.95	0.314	1.27	21.54	5.00	1.20	30.85	0.52	1.00	-	-	Non-liquefiable
	9.00	SM	36	18.00	170.10	90.00	80.10	0.93	0.308	1.12	20.11	5.00	1.20	29.13	0.42	1.00	0.497	1.612	Non-liquefiable
	10.00	SM	36	21.00	189.00	100.00	89.00	0.91	0.300	1.06	22.26	5.00	1.20	31.71	0.52	1.00	0.620	2.064	Non-liquefiable
	11.00	CL	78	21.00	227.70	110.00	117.70	0.88	0.266	0.92	19.36	5.00	1.20	28.23	0.38	1.00	-	-	Non-liquefiable
	12.50	CL	87	24.00	258.75	125.00	133.75	0.84	0.254	0.86	20.75	5.00	1.20	29.90	0.46	1.00	-	-	Non-liquefiable
	15.50	CL	73	26.00	322.40	155.00	167.40	0.76	0.228	0.77	20.10	5.00	1.20	29.11	0.42	0.88	-	-	Non-liquefiable
	18.50	CL	64	18.00	384.80	185.00	199.80	0.68	0.204	0.71	12.73	5.00	1.20	20.28	0.22	0.81	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	21.50	CL	64	22.00	447.20	215.00	232.20	0.60	0.180	0.66	14.44	5.00	1.20	22.32	0.25	0.83	-	-	Non-liquefiable
	24.50	CL	65	35.00	509.60	245.00	264.60	0.56	0.168	0.61	21.52	5.00	1.20	30.82	0.52	0.80	-	-	Non-liquefiable
	26.00	SM	40	35.00	501.80	260.00	241.80	0.56	0.181	0.64	22.51	5.00	1.20	32.01	0.52	0.82	0.509	2.806	Non-liquefiable
	27.50	CL	76	37.00	530.75	275.00	255.75	0.56	0.181	0.63	23.14	5.00	1.20	32.76	0.52	0.81	-	-	Non-liquefiable
	29.00	ML	68	37.00	591.60	290.00	301.60	0.56	0.171	0.58	21.31	5.00	1.20	30.57	0.51	0.70	0.428	2.500	Non-liquefiable
	30.50	ML	68	48.00	622.20	305.00	317.20	0.56	0.171	0.56	26.95	5.00	1.20	37.34	0.52	0.68	0.422	2.462	Non-liquefiable
	32.00	CL	67	48.00	656.00	320.00	336.00	0.56	0.171	0.55	26.19	5.00	1.20	36.42	0.52	0.67	-	-	Non-liquefiable
	33.50	ML	63	50.00	686.75	335.00	351.75	0.56	0.171	0.53	26.66	5.00	1.20	36.99	0.52	0.66	0.409	2.400	Non-liquefiable
	35.00	SM	43	50.00	717.50	350.00	367.50	0.56	0.171	0.52	26.08	5.00	1.20	36.30	0.52	0.65	0.403	2.364	Non-liquefiable
	36.50	SM	40	55.00	748.25	365.00	383.25	0.56	0.171	0.51	28.09	5.00	1.20	38.71	0.52	0.64	0.397	2.328	Non-liquefiable
	40.00	CL-ML	74	62.00	820.00	400.00	420.00	0.56	0.171	0.49	30.25	5.00	1.20	41.30	0.52	0.62	-	-	Non-liquefiable
P89	0.50	ML	53	4	10.10	5.00	5.10	1.00	0.308	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.551	Liquefiable
	1.00	CL	54	4	20.20	10.00	10.20	0.99	0.307	1.70	6.80	5.00	1.20	13.16	0.14	1.00	-	-	Non-liquefiable
	2.00	CL	54	4	40.40	20.00	20.40	0.98	0.304	1.70	6.80	5.00	1.20	13.16	0.14	1.00	-	-	Non-liquefiable
	3.00	SM	41	5	60.60	30.00	30.60	0.98	0.302	1.70	8.50	5.00	1.20	15.20	0.16	1.00	0.193	0.640	Liquefiable
	5.00	SM	41	5	101.00	50.00	51.00	0.96	0.297	1.40	7.00	5.00	1.20	13.40	0.14	1.00	0.172	0.580	Liquefiable
	6.00	SM	41	7	117.00	60.00	57.00	0.95	0.306	1.32	9.27	5.00	1.20	16.13	0.17	1.00	0.205	0.670	Liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden (N_1)$_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content (N_1)$_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	7.00	CL-ML	64	7	136.50	70.00	66.50	0.95	0.303	1.23	8.58	5.00	1.20	15.30	0.16	1.00	-	-	Non-liquefiable
	8.00	ML	54	9	155.20	80.00	75.20	0.94	0.302	1.15	10.38	5.00	1.20	17.45	0.19	1.00	0.222	0.733	Liquefiable
	9.00	CL	75	27	174.60	90.00	84.60	0.93	0.300	1.09	29.35	5.00	1.20	40.23	0.52	1.00	-	-	Non-liquefiable
	11.00	CL	78	19	213.40	110.00	103.40	0.88	0.283	0.98	18.69	5.00	1.20	27.42	0.35	1.00	-	-	Non-liquefiable
	12.00	CL	78	21	232.80	120.00	112.80	0.85	0.275	0.94	19.77	5.00	1.20	28.73	0.40	1.00	-	-	Non-liquefiable
	14.50	CL	81	19	281.30	145.00	136.30	0.79	0.253	0.86	16.27	5.00	1.20	24.53	0.28	1.00	-	-	Non-liquefiable
	16.00	SM	42	19	310.40	160.00	150.40	0.75	0.240	0.82	15.49	5.00	1.20	23.59	0.27	0.90	0.287	1.194	Non-liquefiable
	17.50	CL-ML	52	23	337.75	175.00	162.75	0.71	0.229	0.78	18.03	5.00	1.20	26.63	0.33	0.89	-	-	Non-liquefiable
	19.00	CL	82	23	366.70	190.00	176.70	0.67	0.216	0.75	17.30	5.00	1.20	25.76	0.31	0.83	-	-	Non-liquefiable
	20.50	CL	82	40	412.05	205.00	207.05	0.63	0.195	0.69	27.80	5.00	1.20	38.36	0.52	0.79	-	-	Non-liquefiable
	23.50	CL	70	39	472.35	235.00	237.35	0.56	0.174	0.65	25.31	5.00	1.20	35.38	0.52	0.76	-	-	Non-liquefiable
	25.00	SM	45	39	507.50	250.00	257.50	0.56	0.172	0.62	24.30	5.00	1.20	34.16	0.52	0.77	0.475	2.758	Non-liquefiable
	26.50	SM	45	42	519.40	265.00	254.40	0.56	0.178	0.63	26.33	5.00	1.20	36.60	0.52	0.77	0.476	2.672	Non-liquefiable
	28.00	CL-ML	67	42	548.80	280.00	268.80	0.56	0.178	0.61	25.62	5.00	1.20	35.74	0.52	0.76	-	-	Non-liquefiable
	29.50	CL-ML	67	52	578.20	295.00	283.20	0.56	0.178	0.59	30.90	5.00	1.20	42.08	0.52	0.75	-	-	Non-liquefiable
	31.00	SM-SC	50	52	607.60	310.00	297.60	0.56	0.178	0.58	30.14	5.00	1.20	41.17	0.52	0.66	0.406	2.279	Non-liquefiable
	32.50	SM-SC	50	36	656.50	325.00	331.50	0.56	0.173	0.55	19.77	5.00	1.20	28.73	0.40	0.63	0.298	1.724	Non-liquefiable
	35.50	CL	68	41	717.10	355.00	362.10	0.56	0.173	0.53	21.55	5.00	1.20	30.86	0.52	0.61	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	38.50	CL	68	53	777.70	385.00	392.70	0.56	0.173	0.50	26.75	5.00	1.20	37.09	0.52	0.61	-	-	Non-liquefiable
	40.00	CL-ML	64	59	828.00	400.00	428.00	0.56	0.169	0.48	28.52	5.00	1.20	39.22	0.52	0.59	-	-	Non-liquefiable
P90	0.50	ML	59	4	9.95	5.00	4.95	1.00	0.312	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.542	Liquefiable
	1.00	CL-ML	69	4	19.90	10.00	9.90	0.99	0.311	1.70	6.80	5.00	1.20	13.16	0.14	1.00	-	-	Non-liquefiable
	2.00	CL	89	4	39.80	20.00	19.80	0.98	0.309	1.70	6.80	5.00	1.20	13.16	0.14	1.00	-	-	Non-liquefiable
	3.00	ML	55	6	59.70	30.00	29.70	0.98	0.306	1.70	10.20	5.00	1.20	17.24	0.18	1.00	0.219	0.714	Liquefiable
	4.00	SM	38	6	79.60	40.00	39.60	0.97	0.304	1.59	9.53	5.00	1.20	16.44	0.17	1.00	0.209	0.686	Liquefiable
	5.00	SM	38	15	98.00	50.00	48.00	0.96	0.306	1.44	21.65	5.00	1.20	30.98	0.52	1.00	0.620	2.025	Non-liquefiable
	6.00	SM	38	18	117.60	60.00	57.60	0.95	0.304	1.32	23.72	5.00	1.20	33.46	0.52	1.00	0.620	2.041	Non-liquefiable
	7.00	ML	90	18	137.20	70.00	67.20	0.95	0.301	1.22	21.96	5.00	1.20	31.35	0.52	1.00	0.620	2.058	Non-liquefiable
	8.00	CL-ML	81	12	155.20	80.00	75.20	0.94	0.302	1.15	13.84	5.00	1.20	21.61	0.24	1.00	-	-	Non-liquefiable
	9.00	CL-ML	81	15	174.60	90.00	84.60	0.93	0.300	1.09	16.31	5.00	1.20	24.57	0.28	1.00	-	-	Non-liquefiable
	10.00	CL	83	15	194.00	100.00	94.00	0.91	0.292	1.03	15.47	5.00	1.20	23.57	0.27	1.00	-	-	Non-liquefiable
	11.00	CL-ML	89	17	221.10	110.00	111.10	0.88	0.273	0.95	16.13	5.00	1.20	24.35	0.28	1.00	-	-	Non-liquefiable
	12.00	CL-ML	89	19	241.20	120.00	121.20	0.85	0.265	0.91	17.26	5.00	1.20	25.71	0.31	1.00	-	-	Non-liquefiable
	14.50	CL	83	21	291.45	145.00	146.45	0.79	0.244	0.83	17.35	5.00	1.20	25.82	0.31	1.00	-	-	Non-liquefiable
	16.00	ML	59	21	324.80	160.00	164.80	0.75	0.230	0.78	16.36	5.00	1.20	24.63	0.28	0.88	0.299	1.302	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden (N_1)$_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content (N_1)$_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	17.50	CL	69	25	339.50	175.00	164.50	0.71	0.228	0.78	19.49	5.00	1.20	28.39	0.38	0.88	-	-	Non-liquefiable
	19.00	CL-ML	77	25	368.60	190.00	178.60	0.67	0.215	0.75	18.71	5.00	1.20	27.45	0.35	0.83	-	-	Non-liquefiable
	20.50	CL-ML	77	32	416.15	205.00	211.15	0.63	0.193	0.69	22.02	5.00	1.20	31.43	0.52	0.78	-	-	Non-liquefiable
	22.00	CL	74	32	446.60	220.00	226.60	0.59	0.180	0.66	21.26	5.00	1.20	30.51	0.51	0.77	-	-	Non-liquefiable
	23.50	CL	74	36	479.40	235.00	244.40	0.56	0.171	0.64	23.03	5.00	1.20	32.63	0.52	0.76	-	-	Non-liquefiable
	25.00	SM	38	36	510.00	250.00	260.00	0.56	0.171	0.62	22.33	5.00	1.20	31.79	0.52	0.80	0.494	2.885	Non-liquefiable
	26.50	SM	38	41	506.15	265.00	241.15	0.56	0.183	0.64	26.40	5.00	1.20	36.68	0.52	0.81	0.503	2.745	Non-liquefiable
	28.00	ML	54	41	534.80	280.00	254.80	0.56	0.183	0.63	25.69	5.00	1.20	35.82	0.52	0.80	0.497	2.709	Non-liquefiable
	29.50	ML	82	55	563.45	295.00	268.45	0.56	0.183	0.61	33.57	5.00	1.20	45.28	0.52	0.79	0.491	2.676	Non-liquefiable
	31.00	ML	94	59	592.10	310.00	282.10	0.56	0.183	0.60	35.13	5.00	1.20	47.15	0.52	0.78	0.485	2.645	Non-liquefiable
	32.50	CL-ML	71	66	620.75	325.00	295.75	0.56	0.183	0.58	38.38	5.00	1.20	51.05	0.52	0.77	-	-	Non-liquefiable
	35.50	CL-ML	56	62	678.05	355.00	323.05	0.56	0.183	0.56	34.50	5.00	1.20	46.39	0.52	0.62	-	-	Non-liquefiable
	38.50	CL	62	53	789.25	385.00	404.25	0.56	0.171	0.50	26.36	5.00	1.20	36.63	0.52	0.56	-	-	Non-liquefiable
	40.00	CL	62	56	812.00	400.00	412.00	0.56	0.172	0.49	27.59	5.00	1.20	38.11	0.52	0.56	-	-	Non-liquefiable
P91	0.50	ML	55	4.00	9.75	5.00	4.75	1.00	0.319	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.531	Liquefiable
	1.00	CL-ML	63	4.00	19.50	10.00	9.50	0.99	0.318	1.70	6.80	5.00	1.20	13.16	0.14	1.00	-	-	Non-liquefiable
	2.00	CL-ML	67	4.00	39.00	20.00	19.00	0.98	0.315	1.70	6.80	5.00	1.20	13.16	0.14	1.00	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	3.00	ML	56	7.00	58.50	30.00	28.50	0.98	0.313	1.70	11.90	5.00	1.20	19.28	0.21	1.00	0.246	0.788	Liquefiable
	5.00	ML	61	9.00	98.50	50.00	48.50	0.96	0.305	1.44	12.92	5.00	1.20	20.51	0.22	1.00	0.265	0.868	Liquefiable
	6.00	ML	61	11.00	118.20	60.00	58.20	0.95	0.302	1.31	14.42	5.00	1.20	22.30	0.25	1.00	0.294	0.972	Liquefiable
	7.00	CL	67	11.00	137.90	70.00	67.90	0.95	0.300	1.21	13.35	5.00	1.20	21.02	0.23	1.00	-	-	Non-liquefiable
	8.00	CL	67	12.00	157.60	80.00	77.60	0.94	0.297	1.14	13.62	5.00	1.20	21.35	0.23	1.00	-	-	Non-liquefiable
	9.00	CL	68	27.00	177.30	90.00	87.30	0.93	0.295	1.07	28.90	5.00	1.20	39.68	0.52	1.00	-	-	Non-liquefiable
	11.00	CL	83	21.00	226.60	110.00	116.60	0.88	0.267	0.93	19.45	5.00	1.20	28.34	0.38	1.00	-	-	Non-liquefiable
	12.00	CL	83	24.00	247.20	120.00	127.20	0.85	0.259	0.89	21.28	5.00	1.20	30.54	0.51	1.00	-	-	Non-liquefiable
	14.50	CL	82	19.00	304.50	145.00	159.50	0.79	0.234	0.79	15.04	5.00	1.20	23.05	0.26	1.00	-	-	Non-liquefiable
	17.50	CL	77	58.00	364.00	175.00	189.00	0.71	0.212	0.73	42.19	5.00	1.20	55.63	0.52	0.80	-	-	Non-liquefiable
	20.50	CL	76	65.00	448.95	205.00	243.95	0.63	0.180	0.64	41.62	5.00	1.20	54.94	0.52	0.74	-	-	Non-liquefiable
	23.50	CL	72	68.00	465.30	235.00	230.30	0.56	0.176	0.66	44.81	5.00	1.20	58.77	0.52	0.72	-	-	Non-liquefiable
	26.50	CL-ML	56	40.00	524.70	265.00	259.70	0.56	0.176	0.62	24.82	5.00	1.20	34.79	0.52	0.69	-	-	Non-liquefiable
	28.00	MI	91	40.00	565.60	280.00	285.60	0.56	0.173	0.59	23.67	5.00	1.20	33.40	0.52	0.78	-	-	Non-liquefiable
	29.50	ML	55	40.00	595.90	295.00	300.90	0.56	0.173	0.58	23.06	5.00	1.20	32.67	0.52	0.77	0.478	2.761	Non-liquefiable
	31.00	CL	63	40.00	626.20	310.00	316.20	0.56	0.173	0.56	22.49	5.00	1.20	31.99	0.52	0.76	-	-	Non-liquefiable
	32.50	CL	83	42.00	656.50	325.00	331.50	0.56	0.173	0.55	23.07	5.00	1.20	32.68	0.52	0.75	-	-	Non-liquefiable
	35.50	CL	83	45.00	717.10	355.00	362.10	0.56	0.173	0.53	23.65	5.00	1.20	33.38	0.52	0.65	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	38.50	CL	66	56.00	777.70	385.00	392.70	0.56	0.173	0.50	28.26	5.00	1.20	38.91	0.52	0.63	-	-	Non-liquefiable
	40.00	CL	72	61.00	808.00	400.00	408.00	0.56	0.173	0.50	30.20	5.00	1.20	41.24	0.52	0.62	-	-	Non-liquefiable
P92	0.50	ML	54	3.00	9.80	5.00	4.80	1.00	0.317	1.70	5.10	5.00	1.20	11.12	0.12	1.00	0.147	0.463	Liquefiable
	1.00	CL-ML	61	3.00	19.60	10.00	9.60	0.99	0.316	1.70	5.10	5.00	1.20	11.12	0.12	1.00	-	-	Non-liquefiable
	2.00	CL-ML	55	3.00	39.20	20.00	19.20	0.98	0.314	1.70	5.10	5.00	1.20	11.12	0.12	1.00	-	-	Non-liquefiable
	3.00	SM-SC	50	5.00	58.80	30.00	28.80	0.98	0.311	1.70	8.50	5.00	1.20	15.20	0.16	1.00	0.193	0.621	Liquefiable
	4.00	ML	66	5.00	78.40	40.00	38.40	0.97	0.309	1.61	8.07	5.00	1.20	14.68	0.16	1.00	0.187	0.606	Liquefiable
	5.00	ML	66	8.00	98.00	50.00	48.00	0.96	0.306	1.44	11.55	5.00	1.20	18.86	0.20	1.00	0.240	0.785	Liquefiable
	6.00	ML	51	11.00	117.60	60.00	57.60	0.95	0.304	1.32	14.49	5.00	1.20	22.39	0.25	1.00	0.295	0.972	Liquefiable
	7.00	CL	78	11.00	137.20	70.00	67.20	0.95	0.301	1.22	13.42	5.00	1.20	21.10	0.23	1.00	-	-	Non-liquefiable
	8.00	CL	78	17.00	156.80	80.00	76.80	0.94	0.299	1.14	19.40	5.00	1.20	28.28	0.38	1.00	-	-	Non-liquefiable
	9.00	CL	78	18.00	176.40	90.00	86.40	0.93	0.297	1.08	19.36	5.00	1.20	28.24	0.38	1.00	-	-	Non-liquefiable
	11.00	CL	91	16.00	227.70	110.00	117.70	0.88	0.266	0.92	14.75	5.00	1.20	22.70	0.25	1.00	-	-	Non-liquefiable
	12.00	CL	77	8.00	248.40	120.00	128.40	0.85	0.258	0.88	7.06	5.00	1.20	13.47	0.15	1.00	-	-	Non-liquefiable
	14.50	CL	73	12.00	295.80	145.00	150.80	0.79	0.241	0.81	9.77	5.00	1.20	16.73	0.18	1.00	-	-	Non-liquefiable
	17.50	CL-ML	73	25.00	360.50	175.00	185.50	0.71	0.214	0.73	18.36	5.00	1.20	27.03	0.34	0.82	-	-	Non-liquefiable
	19.00	CL	63	25.00	385.70	190.00	195.70	0.67	0.205	0.71	17.87	5.00	1.20	26.44	0.32	0.80	-	-	Non-liquefiable

APPENDIX-H

TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	20.50	CL	63	30.00	416.15	205.00	211.15	0.63	0.193	0.69	20.65	5.00	1.20	29.77	0.45	0.78	-	-	Non-liquefiable
	23.50	CL	67	48.00	472.35	235.00	237.35	0.56	0.174	0.65	31.16	5.00	1.20	42.39	0.52	0.74	-	-	Non-liquefiable
	26.50	CL	73	48.00	540.60	265.00	275.60	0.56	0.171	0.60	28.91	5.00	1.20	39.70	0.52	0.69	-	-	Non-liquefiable
	29.50	CL	79	39.00	601.80	295.00	306.80	0.56	0.171	0.57	22.27	5.00	1.20	31.72	0.52	0.66	-	-	Non-liquefiable
	32.50	CL	82	54.00	663.00	325.00	338.00	0.56	0.171	0.54	29.37	5.00	1.20	40.25	0.52	0.64	-	-	Non-liquefiable
	35.50	CL	80	48.00	727.75	355.00	372.75	0.56	0.171	0.52	24.86	5.00	1.20	34.83	0.52	0.62	-	-	Non-liquefiable
	38.50	CL	80	50.00	789.25	385.00	404.25	0.56	0.171	0.50	24.87	5.00	1.20	34.84	0.52	0.61	-	-	Non-liquefiable
	40.00	SM	47	64.00	820.00	400.00	420.00	0.56	0.171	0.49	31.23	5.00	1.20	42.47	0.52	0.60	0.372	2.182	Non-liquefiable
P93	0.50	ML	51	6	9.70	5.00	4.70	1.00	0.321	1.70	10.20	5.00	1.20	17.24	0.18	1.00	0.219	0.682	Liquefiable
	1.00	SM-SC	49	6	19.40	10.00	9.40	0.99	0.319	1.70	10.20	5.00	1.20	17.24	0.18	1.00	0.219	0.685	Liquefiable
	2.00	SM-SC	49	6	38.80	20.00	18.80	0.98	0.317	1.70	10.20	5.00	1.20	17.24	0.18	1.00	0.219	0.690	Liquefiable
	3.00	SM	47	5	58.20	30.00	28.20	0.98	0.315	1.70	8.50	5.00	1.20	15.20	0.16	1.00	0.193	0.615	Liquefiable
	4.00	CL-ML	57	5	77.60	40.00	37.60	0.97	0.312	1.63	8.15	5.00	1.20	14.78	0.16	1.00	-	-	Non-liquefiable
	5.00	CL-ML	63	14	98.50	50.00	48.50	0.96	0.305	1.44	20.10	5.00	1.20	29.12	0.42	1.00	-	-	Non-liquefiable
	6.00	CL-ML	70	12	118.20	60.00	58.20	0.95	0.302	1.31	15.73	5.00	1.20	23.88	0.27	1.00	-	-	Non-liquefiable
	8.00	SM	42	26	157.60	80.00	77.60	0.94	0.297	1.14	29.51	5.00	1.20	40.42	0.52	1.00	0.620	2.085	Non-liquefiable
	9.00	CL-ML	63	19	177.30	90.00	87.30	0.93	0.295	1.07	20.34	5.00	1.20	29.40	0.43	1.00	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	11.00	CL-ML	77	18	216.70	110.00	106.70	0.88	0.279	0.97	17.43	5.00	1.20	25.91	0.31	1.00	-	-	Non-liquefiable
	12.00	CL	85	16	244.80	120.00	124.80	0.85	0.261	0.90	14.32	5.00	1.20	22.19	0.24	1.00	-	-	Non-liquefiable
	14.50	CL-ML	78	29	295.80	145.00	150.80	0.79	0.241	0.81	23.62	5.00	1.20	33.34	0.52	1.00	-	-	Non-liquefiable
	17.50	CL-ML	78	29	351.75	175.00	176.75	0.71	0.219	0.75	21.81	5.00	1.20	31.18	0.52	0.81	-	-	Non-liquefiable
	19.00	CL	79	29	383.80	190.00	193.80	0.67	0.206	0.72	20.83	5.00	1.20	30.00	0.47	0.91	-	-	Non-liquefiable
	20.50	CL	79	32	381.30	205.00	176.30	0.63	0.211	0.75	24.10	5.00	1.20	33.92	0.52	0.92	-	-	Non-liquefiable
	23.50	CL	72	45	437.10	235.00	202.10	0.56	0.189	0.70	31.65	5.00	1.20	42.98	0.52	0.84	-	-	Non-liquefiable
	25.00	SM	47	45	492.50	250.00	242.50	0.56	0.177	0.64	28.90	5.00	1.20	39.68	0.52	0.70	0.433	2.442	Non-liquefiable
	26.50	SM	47	54	551.20	265.00	286.20	0.56	0.168	0.59	31.92	5.00	1.20	43.30	0.52	0.65	0.405	2.408	Non-liquefiable
	28.00	SM	47	63	582.40	280.00	302.40	0.56	0.168	0.58	36.23	5.00	1.20	48.47	0.52	0.64	0.396	2.355	Non-liquefiable
	29.50	CL	67	59	613.60	295.00	318.60	0.56	0.168	0.56	33.05	5.00	1.20	44.67	0.52	0.63	-	-	Non-liquefiable
	31.00	CL	67	55	644.80	310.00	334.80	0.56	0.168	0.55	30.06	5.00	1.20	41.07	0.52	0.61	-	-	Non-liquefiable
	32.50	CL	67	59	676.00	325.00	351.00	0.56	0.168	0.53	31.49	5.00	1.20	42.79	0.52	0.60	-	-	Non-liquefiable
	34.00	CL	67	70	707.20	340.00	367.20	0.56	0.168	0.52	36.53	5.00	1.20	48.84	0.52	0.59	-	-	Non-liquefiable
	35.50	CL	67	78	738.40	355.00	383.40	0.56	0.168	0.51	39.84	5.00	1.20	52.80	0.52	0.58	-	-	Non-liquefiable
	37.00	CL	67	69	769.60	370.00	399.60	0.56	0.168	0.50	34.52	5.00	1.20	46.42	0.52	0.57	-	-	Non-liquefiable
	38.50	CL	63	60	800.80	385.00	415.80	0.56	0.168	0.49	29.42	5.00	1.20	40.31	0.52	0.56	-	-	Non-liquefiable
	40.00	CL	63	70	832.00	400.00	432.00	0.56	0.168	0.48	33.68	5.00	1.20	45.41	0.52	0.55	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
P94	0.50	ML	65	2.00	10.20	5.00	5.20	1.00	0.305	1.70	3.40	5.00	1.20	9.08	0.11	1.00	0.125	0.411	Liquefiable
	1.00	ML	68	2.00	20.40	10.00	10.40	0.99	0.304	1.70	3.40	5.00	1.20	9.08	0.11	1.00	0.125	0.413	Liquefiable
	2.00	CL-ML	72	2.00	40.80	20.00	20.80	0.98	0.301	1.70	3.40	5.00	1.20	9.08	0.11	1.00	-	-	Non-liquefiable
	3.00	CL-ML	72	3.00	61.20	30.00	31.20	0.98	0.299	1.70	5.10	5.00	1.20	11.12	0.12	1.00	-	-	Non-liquefiable
	4.00	CL-ML	72	6.00	81.60	40.00	41.60	0.97	0.297	1.55	9.30	5.00	1.20	16.16	0.17	1.00	-	-	Non-liquefiable
	5.00	ML	59	6.00	97.50	50.00	47.50	0.96	0.308	1.45	8.71	5.00	1.20	15.45	0.16	1.00	0.196	0.64	Liquefiable
	6.00	CL-ML	60	8.00	117.00	60.00	57.00	0.95	0.306	1.32	10.60	5.00	1.20	17.72	0.19	1.00	-	-	Non-liquefiable
	7.00	CL-ML	60	9.00	136.50	70.00	66.50	0.95	0.303	1.23	11.04	5.00	1.20	18.24	0.19	1.00	-	-	Non-liquefiable
	9.00	CL	68	14.00	182.70	90.00	92.70	0.93	0.286	1.04	14.54	5.00	1.20	22.45	0.25	1.00	-	-	Non-liquefiable
	10.00	CL	68	17.00	203.00	100.00	103.00	0.91	0.279	0.99	16.75	5.00	1.20	25.10	0.29	1.00	-	-	Non-liquefiable
	11.00	CL-ML	73	17.00	223.30	110.00	113.30	0.88	0.271	0.94	15.97	5.00	1.20	24.17	0.28	1.00	-	-	Non-liquefiable
	12.50	CL-ML	73	19.00	253.75	125.00	128.75	0.84	0.258	0.88	16.74	5.00	1.20	25.09	0.29	1.00	-	-	Non-liquefiable
	14.00	CL	82	19.00	278.60	140.00	138.60	0.80	0.251	0.85	16.14	5.00	1.20	24.37	0.28	1.00	-	-	Non-liquefiable
	15.50	CL	82	26.00	308.45	155.00	153.45	0.76	0.238	0.81	20.99	5.00	1.20	30.19	0.48	0.88	-	-	Non-liquefiable
	18.50	CL	67	22.00	382.95	185.00	197.95	0.68	0.205	0.71	15.64	5.00	1.20	23.76	0.27	0.79	-	-	Non-liquefiable
	20.00	CL-ML	75	22.00	432.00	200.00	232.00	0.64	0.186	0.66	14.44	5.00	1.20	22.33	0.25	0.77	-	-	Non-liquefiable
	21.50	CL	69	25.00	464.40	215.00	249.40	0.60	0.174	0.63	15.83	5.00	1.20	24.00	0.27	0.75	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	24.50	CL	85	31.00	485.10	245.00	240.10	0.56	0.176	0.65	20.01	5.00	1.20	29.01	0.41	0.74	-	-	Non-liquefiable
	27.50	CL	71	39.00	566.50	275.00	291.50	0.56	0.170	0.59	22.84	5.00	1.20	32.41	0.52	0.67	-	-	Non-liquefiable
	30.50	ML	53	44.00	631.35	305.00	326.35	0.56	0.169	0.55	24.36	5.00	1.20	34.23	0.52	0.65	0.403	2.39	Non-liquefiable
	33.50	CL	80	57.00	693.45	335.00	358.45	0.56	0.169	0.53	30.11	5.00	1.20	41.13	0.52	0.63	-	-	Non-liquefiable
	35.00	CL-ML	63	57.00	735.00	350.00	385.00	0.56	0.167	0.51	29.05	5.00	1.20	39.86	0.52	0.61	-	-	Non-liquefiable
	36.50	MI	88	67.00	766.50	365.00	401.50	0.56	0.167	0.50	33.44	5.00	1.20	45.12	0.52	0.60	-	-	Non-liquefiable
	40.00	CL	86	79.00	840.00	400.00	440.00	0.56	0.167	0.48	37.66	5.00	1.20	50.19	0.52	0.58	-	-	Non-liquefiable
P95	0.50	CL-ML	53	4	9.70	5.00	4.70	1.00	0.321	1.70	6.80	5.00	1.20	13.16	0.14	1.00	-	-	Non-liquefiable
	1.00	CL-ML	53	4	19.40	10.00	9.40	0.99	0.319	1.70	6.80	5.00	1.20	13.16	0.14	1.00	-	-	Non-liquefiable
	2.00	SM-SC	49	4	38.80	20.00	18.80	0.98	0.317	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.534	Liquefiable
	3.00	SM-SC	49	7	58.20	30.00	28.20	0.98	0.315	1.70	11.90	5.00	1.20	19.28	0.21	1.00	0.246	0.783	Liquefiable
	4.00	SM	44	7	77.60	40.00	37.60	0.97	0.312	1.63	11.42	5.00	1.20	18.70	0.20	1.00	0.238	0.764	Liquefiable
	5.00	CL-ML	54	7	97.00	50.00	47.00	0.96	0.310	1.46	10.21	5.00	1.20	17.25	0.18	1.00	-	-	Non-liquefiable
	6.00	SM	45	16	117.60	60.00	57.60	0.95	0.304	1.32	21.08	5.00	1.20	30.30	0.49	1.00	0.584	1.923	Non-liquefiable
	7.00	SM	45	11	137.20	70.00	67.20	0.95	0.301	1.22	13.42	5.00	1.20	21.10	0.23	1.00	0.274	0.909	Liquefiable
	8.00	CL	64	11	156.80	80.00	76.80	0.94	0.299	1.14	12.55	5.00	1.20	20.06	0.22	1.00	-	-	Non-liquefiable
	9.00	CL	64	24	181.80	90.00	91.80	0.93	0.288	1.04	25.05	5.00	1.20	35.06	0.52	1.00	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	10.00	CL	88	28	202.00	100.00	102.00	0.91	0.280	0.99	27.72	5.00	1.20	38.27	0.52	1.00	-	-	Non-liquefiable
	12.50	CL	89	15	252.50	125.00	127.50	0.84	0.260	0.89	13.28	5.00	1.20	20.94	0.23	1.00	-	-	Non-liquefiable
	15.50	CL	81	25	314.65	155.00	159.65	0.76	0.234	0.79	19.79	5.00	1.20	28.74	0.40	0.90	-	-	Non-liquefiable
	18.50	CL-ML	64	35	358.90	185.00	173.90	0.68	0.219	0.76	26.54	5.00	1.20	36.85	0.52	0.89	-	-	Non-liquefiable
	20.00	CL	73	35	388.00	200.00	188.00	0.64	0.206	0.73	25.53	5.00	1.20	35.63	0.52	0.83	-	-	Non-liquefiable
	21.50	CL	73	46	423.55	215.00	208.55	0.60	0.190	0.69	31.85	5.00	1.20	43.22	0.52	0.81	-	-	Non-liquefiable
	23.00	CL-ML	82	46	453.10	230.00	223.10	0.56	0.177	0.67	30.80	5.00	1.20	41.96	0.52	0.79	-	-	Non-liquefiable
	24.50	CL-ML	82	48	509.60	245.00	264.60	0.56	0.168	0.61	29.51	5.00	1.20	40.41	0.52	0.76	-	-	Non-liquefiable
	27.50	ML	81	45	572.00	275.00	297.00	0.56	0.168	0.58	26.11	5.00	1.20	36.33	0.52	0.73	0.453	2.693	Non-liquefiable
	30.50	CL-ML	55	52	634.40	305.00	329.40	0.56	0.168	0.55	28.65	5.00	1.20	39.38	0.52	0.69	-	-	Non-liquefiable
	32.00	CL	79	67	643.20	320.00	323.20	0.56	0.174	0.56	37.27	5.00	1.20	49.72	0.52	0.69	-	-	Non-liquefiable
	33.50	CL	79	67	673.35	335.00	338.35	0.56	0.174	0.54	36.42	5.00	1.20	48.71	0.52	0.68	-	-	Non-liquefiable
	35.00	SM	46	64	703.50	350.00	353.50	0.56	0.174	0.53	34.04	5.00	1.20	45.85	0.52	0.67	0.416	2.393	Non-liquefiable
	36.50	CL	80	58	733.65	365.00	368.65	0.56	0.174	0.52	30.21	5.00	1.20	41.25	0.52	0.66	-	-	Non-liquefiable
	38.00	CL	80	56	763.80	380.00	383.80	0.56	0.174	0.51	28.58	5.00	1.20	39.30	0.52	0.65	-	-	Non-liquefiable
	40.00	CL	84	58	804.00	400.00	404.00	0.56	0.174	0.50	28.86	5.00	1.20	39.63	0.52	0.64	-	-	Non-liquefiable
P96	0.50	ML	57	3	10.10	5.00	5.10	1.00	0.308	1.70	5.10	5.00	1.20	11.12	0.12	1.00	0.147	0.477	Liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden (N_1)$_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content (N_1)$_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	1.00	CL-ML	53	3	20.20	10.00	10.20	0.99	0.307	1.70	5.10	5.00	1.20	11.12	0.12	1.00	-	-	Non-liquefiable
	2.00	SM	35	3	40.40	20.00	20.40	0.98	0.304	1.70	5.10	5.00	1.20	11.12	0.12	1.00	0.147	0.483	Liquefiable
	3.00	SM	35	5	60.60	30.00	30.60	0.98	0.302	1.70	8.50	5.00	1.20	15.20	0.16	1.00	0.193	0.640	Liquefiable
	4.00	CL-ML	61	4	80.80	40.00	40.80	0.97	0.299	1.57	6.26	5.00	1.20	12.51	0.14	1.00	-	-	Non-liquefiable
	6.00	SM	42	10	121.20	60.00	61.20	0.95	0.295	1.28	12.78	5.00	1.20	20.34	0.22	1.00	0.262	0.889	Liquefiable
	7.00	SM	42	11	135.80	70.00	65.80	0.95	0.305	1.23	13.56	5.00	1.20	21.27	0.23	1.00	0.277	0.908	Liquefiable
	8.00	CL	85	11	155.20	80.00	75.20	0.94	0.302	1.15	12.68	5.00	1.20	20.22	0.22	1.00	-	-	Non-liquefiable
	9.00	CL	85	14	174.60	90.00	84.60	0.93	0.300	1.09	15.22	5.00	1.20	23.27	0.26	1.00	-	-	Non-liquefiable
	10.00	CL	85	16	194.00	100.00	94.00	0.91	0.292	1.03	16.50	5.00	1.20	24.80	0.29	1.00	-	-	Non-liquefiable
	12.50	CL	90	18	242.50	125.00	117.50	0.84	0.271	0.92	16.61	5.00	1.20	24.93	0.29	1.00	-	-	Non-liquefiable
	14.00	CL-ML	80	18	282.80	140.00	142.80	0.80	0.247	0.84	15.06	5.00	1.20	23.08	0.26	1.00	-	-	Non-liquefiable
	15.50	CL-ML	80	24	311.55	155.00	156.55	0.76	0.236	0.80	19.18	5.00	1.20	28.02	0.37	0.88	-	-	Non-liquefiable
	17.00	SM	40	24	341.70	170.00	171.70	0.72	0.224	0.76	18.32	5.00	1.20	26.98	0.34	0.82	0.329	1.470	Non-liquefiable
	18.50	SM	40	39	375.55	185.00	190.55	0.68	0.209	0.72	28.25	5.00	1.20	38.90	0.52	0.78	0.487	2.327	Non-liquefiable
	20.00	CL-ML	69	39	406.00	200.00	206.00	0.64	0.197	0.70	27.17	5.00	1.20	37.61	0.52	0.76	-	-	Non-liquefiable
	21.50	CL-ML	69	43	436.45	215.00	221.45	0.60	0.184	0.67	28.90	5.00	1.20	39.67	0.52	0.74	-	-	Non-liquefiable
	23.00	CL	71	43	466.90	230.00	236.90	0.56	0.172	0.65	27.94	5.00	1.20	38.52	0.52	0.83	-	-	Non-liquefiable
	24.50	CL	71	45	487.55	245.00	242.55	0.56	0.176	0.64	28.89	5.00	1.20	39.67	0.52	0.83	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	26.00	SM	43	45	517.40	260.00	257.40	0.56	0.176	0.62	28.05	5.00	1.20	38.66	0.52	0.82	0.506	2.883	Non-liquefiable
	27.50	SM	43	52	547.25	275.00	272.25	0.56	0.176	0.61	31.52	5.00	1.20	42.82	0.52	0.81	0.500	2.848	Non-liquefiable
	29.00	CL-ML	60	52	577.10	290.00	287.10	0.56	0.176	0.59	30.69	5.00	1.20	41.83	0.52	0.68	-	-	Non-liquefiable
	30.50	CL-ML	60	55	649.65	305.00	344.65	0.56	0.165	0.54	29.63	5.00	1.20	40.55	0.52	0.64	-	-	Non-liquefiable
	32.00	SM	49	59	681.60	320.00	361.60	0.56	0.165	0.53	31.03	5.00	1.20	42.23	0.52	0.63	0.388	2.356	Non-liquefiable
	33.50	CL-ML	60	50	713.55	335.00	378.55	0.56	0.165	0.51	25.70	5.00	1.20	35.84	0.52	0.62	-	-	Non-liquefiable
	35.00	SM	47	50	745.50	350.00	395.50	0.56	0.165	0.50	25.14	5.00	1.20	35.17	0.52	0.56	0.350	2.125	Non-liquefiable
	36.50	CL	80	53	762.85	365.00	397.85	0.56	0.167	0.50	26.57	5.00	1.20	36.89	0.52	0.56	-	-	Non-liquefiable
	38.00	CL	80	62	794.20	380.00	414.20	0.56	0.167	0.49	30.46	5.00	1.20	41.56	0.52	0.55	-	-	Non-liquefiable
	40.00	CL-ML	82	69	836.00	400.00	436.00	0.56	0.167	0.48	33.05	5.00	1.20	44.65	0.52	0.54	-	-	Non-liquefiable
P97	0.50	CL-ML	62	3.00	9.95	5.00	4.95	1.00	0.312	1.70	5.10	5.00	1.20	11.12	0.12	1.00	-	-	Non-liquefiable
	2.00	CL	60	3.00	39.80	20.00	19.80	0.98	0.309	1.70	5.10	5.00	1.20	11.12	0.12	1.00	-	-	Non-liquefiable
	3.00	ML	57	7.00	59.70	30.00	29.70	0.98	0.306	1.70	11.90	5.00	1.20	19.28	0.21	1.00	0.246	0.804	Liquefiable
	4.00	SM	41	7.00	79.60	40.00	39.60	0.97	0.304	1.59	11.12	5.00	1.20	18.35	0.20	1.00	0.233	0.768	Liquefiable
	5.00	SM	41	10.00	99.50	50.00	49.50	0.96	0.302	1.42	14.21	5.00	1.20	22.06	0.24	1.00	0.290	0.960	Liquefiable
	6.00	SM	41	12.00	119.40	60.00	59.40	0.95	0.299	1.30	15.57	5.00	1.20	23.68	0.27	1.00	0.320	1.068	Non-liquefiable
	7.00	ML	51	12.00	140.70	70.00	70.70	0.95	0.294	1.19	14.27	5.00	1.20	22.13	0.24	1.00	0.291	0.990	Liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	8.00	CL	57	14.00	160.80	80.00	80.80	0.94	0.291	1.11	15.57	5.00	1.20	23.69	0.27	1.00	-	-	Non-liquefiable
	9.00	CL	57	23.00	180.90	90.00	90.90	0.93	0.289	1.05	24.12	5.00	1.20	33.95	0.52	1.00	-	-	Non-liquefiable
	11.00	CL	96	11.00	223.30	110.00	113.30	0.88	0.271	0.94	10.33	5.00	1.20	17.40	0.19	1.00	-	-	Non-liquefiable
	12.00	CL	88	14.00	243.60	120.00	123.60	0.85	0.262	0.90	12.59	5.00	1.20	20.11	0.22	1.00	-	-	Non-liquefiable
	14.50	CL	79	17.00	298.70	145.00	153.70	0.79	0.239	0.81	13.71	5.00	1.20	21.45	0.23	1.00	-	-	Non-liquefiable
	17.50	CL	78	20.00	346.50	175.00	171.50	0.71	0.223	0.76	15.27	5.00	1.20	23.33	0.26	0.83	-	-	Non-liquefiable
	20.50	CL	78	25.00	405.90	205.00	200.90	0.63	0.198	0.71	17.64	5.00	1.20	26.17	0.32	0.79	-	-	Non-liquefiable
	23.50	CL	72	43.00	493.50	235.00	258.50	0.56	0.167	0.62	26.74	5.00	1.20	37.09	0.52	0.78	-	-	Non-liquefiable
	26.50	CL-ML	69	39.00	556.50	265.00	291.50	0.56	0.167	0.59	22.84	5.00	1.20	32.41	0.52	0.75	-	-	Non-liquefiable
	29.50	SM	48	77.00	619.50	295.00	324.50	0.56	0.167	0.56	42.74	5.00	1.20	56.29	0.52	0.72	0.447	2.678	Non-liquefiable
	32.50	ML	53	72.00	659.75	325.00	334.75	0.56	0.172	0.55	39.35	5.00	1.20	52.22	0.52	0.66	0.409	2.378	Non-liquefiable
	35.50	ML	62	73.00	720.65	355.00	365.65	0.56	0.172	0.52	38.18	5.00	1.20	50.81	0.52	0.64	0.397	2.306	Non-liquefiable
	38.50	CL-ML	64	71.00	839.30	385.00	454.30	0.56	0.161	0.47	33.31	5.00	1.20	44.97	0.52	0.65	-	-	Non-liquefiable
	40.00	SM	45	71.00	872.00	400.00	472.00	0.56	0.161	0.46	32.68	5.00	1.20	44.22	0.52	0.64	0.397	2.460	Non-liquefiable
P98	0.50	ML	53	3	9.60	5.00	4.60	1.00	0.324	1.70	5.10	5.00	1.20	11.12	0.12	1.00	0.147	0.453	Liquefiable
	1.00	SM	46	3	19.20	10.00	9.20	0.99	0.323	1.70	5.10	5.00	1.20	11.12	0.12	1.00	0.147	0.455	Liquefiable
	2.00	SM	48	3	38.40	20.00	18.40	0.98	0.321	1.70	5.10	5.00	1.20	11.12	0.12	1.00	0.147	0.458	Liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	3.00	SM	48	4	57.60	30.00	27.60	0.98	0.318	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.533	Liquefiable
	5.00	CL-ML	59	6	96.00	50.00	46.00	0.96	0.313	1.47	8.85	5.00	1.20	15.62	0.17	1.00	-	-	Non-liquefiable
	6.00	ML	52	8	117.00	60.00	57.00	0.95	0.306	1.32	10.60	5.00	1.20	17.72	0.19	1.00	0.225	0.736	Liquefiable
	7.00	CL-ML	53	8	136.50	70.00	66.50	0.95	0.303	1.23	9.81	5.00	1.20	16.77	0.18	1.00	-	-	Non-liquefiable
	8.00	CL	78	12	158.40	80.00	78.40	0.94	0.296	1.13	13.55	5.00	1.20	21.26	0.23	1.00	-	-	Non-liquefiable
	9.00	CL	78	15	178.20	90.00	88.20	0.93	0.293	1.06	15.97	5.00	1.20	24.17	0.28	1.00	-	-	Non-liquefiable
	11.00	CL	82	18	217.80	110.00	107.80	0.88	0.277	0.96	17.34	5.00	1.20	25.80	0.31	1.00	-	-	Non-liquefiable
	12.00	CL	82	21	235.20	120.00	115.20	0.85	0.272	0.93	19.57	5.00	1.20	28.48	0.39	1.00	-	-	Non-liquefiable
	14.50	CL-ML	72	25	284.20	145.00	139.20	0.79	0.251	0.85	21.19	5.00	1.20	30.43	0.50	1.00	-	-	Non-liquefiable
	17.50	CL-ML	66	21	353.50	175.00	178.50	0.71	0.218	0.75	15.72	5.00	1.20	23.86	0.27	0.80	-	-	Non-liquefiable
	19.00	SM	36	21	389.50	190.00	199.50	0.67	0.203	0.71	14.87	5.00	1.20	22.84	0.25	0.74	0.226	1.111	Non-liquefiable
	20.50	CL-ML	68	30	399.75	205.00	194.75	0.63	0.201	0.72	21.50	5.00	1.20	30.80	0.52	0.75	-	-	Non-liquefiable
	22.00	ML	54	30	429.00	220.00	209.00	0.59	0.188	0.69	20.75	5.00	1.20	29.90	0.46	0.73	0.400	2.132	Non-liquefiable
	23.50	CL-ML	73	37	458.25	235.00	223.25	0.56	0.179	0.67	24.76	5.00	1.20	34.72	0.52	0.71	-	-	Non-liquefiable
	26.50	CL-ML	68	42	516.75	265.00	251.75	0.56	0.179	0.63	26.47	5.00	1.20	36.76	0.52	0.80	-	-	Non-liquefiable
	28.00	SM	42	42	546.00	280.00	266.00	0.56	0.179	0.61	25.75	5.00	1.20	35.90	0.52	0.74	0.461	2.573	Non-liquefiable
	29.50	SM	42	54	584.10	295.00	289.10	0.56	0.176	0.59	31.76	5.00	1.20	43.11	0.52	0.73	0.450	2.549	Non-liquefiable
	31.00	SM	31	58	613.80	310.00	303.80	0.56	0.176	0.57	33.28	4.77	1.16	43.46	0.52	0.71	0.443	2.511	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	32.50	SM	31	62	643.50	325.00	318.50	0.56	0.176	0.56	34.74	4.77	1.16	45.16	0.52	0.70	0.437	2.476	Non-liquefiable
	35.50	SM	40	58	702.90	355.00	347.90	0.56	0.176	0.54	31.10	5.00	1.20	42.31	0.52	0.59	0.363	2.056	Non-liquefiable
	38.50	SM	40	60	812.35	385.00	427.35	0.56	0.166	0.48	29.02	5.00	1.20	39.83	0.52	0.54	0.332	2.000	Non-liquefiable
	40.00	SM	40	62	844.00	400.00	444.00	0.56	0.166	0.47	29.42	5.00	1.20	40.31	0.52	0.53	0.327	1.968	Non-liquefiable
	0.50	CL	57	5.00	10.35	5.00	5.35	1.00	0.301	1.70	8.50	5.00	1.20	15.20	0.16	1.00	-	-	Non-liquefiable
	1.00	SM-SC	46	5.00	20.70	10.00	10.70	0.99	0.299	1.70	8.50	5.00	1.20	15.20	0.16	1.00	0.193	0.645	Liquefiable
	2.00	SM-SC	46	5.00	41.40	20.00	21.40	0.98	0.297	1.70	8.50	5.00	1.20	15.20	0.16	1.00	0.193	0.650	Liquefiable
	3.00	SM	44	13.00	62.10	30.00	32.10	0.98	0.295	1.70	22.10	5.00	1.20	31.52	0.52	1.00	0.620	2.103	Non-liquefiable
	4.00	ML	52	13.00	79.20	40.00	39.20	0.97	0.306	1.60	20.76	5.00	1.20	29.92	0.46	1.00	0.551	1.803	Non-liquefiable
	5.00	ML	69	17.00	99.00	50.00	49.00	0.96	0.303	1.43	24.29	5.00	1.20	34.14	0.52	1.00	0.620	2.046	Non-liquefiable
P99	6.00	SM	47	21.00	118.80	60.00	58.80	0.95	0.301	1.30	27.39	5.00	1.20	37.86	0.52	1.00	0.620	2.063	Non-liquefiable
	7.00	CL-ML	54	21.00	138.60	70.00	68.60	0.95	0.298	1.21	25.35	5.00	1.20	35.43	0.52	1.00	-	-	Non-liquefiable
	8.00	CL	91	25.00	158.40	80.00	78.40	0.94	0.296	1.13	28.23	5.00	1.20	38.88	0.52	1.00	-	-	Non-liquefiable
	9.00	CL	91	31.00	178.20	90.00	88.20	0.93	0.293	1.06	33.01	5.00	1.20	44.61	0.52	1.00	-	-	Non-liquefiable
	11.00	CL	86	20.00	225.50	110.00	115.50	0.88	0.268	0.93	18.61	5.00	1.20	27.33	0.35	1.00	-	-	Non-liquefiable
	12.00	CL	82	11.00	246.00	120.00	126.00	0.85	0.260	0.89	9.80	5.00	1.20	16.76	0.18	1.00	-	-	Non-liquefiable
	14.50	CL	82	20.00	292.90	145.00	147.90	0.79	0.243	0.82	16.45	5.00	1.20	24.73	0.29	1.00	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	17.50	CL	64	18.00	346.50	175.00	171.50	0.71	0.223	0.76	13.74	5.00	1.20	21.49	0.23	0.82	-	-	Non-liquefiable
	19.00	SM	49	18.00	378.10	190.00	188.10	0.67	0.209	0.73	13.12	5.00	1.20	20.75	0.22	0.80	0.215	1.027	Non-liquefiable
	20.50	SM	49	19.00	407.95	205.00	202.95	0.63	0.197	0.70	13.34	5.00	1.20	21.00	0.23	0.78	0.212	1.081	Non-liquefiable
	22.00	CL	65	19.00	444.40	220.00	224.40	0.59	0.181	0.67	12.68	5.00	1.20	20.22	0.22	0.82	-	-	Non-liquefiable
	23.50	CL-ML	60	30.00	474.70	235.00	239.70	0.56	0.173	0.65	19.38	5.00	1.20	28.25	0.38	0.80	-	-	Non-liquefiable
	25.00	SM	47	30.00	505.00	250.00	255.00	0.56	0.173	0.63	18.79	5.00	1.20	27.54	0.35	0.79	0.334	1.931	Non-liquefiable
	26.50	SM	47	48.00	535.30	265.00	270.30	0.56	0.173	0.61	29.20	5.00	1.20	40.03	0.52	0.78	0.484	2.797	Non-liquefiable
	28.00	CL	58	48.00	562.80	280.00	282.80	0.56	0.174	0.59	28.54	5.00	1.20	39.25	0.52	0.74	-	-	Non-liquefiable
	29.50	CL	67	39.00	592.95	295.00	297.95	0.56	0.174	0.58	22.59	5.00	1.20	32.11	0.52	0.72	-	-	Non-liquefiable
	31.00	ML	55	39.00	623.10	310.00	313.10	0.56	0.174	0.57	22.04	5.00	1.20	31.45	0.52	0.71	0.440	2.533	Non-liquefiable
	32.50	ML	55	43.00	653.25	325.00	328.25	0.56	0.174	0.55	23.73	5.00	1.20	33.48	0.52	0.70	0.434	2.498	Non-liquefiable
	35.50	ML	57	56.00	724.20	355.00	369.20	0.56	0.171	0.52	29.14	5.00	1.20	39.97	0.52	0.64	0.397	2.317	Non-liquefiable
	37.00	SM	47	56.00	754.80	370.00	384.80	0.56	0.171	0.51	28.55	5.00	1.20	39.26	0.52	0.63	0.391	2.281	Non-liquefiable
	38.50	SM	47	58.00	785.40	385.00	400.40	0.56	0.171	0.50	28.99	5.00	1.20	39.78	0.52	0.62	0.385	2.244	Non-liquefiable
	40.00	SM	47	64.00	816.00	400.00	416.00	0.56	0.171	0.49	31.38	5.00	1.20	42.65	0.52	0.61	0.378	2.208	Non-liquefiable
P100	0.50	CL-ML	51	4	10.05	5.00	5.05	1.00	0.309	1.70	6.80	5.00	1.20	13.16	0.14	1.00	-	-	Non-liquefiable
	1.00	ML	51	4	20.10	10.00	10.10	0.99	0.308	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.550	Liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	2.00	ML	51	4	40.20	20.00	20.20	0.98	0.306	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.554	Liquefiable
	3.00	CL-ML	58	6	60.30	30.00	30.30	0.98	0.303	1.70	10.20	5.00	1.20	17.24	0.18	1.00	-	-	Non-liquefiable
	5.00	ML	52	8	100.50	50.00	50.50	0.96	0.299	1.41	11.26	5.00	1.20	18.51	0.20	1.00	0.236	0.789	Liquefiable
	6.00	SM	39	16	112.20	60.00	52.20	0.95	0.320	1.38	22.15	5.00	1.20	31.57	0.52	1.00	0.620	1.939	Non-liquefiable
	8.00	CL-ML	83	20	149.60	80.00	69.60	0.94	0.315	1.20	23.97	5.00	1.20	33.77	0.52	1.00	-	-	Non-liquefiable
	9.00	CL-ML	83	23	180.00	90.00	90.00	0.93	0.291	1.05	24.24	5.00	1.20	34.09	0.52	1.00	-	-	Non-liquefiable
	10.00	CL	84	23	200.00	100.00	100.00	0.91	0.283	1.00	23.00	5.00	1.20	32.60	0.52	1.00	-	-	Non-liquefiable
	11.00	ML	89	24	217.80	110.00	107.80	0.88	0.277	0.96	23.12	5.00	1.20	32.74	0.52	1.00	0.620	2.235	Non-liquefiable
	12.00	ML	89	31	237.60	120.00	117.60	0.85	0.269	0.92	28.59	5.00	1.20	39.30	0.52	1.00	0.620	2.305	Non-liquefiable
	14.50	CL	84	18	287.10	145.00	142.10	0.79	0.248	0.84	15.10	5.00	1.20	23.12	0.26	1.00	-	-	Non-liquefiable
	16.00	SM-SC	45	18	316.80	160.00	156.80	0.75	0.235	0.80	14.37	5.00	1.20	22.25	0.25	0.84	0.247	1.051	Non-liquefiable
	17.50	SM-SC	45	47	351.75	175.00	176.75	0.71	0.219	0.75	35.35	5.00	1.20	47.42	0.52	0.81	0.501	2.281	Non-liquefiable
	19.00	SM	41	47	381.90	190.00	191.90	0.67	0.207	0.72	33.93	5.00	1.20	45.71	0.52	0.82	0.506	2.446	Non-liquefiable
	20.50	ML	53	37	410.00	205.00	205.00	0.63	0.196	0.70	25.84	5.00	1.20	36.01	0.52	0.80	0.496	2.537	Non-liquefiable
	22.00	CL	72	37	440.00	220.00	220.00	0.59	0.183	0.67	24.95	5.00	1.20	34.93	0.52	0.79	-	-	Non-liquefiable
	23.50	CL	72	30	458.25	235.00	223.25	0.56	0.179	0.67	20.08	5.00	1.20	29.09	0.41	0.79	-	-	Non-liquefiable
	25.00	SM	47	30	487.50	250.00	237.50	0.56	0.179	0.65	19.47	5.00	1.20	28.36	0.38	0.80	0.364	2.030	Non-liquefiable
	26.50	SM	47	38	516.75	265.00	251.75	0.56	0.179	0.63	23.95	5.00	1.20	33.74	0.52	0.78	0.487	2.715	Non-liquefiable

APPENDIX-H

TABLE 5: LIQUEFACTION ANALYSIS

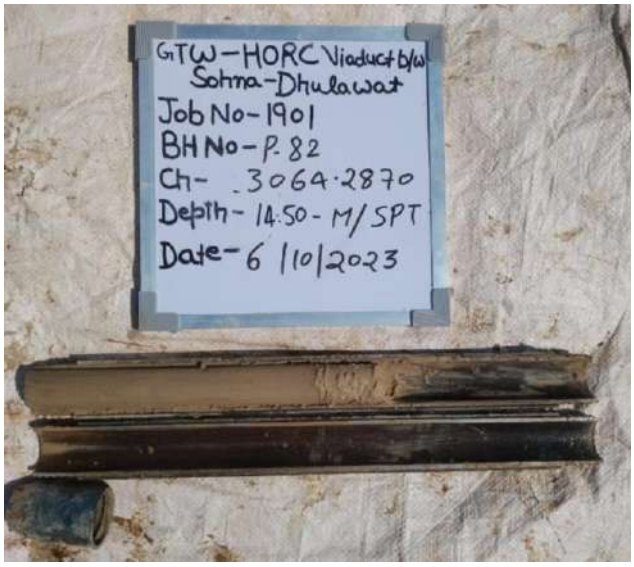
Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	29.50	SM	43	44	575.25	295.00	280.25	0.56	0.179	0.60	26.28	5.00	1.20	36.54	0.52	0.76	0.473	2.640	Non-liquefiable
	31.00	ML	51	44	604.50	310.00	294.50	0.56	0.179	0.58	25.64	5.00	1.20	35.77	0.52	0.66	0.410	2.286	Non-liquefiable
	32.50	ML	51	54	672.75	325.00	347.75	0.56	0.169	0.54	28.96	5.00	1.20	39.75	0.52	0.62	0.384	2.275	Non-liquefiable
	34.00	SM	50	50	703.80	340.00	363.80	0.56	0.169	0.52	26.21	5.00	1.20	36.46	0.52	0.61	0.378	2.236	Non-liquefiable
	35.50	SM	44	29	734.85	355.00	379.85	0.56	0.169	0.51	14.88	5.00	1.20	22.86	0.25	0.60	0.182	1.077	Non-liquefiable
	38.50	SM	46	47	796.95	385.00	411.95	0.56	0.169	0.49	23.16	5.00	1.20	32.79	0.52	0.57	0.355	2.098	Non-liquefiable
	40.00	SM	46	58	824.00	400.00	424.00	0.56	0.170	0.49	28.17	5.00	1.20	38.80	0.52	0.57	0.351	2.065	Non-liquefiable

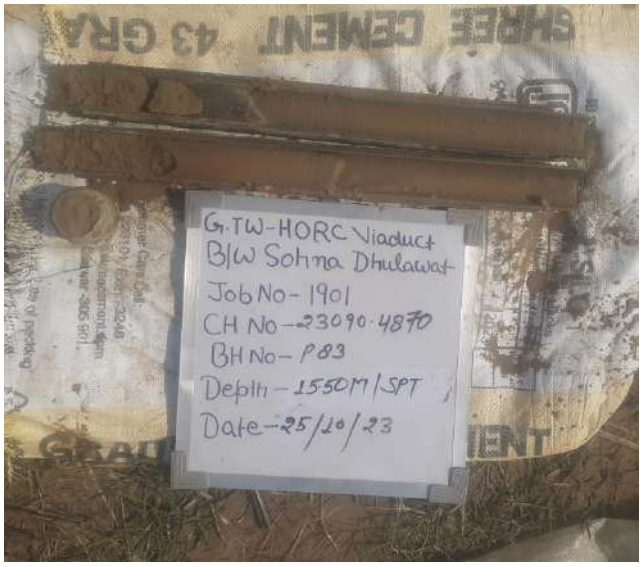
APPENDIX-I
SITE PHOTOGRAPHS

SPT at depth 29.50m

SPT at depth 2.00 m



SPT sample at depth 14.50 m



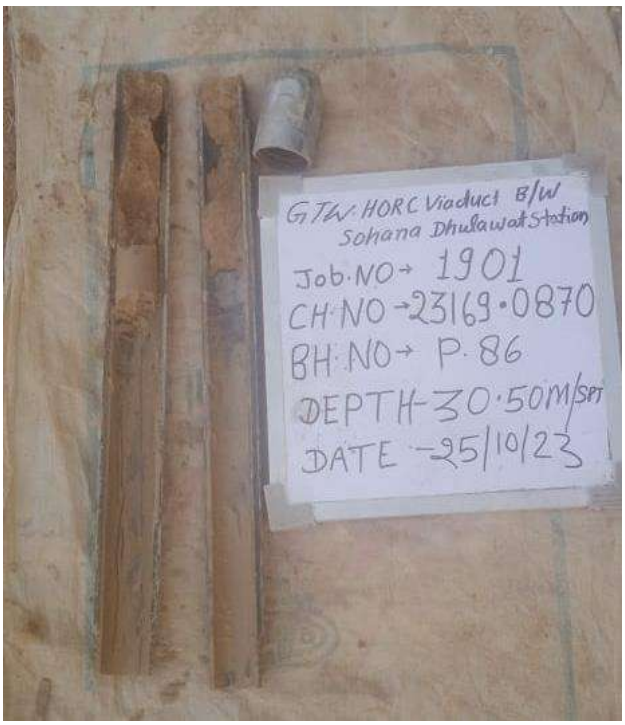
SPT sample at depth 15.50m

APPENDIX-I
SITE PHOTOGRAPHS

UDS at depth 13.00 m

SPT at depth 35.50 m

SPT at depth 12.50 m



SPT sample at depth 30.50 m

APPENDIX-I
SITE PHOTOGRAPHS

SPT at depth 23.50m

SPT sample at depth 15.50 m

SPT at depth 33.50 m

UDS at depth 13.00m

APPENDIX-I
SITE PHOTOGRAPHS

UDS at depth 13.00 m

SPT at depth 6.00 m

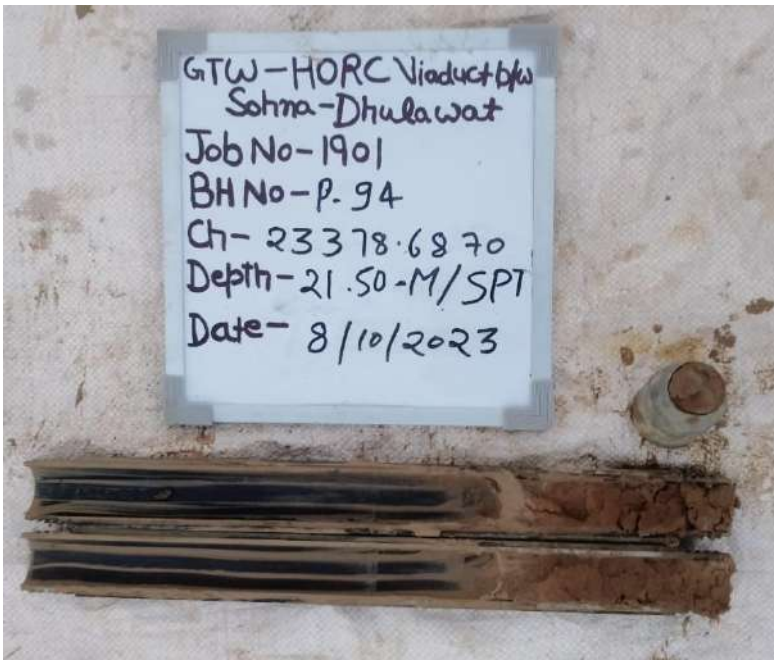
SPT sample at depth 29.50 m

SPT at depth 17.50 m

APPENDIX-I
SITE PHOTOGRAPHS

SPT at depth 9.00 m

UDS at depth 14.00 m



SPT sample at depth 21.50 m

APPENDIX-I
SITE PHOTOGRAPHS

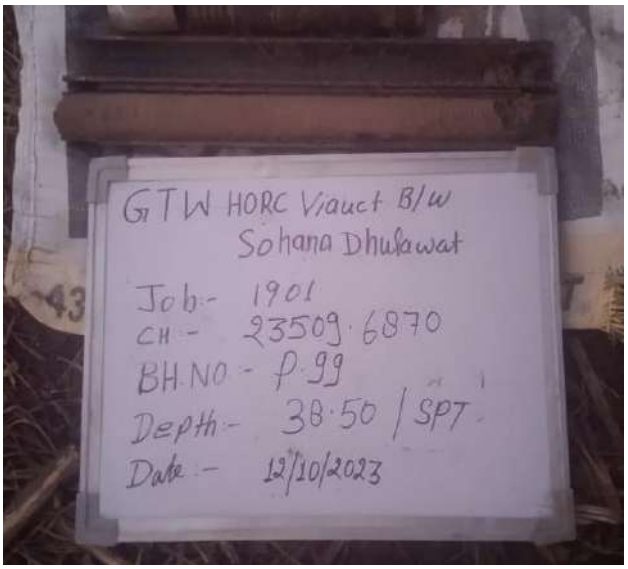
SPT sample at depth 24.50 m

SPT at depth 30.50 m

SPT at depth 23.50 m

SPT at depth 26.50 m

APPENDIX-I
SITE PHOTOGRAPHS



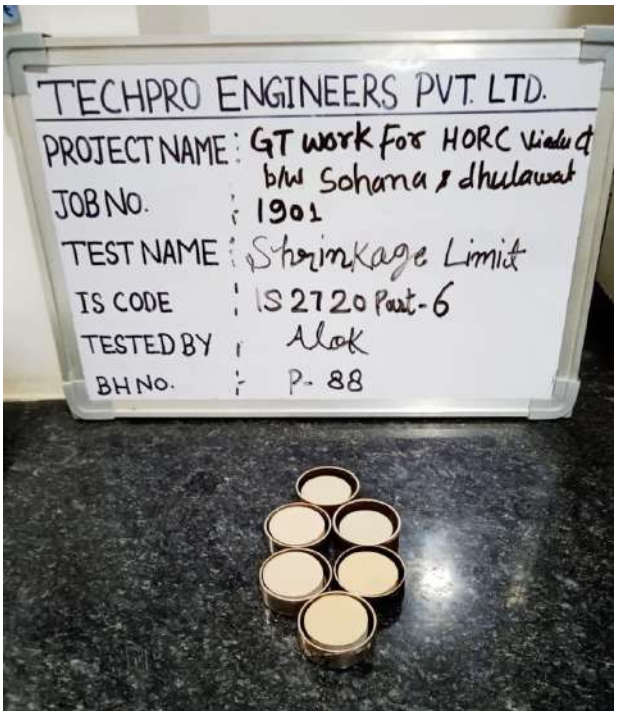
SPT sample at depth 38.50 m

SPT at depth 14.50 m

SPT sample at depth 23.50 m

APPENDIX-J
LABORATORY PHOTOGRAPHS

Water content test



Shrinkage limit test

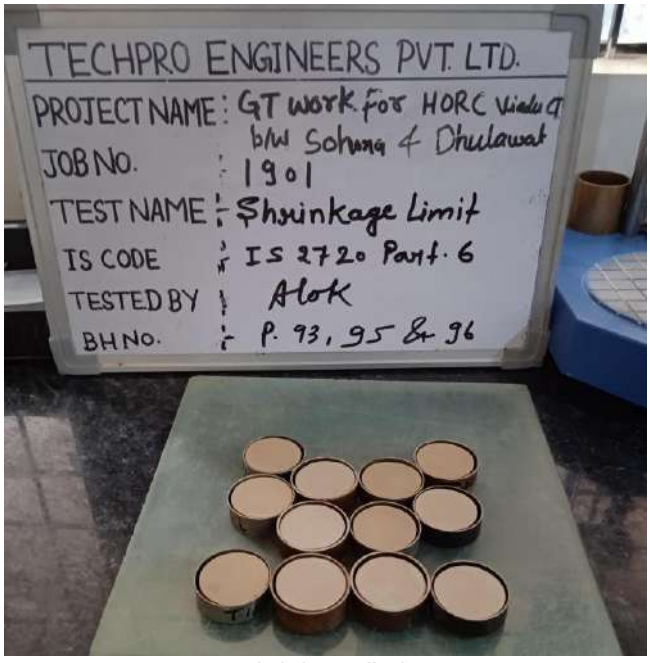
UCS test of soil

Atterbergs' limit test

APPENDIX-J
LABORATORY PHOTOGRAPHS

Free swell index test

Atterbergs' limit test



Shrinkage limit

Triaxial test

APPENDIX-K
CHART 1: FIELD BORE LOG CHARTS (P81)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW FOR HORC Viaduct between Sohana Dhulawat station					Project Code:	1901
Coordinate:	N: 3119974.676		E: 701006.108		Location/ Chainage:	23038.0870	
Method of Drilling:	Percussion		Drilling Equipment:	Manual/ Power winch	Bore No.:	P-81	
Casing Lowered (M):	22.00	Bentonite Used: NA	Standard Sampler:	Yes	Barrel Type:	NA	
Ground Elevation:	R.L-193.105		Date: From 21/10/23 to 23/10/23		Water Table (M):	2.40m	

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
21/10/23	0.00	0.50	0.50	D	SX	Collected				—	—	—	—	—	—	Non cohesive soil
"	1.00	1.45	0.45	U	"	Received				—	—	—	—	—	—	do
"	2.00	2.45	0.45	DP	"	1	1	1	2	—	—	—	—	—	—	do
"	3.00	3.45	0.45	DP	"	2	3	4	7	—	—	—	—	—	—	do
"	4.00	4.45	0.45	U	"	Received				—	—	—	—	—	—	Non cohesive soil
"	5.00	5.45	0.45	DP	"	2	3	5	8	—	—	—	—	—	—	do
"	6.00	6.45	0.45	DP	"	3	6	8	14	—	—	—	—	—	—	do
"	7.00	7.45	0.45	U	"	Received				—	—	—	—	—	—	cohesive soil.
"	8.00	8.45	0.45	DP	"	5	7	9	16	—	—	—	—	—	—	cohesive soil with gravel
"	9.00	9.45	0.45	DP	"	6	9	10	19	—	—	—	—	—	—	cohesive soil.
"	10.00	10.45	0.45	U	"	Received				—	—	—	—	—	—	do
"	11.00	11.45	0.45	DP	"	6	10	11	21	—	—	—	—	—	—	cohesive soil
"	12.00	12.45	0.45	DP	"	7	11	13	24	—	—	—	—	—	—	do
"	13.00	13.45	0.45	U	"	Received				—	—	—	—	—	—	do
"	14.50	14.95	0.45	DP	"	8	12	17	29	—	—	—	—	—	—	do
"	16.00	16.45	0.45	U	"	Received				—	—	—	—	—	—	cohesive soil
"	17.50	17.95	0.45	DP	"	7	13	15	28	—	—	—	—	—	—	do
"	19.00	19.45	0.45	U	"	Received				—	—	—	—	—	—	cohesive soil
"	20.50	20.95	0.45	DP	"	15	24	54	78	—	—	—	—	—	—	do
"	22.00	22.45	0.45	U/DS	"	Shipped				—	—	—	—	—	—	Non cohesive soil
"	23.50	23.95	0.45	DP	"	20	40	62	102	—	—	—	—	—	—	do
22/10/23	25.00	25.45	0.45	U/DP	"	17	32	40	72	—	—	—	—	—	—	do
"	26.50	26.95	0.45	DP	"	15	23	32	55	—	—	—	—	—	—	do
"	28.00	28.45	0.45	U/DP	"	17	32	35	67	—	—	—	—	—	—	do

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E - in - C

Abbreviation Used : U- Undisturbed Sample, C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test N = 100), Sampler means SPT sampler

APPENDIX-K
CHART 2: FIELD BORE LOG CHARTS (P81)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW FOR HORC Viaduct between Sohana Mukarrel Station					Project Code:	1901
Coordinate:	N: 3119974.676		E: 701006.108			Location/ Chainage:	23038.0870
Method of Drilling:	Percussion			Drilling Equipment:	Powermach	Bore No.:	P-81
Casing Lowered (M):	22.00	Bentonite Used:	NA	Standard Sampler:	Yes	Barrel Type:	NA
Ground Elevation:	R.L-193.105		Date: From 21/10/23	to	23/10/23	Water Table (M):	2.40M

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
20/10/23	29.50	29.95	0.45	DP	SX	21	45	50	95	—	—	—	—	—	—	Non cohesive soil with Gravel
〃	31.00	31.45	0.45	DP	〃	15	22	30	52	—	—	—	—	—	—	do
〃	32.50	32.95	0.45	DP	〃	17	25	35	60	—	—	—	—	—	—	do
〃	34.00	34.45	0.45	DP	〃	16	27	36	63	—	—	—	—	—	—	cohesive soil with Gravel
23/10/23	35.50	35.95	0.45	DP	〃	18	30	34	64	—	—	—	—	—	—	do
〃	37.00	37.45	0.45	DP	〃	21	35	42	77	—	—	—	—	—	—	do
〃	38.50	38.95	0.45	DP	〃	23	37	48	85	—	—	—	—	—	—	Non cohesive soil.
〃	40.00	40.45	0.45	DP	〃	27	42	50	92	—	—	—	—	—	—	cohesive soil.

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E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 3: FIELD BORE LOG CHARTS (P82)

TECHPRO ENGINEERS PVT. LTD. — **BORE/ DRILL LOG**

Doc No:	GT/ 003
Date of Issue:	01.04.2018
Rev. No.:	R03
Rev. Date.:	28.12.2021
Project Code:	1901

Project Name: GT work for HORC Viaduct B/w Sohana & Dhulawat Station

Coordinate:	N: 3120000.559	E: 701001.381	Location/ Chainage:	23069.2870	
Method of Drilling:	Percussion	Drilling Equipment:	Powerwinch	Bore No.:	P-82
Casing Lowered (M):	18.m Bentonite Used: Not	Standard Sampler:	Yes	Barrel Type:	N/A
Ground Elevation:	R.L-193.262	Date: From 5/10/2023 to 7/10/2023		Water Table (M):	2.30

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
5/10/23	0.00	0.50	0.50	DS	SX	Collected				—	—	—	—	—	—	Cohesive soil
11	1.00	1.45	0.45	U	—	Received				—	—	—	—	—	—	— do —
11	2.00	2.45	0.45	DP	—	1	1	2	3	—	—	—	—	—	—	Non cohesive soil
11	3.00	3.45	0.45	DP	—	1	2	3	5	—	—	—	—	—	—	— do —
11	4.00	4.45	0.45	U	—	Received				—	—	—	—	—	—	cohesive soil with
11	5.00	5.45	0.45	DP	—	2	3	5	8	—	—	—	—	—	—	Gravels
11	6.00	6.45	0.45	DP	—	3	4	7	11	—	—	—	—	—	—	Non cohesive soil
6/10/23	7.00	7.45	0.45	U	—	Received				—	—	—	—	—	—	— do —
11	8.00	8.45	0.45	DP	—	5	7	10	17	—	—	—	—	—	—	— do —
11	9.00	9.45	0.45	DP	—	6	7	11	18	—	—	—	—	—	—	— do —
11	10.00	10.45	0.45	U	—	Slipped				—	—	—	—	—	—	— do / DS collected
11	11.00	11.45	0.45	DP	—	8	10	14	24	—	—	—	—	—	—	cohesive soil with
11	12.00	12.45	0.45	DP	—	9	12	17	29	—	—	—	—	—	—	gravels — do —
11	13.00	13.45	0.45	U	—	Received				—	—	—	—	—	—	— do —
11	14.50	14.95	0.45	DP	—	12	15	18	33	—	—	—	—	—	—	— do —
11	16.00	16.45	0.45	U	—	Received				—	—	—	—	—	—	— do —
11	17.50	17.95	0.45	DP	—	11	17	20	37	—	—	—	—	—	—	Non cohesive soil
11	19.00	19.45	0.45	U	—	Received				—	—	—	—	—	—	— do —
11	20.50	20.95	0.45	DP	—	13	20	21	41	—	—	—	—	—	—	— do —
11	22.00	22.45	0.45	U	—	Received				—	—	—	—	—	—	— do —
11	23.50	23.95	0.45	DP	—	15	23	25	48	—	—	—	—	—	—	— do —
11	25.00	25.45	0.45	U	—	Slipped				—	—	—	—	—	—	— do —
11	26.50	26.95	0.45	DP	—	15	24	27	51	—	—	—	—	—	—	— do —
11	28.00	28.45	0.45	U	—	Received				—	—	—	—	—	—	— do —

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E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 4: FIELD BORE LOG CHARTS (P82)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No	GT/003
		Date of Issue	01.04.2018
		Rev No	R03
		Rev Date	28.12.2021

Project Name:	Cut work for HORC viaduct B/w Sohana & Dhulawat stations			Project Code:	1901
Coordinate:	N: 3120000.559	E: 761001.381		Location/ Chainage:	23064 - 2370
Method of Drilling:	Percussion	Drilling Equipment:	Powerwinch	Bore No.:	P.82
Casing Lowered (M):	18.m Bentonite Used: Not	Standard Sampler:	Yes	Barrel Type:	N/A
Ground Elevation:	R.L-193.262	Date: From 5/10/2023 to 7/10/2023		Water Table (M):	2.30

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
6/10/23	29.50	29.95	045	DP	SX	14	25	30	55	-	-	-	-	-	-	Non cohesive soil
"	31.00	31.48	048	U	"	Received				-	-	-	-	-	-	— do —
"	32.50	32.95	045	DP	"	17	28	32	60	-	-	-	-	-	-	— do —
"	34.00	34.45	045	DP	"	19	31	36	67	-	-	-	-	-	-	— do —
"	35.50	35.95	045	DP	"	22	34	37	71	-	-	-	-	-	-	Non cohesive soil
"	37.00	37.48	045	U	"	51	PP+C			-	-	-	-	-	-	— do —
"	38.50	38.95	045	DP	"	25	36	39	75	-	-	-	-	-	-	— do —
"	40.00	40.45	045	DP	"	28	39	42	81	-	-	-	-	-	-	Non cohesive soil

Supervisor

E - in - C

Abbreviation Used : U - Undisturbed Sample. C - Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 5: FIELD BORE LOG CHARTS (P83)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW-HORC Viaduct b/w Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 5120026.492	E: 700997.207		Location/ Chainage:	23090.4870
Method of Drilling:	Percussion	Drilling Equipment:	Manual + Powerwinch	Bore No.:	P83
Casing Lowered (M):	21.00	Bentonite Used: NO	Standard Sampler: Yes	Barrel Type:	N/A
Ground Elevation:	R.L-193.307	Date: From 23/10/23 to 27/10/23		Water Table (M):	1.20

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
23/10/23	0.00	0.50	0.50	DS	SX	collected										Non-cohesive soil
	1.00	1.45	0.45	DP	"	1	2	3	5							— do —
"	2.00	2.45	0.45	U	"	Received										— do —
"	3.00	3.45	0.45	DP	"	1	2	4	6							— do —
"	4.00	4.45	0.45	DP	"	2	3	4	7							— do —
"	5.00	5.45	0.45	U	"	Received										— do —
"	6.00	6.45	0.45	DP	"	6	9	30	39							— do —
"	7.00	7.45	0.45	DP	"	2	2	6	8							— do —
"	8.00	8.45	0.45	U	"	Received										— do —
"	9.00	9.45	0.45	DP	"	9	14	18	32							— do —
"	10.00	10.45	0.45	DP	"	10	15	19	34							— do —
"	11.00	11.45	0.45	U	"	Received										— do —
"	12.50	12.95	0.45	DP	"	9	14	18	32							— do —
"	14.00	14.45	0.45	U	"	Received										cohesive soil with gravel
25/10/23	15.50	15.95	0.45	DP	"	9	17	21	38							— do —
"	17.00	17.45	0.45	U	"	slipped										— do — DS collected
"	18.50	18.95	0.45	DP	"	8	18	23	41							cohesive soil with gravel
"	20.00	20.45	0.45	U	"	Received										— do —
"	21.50	21.95	0.45	DP	"	14	24	25	49							— do —
"	23.00	23.45	0.45	U	"	Received										— do —
"	24.50	24.95	0.45	DP	"	15	20	30	50							Non-cohesive soil with gravel
"	26.00	26.45	0.45	U	"	slipped										— do — DS collected
"	27.50	27.95	0.45	DP	"	17	19	24	43							Non-cohesive soil
"	29.00	29.45	0.45	U	"	slipped										— do — DS collected

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Abbreviation Used: U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 6: FIELD BORE LOG CHARTS (P83)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	(7TH)-HORC Viaduct blw. Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 23090.4870	E: 700997.207		Location/ Chainage:	23090.4870
Method of Drilling:	Percussion	Drilling Equipment	Manual + Powerwinch	Bore No.:	P83
Casing Lowered (M):	21.00 Bentonite Used: NO	Standard Sampler:	Yes	Barrel Type:	N/A
Ground Elevation:	R.L-193.307	Date: From 23/10/23	to 27/10/23	Water Table (M):	1.20

Day	Depth/RUN (m) From	To	Length (m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
26/10/23	30.50	30.95	0.45	DP	SK	18	21	26	47							Non-cohesive soil
11	32.00	32.45	0.45	U	11	Slipped										-do- DS collected
27/10/23	33.50	33.95	0.45	DP	11	16	22	28	50							Non-cohesive soil
11	35.00	35.45	0.45	U	11	Slipped										-do- DS collected
11	36.50	36.95	0.45	DP	11	18	26	29	55							Non-cohesive soil
11	38.00	38.45	0.45	DP	11	20	28	30	58							-do-
11	40.00	40.45	0.45	DP	11	18	30	31	61							-do-

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Abbreviation used: U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 7: FIELD BORE LOG CHARTS (P 84)

TECHPRO ENGINEERS PVT. LTD. — **BORE/ DRILL LOG**

Doc No:	GT/ 003
Date of Issue:	01.04.2018
Rev. No.:	R03
Rev. Date.:	28.12.2021

Project Name: GTL-HORC Viaduct b/w Sohana Dhulawat Station — Project Code: 1901

Coordinate: N: 3120052.551 E: 700993.573 — Location/ Chainage: 23116.6870

Method of Drilling: Percussion — Drilling Equipment: Manual + Power winch — Bore No.: P84

Casing Lowered (M): 18.00 — Bentonite Used: NO — Standard Sampler: Yes — Barrel Type: N/A

Ground Elevation: R.L-193.358 — Date: From 23/10/23 to 26/10/23 — Water Table (M): 1.70

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
25/10/23	0.00	0.50	0.50	DS	SX	collected										Non-cohesive soil
	1.00	1.45	0.45	DP	11	3	3	4	7							— do —
11	2.00	2.45	0.45	U	11	Received										— do —
11	3.00	3.45	0.45	DP	11	2	4	5	9							— do —
11	4.00	4.45	0.45	DP	11	3	6	8	14							— do —
11	5.00	5.45	0.45	U	11	Received										Non-cohesive soil with gravel
11	6.00	6.45	0.45	DP	11	3	10	12	22							Non-cohesive soil with gravel
11	7.00	7.45	0.45	DP	11	4	11	13	24							— do —
11	8.00	8.45	0.45	U	11	Received										— do —
11	9.00	9.45	0.45	DP	11	5	8	11	19							— do —
11	10.00	10.45	0.45	DP	11	8	13	15	28							— do —
11	11.00	11.45	0.45	U	11	Received										— do —
11	12.50	12.95	0.45	DP	11	7	10	17	27							— do —
25/10/23	14.00	14.45	0.45	U	11	Received										cohesive soil with gravel
11	15.50	15.95	0.45	DP	11	9	14	16	30							— do —
11	17.00	17.45	0.45	U	11	Received										— do —
11	18.50	18.95	0.45	DP	11	11	15	16	31							— do —
11	20.00	20.45	0.45	U	11	slipped										-do- DS collected
11	21.50	21.95	0.45	DP	11	12	17	20	37							cohesive soil
11	23.00	23.45	0.45	U	11	Received										— do —
11	24.50	24.95	0.45	DP	11	9	18	22	40							— do —
11	26.00	26.45	0.45	U	11	slipped										-do- DS collected
11	27.50	27.95	0.45	DP	11	13	21	27	48							Non-cohesive soil
11	29.00	29.45	0.45	U	11	slipped										-do- DS collected

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Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 8: FIELD BORE LOG CHARTS (P 84)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW-HORC Viaduct b/w Sohana Dhulawat station			Project Code:	1901
Coordinate:	N: 3120052.551	E: 700993.573		Location/ Chainage:	23116.6870
Method of Drilling:	Rotation	Drilling Equipment:	Manual + Pneumatic	Bore No.:	P84
Casing Lowered (M):	18.00	Bentonite Used: NO	Standard Sampler:	Yes	Barrel Type:	N/A
Ground Elevation:	R.L-193.358	Date: From 23/10/23	to 26/10/23	Water Table (M):	1.70

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
25/10/23	30.50	30.95	0.45	DP	SX	10	18	24	42							Non-cohesive soil
"	31.50	31.95	0.45	U	"	Slipped										-do- DS collected
"	33.50	33.95	0.45	DP	"	12	19	23	42							Non-cohesive soil
26/10/23	35.00	35.45	0.45	U	"	Slipped										-do- DS collected
	36.50	36.95	0.45	DP	"	14	20	26	46							Non-cohesive soil
"	38.00	38.45	0.45	U	"	Slipped										-do- DS collected
"	40.00	40.45	0.45	DP	"	17	24	28	52							Non-cohesive soil

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Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 9: FIELD BORE LOG CHARTS (P 85)

TECHPRO ENGINEERS PVT. LTD. — **BORE/ DRILL LOG**

Doc No:	GT/ 003
Date of Issue:	01.04.2018
Rev. No.:	R03
Rev. Date.:	28.12.2021

Project Name: GT Work For HORC Viaduct b/w Sohana Dhulawat station — Project Code: 1901

Coordinate: N: 3120790.652 E: 760990.491 — Location/ Chainage: 23142.8870

Method of Drilling: Percussion — Drilling Equipment: Rope winch — Bore No.: P85

Casing Lowered (M): 7.0 — Bentonite Used: No — Standard Sampler: Yes — Barrel Type: N/A

Ground Elevation: R.L-193.345 — Date: From 5/10/23 to 7/10/23 — Water Table (M): 2.20

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
5/10/23	0.00	0.50	0.50	DS	SX	Received										Non-cohesive soil
"	1.00	1.45	0.45	U	"	Received										— do —
"	2.00	2.45	0.45	DP	"	1	2	2	4							— do —
"	3.00	3.45	0.45	DP	"	2	3	3	6							— do —
"	4.00	4.45	0.45	U	"	slipped										— do —
"	5.00	5.45	0.45	DP	"	3	4	7	11							— do —
"	6.00	6.45	0.45	DP	"	2	4	7	11							— do —
"	7.00	7.45	0.45	U	"	Received										— do —
"	8.00	8.45	0.45	DP	"	4	6	8	14							— do —
"	9.00	9.45	0.45	DP	"	5	7	10	17							— do —
"	10.00	10.45	0.45	U	"	Received										Cohesive soil
"	11.00	11.45	0.45	DP	"	7	13	15	28							— do —
"	12.00	12.45	0.45	DP	"	6	9	11	20							— do —
"	13.00	13.45	0.45	U	"	Received										— do —
6/10/23	14.50	14.95	0.45	DP	"	8	8	14	22							Cohesive soil with fine sand
"	16.00	16.45	0.45	U	"	Received										— do —
"	17.50	17.95	0.45	DP	"	6	13	24	37							— do —
"	19.00	19.45	0.45	U	"	Received										— do —
"	20.50	20.95	0.45	DP	"	8	11	32	43							— do —
"	22.00	22.45	0.45	U	"	Received										— do —
"	23.50	23.95	0.45	DP	"	6	10	17	27							— do —
"	25.00	25.45	0.45	U	"	Received										— do —
"	26.50	26.95	0.45	DP	"	7	18	29	47							— do —
"	28.00	28.45	0.45	U	"	Received										— do —

Supervisor — E - in - C

Abbreviation Used : U- Undisturbed Sample, C- Core Sample, D- Disturbed Sample, P- Standard Penetration Test, R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 10: FIELD BORE LOG CHARTS (P 85)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	Work for HORC Viaduct b/w Sohana Dhulawat station			Project Code:	1901
Coordinate:	N: 3120078.652	E: 760990.491		Location/ Chainage:	23142.8870
Method of Drilling:	Percussion	Drilling Equipment	Powerwinch	Bore No.:	P85
Casing Lowered (M):	21.0	Bentonite Used: NO	Standard Sampler:	Yes	Barrel Type:	NIA
Ground Elevation:	R.L-193.345	Date: From 5/10/23 to 7/10/23			Water Table (M):	2.20

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
6/10/23	29.50	29.95	0.45	DP	SX	10	30	36	66							do
11	31.00	31.45	0.45	U	11	slipped										Non-cohesive soil
11	32.50	32.95	0.45	DP	11	14	27	33	60							do
11	34.00	34.45	0.45	U	11	slipped										do
11	35.50	35.95	0.45	DP	11	16	28	36	64							do
7/10/23	37.00	37.45	0.45	U	11	slipped										do
11	38.50	38.95	0.45	DP	11	18	30	38	68							do
11	46.00	46.45	0.45	DP	11	18	32	40	72							do

Supervisor

E - In - C

Abbreviation Used: U- Undisturbed Sample, C- Core Sample, D- Disturbed Sample, P- Standard Penetration Test, R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 11: FIELD BORE LOG CHARTS (P 86)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW-Portal Viaduct B/w Sohana-Dhulawat Station					Project Code:	1901
Coordinate:	N: 3120104.84	E: 700987.956			Location/ Chainage:	23169.0870	
Method of Drilling:	Percussion		Drilling Equipment	Auto Rig + Borecrowinch		Bore No.:	P-86
Casing Lowered (M):	18	Bentonite Used: NO	Standard Sampler :	YES		Barrel Type :	NA
Ground Elevation:	R.L-193.548	Date: From 22/10/22 to 26/10/22				Water Table (M):	1.20

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	CR (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
25/10/25	0.0	0.50	0.50	DP	SX	Casing Lowered				-	-	-	-	-		Non Cohesive Soil
"	1.00	1.45	0.45	DP	"	9	3	4	7	-	-	-	-	-		- do -
"	2.00	2.45	0.45	U	"	Slipped				-	-	-	-	-		Non Cohesive Soil with gravel
"	3.00	3.45	0.45	DP	"	3	2	4	6	-	-	-	-	-		- do -
"	4.00	4.45	0.45	DP	"	2	3	5	8	-	-	-	-	-		Non Cohesive Soil
"	5.00	5.45	0.45	U	"	Received				-	-	-	-	-		- do -
"	6.00	6.45	0.45	DP	"	3	5	8	13	-	-	-	-	-		- do -
"	7.00	7.45	0.45	DP	"	8	15	21	36	-	-	-	-	-		Cohesive Soil with gravel
"	8.00	8.45	0.45	U	"	Received				-	-	-	-	-		- do -
"	9.00	9.45	0.45	DP	"	7	13	18	31	-	-	-	-	-		- do -
"	10.00	10.45	0.45	DP	"	9	12	15	27	-	-	-	-	-		- do -
"	11.00	11.45	0.45	U	"	Received				-	-	-	-	-		Non Cohesive Soil
"	12.50	12.95	0.45	DP	"	8	8	15	23	-	-	-	-	-		- do -
"	14.00	14.45	0.45	U	"	Received				-	-	-	-	-		Cohesive Soil with gravel
"	15.50	15.95	0.45	DP	"	6	7	12	19	-	-	-	-	-		- do -
"	17.00	17.45	0.45	U	"	Received				-	-	-	-	-		- do -
"	18.50	18.95	0.45	DP	"	6	12	18	30	-	-	-	-	-		- do -
"	20.00	20.45	0.45	U	"	Slipped				-	-	-	-	-		- do -
25/10/25	21.50	21.95	0.45	DP	"	10	19	30	49	-	-	-	-	-		Cohesive Soil with gravel
"	23.00	23.45	0.45	U	"	Received				-	-	-	-	-		- do -
"	24.50	24.95	0.45	DP	"	12	18	26	44	-	-	-	-	-		- do -
"	26.00	26.45	0.45	U	"	Received				-	-	-	-	-		- do -
"	27.50	27.95	0.45	DP	"	11	21	28	49	-	-	-	-	-		Non Cohesive Soil
"	29.00	29.45	0.45	U	"	Slipped				-	-	-	-	-		- do -

Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 12: FIELD BORE LOG CHARTS (P 86)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW-for HORC Viaduct Blw Sohana-Dhulawat Station			Project Code:	1901
Coordinate:	N: 312.0104.84	E: 700987.956		Location/ Chainage:	93169.0870
Method of Drilling:	Percussion	Drilling Equipment	Auger bit Percussion	Bore No.:	P-86
Casing Lowered (M):	18 Bentonite Used:	NO	Standard Sampler :	YES	Barrel Type :	NA
Ground Elevation:	R.L – 193.548	Date: From 23/10/22	to 26/10/22	Water Table (M):	1.20

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
V	30.50	30.95	0.45	DP	Sx	12	22	30	52	—	—	—	—	—	—	Non Cohesive Soil
"	32.00	32.45	0.45	DP	"	15	25	26	51	—	—	—	—	—	—	- do -
"	33.50	33.95	0.45	DP	"	18	23	25	48	—	—	—	—	—	—	- do -
26/10/22	35.00	35.45	0.45	U	"	Slipped				—	—	—	—	—	—	Cohesive Soil with gravel
V	36.50	36.95	0.45	DP	"	17	29	27	47	—	—	—	—	—	—	- do -
"	38.00	38.45	0.45	U	"	Slipped				—	—	—	—	—	—	- do -
"	40.00	40.45	0.45	DP	"	20	24	30	54	—	—	—	—	—	—	- do -

Techpro Engineers (P) Ltd. Gurgaon

Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 13: FIELD BORE LOG CHARTS (P 87)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW for HORC viaduct B/W Sohanadhulawat Station			Project Code:	1901
Coordinate:	N: 3120131.106	E: 700985.969		Location/ Chainage:	23195.2870
Method of Drilling:	Percussion	Drilling Equipment	Autokwpt Power Wind	Bore No.:	P-87
Casing Lowered (M):	20.00	Bentonite Used: NO	Standard Sampler : Yes	Barrel Type :	NA
Ground Elevation:	R.L-193.452	Date: From 25/10/23 to 27/10/23		Water Table (M):	1.26

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
25/10/23	0.00	0.50	0.50	DS	Sx	Collected				-	-	-	-	-	-	Non Cohesive Soil
"	1.00	1.45	0.45	U	"	Received				-	-	-	-	-	-	- do -
"	2.00	2.45	0.45	DP	"	2	3	3	6	-	-	-	-	-	-	- do -
"	3.00	3.45	0.45	DP	"	2	2	4	6	-	-	-	-	-	-	- do -
"	4.00	4.45	0.45	U	"	Received				-	-	-	-	-	-	Non Cohesive Soil with gravel
"	5.00	5.45	0.45	DP	"	3	4	5	9	-	-	-	-	-	-	Non Cohesive Soil
"	6.00	6.45	0.45	DP	"	3	5	4	9	-	-	-	-	-	-	- do -
"	7.00	7.45	0.45	U	"	Received				-	-	-	-	-	-	- do -
"	8.00	8.45	0.45	DP	"	4	4	6	10	-	-	-	-	-	-	- do -
"	9.00	9.45	0.45	DP	"	6	12	19	31	-	-	-	-	-	-	Cohesive Soil with gravel
"	10.00	10.45	0.45	U	"	Slipped				-	-	-	-	-	-	- do -
"	11.00	11.45	0.45	DP	"	6	8	12	20	-	-	-	-	-	-	- do -
"	12.00	12.45	0.45	DP	"	8	11	15	26	-	-	-	-	-	-	do -
"	13.00	13.45	0.45	U	"	Received				-	-	-	-	-	-	do -
"	14.50	14.95	0.45	DP	"	8	15	18	33	-	-	-	-	-	-	Cohesive Soil with gravel
"	16.00	16.45	0.45	U	"	Received				-	-	-	-	-	-	- do -
"	17.50	17.95	0.45	DP	"	6	12	16	28	-	-	-	-	-	-	- do -
"	19.00	19.45	0.45	U	"	Received				-	-	-	-	-	-	Cohesive Soil with gravel
26/10/23	20.50	20.95	0.45	DP	"	8	16	22	38	-	-	-	-	-	-	- do -
"	22.00	22.45	0.45	U	"	Received				-	-	-	-	-	-	- do -
"	23.50	23.95	0.45	DP	"	12	18	15	33	-	-	-	-	-	-	- do -
"	25.00	25.45	0.45	U	"	Received				-	-	-	-	-	-	- do -
"	26.50	26.95	0.45	DP	"	8	15	27	42	-	-	-	-	-	-	Non Cohesive Soil with gravel
"	28.00	28.45	0.45	U	"	Slipped				-	-	-	-	-	-	- do -

Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 14: FIELD BORE LOG CHARTS (P 87)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW Hors viaduct B/w Sohana dhulawat station			Project Code:	1901
Coordinate:	N: 3120131.106	E: 700985.969		Location/ Chainage:	23195.2870
Method of Drilling:	Percussion	Drilling Equipment	Autotript Powerwinch	Bore No.:	P.87
Casing Lowered (M):	20.00	Bentonite Used:	NO	Standard Sampler :	Yes	Barrel Type :	NA
Ground Elevation:	R.L-193-452	Date: From 25/10/23 to 27/10/23		Water Table (M):	1.26

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
26/10/23	29.50	29.95	0.45	DP	9x	12	21	28	49	-	-	-	-	-	-	Non Cohesive Soil with gravel
"	31.00	31.45	0.45	U	"	Slipped				-	-	-	-	-	-	- do -
"	32.50	32.95	0.45	DP	"	15	20	25	45	-	-	-	-	-	-	- do -
"	34.00	34.45	0.45	U	"	Slipped				-	-	-	-	-	-	- do -
"	35.50	35.95	0.45	DP	"	16	21	27	48	-	-	-	-	-	-	- do -
27/10/23	37.00	37.45	0.45	U	"	Slipped				-	-	-	-	-	-	- do -
"	38.50	38.95	0.45	DP	"	18	24	29	53	-	-	-	-	-	-	- do -
"	40.00	40.45	0.45	DP	"	20	26	31	57	-	-	-	-	-	-	Non Cohesive Soil

Supervisor

E - in - C

Abbreviation Used - U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 15: FIELD BORE LOG CHARTS (P 88)

TECHPRO ENGINEERS PVT. LTD. — **BORE/ DRILL LOG**

Doc No:	GT/ 003
Date of Issue:	01.04.2018
Rev. No.:	R03
Rev. Date.:	28.12.2021

Project Name:	GTW-HORC Viaduct b/w Sohana Dhulawat station	Project Code:	1901
Coordinate:	N: 3120157.378 E: 700904.542	Location/ Chainage:	23271.4870
Method of Drilling:	Percussion	Drilling Equipment:	Powerwinch
Bore No.:	P88		
Casing Lowered (M):	18.M	Bentonite Used:	NO
Standard Sampler:	Yes	Barrel Type:	N/A
Ground Elevation:	R.L-193.536	Date: From 5/10/23 to 7/10/23	Water Table (M): 1.70

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
5/10/23	0.00	0.50	0.50	DS	SX	Collected										Non-cohesive soil
"	1.00	1.45	0.45	DP	"	1	2	3	5							— do —
"	2.00	2.45	0.45	U	"	Received										— do —
"	3.00	3.45	0.45	DP	"	1	2	5	7							— do —
"	4.00	4.45	0.45	DP	"	2	3	6	9							— do —
"	5.00	5.45	0.45	U	"	Received										Non-cohesive soil with Gravel
"	6.00	6.45	0.45	DP	"	5	6	7	13							— do —
6/10/23	7.00	7.45	0.45	DP	"	6	8	9	17							— do —
"	8.00	8.45	0.45	U	"	slipped										— do — DS collected
"	9.00	9.45	0.45	DP	"	6	8	10	18							— do —
"	10.00	10.45	0.45	DP	"	7	10	11	21							— do —
"	11.00	11.45	0.45	U	"	Received										— do —
"	12.50	12.95	0.45	DP	"	8	11	13	24							— do —
"	14.00	14.45	0.45	U	"	Received										— do —
"	15.50	15.95	0.45	DP	"	5	10	16	26							— do —
"	17.00	17.45	0.45	U	"	slipped										Cohesive soil with Gravel (DS collected)
"	18.50	18.95	0.45	DP	"	4	8	10	18							— do —
7/10/23	20.00	20.45	0.45	U	"	slipped										— do — (DS collected)
"	21.50	21.95	0.45	DP	"	7	10	12	22							— do —
"	23.00	23.45	0.45	U	"	slipped										— do —
"	24.50	24.95	0.45	DP	"	10	15	20	35							— do —
"	26.00	26.45	0.45	U	"	Received										— do —
"	27.50	27.95	0.45	DP	"	11	16	21	37							— do —
"	29.00	29.45	0.45	U	"	Received										Non-cohesive soil with Gravel

Nitesh
Supervisor

Techpro Engineers Pvt. Ltd. Karnal

S.E. - Gupta
E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 16: FIELD BORE LOG CHARTS (P 88)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	C&TW-HORC Viaduct blw Sohana Dhulawat station					Project Code:	1901
Coordinate:	N: 3120157.378	E: 760984.542			Location/ Chainage:	23911.4870	
Method of Drilling:	Percussion		Drilling Equipment	Rawewich		Bore No.:	P 88
Casing Lowered (M):	18M	Bentonite Used: NO	Standard Sampler :	Yes		Barrel Type :	N/A
Ground Elevation:	R.L-193.536	Date: From 5/10/23 to 7/10/23				Water Table (M):	1.70M

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
7/10/23	30.50	30.95	0.45	DP	SX	15	20	28	48							Non-cohesive soil with Gravel
11	32.00	32.45	0.45	U	11	Received										—do—
11	33.50	33.95	0.45	DP	11	16	21	29	50							—do—
11	35.00	35.45	0.45	U	11	slipped										—do— Discollected
11	36.50	36.95	0.45	DP	11	18	25	30	55							—do—
11	38.00	38.45	0.45	U	11	slipped										—do—
11	40.00	40.45	0.45	DP	11	20	29	33	62							—do—

Techpro Engineers Pvt. Ltd. Rohini

Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 17: FIELD BORE LOG CHARTS (P 89)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GT for HORC Viaduct b/w Sohna Dhulawat station	Project Code:	1901
Coordinate:	N: 3120183.668 E: 700983.655	Location/ Chainage:	23247.6870
Method of Drilling:	Percussion	Drilling Equipment:	Awotri P Powerwinch
Bore No.:	P 89		
Casing Lowered (M):	20.00	Bentonite Used:	NO
Standard Sampler:	Yes	Barrel Type:	N/A
Ground Elevation:	R.L-193.53	Date: From 25/10/23 to 27/10/23	Water Table (M): 1.90

Day / Date	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
25/10/23	0.0	0.50	0.50	DS	SX	Received										NON cohesvie soil
	1.00	1.45	0.45	U	"	Received										-do-
"	2.00	2.45	0.45	DP	"	1	2	2	4							-do-
"	3.00	3.45	0.45	DP	"	1	2	3	5							-do-
"	4.00	4.45	0.45	U	"	Received										-do-
"	5.00	5.45	0.45	DP	"	2	2	3	5							-do-
"	6.00	6.45	0.45	DP	"	2	3	4	7							NON cohesvie soil
"	7.00	7.45	0.45	U	"	Slipped										-do-
"	8.00	8.45	0.45	DP	"	3	4	5	9							-do-
"	9.00	9.45	0.45	DP	"	9	13	14	27							-do-
"	10.00	10.45	0.45	U	"	Received										-do-
"	11.00	11.45	0.45	DP	"	5	9	10	19							-do-
"	12.00	12.45	0.45	DP	"	5	9	12	21							-do-
"	13.00	13.45	0.45	U	"	Slipped										-do-
"	14.50	14.95	0.45	DP	"	4	8	11	19							cohesvie soil with
"	16.00	16.45	0.45	U	"	Received										Gravel soil
26/10/23	17.50	17.95	0.45	DP	"	6	10	13	23							-do-
	19.00	19.45	0.45	U	"	Received										-do-
"	20.50	20.95	0.45	DP	"	13	19	21	40							-do-
"	22.00	22.45	0.45	U	"	Received										-do-
"	23.50	23.95	0.45	DP	"	12	19	20	39							-do-
"	25.00	25.45	0.45	U	"	Received										NON cohesvie soil
"	26.50	26.95	0.45	DP	"	12	20	22	42							-do-
"	28.00	28.45	0.45	U	"	Slipped										-do-

Supervisor

Abbreviation Used: U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

E - in - C

APPENDIX-K
CHART 18: FIELD BORE LOG CHARTS (P 89)

TECHPRO ENGINEERS PVT. LTD. — **BORE/ DRILL LOG**

Doc No:	GT/ 003		
Date of Issue:	01.04.2018		
Rev. No.:	R03		
Rev. Date.:	28.12.2021		
Project Name:	G/T. for HORC viaduct b/w sohna Dhulawat station	Project Code:	1901
Coordinate:	N: 3120183.668 E: 700982.655	Location/ Chainage:	23247.687 0
Method of Drilling:	Percussion	Drilling Equipment:	Auto trip Power winch
Casing Lowered (M):	20.00 Bentonite Used: NO	Standard Sampler:	Yes
Ground Elevation:	R.L-193.53	Date: From 25/10/23 to 27/10/23	
Bore No.:	P 89	Barrel Type:	N/A
Water Table (M):	1.90		

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
25/10/23	29.50	29.95	0.45	DP	SX	13	25	27	52							Cohesvie soil with
11	31.00	31.45	0.45	U	11	Received										Gravel soil
11	32.50	32.95	0.45	DP	11	11	15	21	36							—do—
11	34.00	34.45	0.45	U	11	slipped										— do —
11	35.50	35.95	0.45	DP	11	14	17	24	41							NON cohesvie soil
27/10/23	37.00	37.45	0.45	U	11	slipped										— do —
11	38.50	38.95	0.45	DP	11	17	24	29	53							— do —
11	40.00	40.45	0.45	DP	11	20	28	31	59							— do —

Supervisor

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

E - in - C

APPENDIX-K
CHART 19: FIELD BORE LOG CHARTS (P 90)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GT. W for HORC Viaduct B/w Sohana Dhulawat Station					Project Code:	
Coordinate:	N: 3120209.933	E: 700983.219		Location/ Chainage:	23273.8870		
Method of Drilling:	Percussion		Drilling Equipment:	Rig with DTH Hammer & Tricone Bit		Bore No.:	P-90
Casing Lowered (M):	23.0 m	Bentonite Used: NO	Standard Sampler:	YES		Barrel Type:	N/A
Ground Elevation:	R.L-193.532	Date: From 25/10/2023 to 27/10/2023				Water Table (M):	1.60 m

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
25/10/23	0.00	0.50	0.50	D	SX	Collected				-	-	-	-	-	-	Non cohesive soil
"	1.00	1.45	0.45	U	-	Received				-	-					cohesive soil
"	2.00	2.45	0.45	DP	-	1	2	2	4	-	-	-	-	-	-	—do—
"	3.00	3.45	0.45	DP	-	2	3	3	6	-	-	-	-	-	-	Non cohesive soil
"	4.00	4.45	0.45	U	-	Received				-	-	-	-	-	-	Non cohesive soil
"	5.00	5.45	0.45	DP	-	4	7	8	15	-	-	-	-	-	-	—do—
"	6.00	6.45	0.45	DP	-	3	8	10	18	-	-	-	-	-	-	—do—
"	7.00	7.45	0.45	U	-	Received				-	-	-	-	-	-	cohesive soil with gravel
"	8.00	8.45	0.45	DP	-	3	5	7	12	-	-	-	-	-	-	—do—
"	9.00	9.45	0.45	DP	-	4	6	9	15	-	-	-	-	-	-	—do—
"	10.00	10.45	0.45	U	-	Received				-	-	-	-	-	-	—do—
"	11.00	11.45	0.45	DP	-	5	7	10	17	-	-	-	-	-	-	cohesive soil
"	12.00	12.45	0.45	DP	-	4	8	11	19	-	-	-	-	-	-	—do—
"	13.00	13.45	0.45	U	-	Received				-	-	-	-	-	-	cohesive soil with gravel
"	14.50	14.95	0.45	DP	-	6	8	13	21	-	-	-	-	-	-	—do—
"	16.00	16.45	0.45	U	-	Received				-	-	-	-	-	-	—do—
"	17.50	17.95	0.45	DP	-	8	10	15	25	-	-	-	-	-	-	—do—
"	19.00	19.45	0.45	U	-	Received				-	-	-	-	-	-	—do—
"	20.50	20.95	0.45	DP	-	7	13	19	32	-	-	-	-	-	-	—do—
26/10/23	22.00	22.45	0.45	U	-	Received				-	-	-	-	-	-	—do—
"	23.50	23.95	0.45	DP	-	9	15	21	36	-	-	-	-	-	-	—do—
"	25.00	25.45	0.45	U	-	Received				-	-	-	-	-	-	Non cohesive Soil
"	26.50	26.95	0.45	DP	-	10	18	23	41	-	-	-	-	-	-	—do—
"	28.00	28.45	0.45	U	-	Skipped				-	-	-	-	-	-	—do—

Supervisor

Techpro Engineers Pvt. Ltd.

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 20: FIELD BORE LOG CHARTS (P 90)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GT. W.O. for HORC Viaduct B/w Sohana Dhaulawat Station			Project Code:	1901
Coordinate:	N: 3120209.933	E: 700983.219		Location/ Chainage:	23273.8876
Method of Drilling:	Percusston		Drilling Equipment:	Autolift Powerwinch	Bore No.: P-90
Casing Lowered (M):	23.m	Bentonite Used: NO	Standard Sampler:	Yes	Barrel Type: N/A
Ground Elevation:	R.L-193.532	Date: From 25/10/2023 to 27/10/2023			Water Table (M): 1.60.m

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	CR (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
26/10/23	29.50	29.95	0.45	DP	SX	15	20	35	55	—	—	—	—	—	—	Non cohesive soil
11	31.00	31.45	0.45	DP	—	17	22	37	59	—	—	—	—	—	—	cohesive soil
11	32.50	32.95	0.45	DP	—	20	27	39	66	—	—	—	—	—	—	— do —
11	34.00	34.45	0.45	U	—	Slipped				—	—	—	—	—	—	Non cohesive soil
11	35.50	35.95	0.45	DP	—	18	25	37	62	—	—	—	—	—	—	— do —
11	37.00	37.45	0.45	U	—	Slipped				—	—	—	—	—	—	— do —
27/10/23	38.50	38.95	0.45	DP	—	15	22	31	53	—	—	—	—	—	—	— do —
11	40.00	40.45	0.45	DP	—	16	29	32	56	—	—	—	—	—	—	Non cohesive soil

Supervisor

Techpro Engineers Pvt. Ltd.

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 21: FIELD BORE LOG CHARTS (P 91)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue	01.04.2018
		Rev. No.:	R03
		Rev. Date	28.12.2021

Project Name:	GT work for HORC viaduct b/w Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 3126236.169	E: 7100983.157		Location/ Chainage:	23300.870
Method of Drilling:	Percussion	Drilling Equipment:	Rotary winch	Bore No.:	P91
Casing Lowered (M):	29.00	Bentonite Used:	NO	Standard Sampler:	Yes	Barrel Type:	N/A
Ground Elevation:	R.L – 193.953	Date: From	7/10/23 to 9/10/23	Water Table (M):	1.80

Day / Date	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
7/10/23	0.0	0.50	0.50	DS	SX	Received										NON cohesive soil
"	1.00	1.45	0.45	U	"	Received										– do –
"	2.00	2.45	0.45	DP	"	1	2	2	4							– do –
"	3.00	3.45	0.45	DP	"	2	3	4	7							– do –
"	4.00	4.45	0.45	U	"	Received										– do –
"	5.00	5.45	0.45	DP	"	3	4	5	9							– do –
"	6.00	6.45	0.45	DP	"	4	5	6	11							– do –
"	7.00	7.45	0.45	U	"	Slipped										– do –
"	8.00	8.45	0.45	DP	"	3	6	6	12							– do –
"	9.00	9.45	0.45	DP	"	3	10	17	27							– do –
"	10.00	10.45	0.45	U	"	Received										NON cohesive soil
"	11.00	11.45	0.45	DP	"	6	9	12	21							with Gravel Soil
"	12.00	12.45	0.45	DP	"	5	10	14	24							– do –
"	13.00	13.45	0.45	U	"	Received										– do –
"	14.00	14.45	0.45	DP	"	5	9	10	19							– do –
"	16.00	16.45	0.45	U	"	Received										Cohesive Soil with
"	17.00	17.45	0.45	DP	"	8	25	33	58							Gravel Soil
"	18.00	18.45	0.45	U	"	Received										NON Cohesive soil
"	20.00	20.45	0.45	DP	"	6	29	36	65							with Gravel Soil
"	22.00	22.45	0.45	U	"	Received										– do –
"	23.00	23.45	0.45	DP	"	9	25	43	68							– do –
"	25.00	25.45	0.45	U	"	Slipped										– do –
"	26.50	26.95	0.45	DP	"	7	14	26	40							– do –
"	28.00	28.45	0.45	U	"	Received										– do –

Supervisor

E-in-C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 22: FIELD BORE LOG CHARTS (P 91)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	[illegible] for HORC viaduct b/w Sohana Dhulawat Station					Project Code:	1901
Coordinate:	N: 3125236.169		E: 7009833.157			Location/ Chainage:	23300.827 C
Method of Drilling:	Percussion			Drilling Equipment:	Power winch	Bore No.:	P91
Casing Lowered (M):	12.00	Bentonite Used:	NO	Standard Sampler:	Yes	Barrel Type:	N/A
Ground Elevation:	R.L-193.953	Date: From	7/10/22 to	9/10/22		Water Table (M):	1.20

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
8/10/22	29.80	30.25	0.45	DP	SX	6	11	29	40							NON cohesive soil with
"	31.00	31.45	0.45	U	"	Slipped										curved soil
"	32.80	33.25	0.45	DP	"	10	18	29	42							cohesive soil with
"	34.00	34.45	0.45	U	"	Slipped										curved soil
"	35.50	35.95	0.45	DP	"	12	19	26	45							—do—
9/10/22	37.00	37.45	0.45	U	"	Slipped										—do—
"	38.50	38.95	0.45	DP	"	16	26	30	56							NON cohesive soil
"	40.00	40.45	0.45	DP	"	20	28	33	61							—do—

Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 23: FIELD BORE LOG CHARTS (P 92)

TECHPRO ENGINEERS PVT. LTD. — **BORE/ DRILL LOG**

Doc No:	GT/003		
Date of Issue:	01.04.2018		
Rev. No.:	R03		
Rev. Date.:	28.12.2021		
Project Code:	1901		
Project Name:	GTW-HORC Viaduct b/w Sohana Dhulawat Station		
Coordinate:	N: 3190262.593	E: 700983.302	
Location/ Chainage:	23326.2870		
Method of Drilling:	Percussion	Drilling Equipment:	Powerwinch
Bore No.:	P92		
Casing Lowered (M):	22.00	Bentonite Used:	NO
Standard Sampler:	Yes		
Barrel Type:	N/A		
Ground Elevation:	R.L-193.93	Date: From 9/10/23 to 11/10/23	
Water Table (M):	1.90		

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	CR (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
9/10/23	0.00	0.50	0.50	DS	SX	Received										Non-cohesive soil
11	1.00	1.45	0.45	NR	11	slipped										— do —
11	2.00	2.45	0.45	DP	11	1	1	2	3							— do —
11	3.00	3.45	0.45	DP	11	2	2	3	5							— do —
11	4.00	4.45	0.45	U	11	Received										— do —
11	5.00	5.45	0.45	DP	11	2	3	5	8							— do —
11	6.00	6.45	0.45	DP	11	3	4	7	11							— do —
11	7.00	7.45	0.45	U	11	Received										Non-cohesive soil with gravel
11	8.00	8.45	0.45	DP	11	5	6	11	17							— do —
11	9.00	9.45	0.45	DP	11	6	6	12	18							— do —
11	10.00	10.45	0.45	U	11	Received										— do —
11	11.00	11.45	0.45	DP	11	4	8	8	16							— do —
11	12.00	13.45	0.45	DP	11	3	4	4	8							cohesive soil with gravel
11	15.00	13.45	0.45	U	11	Received										— do —
11	14.50	14.95	0.45	DP	11	5	5	7	12							— do —
11	16.00	16.45	0.45	U	11	Received										— do —
11	17.50	17.95	0.45	DP	11	6	10	15	25							— do —
11	19.00	19.45	0.45	U	11	Received										Non-cohesive soil with gravel
11	20.50	20.95	0.45	DP	11	7	12	18	30							— do —
11	22.00	22.45	0.45	U	11	Received										— do —
14/10/23	23.50	23.95	0.45	DP	11	8	21	27	48							cohesive soil with gravel
11	25.00	25.45	0.45	U	11	Received										— do —
11	26.50	26.95	0.45	DP	11	9	19	29	48							— do —
11	28.00	28.45	0.45	U	11	slipped										— do —

Supervisor

E - in - C

Abbreviation Used - U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 24: FIELD BORE LOG CHARTS (P 92)

TECHPRO ENGINEERS PVT. LTD.

BORE/ DRILL LOG

Doc No:	GT/ 003
Date of Issue:	01.04.2018
Rev. No.:	R03
Rev. Date.:	28.12.2021

Project Name:	GTW-HORC Viaduct b/w Sohana Dhulawat Station	Project Code:	1901
Coordinate:	N: 3120262.393 E: 700983.302	Location/ Chainage:	23326.3070
Method of Drilling:	Percussion	Drilling Equipment:	Powerwinch
Bore No.:	P93		
Casing Lowered (M):	22.00	Bentonite Used:	No
Standard Sampler:	Yes	Barrel Type:	N/A
Ground Elevation:	R.L-193.93	Date: From 9/10/23 to 11/10/23	
Water Table (M):	1.90		

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
10/10/23	29.50	29.95	0.45	DP	SX	6	12	27	39							— do —
"	31.00	31.45	0.45	U	"	slipped										Non-cohesive soil
"	32.50	32.95	0.45	DP	"	12	26	28	54							— do —
"	34.00	34.45	0.45	U	"	slipped										— do —
"	35.50	35.95	0.45	DP	"	12	19	29	48							Cohesive soil with gravel
11/10/23	37.00	37.45	0.45	U	"	slipped										— do —
"	38.50	38.95	0.45	DP	"	14	20	30	50							Non-cohesive soil
"	40.00	40.45	0.45	DP	"	17	28	36	64							— do —
"																

Supervisor

Techpro Engineers Pvt. Ltd.

E-in-C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 25: FIELD BORE LOG CHARTS (P 93)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date:	28.12.2021

Project Name:	GTW for Horc Viaduct B/W Sohana Dhulawat Station	Project Code:	1901
Coordinate:	N: 3120288.593 E: 700983.613	Location/ Chainage:	23552.4870
Method of Drilling:	Percussion	Drilling Equipment: Hydrop Powerwinch	Bore No.: P-93
Casing Lowered (M):	25 Bentonite Used: NO	Standard Sampler: Yes	Barrel Type: NA
Ground Elevation:	R.L-193.956	Date: From 26/10/23 to 29/10/23	Water Table (M): 1.40

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
26/10/23	0.00	0.50	0.50	DS	SX	Collected -				-	-	-	-	-	-	Non Cohesive Soil
"	1.00	1.45	0.45	U	"	Received -				-	-	-	-	-	-	- do -
"	2.00	2.45	0.45	DP	"	2	3	3	6	-	-	-	-	-	-	- do -
"	3.00	3.45	0.45	DP	"	2	2	3	5	-	-	-	-	-	-	- do -
"	4.00	4.45	0.45	U	"	Received				-	-	-	-	-	-	- do -
27/10/23	5.00	5.45	0.45	DP	"	4	6	8	14	-	-	-	-	-	-	- do -
"	6.00	6.45	0.45	DP	"	3	5	7	12	-	-	-	-	-	-	- do -
"	7.00	7.45	0.45	U	"	Slipped -				-	-	-	-	-	-	- do -
"	8.00	8.45	0.45	DP	"	8	11	15	26	-	-	-	-	-	-	Cohesive Soil
"	9.00	9.45	0.45	DP	"	4	7	12	19	-	-	-	-	-	-	- do -
"	10.00	10.45	0.45	U	"	Received				-	-	-	-	-	-	- do -
"	11.00	11.45	0.45	DP	"	7	6	12	18	-	-	-	-	-	-	- do -
"	12.00	12.45	0.45	DP	"	4	6	10	16	-	-	-	-	-	-	- do -
"	13.00	13.45	0.45	U	"	Received				-	-	-	-	-	-	- do -
"	14.50	14.95	0.45	DP	"	9	12	17	29	-	-	-	-	-	-	Non Cohesive Soil
"	16.00	16.45	0.45	U	"	Received				-	-	-	-	-	-	- do - with gravel
"	17.50	17.95	0.45	DP	"	8	12	17	29	-	-	-	-	-	-	- do -
"	19.00	19.45	0.45	U	"	Received				-	-	-	-	-	-	- do -
"	20.50	20.95	0.45	DP	"	8	14	18	32	-	-	-	-	-	-	- do -
"	22.00	22.45	0.45	U	"	Received				-	-	-	-	-	-	- do -
"	23.50	23.95	0.45	DP	"	10	20	25	45	-	-	-	-	-	-	- do -
28/10/23	25.00	25.45	0.45	U	"	Slipped -				-	-	-	-	-	-	- do -
"	26.50	26.95	0.45	DP	"	14	26	28	54	-	-	-	-	-	-	- do -
"	28.00	28.45	0.45	DP	"	16	30	33	63	-	-	-	-	-	-	- do -

Supervisor

E-in-C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 26: FIELD BORE LOG CHARTS (P 93)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW For Horc Viaduct B/W Sohana Dhulawat Stn			Project Code:	1901
Coordinate:	N: 3120288.593	E: 700983.613		Location/ Chainage:	23352.4870
Method of Drilling:	Percussion	Drilling Equipment	Autotript Powerwinch	Bore No.:	P. 93
Casing Lowered (M):	20	Bentonite Used:	No	Standard Sampler :	Yes	Barrel Type :	NA
Ground Elevation:	R.L-193.956	Date: From 26/10/23 to 29/10/23		Water Table (M):	1.40

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
28/10/23	29.50	29.95	0.45	DP	Sx	15	29	30	59	–	–	–	–	–	–	Non Cohesive Soil with gravel
"	31.00	31.45	0.45	DP	"	16	26	29	55	–	–	–	–	–	–	– do –
"	32.50	32.95	0.45	DP	"	17	28	31	59	–	–	–	–	–	–	– do –
"	34.00	34.45	0.45	DP	"	15	30	40	70	–	–	–	–	–	–	– do –
"	35.50	35.95	0.45	DP	"	18	33	45	78	–	–	–	–	–	–	– do –
"	37.00	37.45	0.45	DP	"	20	30	39	69	–	–	–	–	–	–	– do –
29/10/23	38.50	38.95	0.45	DP	"	21	23	37	60	–	–	–	–	–	–	– do –
"	40.00	40.45	0.45	DP	"	25	30	40	70	–	–	–	–	–	–	– do –

Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 27: FIELD BORE LOG CHARTS (P 94)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	Cut work for HORC viaduct B/w Sohana & Dhulawat Station			Project Code:	1901
Coordinate:	N: 3120314.829	E: 700983.967	Location/ Chainage:	23378-6870	
Method of Drilling:	Percussion	Drilling Equipment:	Powerwinch	Bore No.: ~~P-94~~	P-94
Casing Lowered (M):	26.0 m Bentonite Used:	No	Standard Sampler:	Yes	Barrel Type:	N/A
Ground Elevation:	R.L-193.994	Date: From 7/10/2023 to 9/10/2023		Water Table (M):	1.60 m

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
7/10	0.00	0.50	0.5	DS	SX	Collected				—	—	—	—	—	—	cohesive Soil
"	1.00	1.45	0.45	DP	"	1	1	1	2	—	—	—	—	—	—	Non cohesive soil
"	2.00	2.45	0.45	U	—	Received				—	—	—	—	—	—	— do —
"	3.00	3.45	0.45	DP	—	1	1	2	3	—	—	—	—	—	—	— do —
"	4.00	4.45	0.45	DP	—	2	2	4	6	—	—	—	—	—	—	— do —
"	5.00	5.45	0.45	U	—	Received				—	—	—	—	—	—	Cohesive Soil
"	6.00	6.45	0.45	DP	—	2	3	5	8	—	—	—	—	—	—	Non cohesive soil
7/10	7.00	7.45	0.45	DP	—	3	3	6	9	—	—	—	—	—	—	— do —
"	8.00	8.45	0.45	U	—	Received				—	—	—	—	—	—	— do —
"	9.00	9.45	0.45	DP	—	4	5	9	14	—	—	—	—	—	—	Cohesive soil with gravels
"	10.00	10.45	0.45	DP	—	5	7	10	17	—	—	—	—	—	—	— do —
"	11.00	11.45	0.45	U	—	Slipped				—	—	—	—	—	—	— do — ros collected
"	12.50	12.95	0.45	DP	—	3	8	11	19	—	—	—	—	—	—	— do —
"	14.00	14.45	0.45	U	—	Received				—	—	—	—	—	—	— do —
"	15.50	15.95	0.45	DP	—	5	11	15	26	—	—	—	—	—	—	— do —
"	17.00	17.45	0.45	U	—	Received				—	—	—	—	—	—	Cohesive Soil
"	18.50	18.95	0.45	DP	—	7	10	12	22	—	—	—	—	—	—	— do —
"	20.00	20.45	0.45	U	—	Received				—	—	—	—	—	—	— do —
"	21.50	21.95	0.45	DP	—	7	11	14	25	—	—	—	—	—	—	— do —
"	23.00	23.45	0.45	U	—	Received										
"	24.50	24.95	0.45	DP	—	10	13	18	31							cohesive soil with gravels
"	26.00	26.45	0.45	U	—	Received										— do —
"	27.50	27.95	0.45	DP	—	12	17	22	39							Non cohesive soil
7/10	29.00	29.45	0.45	U		Received										— do —
																— do —

Supervisor

Techpro Engineers Pvt. Ltd.

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

E - in - C

APPENDIX-K
CHART 28: FIELD BORE LOG CHARTS (P 94)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GT work for HORC viaduct B/w Sohana & Dhulawat stailon			Project Code:	1901
Coordinate:	N: 3120314.829	E: 700983.967		Location/ Chainage:	23378-6870
Method of Drilling:	Percussion	Drilling Equipment:	Powerwinch	Bore No.:	P-94
Casing Lowered (M):	20.m	Bentonite Used:	No	Standard Sampler:	Yes	Barrel Type:	N/A
Ground Elevation:	R.L-193.994	Date: From 7/10/2023 to 9/10/2023		Water Table (M):	1.60 m

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
9/10/23	30.50	30.95	045	DP	SX	13	19	25	44	—	—	—	—	—	—	Non cohesive soil
"	32.00	32.45	045	U	—	Silpped				—	—	—	—	—	—	— do pscollectd
"	33.50	33.95	045	DP	—	16	24	33	57	—	—	—	—	—	—	cohesive soil with gravels
"	35.00	35.45	045	U	—	Silpped				—	—	—	—	—	—	— do —
"	36.50	36.95	045	DP	—	21	28	39	67	—	—	—	—	—	—	— do —
"	38.00	38.45	045	U	—	Silpped				—	—	—	—	—	—	Non cohesive soil
"	40.00	40.45	045	DP	—	24	33	46	79	—	—	—	—	—	—	cohesive soil with gravels

Supervisor

Techpro Engineers Pvt. Ltd. Kanpur

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 29: FIELD BORE LOG CHARTS (P 95)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW-HORC Viaduct blw Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N:3120341.027	E:700984.323	Location/ Chainage:	23404.8870	
Method of Drilling:	Percussion	Drilling Equipment:	Mannual Powerwinch	Bore No.:	P95
Casing Lowered (M):	18.00 Bentonite Used:	NO	Standard Sampler:	Yes	Barrel Type: N/A
Ground Elevation:	R.L-193.924	Date: From 17/10/23	to 29/10/23	Water Table (M):	1.20

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
27/10/23	0.00	0.50	0.50	DS	SX	collected										Non-cohesive soil
11	1.00	1.45	0.45	DP	11	1	2	2	4							— do —
11	2.00	2.45	0.45	U	11	Received										— do —
11	3.00	3.45	0.45	DP	11	2	3	4	7							— do —
11	4.00	4.45	0.45	DP	11	3	3	4	7							— do —
11	5.00	5.45	0.45	U	11	Received										— do —
11	6.00	6.45	0.45	DP	11	4	7	9	16							— do —
11	7.00	7.45	0.45	DP	11	4	5	6	11							Non-cohesive soil with gravel
11	8.00	8.45	0.45	U	11	Received										— do —
11	9.00	9.45	0.45	DP	11	8	10	14	24							Non-cohesive soil
11	10.00	10.45	0.45	DP	11	9	12	16	28							— do —
11	11.00	11.45	0.45	U	11	Received										— do —
11	12.50	13.95	0.45	DP	11	5	6	9	15							— do —
11	14.00	14.45	0.45	U	11	Received										Cohesive soil with gravel
11	15.50	15.95	0.45	DP	11	7	11	14	25							— do —
11	17.00	17.45	0.45	U	11	Slipped										— do —
11	18.50	18.95	0.45	DP	11	8	15	20	35							— do —
28/10/23	20.00	20.45	0.45	U	11	Received										— do —
11	21.50	21.95	0.45	DP	11	14	20	26	46							Non-cohesive soil
11	23.00	23.45	0.45	U	11	Slipped										-do- DS collected
11	24.50	24.95	0.45	DP	11	16	21	27	48							Non-cohesive soil
11	26.00	26.45	0.45	U	11	Slipped										-do- DS collected
11	27.50	27.95	0.45	DP	11	17	20	25	45							Non-cohesive soil
11	29.00	29.45	0.45	U	11	Received										— do —

Nitesh
Supervisor

S.E - In - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 30: FIELD BORE LOG CHARTS (P 95)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	NTW-HORC Viaduct b/w Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 3120341.027	E: 700984.323		Location/ Chainage:	23404.0870
Method of Drilling:	Percussion	Drilling Equipment:	Manual Powerwinch	Bore No.:	P 95
Casing Lowered (M):	18.00	Bentonite Used: NO	Standard Sampler:	Yes	Barrel Type: N/A
Ground Elevation:	R.L-193.924	Date: From 27/10/23	to 29/10/23	Water Table (M):	1.20

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
28/10/23	30.00	30.45	0.45	DP	SX	14	23	29	52							Non-cohesive soil with gravel
11	32.00	32.45	0.45	DP	11	13	30	37	67							— do —
11	33.50	33.95	0.45	DP	11	15	31	36	67							Non-cohesive soil
11	35.00	35.45	0.45	DP	11	13	29	35	64							— do —
11	36.50	36.95	0.45	DP	11	12	25	33	58							— do —
29/10/23	38.00	38.45	0.45	DP	11	12	26	30	56							— do —
11	40.00	40.45	0.45	DP	11	14	26	32	58							— do —

Nitesh
Supervisor

S.E-cum-J
E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 31: FIELD BORE LOG CHARTS (P 96)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	YTW-HORC Viaduct blw Sohana Dhulawat station			Project Code:	1904
Coordinate:	N: 3120367.185	E: 700984.677		Location/ Chainage:	23431.0870
Method of Drilling:	Percussion	Drilling Equipment	Auto Shift Power Winch	Bore No.:	P96
Casing Lowered (M):	21.00 Bentonite Used: NO	Standard Sampler :	Yes	Barrel Type :	N/A
Ground Elevation:	R.L-193.961	Date: From 28/10/23 to 30/10/23		Water Table (M):	1.20

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
28/10/23	0.0	0.50	0.50	DS	SX	Received										NON cohesive soil
	1.00	1.45	0.45	DP	11	1	1	2	3							— do —
11	2.00	2.45	0.45	U	11	Received										— do —
11	3.00	3.45	0.45	DP	11	2	2	3	5							— do —
11	4.00	4.45	0.45	DP	11	1	1	3	4							— do —
11	5.00	5.45	0.45	U	11	Skipped										NON cohesive soil
11	6.00	6.45	0.45	DP	11	3	4	6	10							— do —
11	7.00	7.45	0.45	DP	11	3	4	7	11							— do —
11	8.00	8.45	0.45	U	11	Skipped										— do —
11	9.00	9.45	0.45	DP	11	4	6	8	14							— do —
11	10.0	10.45	0.45	DP	11	5	7	9	16							— do —
11	11.00	11.45	0.45	U	11	Received										NON cohesive soil
11	12.50	12.95	0.45	DP	11	5	8	10	18							with Gravel soil
11	14.00	14.45	0.45	U	11	Received										— do —
11	15.50	15.95	0.45	DP	11	6	10	14	24							— do —
11	17.00	17.45	0.45	U	11	Received										— do —
11	18.50	18.95	0.45	DP	11	10	17	22	39							— do —
11	20.00	20.45	0.45	U	11	Skipped										— do —
11	21.50	21.95	0.45	DP	11	12	19	24	43							cohesive soil with
29/10/23	23.00	23.45	0.45	U	11	Received										Gravel soil
	24.50	24.95	0.45	DP	11	14	21	24	45							— do —
11	26.00	26.45	0.45	U	11	Skipped										— do —
11	27.50	27.95	0.45	DP	11	12	24	28	52							— do —
11	29.00	29.45	0.45	U	11	Skipped										— do —

Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 32: FIELD BORE LOG CHARTS (P 96)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date:	28.12.2021

Project Name:	GTW - HORC viaduct b/w Sohana Dhulawat station			Project Code:	1901
Coordinate:	N: 3120367.185	E: 700984.677		Location/ Chainage:	23431.0870
Method of Drilling:	Percussion	Drilling Equipment	Autotript Powerwinch	Bore No.:	P96
Casing Lowered (M):	91.00	Bentonite Used: NO	Standard Sampler : Yes	Barrel Type :	N/A
Ground Elevation:	R.L-193.961	Date: From 28/10/23 to 30/10/23		Water Table (M):	1.20

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
29/10/23	30.50	30.95	0.45	DP	SX	14	25	30	55							NON cohesive soil
"	32.00	32.45	0.45	DP	"	16	26	33	59							— do —
"	33.50	33.95	0.45	DP	"	15	21	29	50							— do —
"	35.00	35.45	0.45	U	"	Slipped										NON cohesive soil
30/10/23	36.50	36.95	0.45	DP	"	17	24	29	53							with Gravel soil
"	38.00	38.45	0.45	DP	"	19	30	32	62							— do —
"	40.00	40.45	0.45	DP	"	22	33	36	69							— do —

Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 33: FIELD BORE LOG CHARTS (P 97)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW-HORC Viaduct Hw Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 3120393.383	E: 700905.033	Location/ Chainage:	23457.2870	
Method of Drilling:	Percussion	Drilling Equipment:	Powerwinch	Bore No.:	P97
Casing Lowered (M):	19M	Bentonite Used: NO	Standard Sampler: Yes	Barrel Type:	N/A
Ground Elevation:	R.L-194.016	Date: From 8/10/23 to 10/10/23		Water Table (M):	1.80

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
8/10/23	0.00	0.50	0.50	DS	SX	collected										Non-cohesive soil
"	1.00	1.45	0.45	U	"	slipped										-do- DS collected
"	2.00	2.45	0.45	DP	"	1	1	2	3							Non-cohesive soil
"	3.00	3.45	0.45	DP	"	2	3	4	7							Non-cohesive soil with gravel
"	4.00	4.45	0.45	U	"	Received										-do-
"	5.00	5.45	0.45	DP	"	3	4	6	10							-do-
"	6.00	6.45	0.45	DP	"	3	5	7	12							-do-
"	7.00	7.45	0.45	U	"	Received										-do-
"	8.00	8.45	0.45	DP	"	4	6	8	14							-do-
"	9.00	9.45	0.45	DP	"	5	9	14	23							-do-
"	10.00	10.45	0.45	U	"	Received										-do-
"	11.00	11.45	0.45	DP	"	3	5	6	11							-do-
"	12.00	12.45	0.45	DP	"	5	6	8	14							-do-
"	13.00	13.45	0.45	U	"	Received										-do-
9/10/23	14.50	14.95	0.45	DP	"	6	8	9	17							-do-
"	16.00	16.45	0.45	U	"	Received										Cohesive soil with gravel
"	17.50	17.95	0.45	DP	"	7	9	11	20							-do-
"	19.00	19.45	0.45	U	"	slipped										-do- DS
"	20.50	20.95	0.45	DP	"	3	10	15	25							Cohesive soil with gravel
"	22.00	22.45	0.45	U	"	slipped										-do- DS collected
"	23.50	23.95	0.45	DP	"	8	16	27	43							-do-
"	25.00	25.45	0.45	U	"	slipped										-do- DS collected
10/10/23	26.50	26.95	0.45	DP	"	7	14	25	39							-do-
"	28.00	28.45	0.45	U	"	slipped										-do- DS collected

Nifesh
Supervisor

Techpro Engineers Pvt. Ltd. Rampur

E-in-C

Abbreviation Used: U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 34: FIELD BORE LOG CHARTS (P 97)

TECHPRO ENGINEERS PVT. LTD. — **BORE/ DRILL LOG**

Doc No:	GT/ 003
Date of Issue:	01.04.2018
Rev. No.:	R03
Rev. Date:	28.12.2021

Project Name:	GTW-HORC Viaduct b/w Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 3120393.383	E: 700985.033		Location/ Chainage:	23457.2870
Method of Drilling:	Percussion		Drilling Equipment:	Powermach	Bore No.: P97
Casing Lowered (M):	19M	Bentonite Used: NO	Standard Sampler:	Yes	Barrel Type: N/A
Ground Elevation:	R.L-194.016	Date: From 8/10/23	to 10/10/23		Water Table (M): 1.80

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
9/10	29.50	29.95	0.45	DP	SX	15	37	40	77							Non-cohesive soil
11	31.00	31.45	0.45	U	11	Received										— do —
11	32.50	32.95	0.45	DP	11	16	33	39	72							— do —
11	34.00	34.45	0.45	U	11	Slipped										— do - ps collected
11	35.50	35.95	0.45	DP	11	15	35	38	73							— do —
11	37.00	37.45	0.45	U	11	Received										— do —
11	38.50	38.95	0.45	DP	11	17	34	37	71							— do —
11	40.00	40.45	0.45	DP	11	20	32	39	71							— do —

Techpro Engineers Pvt. Ltd. Sampler

Supervisor

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

E-in-C

APPENDIX-K
CHART 35: FIELD BORE LOG CHARTS (P 98)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	C/O T.W. for HORC Viaduct B/w Sohana Dhulawat station			Project Code:	1901
Coordinate:	N: 3120419, 581	E: 700985, 388		Location/ Chainage:	23483.487
Method of Drilling:	Percussion		Drilling Equipment:	Auto Rupt Powermunch	Bore No.: P-98
Casing Lowered (M):	21.m Bentonite Used: No		Standard Sampler:	Yes	Barrel Type: N/A
Ground Elevation:	R.L-193.03	Date: From 28/10/2023 to 30/10/23			Water Table (M): 9.05

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
28/10/23	0.00	0.50	0.50	D	SX	Collected				—	—	—	—	—	—	Non cohesive soil
〃	1.00	1.45	0.45	U	—	Received				—	—	—	—	—	—	— do —
〃	2.00	2.45	0.45	DP	—	1	1	2	3	—	—	—	—	—	—	Non cohesive soil with gravel
〃	3.00	3.45	0.45	DP	—	1	2	2	4	—	—	—	—	—	—	— do —
〃	4.00	4.45	0.45	U	—	Received				—	—	—	—	—	—	— do —
〃	5.00	5.45	0.45	DP	—	2	3	3	6	—	—	—	—	—	—	Non cohesive soil
〃	6.00	6.45	0.45	DP	—	2	3	5	8	—	—	—	—	—	—	— do —
〃	7.00	7.45	0.45	U	—	Received				—	—	—	—	—	—	cohesive soil with gravel
〃	8.00	8.45	0.45	DP	—	4	5	7	12	—	—	—	—	—	—	— do —
〃	9.00	9.45	0.45	DP	—	3	6	9	15	—	—	—	—	—	—	— do —
〃	10.00	10.45	0.45	U	—	Received				—	—	—	—	—	—	cohesive soil
〃	11.00	11.45	0.45	DP	—	5	8	10	18	—	—	—	—	—	—	— do —
〃	12.00	12.45	0.45	DP	—	6	9	12	21	—	—	—	—	—	—	cohesive soil
〃	13.00	13.45	0.45	U	—	Received				—	—	—	—	—	—	cohesive soil with gravel
〃	14.50	14.95	0.45	DP	—	6	10	15	25	—	—	—	—	—	—	— do —
〃	16.00	16.45	0.45	U	—	Received				—	—	—	—	—	—	— do —
〃	17.50	17.95	0.45	DP	—	5	9	12	21	—	—	—	—	—	—	— do —
〃	19.00	19.45	0.45	U	—	Received				—	—	—	—	—	—	(Non cohesive) cohesive soil gravel
〃	20.50	20.95	0.45	DP	—	8	18	17	30	—	—	—	—	—	—	cohesive soil
〃	22.00	22.45	0.45	U	—	Slipped				—	—	—	—	—	—	— do —
〃	23.50	23.95	0.45	DP	—	10	16	21	37	—	—	—	—	—	—	— do —
〃	25.00	25.45	0.45	U	—	Received				—	—	—	—	—	—	— do —
29/10/23	26.00	26.45	0.45	DP	—	11	18	24	42	—	—	—	—	—	—	— do —
〃	28.00	28.45	0.45	U	—	Received				—	—	—	—	—	—	Non cohesive soil

Supervisor

Techpro Engineers Pvt. Ltd. Rohtak

Engr - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 36: FIELD BORE LOG CHARTS (P 98)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date:	28.12.2021

Project Name:	GTW for HORC Viaduct B/w Sohana Dhulawat station			Project Code:	1901
Coordinate:	N: 3120419.581	E: 700985.388		Location/ Chainage:	23483.4870
Method of Drilling:	Percussion	Drilling Equipment:	Autobrit Power winch	Bore No.:	P-98
Casing Lowered (M):	21.M	Bentonite Used: No	Standard Sampler: Yes	Barrel Type:	N/A
Ground Elevation:	R.L- 193.03	Date: From 28/10/2023 to 30/10/23		Water Table (M):	21.05

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
27/10/23	29.50	29.95	0.45	DP	SX	14	23	31	54	–	–	–	–	–	–	Non cohesive soil
"	31.00	31.45	0.45	DP	–	16	25	33	58	–	–	–	–	–	–	– do –
"	32.50	32.95	0.45	DP	–	15	28	34	62	–	–	–	–	–	–	– do –
"	34.00	34.45	0.45	U	–	Silpped				–	–	–	–	–	–	Non cohesive soil
"	35.50	35.95	0.45	DP	–	13	26	32	58	–	–	–	–	–	–	– do –
30/10/23	37.00	37.45	0.45	U	–	Silpped				–	–	–	–	–	–	– do –
"	38.50	38.95	0.45	DP	–	15	27	33	60	–	–	–	–	–	–	– do –
"	40.00	40.45	0.45	DP	–	15	29	33	62	–	–	–	–	–	–	Non cohesive soil

Supervisor

Techpro Engineers Pvt. Ltd.

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 37: FIELD BORE LOG CHARTS (P 99)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GT For Hsrc Viaduct Sohana Dhulawat Station			**Project Code:**	1901
Coordinate:	N: 3120145.778	E: 706985.744		**Location/ Chainage:**	23509.6870
Method of Drilling:	Percussion	**Drilling Equipment:**	Rig-winch	**Bore No.:**	P99
Casing Lowered (M):	19.00 **Bentonite Used:** NIL	**Standard Sampler :**	YES	**Barrel Type :**	NA
Ground Elevation:	R.L-193.271	**Date: From** 9/10/23 **to** 12/10/23		**Water Table (M):**	1.00m

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
9/10/23	0.00	0.50	0.50	DP	SX	Collected					-	-	-	-	-	Non Cohesive Soil
"	1.00	1.45	0.45	U	"	Received					-	-	-	-	-	- do -
"	2.00	2.45	0.45	DP	"	2	2	3	5		-	-	-	-	-	Cohesive Soil
10/10/23	3.00	3.45	0.45	DP	"	3	5	8	13		-	-	-	-	-	- do -
"	4.00	4.45	0.45	U	"	Received				-	-	-	-	-	-	Non Cohesive Soil
"	5.00	5.45	0.45	DP	"	6	8	9	17		-	-	-	-	-	- do -
"	6.00	6.45	0.45	DP	"	5	9	12	21		-	-	-	-	-	- do -
"	7.00	7.45	0.45	U	"	Slipped				-	-	-	-	-	-	- do -
"	8.00	8.45	0.45	DP	"	7	10	15	25		-	-	-	-	-	Cohesive Soil
"	9.00	9.45	0.45	DP	"	9	13	18	31		-	-	-	-	-	- do -
"	10.00	10.45	0.45	U	"	Slipped				-	-	-	-	-	-	- do -
"	11.00	11.45	0.45	DP	"	5	9	11	20		-	-	-	-	-	- do -
"	12.00	12.45	0.45	DP	"	3	5	6	11		-	-	-	-	-	- do -
"	13.00	13.45	0.45	U	"	Received				-	-	-	-	-	-	Cohesive Soil with gravel
"	14.00	14.45	0.45	DP	"	6	8	12	20		-	-	-	-	-	- do -
"	16.00	16.45	0.45	U	"	Received				-	-	-	-	-	-	- do -
"	17.00	17.45	0.45	DP	"	3	8	10	18		-	-	-	-	-	Non Cohesive Soil
"	19.00	19.45	0.45	U	"	Received				-	-	-	-	-	-	- do -
"	20.00	20.45	0.45	DP	"	4	7	12	19		-	-	-	-	-	- do -
11/10/23	22.00	22.45	0.45	U	"	Received				-	-	-	-	-	-	Cohesive Soil with gravel
"	23.50	23.95	0.45	DP	"	7	12	18	30	-	-	-	-	-	-	
"	25.00	25.45	0.45	U	"	Slipped				-	-	-	-	-	-	- do -
12/10/23	26.50	26.95	0.45	DP	"	14	20	28	48	-	-	-	-	-	-	- do -
"	28.00	28.45	0.45	U	"	Received				-	-	-	-	-	-	- do -

Supervisor

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

E - in - C

APPENDIX-K
CHART 38: FIELD BORE LOG CHARTS (P 99)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GT for Horc viaduct Sohana Dhulawat station			Project Code:	1901
Coordinate:	N: 3120445.778	E: 700985.744		Location/ Chainage:	23509.6870
Method of Drilling:	Percussion	Drilling Equipment:	Power winch	Bore No.:	P-99
Casing Lowered (M):	19.00 Bentonite Used:	NO	Standard Sampler :	YES	Barrel Type :	NA
Ground Elevation:	R.L - 193.271	Date: From 9/10/2023 to	12/10/2023	Water Table (M):	1.0m

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
12/10/23	29.50	29.95	0.45	DP	SX	14	17	22	39	–	–	–	–	–	–	Non Cohesive Soil
"	31.00	31.45	0.45	U	"	Slipped	–	–	–	–	–	–	–	–	–	with gravel
"	32.50	32.95	0.45	DP	"	16	19	24	43	–	–	–	–	–	–	– do –
"	34.00	34.45	0.45	U	"	Slipped	–	–	–	–	–	–	–	–	–	– do –
"	35.50	35.95	0.45	DP	"	20	26	30	56	–	–	–	–	–	–	– do –
"	37.00	37.45	0.45	U	"	Slipped	–	–	–	–	–	–	–	–	–	– do –
"	38.50	38.95	0.45	DP	"	21	26	32	58	–	–	–	–	–	–	– do –
"	40.00	40.45	0.45	DP	"	18	30	34	64	–	–	–	–	–	–	– do –

Supervisor

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

E - in - C

APPENDIX-K
CHART 39: FIELD BORE LOG CHARTS (P 100)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW FOR HORC Viaduct B/w Sohana Dhulawat station			Project Code:	1901
Coordinate:	N: 3120471.976	E: 700986.099		Location/ Chainage:	23535.8870
Method of Drilling:	Percussion	Drilling Equipment:	Autotrip Power winch	Bore No.:	P-100
Casing Lowered (M):	24.0M	Bentonite Used: NA	Standard Sampler: Yes	Barrel Type:	NA
Ground Elevation:	R.L-193.996	Date: From 28/10/23 to 30/10/23		Water Table (M):	1.30

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
28/10/23	0.00	0.50	0.50	D	SX	collected				-	-	-	-	-	-	Non Cohesive soil
"	1.00	1.45	0.45	U	"	Received				-	-	-	-	-	-	do
"	2.00	2.45	0.45	DP	"	1	2	2	4	-	-	-	-	-	-	do
"	3.00	3.45	0.45	DP	"	2	3	3	6	-	-	-	-	-	-	do
"	4.00	4.45	0.45	U/DS	"	slipped				-	-	-	-	-	-	do
"	5.00	5.45	0.45	DP	"	2	3	5	8	-	-	-	-	-	-	Non cohesive soil
"	6.00	6.45	0.45	DP	"	5	7	9	16	-	-	-	-	-	-	do
"	7.00	7.45	0.45	U	"	slipped				-	-	-	-	-	-	do
"	8.00	8.45	0.45	DP	"	6	7	13	20	-	-	-	-	-	-	do
"	9.00	9.45	0.45	DP	"	8	10	13	23	-	-	-	-	-	-	do
"	10.00	10.45	0.45	U	"	Received				-	-	-	-	-	-	Cohesive soil
"	11.00	11.45	0.45	DP	"	7	11	13	24	-	-	-	-	-	-	do
"	12.00	12.45	0.45	DP	"	8	13	18	31	-	-	-	-	-	-	do
"	13.00	13.45	0.45	U/D	"	slipped				-	-	-	-	-	-	do
"	14.50	14.95	0.45	DP	"	5	8	10	18	-	-	-	-	-	-	Non cohesive soil
"	16.00	16.45	0.45	U	"	Received				-	-	-	-	-	-	do
"	17.50	17.95	0.45	DP	"	12	20	27	47	-	-	-	-	-	-	Non cohesive soil with gravel
"	19.00	19.45	0.45	U	"	Received				-	-	-	-	-	-	do
"	20.50	20.95	0.45	DP	"	7	15	22	37	-	-	-	-	-	-	do
"	22.00	22.45	0.45	U	"	Received				-	-	-	-	-	-	do
29/10/23	23.50	23.95	0.45	DP	"	7	12	18	30	-	-	-	-	-	-	do
"	25.00	25.45	0.45	U	"	Received				-	-	-	-	-	-	Non cohesive soil
"	26.50	26.95	0.45	DP	"	8	15	23	38	-	-	-	-	-	-	do
"	28.00	28.45	0.45	U/D	"	slipped				-	-	-	-	-	-	do

Techpro Engineers Pvt. Ltd. Kanpur

Supervisor Lab

Sr. Engineer

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 40: FIELD BORE LOG CHARTS (P 100)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW FOR HORC Viaduct B/w Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 3120471.976	E: 700986.099		Location/ Chainage:	23535.8870
Method of Drilling:	Percussion	Drilling Equipment:	Autotrip Powerwrench	Bore No.:	P-100
Casing Lowered (M):	24.0 M	Bentonite Used: NA	Standard Sampler: Yes	Barrel Type:	NA
Ground Elevation:	R.L- 193.996	Date: From 28/10/23 to 30/10/23		Water Table (M):	1.30

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
29/10/23	29.50	29.95	0.45	DP	SX	18	21	23	44	—	—	—	—	—	—	Non cohesive soil.
	31.00	31.45	0.45	U/D	"	slipped				—	—	—	—	—	—	do
	32.50	32.95	0.45	DP	"	15	30	24	54	—	—	—	—	—	—	Non cohesive soil with Gravel
	34.00	34.45	0.45	U	"	14	24	26	50	—	—	—	—	—	—	do
30/10/23	35.50	35.95	0.45	DP	"	12	13	16	29	—	—	—	—		—	do
	37.00	37.45	0.45	DP	"	slipped-				—	—	—	—	—	—	do
	38.50	38.95	0.45	DP	"	18	24	23	47	—	—	—	—	—	—	do
	40.00	40.45	0.45	DP	"	15	28	30	58	—	—	—	—	—	—	do

Supervisor

E-in-C

Abbreviation Used - U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

End of Report

Report No: 1901-HORC-VI

Report No.: 1901-HORC-VI

Date: Nov 30th; 2023

GEOTECHNICAL INVESTIGATION REPORT

ULR No.: TC916923000000032P
REVISION-R2

AT THE SITE FOR

HORC VIADUCT BETWEEN SOHANA & DHULAWAT STATIONS OF HARYANA ORBITAL RAIL CORRIDOR (HORC) PROJECT, HARYANA

FROM BOREHOLES P101 TO P113

CLIENT

HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LTD.

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e-mail: info@techproindia.com

TC-9169

REVISION NOTES

REVISION NO.	DATE	DESCRIPTION
R1	09.12.2023	• Vertical and Lateral pile load capacity in Table 1 to 4 of Appendix-H and recommendations revised. • Field bore log charts added in Appendix-K.
R2	12.12.2023	• Lithological profile added in Appendix-C.

REPORT FORMAT

Report No.	Bore included	Total Number of Bores
1901-HORC-I	A1 to P20	21
1901-HORC-II	P21 to P40	20
1901-HORC-III	P41 to P60	20
1901-HORC-IV	P61 to P80	20
1901-HORC-V	P81 to P100	20
1901-HORC-VI	P101 to P113	13
1901-HORC-VII	P114A to P133A	20
1901-HORC-VIII	P134A to A2A	16
1901-HORC-IX	P114B to P133B	20
1901-HORC-X	P134B to A2B	16

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Nov 30th; 2023

ACKNOWLEDGEMENTS

We are pleased to submit the part-6 of the report of Geotechnical investigation, conducted for the boreholes P101 to P113 for the design of foundations for HORC Viaduct between Sohana & Dhulawat stations of Haryana Orbital Rail Corridor (HORC) project in the state of Haryana, India.

We hereby, convey our sincere thanks to Mr. Neeraj Bhandari (CPM/South) and Mr. Raju Solanki (DGM/C/South), HRIDCL for trust and support during the investigation. We also acknowledge our thanks to Mr. Uma Maheshwara Rao B, DGM/C/West, HRIDCL for awarding the said work to us. We are also grateful Mr. Ravindra Dutta Upadhyay (Geotech Expert), Mr. PS Gautam & Mr. Jitender Parashar, Site Engineer from the RITES- SMEC JV and Mohd. Ishak (Executive/Civil) from HRIDCL, for their help rendered during and prior to the investigation work.

We are also thankful to our staff members for conducting field and laboratory test, preparing sketches, and typing the report.

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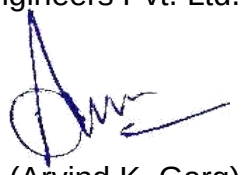


(Arvind K. Garg)
B.Tech. (Civil), M.Tech.
Principal Consultant &
Managing Director

1. INTRODUCTION:

Haryana Rail Infrastructure Development Corporation Ltd. (HRIDC) and Ministry of Railways, Govt. of India has come together to form a new company namely Haryana Orbital Rail Corporation Limited (HORCL), to design and construction of new BG line from Palwal to Sonipat named Haryana Orbital Rail Corridor (HORC), in the state of Haryana, India. In this connection, a Geotechnical investigation has been planned for the design of foundations of Viaduct between Sohana & Dhulawat stations of Haryana Orbital Rail Corridor (HORC) Project in the state of Haryana. The work of conducting the detailed Geotechnical Investigation has been awarded to us by HRIDC, through work order No. HRIDC/HORC/GTI/211/2023-2024/Vol-0 dated 02-09-2023, which includes investigation in field, laboratory testing of disturbed and undisturbed samples, collected from the field, and submission of the geotechnical **investigation** test report.

A geotechnical investigation was carried out, with the locations, planned by the client. Purpose of the investigation is to determine the nature and properties of soil and rock strata across the bore holes and representing them through log sections showing the levels, nature, and properties of various strata up to a sufficient depth below the founding level, proneness of site to artesian conditions, seismic disturbance and other engineering properties of soil and rock strata.

This part -6 of the report includes the detailed methodology of investigation, collection of samples, field and laboratory test result including their interpretation/ analysis, recommendations on the properties of soils and rock required for design of foundation and suggesting suitable type and depth of foundation with allowable bearing capacity for safe and strong foundations for the Bore Hole numbers P101 to P113.

2. SCOPE OF WORK:

For the design of foundation of viaduct, it is required to determine the allowable bearing capacity together with necessary engineering characteristics of underlying soil & rock strata. In general, the geotechnical investigation has been planned as per IS:1892-2021 and further extended to IS: 1904, IS:2911 (part-1/Sec 2) & IRC 78:2014 for planning the laboratory testing and computing the allowable bearing capacity, hence the scope of work is as follows:

2.1. Mobilisation of all tools & plants along with accessories, materials, labours etc. at site of work for drilling and testing work, including setting up boring and shifting to different bore holes point etc.

2.2. Exploratory drilling of 150 mm diameter bore holes through soil deposits and 75 mm in rock within the proposed alignment upto the required depth.

2.3. Collection of disturbed soil samples at an interval of 3.00 meter in all the bore holes.

2.4. Collection of undisturbed soil samples at every 3.00 m interval or at change of stratum from all the boreholes.

2.5. To conduct Standard Penetration Test (SPT) at an interval of 3.00 m or noticeable change of stratum in soil deposits in all bore holes.

2.6. Collection of rock core samples and preserving them in core boxes.

2.7. To collect ground water sample on completion of bore holes.

2.8. To record the ground water table in all the bore holes.

2.9. Transporting all the disturbed, undisturbed soil and rock core samples collected during the field investigation to our NABL accredited Geotech Engineering laboratory at Kanpur.

2.10. To conduct the laboratory tests on all the soil and rock core samples collected during field investigation for determination of their engineering characteristics.

2.11. To compile of field and laboratory test results, working out the allowable bearing capacity and preparing the report including detailed recommendations and necessary precautions.

3. GEOLOGICAL INFORMATION OF THE REGION:

3.1. Geography:

The project location is in the bordering area of Gurugram and Nuh (recent old name-Mewat), districts in the Indian state of Haryana. The stretch of the alignment of the proposed corridor starts from southmost part of Gurugram in the town of Sohna and ends at Dhulawat, which is a village lying at the north of Nuh district.

Haryana is a state located in the northern part of India. Gurugram is among one

of the districts in Haryana which is also the part of National Capital Region (30km south of New Delhi). It lies at an elevation of 217 m above msl. Sohna is a small town located 25km in the south of Gurugram. Sohna is well known for its hot water springs and famous Shiva temple. Sohna is located in between 28°15' N latitude and 77°40' E longitude at the elevation of 212.14m above msl. Mewat district is located at 28 °12′ N latitude, 77 °3′ E longitude, at the south of Gurugram at an elevation of 199 m above msl. The location is bordered by Rewari district on west and Faridabad & Palwal district on the east.

3.2. Geology:

The Gurugram district is having of almost flat topography, however, in the north-eastern part small isolated hillocks of Precambrian rocks are exposed. Small hill ranges which are part of the Aravali and Mangar Bani ranges exists in the district. The major part of district is underlain by Quaternary alluvium consisting of sand, clay and silt. The alluvial plain is formed by the Sahibi river which is a tributary of River Yamuna. Soils of the Gurgaon district is classified as tropical and brown soils, existing in the north western extreme, northern and north eastern parts of the district and water logged and salt affected soils in the southern parts of the district. The soils are medium textured loamy sand is the average texture in Gurgaon and Sohna blocks.

3.3. Rainfall and Climate:

The area has hot semi-arid type of climate characterising extreme dryness of the air except in the monsoon season. Intense hot summer and cold winters. The total annual rainfall in the region is about 596 mm, of which 75 to 80% is because of the south-west monsoon.

3.4. Seismicity:

The site under consideration exists in the district of Gurugram and Mewat which lies in the Seismic Zone IV (high damage risk zone), as per the current seismic zonation map of India (IS 1893-2016): RA 2021 and have a zone factor of 0.24 for design basis earthquake. The region is surrounded by many in-homogeneities in the form of faults and ridges like Sohna Fault, Moradabad Fault, Delhi-Moradabad Fault, Delhi-Haridwar ridge, junction of Aravalli and Alluvium near Delhi. The Sohna fault line lies between the Delhi ridge and Sohna town and falls between the Arjangarh and

Manesar outcrops. All the developed area in Gurugram comes within 200 km of the fault line. The Sohna fault line is located at the junction between the hard rock terrain of the Aravalli hills and the sandy formation of the Yamuna River and is currently inactive from several years and is capable of a disastrous earthquake.

The project location has been marked in Fig.1 Seismic zone map of India.

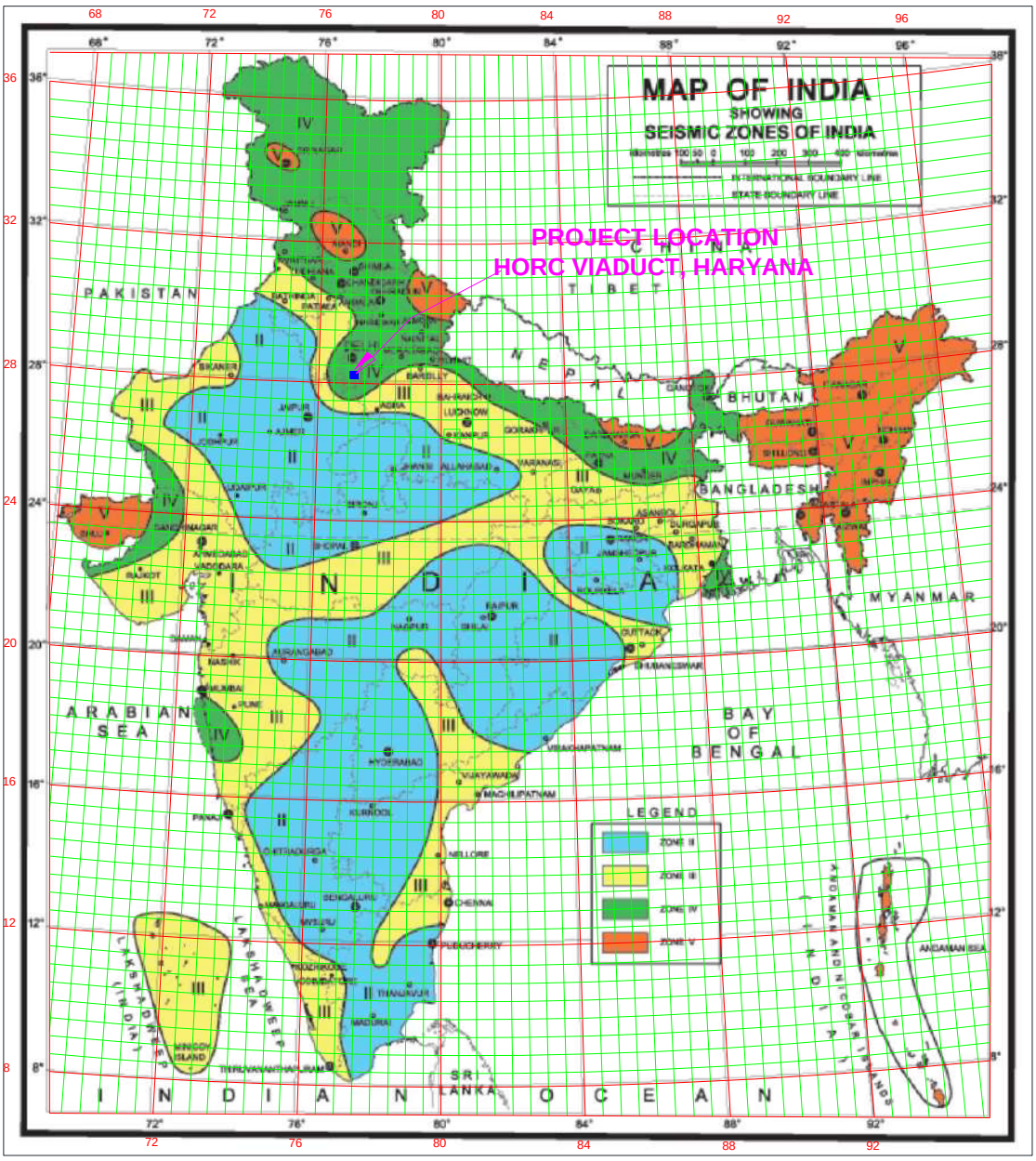


Fig.1: Seismic Zone Map of India

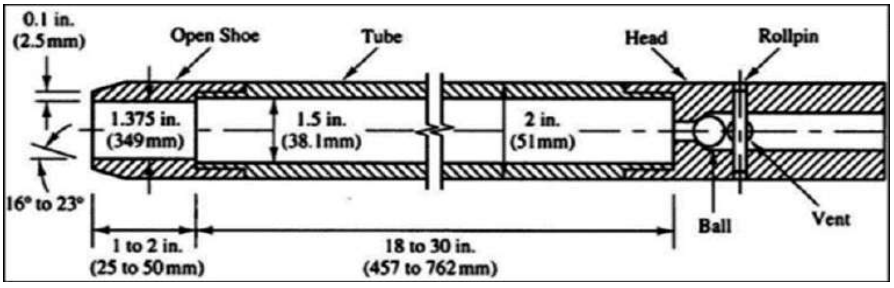
4. FIELD INVESTIGATION:

The field investigation work at this site was carried out from Oct 11th; 2023 to Nov 2nd; 2023. The following investigation work was carried out:

4.1. **Seven number** of **boreholes** (marked as P101, P102, P103, P104, P105, P106, P111) of diameter 150 mm in soil were made within the proposed alignment for conducting Standard Penetration Test and collection of disturbed and undisturbed samples. The boreholes were progressed using power operated winch and hydraulic rig machine under percussion and rotary method of drilling respectively. Casing was used to keep the borehole stable. The records of achieved depth of bore holes have been given in Para No. 6, the details of drilled bores along with depth of casing used have been reported in Appendix B. Locations of boreholes have been reported in "TEST LOCATION PLAN" in Appendix A.

4.2. **Standard Penetration Tests** were conducted at 1.00 to 2.00 metre interval upto the depth of 12.00 meter and 3.00 metre interval, beyond 12.00 metre depth, as per the procedure in IS: 2131-1981-(RA: 2021) in all the bore holes. The **standard SPT sampler** (without liner and with no space for liner) and **auto-trip & rope-pulley driven hammer** of standard weight of 63.50 kg have been used to perform the test.

For conducting the test, the bottom of the borehole was properly cleaned, and split spoon sampler was properly seated in position in the borehole. The split spoon sampler resting on the bottom of borehole was allowed to sink under its own weight; then the sampler was allowed to penetrate 15 cm with the blows of the hammer 63.50 kg weight falling free through 75cm, thereafter the split spoon sampler was further driven by another 15 cm. For the 3rd and final drive, the sampler was further allowed to penetrate 15 cm. The number of blows required to get each 15 cm of penetration, was recorded. The first 15 cm of drive is seating drive.



Structure of SPT Sampler

The total blows of penetration for the second and third 15 cm of penetration is termed the penetration resistance N. The N' values are indicative of the compactness/ relative density of cohesion less soils and consistency of cohesive soils.

In case the blows count of SPT in soil (including the number of blows of seating) exceeds 100, the corresponding penetration was recorded and this particular test at that depth stopped. If the total penetration is more than the seating penetration of 15 cm, then breakup of blow counts for 15 cm seating penetration and for remaining portion of penetration is also given.

SPT 'N' values are correlated with non-cohesive stratum as per BS: 5930 (1999) – for sandy strata and with consistency of cohesive stratum.

Correlation For Clay/Plastic Silt		**Correlation For Sand/Non-Plastic Silt**	
Consistency of clays	**Penetration Value**	**Relative Density of sand**	**Penetration Value**
Very Soft	0 to 2 Blows	Very loose	0 to 4 Blows
Soft	3 to 4 Blows	Loose	5 to 10 Blows
Medium Stiff	5 to 8 Blows	Medium	11 to 30 Blows
Stiff	9 to 16 Blows	Dense	31 to 50 Blows
Very Stiff	17 to 32 Blows	Very Dense	Above 50
Hard	Above 32		

In this method, the sampler acts as a probe and the driving energy is supplied by the fall of the drop weight. The values of 'N' depend on the compactness or relative density of the material. In hard formations, the testing is discontinued if 'N' value is found to be more than 100. It is termed as 'Refusal'. Refusal is also recorded when SPT blow count records 50 or more for any of the single drive of 15 cm.

'N' value depends upon degree of saturation and over burden pressure of the formation. Silty fine sand and fine sand below the water table develop pore water pressure depending on the in-situ void ratio which in turn affects the effective stress. This change in effective stress influences the 'N' value considerably.

Depth of overburden affects the SPT values in none to low cohesive soils and hence need correction. The SPT value after the overburden correction, N' is as follows:

$$N' = 0.77x \log (2000/q) \times N$$

Where, q= Overburden Pressure (kN/m^2) and N = observed SPT value

N' is corrected further for dilatancy in case of saturated fine sands and silts for the values of N' greater than 15.

Modified value after dilatancy correction N" = 15+ (N'-15)/2

Soil samples obtained from split spoon sampler were collected in the polythene bags of suitable size. These samples were property sealed, labelled, and carefully transported to the laboratory for testing. The results have been reported in Table 1 to 7 of Appendix B under the title "SUMMARY OF TEST RESULTS".

4.3. **Disturbed soil samples** were collected at 0.50 metre, then at 1.00 to 2.00 metre interval upto the depth of 12.00 meter and 3.00 metre interval, beyond 12.00 metre depth and at significant change of stratum. Soil from cutting edge of SPT samplers and retained in split spoon, used for Standard Penetration Tests was taken as disturbed samples. These samples were placed without delay in adequately sealed polythene bags. Where the collection of disturbed soil samples could not be collected from SPT samples, Shelby tubes were driven and retained soil samples were obtained. The laboratory tests were conducted on the collected soil samples and reported in Table 1 to 7 of Appendix-B under the title "SUMMARY OF TEST RESULTS".

4.4. **Undisturbed soil samples** were collected in accordance with IS: 2132-1986-(RA: 2021) at an interval of 3.00 metre or at change of stratum, starting from the depth of 1.00 or 2.00 m, by using 100 mm dia. and 450 mm long MS tubes provided with sampler head with ball check arrangement. However, the some of the samples could not be extracted due to the partial penetration or slippage during the evacuation.

Moreover, collection of Undisturbed samples in very hard cohesive soils/ dense granular soils/gravels/ cobbles/ pebbles/ boulders, refusal strata is practically not possible and such collected samples will not truly represent the undisturbed conditions.

Immediately after taking undisturbed sample in the tube, the adopter head was removed along with the disturbed material. The visible ends of the samples shall then be trimmed off any wet disturbed soil. The ends will then be coated alternately with four layers of molten wax. More molten wax will then be added to give a total thickness of not less than 25 mm. The laboratory test results have been reported in Table 1 to 7 of Appendix-B.

4.5. The **ground water table** in the borehole was allowed to stabilize and measured after 8, 16, 24 and 48 hours after completion of the bore hole. It was ensured that last two reading were identical. The records of ground water table have been given in Para No.6.

4.6. **Ground water samples** were collected from borehole as per IS: 6935-1973-(RA:2019) for chemical analysis to determine aggressiveness in relation to attack on concrete / reinforcement including determination of pH value.

5. LABORATORY TESTS:

The following laboratory tests were conducted to determine the engineering characteristics of sub-soils:

5.1. **Field moisture contents** were determined by oven drying method as per IS: 2720 (part II)-1973-(RA: 2020). The results have been reported in Table 1 to 7: "SUMMARY OF TEST RESULTS" of Appendix B.

5.2. **Bulk density** of soil strata was obtained using Shelby tubes in accordance with IS 2720 (part XXIX)-1975-(RA: 2020). The results have been reported in Table 1 to 7: "SUMMARY OF TEST RESULTS" of Appendix B.

5.3. **Mechanical sieve analysis** test was performed in accordance with IS: 2720 (Part IV) – 1985-(RA: 2020), for the purpose of identification by grain size analysis, on coarse part of the soil samples and the results have been reported in Table 1 to 7: "SUMMARY OF TEST RESULTS" of Appendix B.

5.4. **Particle size analysis** test by **Hydrometer method** were performed in accordance with IS: 2720 (Part IV) -1985-(RA: 2020) on the part of soil samples obtained after the sieve analysis. The results have been reported in Table 1 to 7: "SUMMARY OF TEST RESULTS" of Appendix B.

5.5. **Atterbergs' limits tests** were performed in accordance with IS: 2720 (part V)-1985-(RA: 2020) and results have been reported in Table 1 to 7: "SUMMARY OF TEST RESULTS" of Appendix B.

5.6. **Specific gravity tests** were performed in accordance with IS 2720 (part III-sec. 1) -1980-(RA: 2021) and the results have been reported in Table 1 to 7: "SUMMARY OF TEST RESULTS" of Appendix B.

5.7. **Consolidation tests** were performed on cohesive soil samples in accordance with IS: 2720 (part XV)-1965-(RA: 2021). The results have been reported in Table 1 to 7: "SUMMARY OF TEST RESULTS" of Appendix B.

5.8. **Direct shear tests** were performed as per IS: 2720 (part XIII)-1986-(RA: 2021), on the undisturbed soil samples obtained during the field investigation. The results and the density of samples have been reported in Table 1 to 7: "SUMMARY OF TEST RESULTS" of Appendix B.

5.9. **Tri-axial Compression Test** under Unconsolidated Un-drained (UU) condition as per IS: 2720 (Part-XI)-1993-(RA: 2021) were performed on the selected undisturbed soil samples, obtained during the field investigation. The results have been reported in Table 1 to 7: "SUMMARY OF TEST RESULTS" of Appendix B.

5.10. **Unconfined Compressive strength tests** were performed in accordance with IS 2720 (Part-X) -1991-(RA:2020) on selected undisturbed soil samples and the results have been reported in Table 8 of Appendix B.

5.11. **Shrinkage Limit tests** were performed in accordance with IS 2720 (part-VI) -1972-(RA: 2021) and the results have been reported in Table 1 to 7: "SUMMARY OF TEST RESULTS" of Appendix B.

5.12. **Free Swell Index** were performed in accordance with IS 2720 (part-XL) -1977-(RA: 2021) and the results have been reported in Table 1 to 7: "SUMMARY OF TEST RESULTS" of Appendix B.

6. GROUND WATER TABLE:

The water table at this site was encountered during the drilling operation up to the depth of investigation.

Borehole No.	Chainage	Global Co-ordinates (UTM format)		Reduced Level (m)	Depth of Borehole (m)	Water table (m)
		Easting	Northing			
P101	23562.087	700986.455	3120498.173	193.949	40.00	1.30
P102	23588.287	700986.810	3120524.371	194.023	40.00	1.00
P103	23614.487	700987.165	3120550.568	194.050	40.00	0.50
P104	23640.687	700987.521	3120576.766	194.067	40.00	1.20

Borehole No.	Chainage	Global Co-ordinates (UTM format)		Reduced Level (m)	Depth of Borehole (m)	Water table (m)
		Easting	Northing			
P105	23666.887	700987.876	3120602.953	193.916	40.00	1.30
P106	23693.087	700988.231	3120629.123	194.696	40.00	0.60
P111	23830.447	700989.842	3120766.590	194.745	40.00	1.30

7. DESCRIPTION OF STRATA:

The classification of soil stratum has been done with the help of soil characteristics obtained in laboratory tests as per IS 1498-1970-(RA:2021). The classification of rock masses has been done based on RMR as per IS: 4464-1985, IS: 13365-1. The detailed nature of the strata has been reported in Table 1 to 7: "SUMMARY OF TEST RESULTS" of Appendix-B and represented through Lithological plots in Appendix-C.

The strata exhibited in all the bore hole, is predominantly comprising of inorganic silty clays of low plasticity and inorganic silts of non to low plastic category. Silty sands and silty sands containing clay binders were also encountered at variable depths and thickness. Inorganic silty clays of intermediate plastic category was found as exception in borehole P101 at the depth of 22.00 to 25.00 meters and in borehole P105 at the depth of 12.00 to 13.00 meters.

8. SAFE BEARING CAPACITY COMPUTATIONS:

For the construction of viaducts, deep foundation **(Bored Cast-In-Situ RCC piles)** have been considered for computation of load bearing capacity of the underlying soil strata. The computation of load bearing capacity of bored cast-in-situ RCC piles have been done as per IS 2911 (part-1, section-2)-2010-(RA: 2020) with due consideration of effects of liquefaction.

8.1. Design Parameters:

Factor of safety in compression = 2.50
Factor of safety in tension = 3.00
Depth of critical water table = 0.00 m
Diameter of pile = 1.00 & 1.20 m

Cut off length = 2.50 m

Type of pile head consider = Fixed

8.2. Computation of friction along pile stem:

$Q_{uf} = \sum K_i.P_{di}.\tan\delta_i.A_{si}$

where,

Q_{uf} = Ultimate shaft friction (kN/m^2)

K_i = Coefficient of earth pressure at mid-depth of ith layer

P_{di} = Effective overburden pressure at mid-depth of ith layer (kN/m^2)

A_{si} = Surface area of pile stem in i^{th} layer (m^2)

δ_i = Angle of wall friction between pile and soil of ith layer (= ϕ) (degree)

ϕ_i = Angle of internal friction of soil in i^{th} layer (degree)

$\sum$ = Sum of all layers up to i^{th} layer

8.3. Computation of Cohesion along the stem of pile:

$Q_{uc} = \sum \alpha_i.c_i.A_{si}$

Where,

c_i = Cohesion in i^{th} layer

A_{si} = Surface area of pile stem in i^{th} layer (m^2)

α_i = Adhesion factor for i^{th} layer of soil depending of consistency of soils

$\sum$ = Sum of cohesion of all layers considered

8.4. Computation of end bearing resistance:

$Q_{ub} = A_p\ (c.Nc + q.Nq + 0.5.\ \gamma.B.N\gamma)$

Where,

A_p = Area of the pile toe (m^2)

c = cohesion of soils at pile toe (kN/m^2)

γ = Effective Unit weight of soils at pile toe (kN/m^3)

B = Diameter of pile (m)

q = Effective overburden pressure at pile toe (kN/m^2)

N_c = Bearing Capacity Factor (Recommended equal to 9)

N_q, N_γ = Bearing Capacity Factor

8.5. Lateral load capacity of piles in soils:

$$Q_u = 12.E.I.\delta/(L_1+L_f)^3$$

where,

Q_u = Ultimate lateral load capacity of pile (kN)

δ = Permissible deflection (m) = 5 mm

E = Young Modulus of pile material (kN/m^2)

I = Moment of Inertia of the pile cross section (m^4)

L_1 = Cantilever Length of pile (m)

L_f = Length of fixity (m)

Detailed calculations of pile load carrying capacity in compression & uplift in soil have been reported in **Table-1 to 2** of **Appendix-H.**

Pile lateral Load capacity has been given in **Table-3 to 4** of **Appendix-H**.

9. LIQUEFACTION ANALYSIS:

Liquefaction is the sudden loss of shear strength of the loose fine sands due to earthquake-induced vibration under saturated conditions. Liquefaction generally takes place in loose fine sands (fines < 10 %, D_{60}= 0.20 mm to 1.0 mm and C_u between 2 to 5) with N value less than 15. In case of soil strata having N>15, liquefaction of soil will not take place normally.

The present site falls in **seismic zone – IV.** Considering the history of past earthquakes and available seismic data, an earthquake of **magnitude 7.0** having peak ground acceleration **a_{max}= 0.24 g** is considered in the present analysis.

Preliminary assessment of liquefaction potential of foundation strata is made by simplified approach proposed by IS: 1893 (part-1)-2016-(RA: 2021) from the data obtained in Standard Penetration Test.

In this method, cyclic shear stress likely to be induced in the foundation strata by Design Basis Earthquake is first evaluated. Next threshold cyclic shear stress, which is good enough to cause liquefaction, is determined from SPT data and the empirical relations. Finally, comparison of these two stresses is used in the estimation of liquefaction susceptibility of the foundation strata.

Cyclic Stress Ratio (CSR):

The equivalent average of shear stress likely to be induced in the foundation material due to an earthquake is calculated by using the equations

Cyclic Resistance Ratio (CRR):

It expresses capacity of soil to resist liquefaction. CRR is determined using correlation between corrected blow count $(N_1)_{60}$ and CRR for earthquake of magnitude 7.5. $(N_1)_{60}$ is the SPT blow count corrected to an effective overburden pressure of 100 kPa and to hammer energy efficiency of 60 %.

Following variable have been adopted in calculation of N_{60} (SPT value for 60% efficiency)

Energy correction to SPT values:

C_{60} = 1.00 (energy efficiency factor)

Design Earthquake Base:

Earthquake zone	= IV
Magnitude of earthquake	= 7
Seismic Zone factor	= 0.24

Status of Liquefaction:

The value of CSR and CRR are computed at different depth and then the ratio of CRR to CSR to get the factor of safety towards the susceptibility of the stratum towards liquefaction potential.

If factor of safety:

< 1.00 : Stratum is to be considered as liquefiable

> 1.20 : Non-Liquefiable

The detailed calculations of liquefaction, have been reported in **Table-5** of **Appendix-H.**

10. RECOMMENDATIONS:

Keeping in mind, the field test results, laboratory test results and IS codes of practice the following recommendations are hereby made:

10.1. **Bored Cast-In-Situ RCC Piles** of diameter 1000 and 1200 mm have been adopted for SBC computations of foundation for Viaduct.

10.2. **Cut off length** of piles have been considered as 2.50 m from the existing ground level for the purpose of computation of SBC.

10.3. **Pile length** recommended in the table below, shall be measured **after the cut-off depth.**

10.4. **Allowable load carrying capacity** of pile corresponding to the length and diameter of pile shall be read from the tables below:

10.4.1. For Pile diameter = 1000 mm

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
P101	25.00	2900	1750	85
	27.50	2900	1950	
	30.00	2750	2150	
	32.50	3000	2400	
	35.00	4000	2600	
P102	25.00	2500	1600	40
	27.50	2700	1800	
	30.00	3100	2000	
	32.50	3800	2250	
	35.00	4050	2500	
P103	25.00	3200	1800	110
	27.50	3500	2100	
	30.00	3300	2350	
	32.50	3300	2600	
	35.00	3650	2850	
P104	25.00	3000	1850	75
	27.50	3750	2050	
	30.00	4200	2300	

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
	32.50	4400	2550	
	35.00	4350	2800	
P105	25.00	2150	1150	15
	27.50	2650	1350	
	30.00	2050	1600	
	32.50	2600	1800	
	35.00	3150	2000	
P106	25.00	2750	1850	85
	27.50	2650	2000	
	30.00	2850	2250	
	32.50	3050	2450	
	35.00	3300	2650	
P111	25.00	3650	2050	140
	27.50	4000	2300	
	30.00	4300	2550	
	32.50	4700	2850	
	35.00	5050	3100	

***** *Indicates Grade of Concrete*

10.4.2. For Pile diameter = 1200 mm

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
P101	25.00	4250	2350	130
	27.50	4250	2650	
	30.00	3850	2950	
	32.50	4150	3250	
	35.00	5850	3600	
P102	25.00	3950	2200	65
	27.50	4150	2500	
	30.00	4900	2800	
	32.50	6100	3200	
	35.00	6500	3600	
P103	25.00	5000	2450	155
	27.50	5500	2850	

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
	30.00	4900	3200	
	32.50	4600	3550	
	35.00	5150	3900	
P104	25.00	4400	2450	115
	27.50	5600	2800	
	30.00	6350	3150	
	32.50	6600	3550	
	35.00	6450	3950	
P105	25.00	3200	1500	25
	27.50	3950	1800	
	30.00	2750	2100	
	32.50	3700	2400	
	35.00	4550	2650	
P106	25.00	3950	2500	130
	27.50	3700	2750	
	30.00	3900	3050	
	32.50	4200	3350	
	35.00	4550	3600	
P111	25.00	5500	2700	215
	27.50	5950	3100	
	30.00	6400	3500	
	32.50	7050	3900	
	35.00	7550	4300	

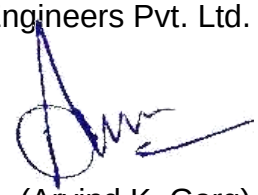
***** *Indicates Grade of Concrete*

10.5. Liquefaction Potential: All the bore holes have been analysed for Liquefaction potential as per IS: 1893 (part-1)-2016-(RA: 2021) with Seismic Zone IV, earthquake intensity of 7.0 on Richter scale and critical ground water table at existing ground level. Out of which several boreholes show the potential at various depths mentioned in the table below:

Bore No.	Liquefiable depth zone (meter)
P101	Top 5.00
P102	Top 3.00, 4.00 to 6.00 & 7.00 to 8.00

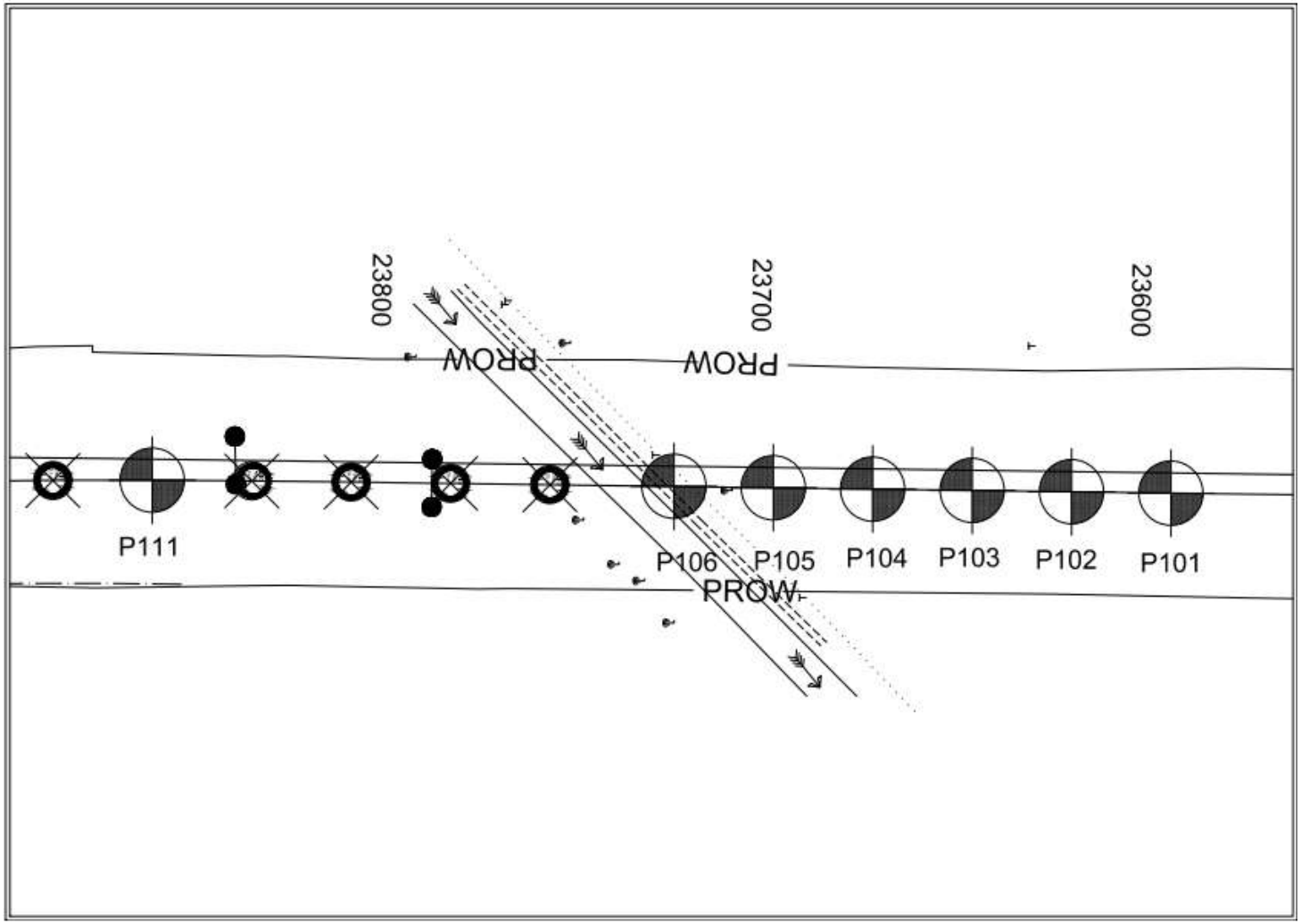
Bore No.	Liquefiable depth zone (meter)
P103	Top 4.00
P104	Top 5.00
P105	3.00 to 4.00, 5.00 to 9.00 & 13.00 to 14.50
P106	None
P111	None

for Techpro Engineers Pvt. Ltd.



(Arvind K. Garg)
B.Tech.(Civil), M.Tech.
Principal Consultant &
Managing Director

APPENDIX-A
TEST LOCATION PLAN



APPENDIX "B"

TABLE 1: SUMMARY OF TEST RESULTS

Bore No: P101	**Ground Elevation: RL 193.949 m**	**Method of drilling: Percussion**	**Depth of Water-table: 1.30 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 28/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 23562.087	**Casing Lowered: 21.50 m**	**Ending Date: 30/10/2023**	**Hammer type: Rope-pulley driven**

FIELD TEST RESULT										LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen												
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	0.50	D	1	-	-	-	-	-	ML	0	0	0	47	49	4	16.22	-	-	26.0	22.0	4.0	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity										
	1.00	U	2	-	-	-	-	-	SM-SC	0	0	1	49	44	6	20.85	2.03	1.68	27.0	21.5	5.5	2.65	-	-	-	-	0.577	-	-	-	-	Silty Sands with clay binder										
	2.00	D	3	2	3	4	7	9.57	-	-	-	-	-	-	-	16.30	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	3.00	D	4	2	2	2	4	5.11	SM	6	2	3	49	40	0	16.91	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	4.00	D	5	-	-	-	-	-	ML	0	0	0	48	46	6	20.15	1.96	1.63	25.0	21.0	4.0	2.65	RDST	8.0	26.6	-	0.626	-	-	-	-	Inorganic Silts of low plasticity										
	5.00	D	6	4	5	7	12	13.87	SM	0	0	1	52	47	0	20.06	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands										
	6.00	D	7	6	8	11	19	18.03	CL-ML	1	1	0	20	73	5	22.59	-	-	28.0	22.0	6.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	7.00	U	8	-	-	-	-	-	ML	1	0	0	14	76	9	21.95	2.06	1.69	30.0	23.0	7.0	2.67	UU	48.0	9.5	0.151	0.580	-	-	-	-	Inorganic Silts of low plasticity										
	8.00	D	9	9	8	13	21	18.24	-	-	-	-	-	-	-	21.62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	9.00	D	10	8	12	16	28	21.32	ML	0	0	1	18	76	5	21.81	-	-	25.0	21.0	4.0	-	-	-	-	-	-	-	-	-	-												
	10.00	U	11	-	-	-	-	-	-	-	-	-	-	-	-	22.89	2.04	1.66	-	-	-	2.65	DST	6.0	26.0	-	0.596	-	-	-	-												
	11.00	D	12	8	13	17	30	21.40	CL	0	0	0	8	84	8	21.29	-	-	29.5	22.5	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity										
	12.00	D	13	7	12	16	28	20.10	-	-	-	-	-	-	-	20.57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	13.00	U	14	-	-	-	-	-	-	-	-	-	-	-	-	19.35	2.05	1.72	-	-	-	2.66	UU	45.0	9.5	-	0.547	-	-	-	-												
	14.50	D	15	5	7	12	19	15.48	CL-ML	1	0	1	11	78	9	18.60	-	-	28.0	21.5	6.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity										
	16.00	U	16	-	-	-	-	-	SM-SC	1	0	1	50	40	8	16.75	2.05	1.76	26.5	19.5	7.0	2.66	UU	43.0	13.0	-	0.511	-	9	16	-												
	17.50	D	17	8	15	23	38	22.33	-	-	-	-	-	-	-	19.40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Silty Sands with clay binder										

APPENDIX "B"
TABLE 1: SUMMARY OF TEST RESULTS

Bore No: P101	**Ground Elevation: RL 193.949 m**	**Method of drilling: Percussion**	**Depth of Water-table: 1.30 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 28/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 23562.087	**Casing Lowered: 21.50 m**	**Ending Date: 30/10/2023**	**Hammer type: Rope-pulley driven**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	19.00	U	18	-	-	-	-	-	SM	0	1	1	57	41	0	19.58	1.89	1.58	Non-Plastic			2.62	DST	0.0	32.1	-	0.658	-	-	-	-	Silty Sands											
	20.50	D	19	14	20	24	44	23.73	-	-	-	-	-	-	-	20.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	22.00	U	20	-	-	-	-	-	CI	7	5	5	14	53	16	20.18	1.97	1.64	38.5	23.0	15.5	2.68	UU	47.0	13.0	-	0.634	-	8	19	-	Inorganic clays of Intermediate plasticity											
	23.50	D	21	13	21	23	44	44.00	-	-	-	-	-	-	-	22.86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	25.00	D	22	-	-	-	-	-	ML	0	0	1	42	53	4	19.36	2.01	1.68	25.0	21.0	4.0	2.66	RDST	7.0	29.6	-	0.583	-	-	-	-	Inorganic Silts of low plasticity											
	26.50	D	23	14	21	25	46	22.63	-	-	-	-	-	-	-	17.61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	28.00	D	24	-	-	-	-	-	ML	1	1	0	38	53	7	17.36	-	-	29.0	22.5	6.5	-	-	-	-	-	-	-	-	-	-												
	29.50	D	25	14	28	48	76	31.36	ML	0	0	1	48	51	0	17.03	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	31.00	D	26	13	21	24	45	45.00	CL	4	6	8	26	44	12	17.18	-	-	32.0	20.0	12.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	32.50	D	27	18	21	23	44	44.00	-	-	-	-	-	-	-	14.67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	34.00	D	28	-	-	-	-	-	CL	2	1	2	22	64	9	18.75	2.04	1.72	30.0	22.0	8.0	2.67	RUU	49.0	12.3	-	0.552	-	-	-	-												
	35.50	D	29	15	23	24	47	20.85	SM	1	0	2	47	50	0	17.04	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	37.00	D	30	-	-	-	-	-	CL-ML	0	0	0	47	48	5	18.42	2.05	1.73	26.0	20.5	5.5	2.66	RDST	5.0	30.0	-	0.538	-	-	-	-	Inorganic Silty Clays of low plasticity											
	38.50	D	31	12	24	28	52	21.55	-	-	-	-	-	-	-	20.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	40.00	D	32	16	23	25	48	20.16	CL-ML	0	0	1	42	53	4	14.65	-	-	25.0	20.5	4.5	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 2: SUMMARY OF TEST RESULTS

Bore No: P102	**Ground Elevation: RL 194.023 m**	**Method of drilling: Percussion**	**Depth of Water-table: 1.00 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 29/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 23588.287	**Casing Lowered: 24.00 m**	**Ending Date: 02/11/2023**	**Hammer type: Rope-pulley driven**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m²)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm²)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	SM	0	0	1	50	49	0	15.33	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	1.00	D	2	1	2	2	4	6.18	SM-SC	0	0	1	54	41	4	18.29	-	-	24.0	20.0	4.0	-	-	-	-	-	-	-	-	-	-	Silty Sands with clay binder											
	2.00	U	3	-	-	-	-	-	SM-SC	0	0	0	56	40	4	14.21	1.96	1.72	25.0	21.0	4.0	2.63	DST	11.0	27.2	-	0.529	-	-	-	-												
	3.00	D	4	3	5	8	13	16.06	SM	0	0	0	60	40	0	19.41	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	4.00	D	5	3	3	4	7	8.70	SM	3	1	2	55	39	0	16.15	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	5.00	D	6	-	-	-	-	-	-	-	-	-	-	-	-	17.82	1.89	1.60	-	-	-	-	RDST	0.0	27.0	-	-	-	-	-	-												
	6.00	D	7	4	6	9	15	16.05	SM	0	0	1	75	24	0	20.43	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	7.00	D	8	4	4	6	10	10.97	-	-	-	-	-	-	-	23.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	8.00	U	9	-	-	-	-	-	CL	4	0	2	11	71	12	17.09	1.96	1.67	31.0	20.0	11.0	2.67	UU	53.0	10.2	0.158	0.599	-	-	-	-	Inorganic clays of low plasticity											
	9.00	D	10	7	9	11	20	20.00	CL	6	1	2	9	72	10	18.48	-	-	30.0	21.0	9.0	-	-	-	-	-	-	-	-	-	-												
	10.00	D	11	7	8	10	18	18.00	CL	1	0	0	7	83	9	21.53	-	-	29.5	21.5	8.0	-	-	-	-	-	-	-	-	-	-												
	11.00	U	12	-	-	-	-	-	ML	1	0	1	6	85	7	18.55	1.99	1.68	29.0	23.5	5.5	2.66	UU	42.0	12.5	-	0.583	-	0	22	-	Inorganic Silts of low plasticity											
	12.50	D	13	5	7	9	16	16.00	CL	3	1	2	11	72	11	18.40	-	-	29.0	20.0	9.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	14.00	U	14	-	-	-	-	-	CL	9	3	2	16	60	10	17.28	2.00	1.71	28.0	20.0	8.0	2.67	UU	44.0	12.9	-	0.566	-	-	-	-												
	15.50	D	15	7	13	15	28	19.37	CL-ML	0	1	1	42	50	6	16.22	-	-	27.0	21.0	6.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	17.00	D	16	-	-	-	-	-	SM	1	1	0	70	28	0	17.89	2.06	1.75	Non-Plastic			-	RDST	0.0	30.1	-	-	-	-	-	-	Silty Sands											
	18.50	D	17	10	12	16	28	18.51	CL	6	2	2	14	68	8	18.88	-	-	29.0	22.0	7.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											

APPENDIX "B"

TABLE 2: SUMMARY OF TEST RESULTS

Bore No: P102	**Ground Elevation: RL 194.023 m**	**Method of drilling: Percussion**	**Depth of Water-table: 1.00 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 29/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 23588.287	**Casing Lowered: 24.00 m**	**Ending Date: 02/11/2023**	**Hammer type: Rope-pulley driven**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m²)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm²)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	20.00	D	18	-	-	-	-	-	SM	0	0	0	62	38	0	16.87	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	21.50	D	19	15	21	23	44	23.69	SM	3	1	1	61	34	0	18.77	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	23.00	D	20	-	-	-	-	-	ML	1	1	1	45	52	0	18.23	2.03	1.72	Non-Plastic			2.65	RDST	3.0	29.6	-	0.541	-	-	-	-	Inorganic Silts of low plasticity											
	24.50	D	21	14	22	28	50	24.80	SM	1	1	1	50	47	0	18.71	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	26.00	D	22	-	-	-	-	-	-	-	-	-	-	-	-	18.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	27.50	D	23	18	21	30	51	24.27	-	-	-	-	-	-	-	19.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	29.00	D	24	-	-	-	-	-	SM	2	1	1	49	47	0	16.05	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	30.50	D	25	16	20	28	48	22.41	-	-	-	-	-	-	-	19.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	32.00	D	26	-	-	-	-	-	-	-	-	-	-	-	-	19.32	2.06	1.73	-	-	-	2.65	RDST	0.0	30.2	-	0.532	-	-	-	-												
	33.50	D	27	17	22	29	51	22.52	SM	1	2	2	69	26	0	19.61	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	35.00	D	28	19	23	33	56	23.56	-	-	-	-	-	-	-	18.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	36.50	D	29	19	24	31	55	22.94	-	-	-	-	-	-	-	18.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	38.00	D	30	20	26	30	56	22.89	ML	1	2	1	40	56	0	18.33	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	40.00	D	31	20	30	36	66	25.15	-	-	-	-	-	-	-	17.34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed samples.

APPENDIX "B"
TABLE 3: SUMMARY OF TEST RESULTS

Bore No: P103	**Ground Elevation: RL 194.05 m**	**Method of drilling: Percussion**	**Depth of Water-table: 0.50 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 11/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 23614.487	**Casing Lowered: 27.00 m**	**Ending Date: 13/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m²)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm²)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	SM	0	0	1	54	45	0	15.68	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	1.00	D	2	1	2	3	5	8.18	-	-	-	-	-	-	-	15.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	2.00	U	3	-	-	-	-	-	SM	0	0	0	57	43	0	18.33	2.00	1.69	Non-Plastic			2.63	DST	2.0	28.5	-	0.556	-	-	-	-												
	3.00	D	4	2	3	4	7	9.47	-	-	-	-	-	-	-	16.15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	4.00	D	5	4	5	7	12	15.11	-	-	-	-	-	-	-	17.90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	5.00	U	6	-	-	-	-	-	SM-SC	1	0	1	52	40	6	19.12	2.01	1.69	26.5	21.5	5.0	2.65	DST	4.0	26.5	-	0.571	-	0	15	-	Silty Sands with clay binder											
	6.00	D	7	5	7	9	16	16.66	SM	0	0	1	58	41	0	21.11	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	7.00	D	8	6	9	11	20	20.00	CL	0	0	1	14	77	8	21.70	-	-	29.0	21.0	8.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	8.00	U	9	-	-	-	-	-	CL	5	1	1	18	66	9	21.16	2.06	1.70	30.0	22.0	8.0	2.66	UU	49.0	10.5	0.156	0.565	-	17	18	-												
	9.00	D	10	5	8	11	19	19.00	-	-	-	-	-	-	-	22.84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	10.00	D	11	5	9	13	22	22.00	-	-	-	-	-	-	-	20.40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	11.00	U	12	-	-	-	-	-	CL	4	0	2	6	81	7	20.57	1.98	1.64	29.5	22.0	7.5	2.66	DST	14.0	24.4	-	0.622	-	-	-	-												
	12.50	D	13	7	8	9	17	17.00	-	-	-	-	-	-	-	21.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	14.00	U	14	-	-	-	-	-	CL	3	0	1	7	83	6	20.77	2.06	1.71	29.0	21.0	8.0	2.66	UU	52.0	9.5	-	0.560	-	-	-	-												
	15.50	D	15	11	16	20	36	22.58	SM	6	2	1	41	50	0	17.14	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	17.00	U	16	-	-	-	-	-	CL	7	3	3	22	55	10	19.14	2.07	1.74	29.0	19.5	9.5	2.66	UU	54.0	10.5	-	0.531	-	9	17	-	Inorganic clays of low plasticity											
	18.50	D	17	8	12	15	27	18.00	SM	3	2	4	58	33	0	16.47	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											

APPENDIX "B"

TABLE 3: SUMMARY OF TEST RESULTS

Bore No: P103	**Ground Elevation: RL 194.05 m**	**Method of drilling: Percussion**	**Depth of Water-table: 0.50 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 11/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 23614.487	**Casing Lowered: 27.00 m**	**Ending Date: 13/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	20.00	U	18	-	-	-	-	-	CL	5	2	2	24	57	10	21.93	2.04	1.67	29.0	19.5	9.5	2.67	UU	51.0	11.0	-	0.596	-	-	-	-	Inorganic clays of low plasticity											
	21.50	D	19	9	19	25	44	44.00	CL	6	3	4	8	67	12	18.01	-	-	32.0	21.0	11.0	-	-	-	-	-	-	-	-	-	-												
	23.00	U	20	-	-	-	-	-	SM	0	1	2	53	44	0	19.33	1.96	1.64	Non-Plastic			2.64	DST	2.0	27.5	-	0.610	-	-	-	-												
	24.50	D	21	10	23	42	65	29.87	-	-	-	-	-	-	-	18.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	26.00	D	22	10	24	43	67	29.95	SM	0	1	1	55	43	0	17.90	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	27.50	D	23	13	26	45	71	30.70	-	-	-	-	-	-	-	19.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Silty Sands											
	29.00	D	24	13	25	46	71	30.17	SM	0	0	1	57	42	0	16.44	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	30.50	D	25	14	25	45	70	29.33	-	-	-	-	-	-	-	18.68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	32.00	D	26	16	28	47	75	30.36	ML	0	1	1	44	54	0	18.54	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	33.50	D	27	16	28	47	75	75.00	CL	3	2	2	18	63	12	17.00	-	-	32.0	20.5	11.5	-	-	-	-	-	-	-	-	-	-												
	35.00	D	28	15	26	46	72	72.00	CL	8	2	2	24	52	12	17.65	-	-	31.5	21.0	10.5	-	-	-	-	-	-	-	-	-	-												
	36.50	D	29	16	27	46	73	73.00	-	-	-	-	-	-	-	14.64	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	38.00	D	30	17	28	47	75	75.00	CL	3	1	2	30	54	10	20.82	-	-	30.0	18.5	11.5	-	-	-	-	-	-	-	-	-	-												
	40.00	D	31	19	34	48	82	82.00	-	-	-	-	-	-	-	14.15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 4: SUMMARY OF TEST RESULTS

Bore No: P104	**Ground Elevation: RL 194.067 m**	**Method of drilling: Percussion**	**Depth of Water-table: 1.20 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 30/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 23640.687	**Casing Lowered: 18.00 m**	**Ending Date: 02/11/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m²)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm²)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																									Classification of ROCK							Classification of SOIL											
	0.50	D	1	-	-	-	-	-	SM	0	0	0	55	45	0	18.84	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	1.00	U	2	-	-	-	-	-	SM-SC	0	0	0	57	38	5	18.90	1.98	1.67	26.0	20.5	5.5	2.65	DST	8.0	24.0	-	0.592	-	-	-	-	Silty Sands with clay binder											
	2.00	D	3	2	2	2	4	5.55	SM	3	2	2	60	33	0	18.11	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	3.00	D	4	2	2	4	6	7.78	-	-	-	-	-	-	-	16.40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	4.00	D	5	-	-	-	-	-	SM	2	1	2	54	41	0	18.93	1.90	1.60	Non-Plastic			-	DST	0.0	25.4	-	-	-	-	-	-												
	5.00	D	6	3	5	7	12	14.11	-	-	-	-	-	-	-	20.94	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	6.00	D	7	3	3	7	10	10.00	CL	5	2	1	19	63	10	20.87	-	-	29.0	20.5	8.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	7.00	U	8	-	-	-	-	-	CL	2	1	2	16	68	11	20.73	2.10	1.74	30.0	21.0	9.0	2.67	UU	50.0	11.1	0.145	0.534	-	10	20	-												
	8.00	D	9	7	8	10	18	16.82	CL-ML	0	0	1	20	72	7	21.83	-	-	28.0	22.0	6.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	9.00	D	10	6	10	12	22	22.00	CL	0	0	1	7	84	8	19.99	-	-	30.0	22.0	8.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	10.00	U	11	-	-	-	-	-	CL	1	1	0	8	81	9	22.58	2.03	1.66	29.0	21.5	7.5	2.66	UU	41.0	11.6	-	0.602	-	8	21	-												
	11.00	D	12	5	6	9	15	15.00	CL	1	0	2	10	74	13	20.33	-	-	34.0	21.0	13.0	-	-	-	-	-	-	-	-	-	-												
	12.00	D	13	6	9	13	22	22.00	CL	2	1	0	17	72	8	17.46	-	-	30.0	22.0	8.0	-	-	-	-	-	-	-	-	-	-												
	13.00	U	14	-	-	-	-	-	-	-	-	-	-	-	-	16.94	1.99	1.70	-	-	-	2.66	DST	11.0	25.6	-	0.565	-	-	-	-												
	14.50	D	15	6	12	16	28	28.00	-	-	-	-	-	-	-	16.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	16.00	U	16	-	-	-	-	-	SM	5	2	2	44	47	0	13.21	2.02	1.78	Non-Plastic			2.63	DST	8.0	26.5	-	0.478	-	-	-	-	Silty Sands											
	17.50	D	17	8	15	20	35	21.35	SM	2	1	1	47	49	0	19.87	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												

APPENDIX "B"
TABLE 4: SUMMARY OF TEST RESULTS

Bore No: P104	**Ground Elevation: RL 194.067 m**	**Method of drilling: Percussion**	**Depth of Water-table: 1.20 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 30/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 23640.687	**Casing Lowered: 18.00 m**	**Ending Date: 02/11/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m²)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm²)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																									Classification of ROCK							Classification of SOIL											
	19.00	D	18	-	-	-	-	-	CL-ML	1	0	1	32	60	6	19.68	-	-	26.0	21.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	20.50	D	19	10	16	23	39	21.98	-	-	-	-	-	-	-	17.41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	22.00	U	20	-	-	-	-	-	CL-ML	3	1	1	25	63	7	20.07	1.98	1.65	27.0	20.5	6.5	2.66	DST	9.0	25.5	-	0.612	-	-	-	-												
	23.50	D	21	13	18	24	42	22.20	ML	1	1	0	44	54	0	16.84	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	25.00	U	22	-	-	-	-	-	SM	0	1	1	59	39	0	18.05	2.01	1.70	Non-Plastic			2.63	DST	4.0	28.0	-	0.547	-	-	-	-	Silty Sands											
	26.50	D	23	13	15	30	45	22.38	-	-	-	-	-	-	-	18.96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	28.00	U	24	-	-	-	-	-	SM	0	0	1	64	35	0	20.18	1.97	1.64	Non-Plastic			2.62	DST	2.0	29.1	-	0.598	-	-	-	-												
	29.50	D	25	13	27	31	58	25.71	SM	0	0	0	62	38	0	18.28	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	31.00	D	26	18	31	32	63	26.79	-	-	-	-	-	-	-	20.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	32.50	D	27	13	28	38	66	27.25	SM	0	1	0	72	27	0	19.33	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	34.00	D	28	14	24	32	56	23.87	-	-	-	-	-	-	-	20.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	35.50	D	29	13	18	35	53	22.65	-	-	-	-	-	-	-	20.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	37.00	D	30	18	28	35	63	25.11	SM	0	0	1	69	30	0	20.14	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	38.50	D	31	12	19	29	48	20.63	-	-	-	-	-	-	-	20.57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	40.00	D	32	17	21	31	52	21.42	SM	0	0	2	65	33	0	18.95	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 5: SUMMARY OF TEST RESULTS

Bore No: P105	Ground Elevation: RL 193.916 m	Method of drilling: Percussion	Depth of Water-table: 1.30 m
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 30/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 23666.887	**Casing Lowered: 20.00 m**	**Ending Date: 02/11/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m²)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm²)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	CL-ML	0	0	1	47	46	6	17.64	-	-	26.0	21.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	1.00	D	2	-	-	-	-	-	CL-ML	0	1	1	44	48	6	19.19	1.97	1.65	26.0	20.5	5.5	2.65	-	-	-	-	0.606	-	-	-	-												
	2.00	D	3	2	2	2	4	5.52	-	-	-	-	-	-	-	18.43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	3.00	D	4	2	3	3	6	7.75	SM	2	1	1	60	36	0	19.20	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	4.00	U	5	-	-	-	-	-	CL-ML	1	1	0	42	51	5	16.36	2.02	1.74	26.0	21.0	5.0	2.65	DST	2.0	28.6	-	0.523	-	-	-	-	Inorganic Silty Clays of low plasticity											
	5.00	D	6	3	3	4	7	8.11	SM	0	1	1	53	45	0	18.33	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	6.00	D	7	3	4	6	10	11.08	SM	0	0	1	69	30	0	21.07	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	7.00	D	8	-	-	-	-	-	-	-	-	-	-	-	-	19.58	1.94	1.62	-	-	-	-	RDST	0.0	28.5	-	-	-	-	-	-												
	8.00	D	9	3	5	7	12	12.38	ML	2	1	0	35	57	5	19.04	-	-	24.0	20.0	4.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	9.00	D	10	4	6	9	15	14.98	-	-	-	-	-	-	-	19.43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	10.00	U	11	-	-	-	-	-	CL	0	1	0	14	76	9	20.99	2.01	1.66	28.0	21.0	7.0	2.66	UU	46.0	10.2	-	0.602	-	-	-	-	Inorganic clays of low plasticity											
	11.00	D	12	3	4	4	8	8.00	CL	2	1	2	9	73	13	18.78	-	-	34.0	21.0	13.0	-	-	-	-	-	-	-	-	-	-												
	12.00	D	13	4	6	8	14	14.00	CI	4	3	5	16	57	15	19.22	-	-	38.0	24.0	14.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of Intermediate plasticity											
	13.00	U	14	-	-	-	-	-	ML	2	1	1	18	66	12	20.25	2.00	1.66	34.0	24.0	10.0	2.68	UU	62.0	9.5	0.163	0.614	-	-	-	-	Inorganic Silts of low plasticity											
	14.50	D	15	9	9	12	21	16.46	ML	1	1	0	25	65	8	18.36	-	-	30.0	23.0	7.0	-	-	-	-	-	-	-	-	-	-												
	16.00	D	16	-	-	-	-	-	-	-	-	-	-	-	-	17.73	1.97	1.67	-	-	-	2.67	RUU	45.0	12.8	-	0.599	-	-	-	-												
	17.50	D	17	9	14	19	33	20.64	ML	0	0	1	45	54	0	20.54	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												

APPENDIX "B"
TABLE 5: SUMMARY OF TEST RESULTS

Bore No: P105	**Ground Elevation: RL 193.916 m**	**Method of drilling: Percussion**	**Depth of Water-table: 1.30 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 30/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 23666.887	**Casing Lowered: 20.00 m**	**Ending Date: 02/11/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m²)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm²)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	19.00	D	18	-	-	-	-	-	CL-ML	3	1	0	35	55	6	18.46	-	-	26.0	21.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	20.50	D	19	13	20	26	46	46.00	CL	0	0	0	14	76	10	17.20	-	-	31.5	23.0	8.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	22.00	U	20	-	-	-	-	-	CL	0	1	0	12	75	12	17.81	2.05	1.74	31.0	22.0	9.0	2.67	UU	48.0	11.2	-	0.534	-	-	-	-												
	23.50	D	21	8	15	23	38	38.00	-	-	-	-	-	-	-	19.91	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	25.00	U	22	-	-	-	-	-	ML	1	1	0	32	59	7	19.99	2.06	1.72	27.0	22.0	5.0	2.66	UU	45.0	10.5	-	0.547	-	-	-	-	Inorganic Silts of low plasticity											
	26.50	D	23	18	25	25	50	23.94	SM	0	0	0	55	45	0	18.72	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	28.00	U	24	-	-	-	-	-	CL	0	0	1	12	77	10	20.09	2.10	1.75	32.0	23.0	9.0	2.67	-	-	-	-	0.526	-	-	-	-	Inorganic clays of low plasticity											
	29.50	D	25	15	24	26	50	23.01	SM	1	0	1	65	33	0	19.86	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	31.00	U	26	-	-	-	-	-	-	-	-	-	-	-	-	16.97	2.08	1.78	-	-	-	2.63	DST	0.0	30.7	-	0.478	-	-	-	-												
	32.50	D	27	11	21	32	53	53.00	CL	0	1	1	12	74	12	16.59	-	-	33.0	22.0	11.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	34.00	D	28	14	24	28	52	22.37	ML	2	1	0	40	57	0	17.24	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	35.50	D	29	18	28	30	58	23.74	SM	0	0	1	55	44	0	16.99	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	37.00	D	30	13	21	28	49	20.94	-	-	-	-	-	-	-	16.39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	38.50	D	31	17	26	35	61	23.89	SM	0	1	1	52	46	0	17.84	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	40.00	D	32	18	28	32	60	23.30	-	-	-	-	-	-	-	17.60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample

APPENDIX "B"
TABLE 6: SUMMARY OF TEST RESULTS

Bore No: P106	**Ground Elevation: RL 194.696 m**	**Method of drilling: Percussion**	**Depth of Water-table: 0.60 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 11/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 23693.087	**Casing Lowered: 20.00 m**	**Ending Date: 13/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT									LABORATORY TEST RESULT																																		
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m²)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm²)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	SM	0	0	0	55	45	0	6.38	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	1.00	U	2	-	-	-	-	-	SM	0	0	0	59	41	0	18.50	1.90	1.60	Non-Plastic			2.64	DST	3.0	27.5	-	0.647	-	-	-	-												
	2.00	D	3	1	1	1	2	2.00	CL	0	1	2	37	53	7	17.80	-	-	27.0	19.5	7.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	3.00	D	4	1	1	2	3	3.00	-	-	-	-	-	-	-	18.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	4.00	U	5	-	-	-	-	-	CL	0	0	1	44	45	10	21.52	1.82	1.50	28.0	20.0	8.0	2.67	UU	45.0	12.5	0.193	0.783	-	17	16	-												
	5.00	D	6	2	2	5	7	8.66	SM	0	0	2	59	39	0	17.69	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	6.00	D	7	2	3	6	9	10.68	-	-	-	-	-	-	-	18.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	7.00	D	8	-	-	-	-	-	CL-ML	0	0	1	44	48	7	23.04	1.98	1.61	26.5	20.0	6.5	2.66	RUU	39.0	12.8	-	0.652	-	-	-	-	Inorganic Silty Clays of low plasticity											
	8.00	D	9	4	4	6	10	10.88	CL-ML	0	1	1	16	75	7	20.11	-	-	25.0	19.5	5.5	-	-	-	-	-	-	-	-	-	-												
	9.00	D	10	3	6	9	15	15.36	-	-	-	-	-	-	-	21.22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	10.00	U	11	-	-	-	-	-	CL	1	1	1	8	77	12	18.03	2.06	1.75	32.0	21.5	10.5	2.67	UU	54.0	8.5	-	0.530	-	9	18	-	Inorganic clays of low plasticity											
	11.00	D	12	8	13	18	31	31.00	-	-	-	-	-	-	-	18.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	12.00	D	13	10	15	21	36	36.00	-	-	-	-	-	-	-	16.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	13.00	U	14	-	-	-	-	-	CL	6	2	4	11	66	11	20.43	2.05	1.70	31.0	20.5	10.5	2.67	UU	52.0	9.0	-	0.571	-	-	-	-												
	14.50	D	15	5	9	10	19	19.00	-	-	-	-	-	-	-	19.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	16.00	U	16	-	-	-	-	-	ML	3	1	1	42	47	6	16.17	1.98	1.70	24.0	20.0	4.0	2.66	DST	8.0	25.5	-	0.561	-	-	-	-	Inorganic Silts of low plasticity											
	17.50	D	17	8	14	17	31	20.15	SM	0	0	0	52	48	0	17.25	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											

APPENDIX "B"

TABLE 6: SUMMARY OF TEST RESULTS

Bore No: P106	**Ground Elevation: RL 194.696 m**	**Method of drilling: Percussion**	**Depth of Water-table: 0.60 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 11/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 23693.087	**Casing Lowered: 20.00 m**	**Ending Date: 13/10/2023**	**Hammer type: Auto-trip**

FIELD TEST RESULT									LABORATORY TEST RESULT																							
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen (Core Recovery %, R.Q.D %, Density (gm /cc), Specific gravity, Moisture content (%), Water absorption (%), Point load Index, U.C.S (MPa), Porosity, Hardness, Modulus of Elasticity, Cerchar Abrasive Index)
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m²)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm²)	Free Swell Index	Shrinkage Limit	Swell Pressure	Classification of SOIL
																							Classification of ROCK									
	19.00	U	18	-	-	-	-	-	SM	2	1	1	53	43	0	19.18	1.92	1.61	Non-Plastic			2.64	DST	4.0	26.5	-	0.640	-	-	-	-	Silty Sands
	20.50	D	19	12	16	20	36	21.30	-	-	-	-	-	-	-	19.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	22.00	D	20	-	-	-	-	-	ML	1	1	1	38	59	0	20.34	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity
	23.50	D	21	13	18	23	41	22.29	-	-	-	-	-	-	-	17.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	25.00	U	22	-	-	-	-	-	ML	0	0	0	48	52	0	18.42	1.98	1.67	Non-Plastic			2.63	DST	7.0	27.0	-	0.573	-	-	-	-	
	26.50	D	23	15	27	39	66	29.98	-	-	-	-	-	-	-	17.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	28.00	D	24	-	-	-	-	-	-	-	-	-	-	-	-	19.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	29.50	D	25	11	22	31	53	24.74	CL-ML	13	4	5	16	55	7	14.63	-	-	25.0	18.5	6.5	-	-	-	-	-	-	-	8	14	-	Inorganic Silty Clays of low plasticity
	31.00	D	26	14	31	45	76	76.00	CL	7	2	3	10	67	11	17.83	-	-	31.0	22.0	9.0	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity
	32.50	D	27	13	29	40	69	69.00	-	-	-	-	-	-	-	16.26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	34.00	D	28	-	-	-	-	-	CL	2	2	3	14	70	9	18.50	2.01	1.70	29.0	19.5	9.5	2.67	RUU	55.0	11.2	-	0.571	-	-	-	-	
	35.50	D	29	15	32	43	75	75.00	-	-	-	-	-	-	-	17.26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	37.00	D	30	-	-	-	-	-	-	-	-	-	-	-	-	18.64	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	38.50	D	31	16	33	40	73	73.00	CL	1	2	3	7	75	12	16.29	-	-	30.0	19.0	11.0	-	-	-	-	-	-	-	-	-	-	
	40.00	D	32	14	35	44	79	79.00	-	-	-	-	-	-	-	14.28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 7: SUMMARY OF TEST RESULTS

Bore No: P111	**Ground Elevation: RL 194.745 m**	**Method of drilling: Rotary**	**Depth of Water-table: 1.30 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 18/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 23830.447	**Casing Lowered: 15.00 m**	**Ending Date: 21/10/2023**	**Hammer type: Rope-pulley driven**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m²)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm²)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	CL-ML	0	0	1	48	46	5	14.48	-	-	26.0	21.0	5.0	-	-	-	-	-	-	-	-	-	-												
	1.00	D	2	1	2	2	4	6.16	-	-	-	-	-	-	-	14.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	2.00	U	3	-	-	-	-	-	-	-	-	-	-	-	-	18.60	2.00	1.69	-	-	-	2.63	DST	7.0	26.5	-	0.556	-	-	-	-												
	3.00	D	4	4	5	5	10	12.83	SM	1	1	2	54	42	0	15.60	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	4.00	D	5	6	7	7	14	15.99	-	-	-	-	-	-	-	16.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	5.00	U	6	-	-	-	-	-	CL	2	2	2	20	66	8	19.11	1.97	1.65	27.5	20.5	7.0	2.67	UU	46.0	11.2	0.145	0.618	-	9	18	-	Inorganic clays of low plasticity											
	6.00	D	7	4	5	6	11	12.20	-	-	-	-	-	-	-	19.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	7.00	D	8	10	14	16	30	23.51	SM	2	3	3	47	45	0	18.89	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	8.00	U	9	-	-	-	-	-	SM	3	6	16	42	33	0	16.86	1.98	1.70	Non-Plastic			2.63	DST	0.0	29.5	-	0.551	-	-	-	-												
	9.00	D	10	10	13	18	31	31.00	CL	5	3	7	11	64	10	21.19	-	-	29.0	21.0	8.0	-	-	-	-	-	-	-	-	-	-												
	10.00	D	11	13	20	24	44	44.00	CL	1	1	1	5	80	12	19.87	-	-	31.0	20.5	10.5	-	-	-	-	-	-	-	-	-	-												
	11.00	U	12	-	-	-	-	-	CL	7	10	9	16	48	10	16.42	2.01	1.73	29.0	20.0	9.0	2.66	UU	48.0	11.5	-	0.538	-	17	16	-	Inorganic clays of low plasticity											
	12.50	D	13	7	12	15	27	27.00	CL	3	2	4	12	71	8	21.13	-	-	28.0	20.0	8.0	-	-	-	-	-	-	-	-	-	-												
	14.00	U	14	-	-	-	-	-	CL	4	4	6	8	66	12	21.13	2.05	1.69	32.0	21.0	11.0	2.68	UU	58.0	9.5	-	0.586	-	-	-	-												
	15.50	D	15	10	17	20	37	37.00	SC	4	8	12	30	36	10	16.10	-	-	28.0	18.5	9.5	-	-	-	-	-	-	-	-	-	-	Clayey Sands											
	17.00	U	16	-	-	-	-	-	SC	5	7	11	30	35	12	17.69	2.03	1.72	30.0	20.0	10.0	2.67	UU	56.0	10.4	-	0.548	-	0	18	-												
	18.50	D	17	9	18	22	40	22.93	CL-ML	2	1	3	40	48	6	14.98	-	-	26.0	21.5	4.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											

APPENDIX "B"
TABLE 7: SUMMARY OF TEST RESULTS

Bore No: P111	**Ground Elevation: RL 194.745 m**	**Method of drilling: Rotary**	**Depth of Water-table: 1.30 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 18/10/2023**	**SPT Sampler: Standard**
Location / Chainage: 23830.447	**Casing Lowered: 15.00 m**	**Ending Date: 21/10/2023**	**Hammer type: Rope-pulley driven**

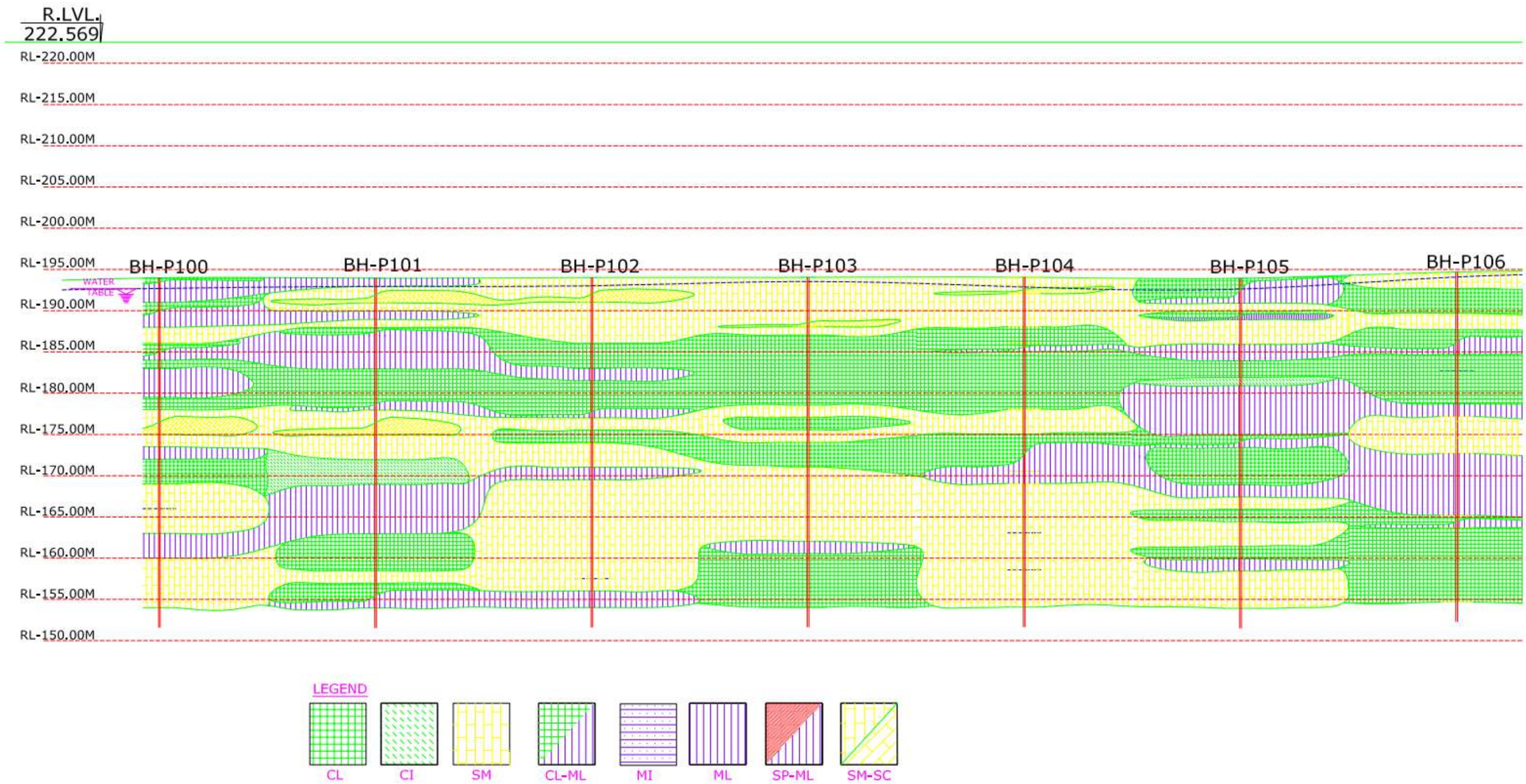
FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m²)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm²)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	20.00	D	18	-	-	-	-	-	SM	0	0	2	63	35	0	19.54	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	21.50	D	19	13	24	30	54	26.98	-	-	-	-	-	-	-	11.26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	23.00	D	20	-	-	-	-	-	SM	2	2	12	54	30	0	16.85	2.07	1.77	Non-Plastic			2.65	RDST	0.0	32.3	-	0.497	-	-	-	-												
	24.50	D	21	14	26	31	57	26.82	SM	7	10	8	28	47	0	13.14	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	26.00	D	22	16	35	51	86	35.81	SM	4	8	18	34	36	0	13.14	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	27.50	D	23	15	36	49	85	34.88	SM	8	8	8	39	37	0	12.75	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	29.00	D	24	16	38	50	88	35.22	-	-	-	-	-	-	-	15.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	30.50	D	25	14	33	46	79	31.85	-	-	-	-	-	-	-	14.96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	32.00	D	26	15	36	47	83	32.50	SM	1	1	3	58	37	0	18.96	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	33.50	D	27	16	37	45	82	31.65	-	-	-	-	-	-	-	18.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	35.00	D	28	18	39	48	87	87.00	SC	8	7	13	38	27	7	17.66	-	-	28.0	20.0	8.0	-	-	-	-	-	-	-	-	-	-	Clayey Sands											
	36.50	D	29	17	40	45	85	85.00	-	-	-	-	-	-	-	17.80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	38.00	D	30	16	42	46	88	88.00	CL	4	4	7	24	50	11	16.60	-	-	30.0	19.5	10.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	40.00	D	31	37	55	-	R	-	SC	0	10	14	34	34	8	16.52	-	-	29.0	20.0	9.0	-	-	-	-	-	-	-	-	-	-	Clayey Sands											

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

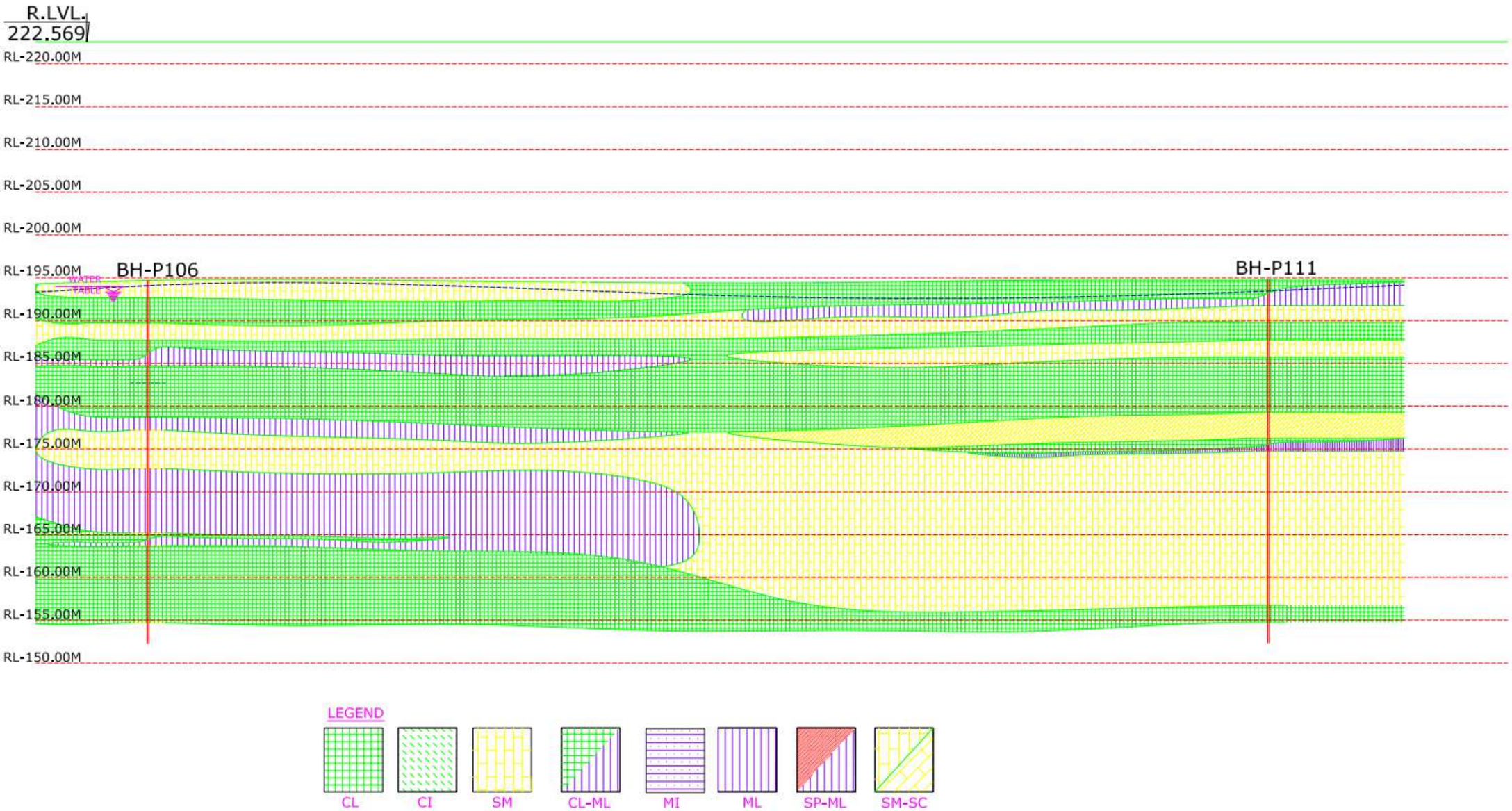
APPENDIX-B
TABLE 8: UCS TEST ON SOIL SAMPLES

BH No.	DEPTH (m)	UCS (kg/cm²)
P101	16.00	0.56
	22.00	0.44
P102	11.00	0.52
	14.00	0.46
P103	8.00	0.59
	14.00	0.64
	17.00	0.66
	20.00	0.63
P104	7.00	0.60
	10.00	0.49
P105	10.00	0.61
	13.00	0.70
	22.00	0.63
	25.00	0.57
P106	4.00	0.53
	10.00	0.66
	13.00	0.60
P111	5.00	0.69
	11.00	0.72
	14.00	0.86
	17.00	0.79

APPENDIX-C
PLOT 1: LITHOLOGICAL PROFILE-01



APPENDIX-C
PLOT 2: LITHOLOGICAL PROFILE-02



APPENDIX-C
PLOT 3: LITHOLOGICAL PLOTS

BH-P101-23562.087

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Inorganic Silts of low plasticity	ML		0.50	D		-	-
			1.00	U		-	-
Silty Sands with clay binder	SM-SC		2.00	D	7	-	-
Silty Sands	SM		3.00	D	4	-	-
Inorganic Silts of low plasticity	ML		4.00	D		-	-
Silty Sands	SM		5.00	D	12	-	-
Inorganic Silty Clays of low plasticity	CL-ML		6.00	D	19	-	-
			7.00	U		-	-
Inorganic Silts of low plasticity	ML		8.00	D	21	-	-
			9.00	D	28	-	-
			10.00	U		-	-
Inorganic clays of low plasticity	CL		11.00	D	30	-	-
			12.00	D	28	-	-
			13.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML		14.50	D	19	-	-
			16.00	U		-	-
Silty Sands with clay binder	SM-SC		17.50	D	38	-	-
Silty Sands	SM		19.00	U		-	-
			20.00	D	44	-	-

BH-P101-23562.087

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Silty Sands	SM		20.50	D	44	-	-
			22.00	U		-	-
Inorganic clays of Intermediate plasticity	CI		23.50	D	44	-	-
			25.00	D		-	-
			26.50	D	46	-	-
Inorganic Silts of low plasticity	ML		28.00	D		-	-
			29.50	D	76	-	-
			31.00	D	45	-	-
Inorganic clays of low plasticity	CL		32.50	D	44	-	-
			34.00	D		-	-
Silty Sands	SM		35.50	D	47	-	-
			37.00	D		-	-
Inorganic Silty Clays of low plasticity	CL-ML		38.50	D	52	-	-
			40.00	D	48	-	-

APPENDIX-C
PLOT 4: LITHOLOGICAL PLOTS

BH-P102-23588.287

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Silty Sands	SM		0.50	D		-	-
			1.00	D	4	-	-
Silty Sands with clay binder	SM-SC		2.00	U		-	-
			3.00	D	13	-	-
			4.00	D	7	-	-
Silty Sands	SM		5.00	D		-	-
			6.00	D	15	-	-
			7.00	D	10	-	-
			8.00	U		-	-
Inorganic clays of low plasticity	CL		9.00	D	20	-	-
			10.00	D	18	-	-
Inorganic Silts of low plasticity	ML		11.00	U		-	-
			12.50	D	16	-	-
Inorganic clays of low plasticity	CL		14.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML		15.50	D	28	-	-
Silty Sands	SM		17.00	D		-	-
Inorganic clays of low plasticity	CL		18.50	D	28	-	-
			20.00	D		-	-

BH-P102-23588.287

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			20.00	D		-	-
Silty Sands	SM		21.50	D	44	-	-
Inorganic Silts of low plasticity	ML		23.00	D		-	-
			24.50	D	50	-	-
			26.00	D		-	-
			27.50	D	51	-	-
			29.00	D		-	-
Silty Sands	SM		30.50	D	48	-	-
			32.00	D		-	-
			33.50	D	51	-	-
			35.00	D	56	-	-
			36.50	D	55	-	-
			38.00	D	56	-	-
Inorganic Silts of low plasticity	ML		40.00	D	66	-	-

APPENDIX-C
PLOT 5: LITHOLOGICAL PLOTS

BH-P103-23614.487

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			0.50	D		-	-
			1.00	D	5	-	-
Silty Sands	SM		2.00	U		-	-
			3.00	D	7	-	-
			4.00	D	12	-	-
Silty Sands with clay binder	SM-SC		5.00	U		-	-
Silty Sands	SM		6.00	D	16	-	-
			7.00	D	20	-	-
			8.00	U		-	-
			9.00	D	19	-	-
			10.00	D	22	-	-
Inorganic clays of low plasticity	CL		11.00	U		-	-
			12.50	D	17	-	-
			14.00	U		-	-
			15.50	D	36	-	-
Silty Sands	SM						
			17.00	U		-	-
Inorganic clays of low plasticity	CL						
			18.50	D	27	-	-
Silty Sands	SM						
			20.00	U		-	-

BH-P103-23614.487

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			20.00	U		-	-
Inorganic clays of low plasticity	CL		21.50	D	44	-	-
			23.00	U		-	-
			24.50	D	65	-	-
			26.00	D	67	-	-
Silty Sands	SM		27.50	D	71	-	-
			29.00	D	71	-	-
			30.50	D	70	-	-
Inorganic Silts of low plasticity	ML		32.00	D	75	-	-
			33.50	D	75	-	-
			35.00	D	72	-	-
Inorganic clays of low plasticity	CL		36.50	D	73	-	-
			38.00	D	75	-	-
			40.00	D	82	-	-

APPENDIX-C
PLOT 6: LITHOLOGICAL PLOTS

BH-P104-23640.687

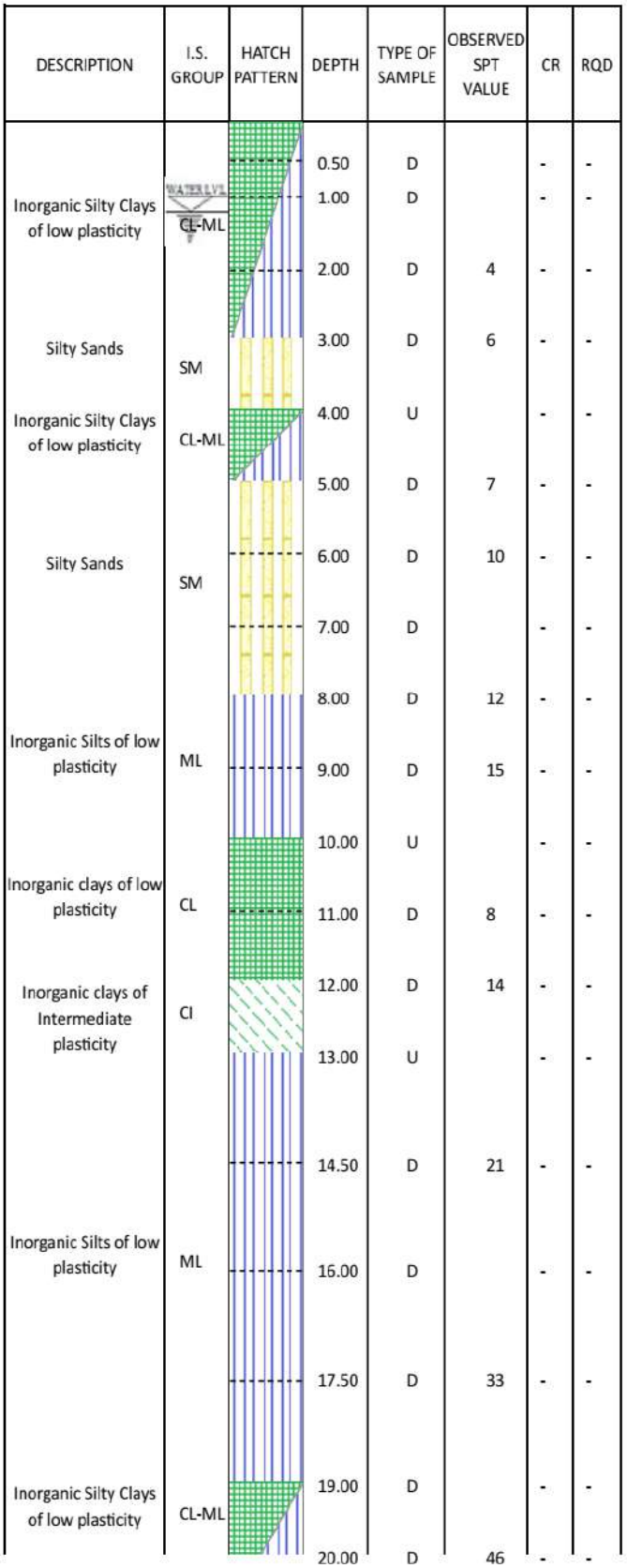
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Silty Sands	SM		0.50	D		-	-
		WATER LVL	1.00	U		-	-
Silty Sands with clay binder	SM-SC						
			2.00	D	4	-	-
			3.00	D	6	-	-
Silty Sands	SM		4.00	D		-	-
			5.00	D	12	-	-
			6.00	D	10	-	-
Inorganic clays of low plasticity	CL		7.00	U		-	-
Inorganic Silty Clays of low plasticity	CL-ML		8.00	D	18	-	-
			9.00	D	22	-	-
			10.00	U		-	-
			11.00	D	15	-	-
Inorganic clays of low plasticity	CL		12.00	D	22	-	-
			13.00	U		-	-
			14.50	D	28	-	-
			16.00	U		-	-
Silty Sands	SM		17.50	D	35	-	-
Inorganic Silty Clays of low plasticity	CL-ML		19.00	D		-	-
			20.00	D	39	-	-

BH-P104-23640.687

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			20.50	D	39	-	-
Inorganic Silty Clays of low plasticity	CL-ML		22.00	U		-	-
			23.50	D	42	-	-
Inorganic Silts of low plasticity	ML		25.00	U		-	-
			26.50	D	45	-	-
			28.00	U		-	-
			29.50	D	58	-	-
			31.00	D	63	-	-
Silty Sands	SM		32.50	D	66	-	-
			34.00	D	56	-	-
			35.50	D	53	-	-
			37.00	D	63	-	-
			38.50	D	48	-	-
			40.00	D	52	-	-

APPENDIX-C
PLOT 7: LITHOLOGICAL PLOTS

BH-P105-23666.887



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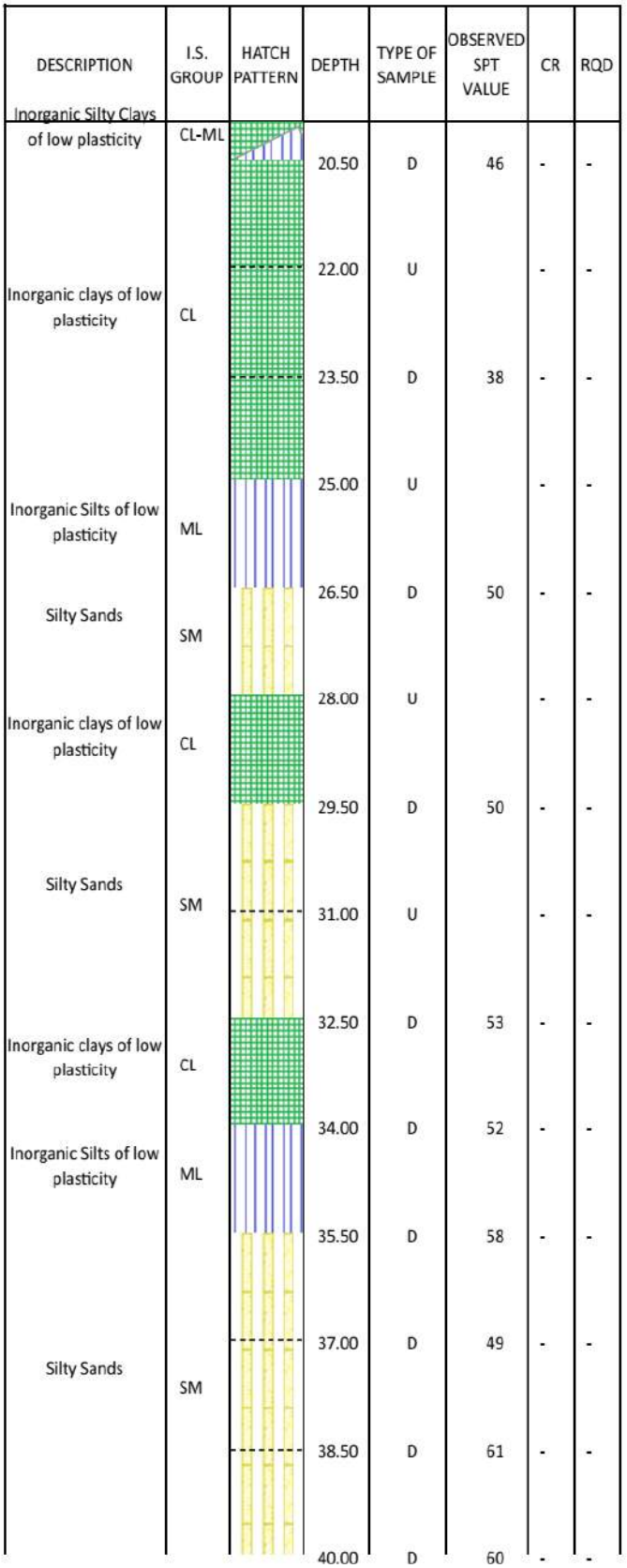
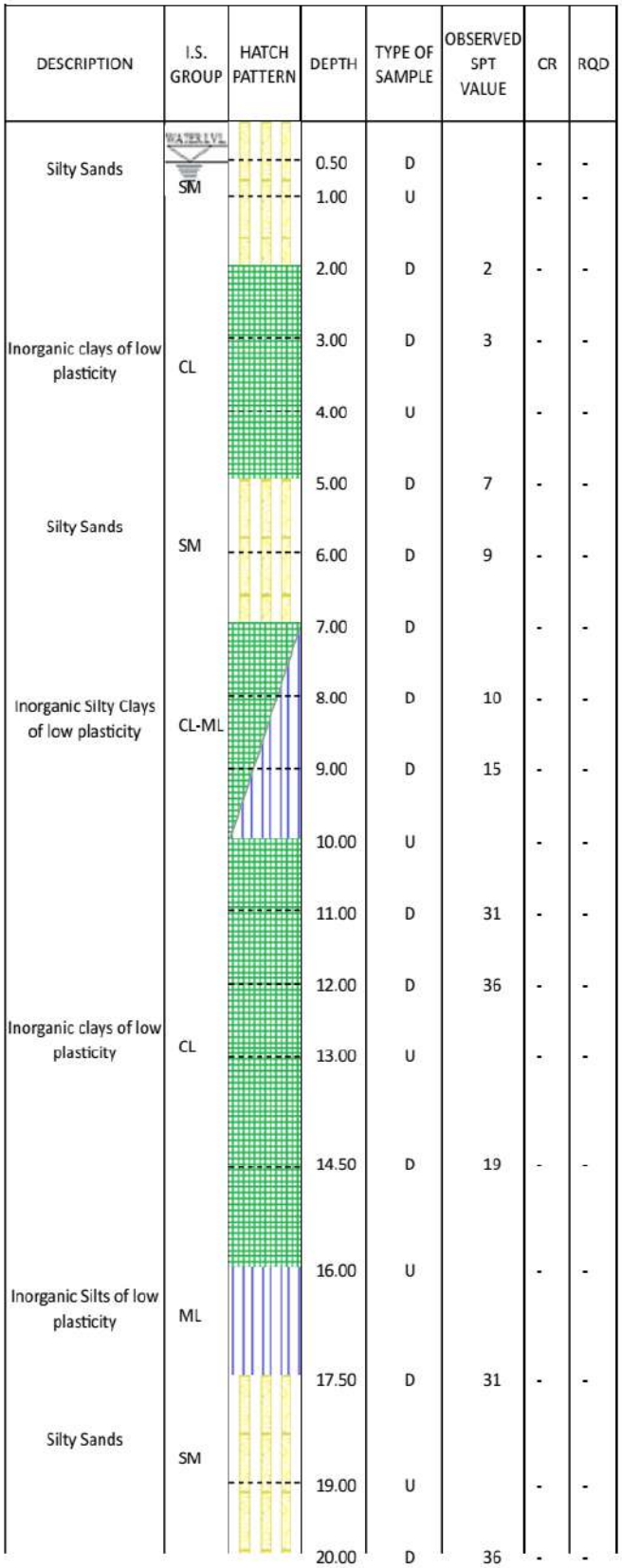


APPENDIX-C
PLOT 8: LITHOLOGICAL PLOTS

BH-P106-23693.087



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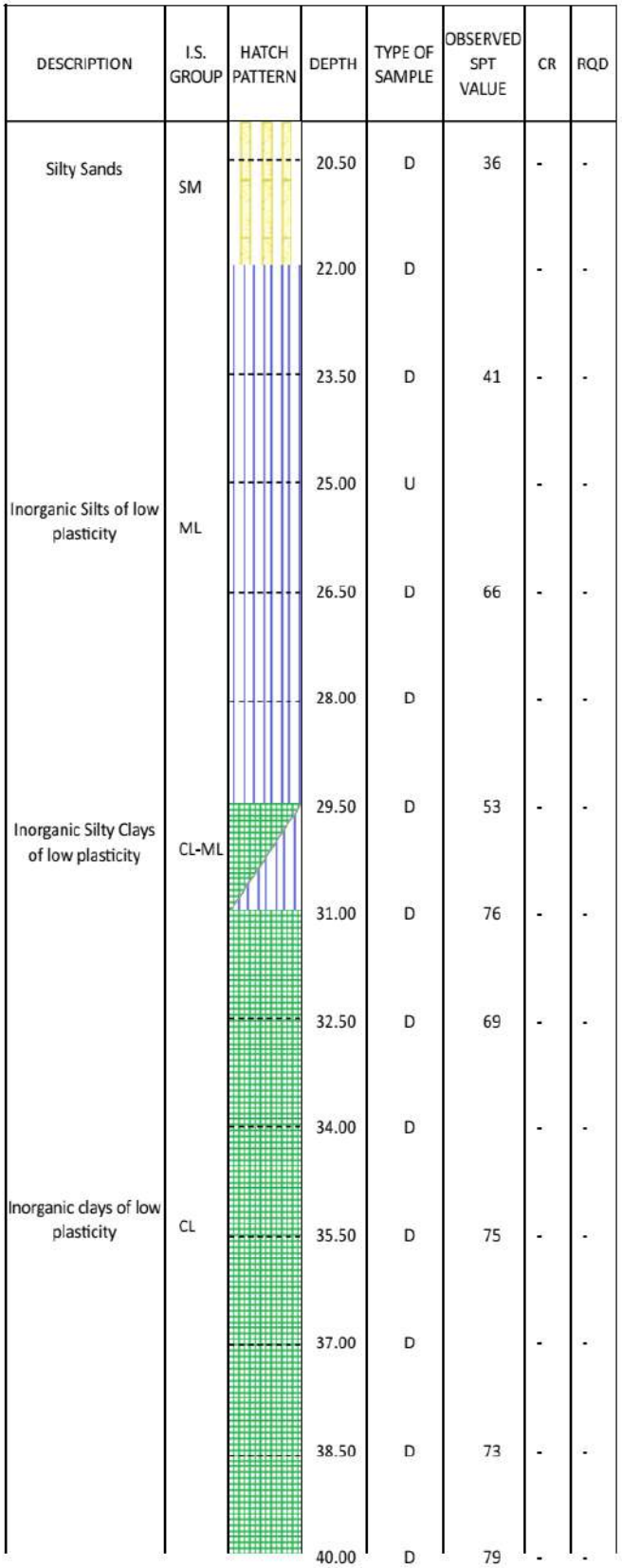


APPENDIX-C
PLOT 9: LITHOLOGICAL PLOTS

BH-P111-23830.447

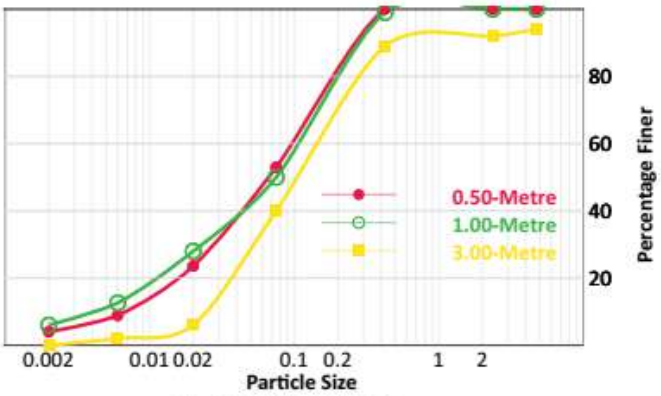
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			0.50	D		-	-
Inorganic Silty Clays of low plasticity	CL-ML		1.00	D	4	-	-
			2.00	U		-	-
			3.00	D	10	-	-
Silty Sands	SM		4.00	D	14	-	-
			5.00	U		-	-
Inorganic clays of low plasticity	CL		6.00	D	11	-	-
			7.00	D	30	-	-
Silty Sands	SM		8.00	U		-	-
			9.00	D	31	-	-
			10.00	D	44	-	-
			11.00	U		-	-
Inorganic clays of low plasticity	CL		12.50	D	27	-	-
			14.00	U		-	-
			15.50	D	37	-	-
Clayey Sands	SC		17.00	U		-	-
			18.50	D	40	-	-
Inorganic Silty Clays of low plasticity	CL-ML		20.00	D		-	-

BH-P111-23830.447

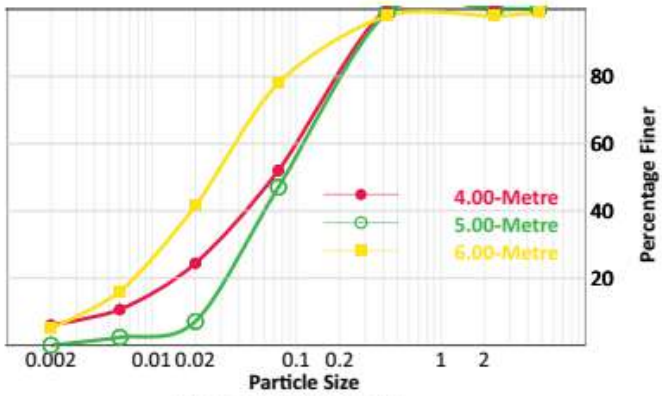
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			20.00	D		-	-
			21.50	D	54	-	-
			23.00	D		-	-
			24.50	D	57	-	-
			26.00	D	86	-	-
Silty Sands	SM		27.50	D	85	-	-
			29.00	D	88	-	-
			30.50	D	79	-	-
			32.00	D	83	-	-
			33.50	D	82	-	-
			35.00	D	87	-	-
Clayey Sands	SC		36.50	D	85	-	-
			38.00	D	88	-	-
Inorganic clays of low plasticity	CL		40.00	D	R	-	-

APPENDIX-D
PLOT 1: GRAIN SIZE DISTRIBUTION PLOTS

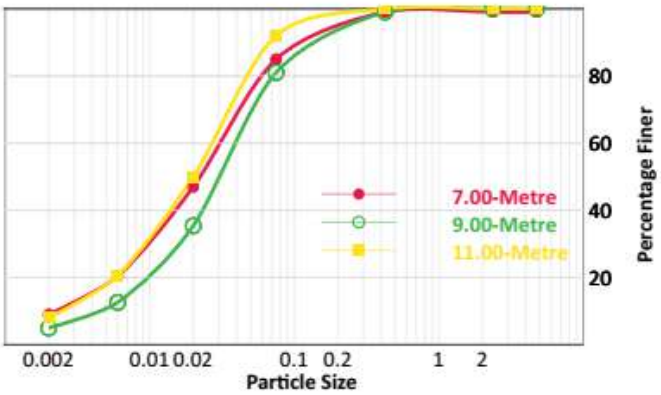
BH- P101-CH.23562.087



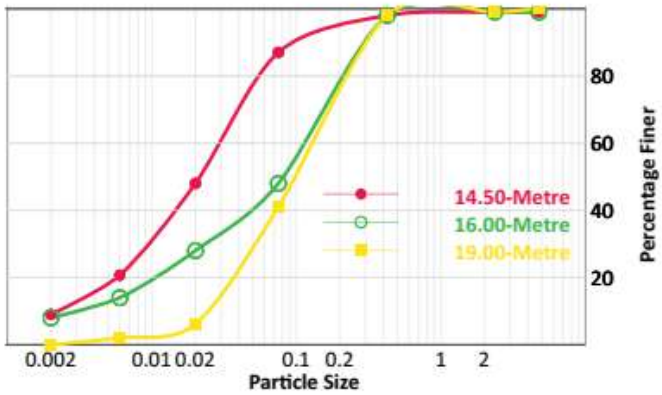
BH- P101-CH.23562.087



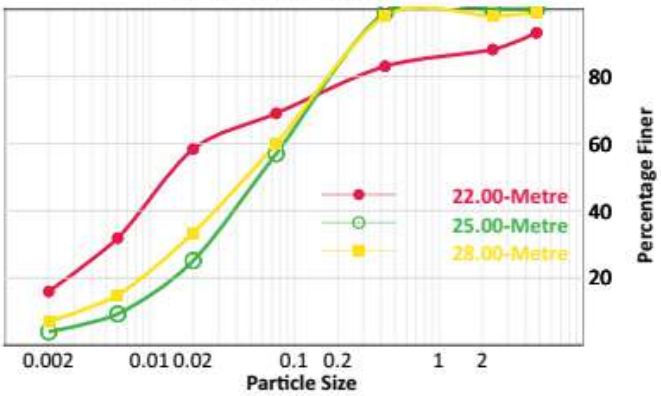
BH- P101-CH.23562.087



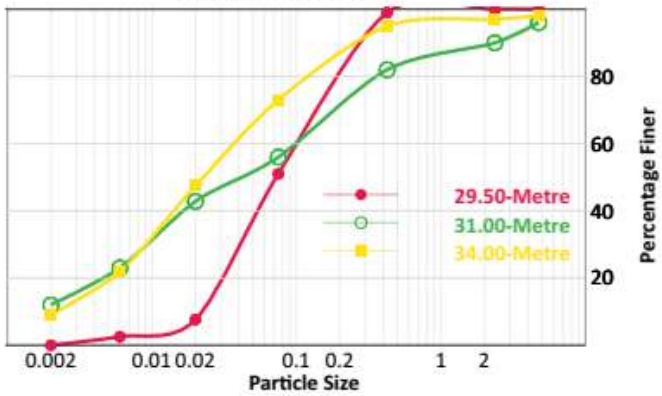
BH- P101-CH.23562.087



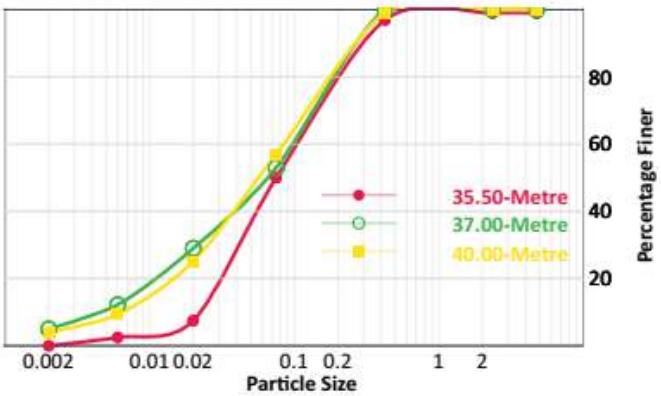
BH- P101-CH.23562.087



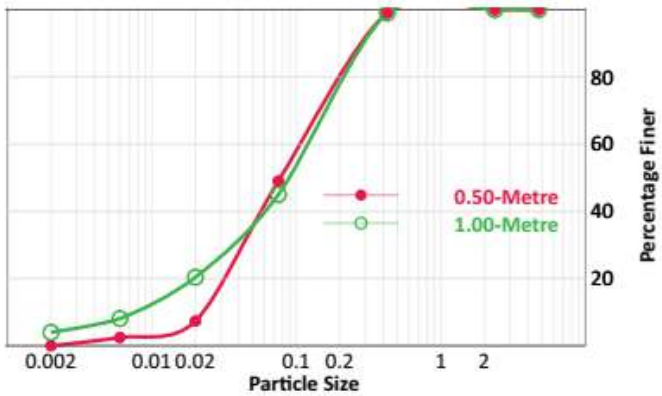
BH- P101-CH.23562.087



BH- P101-CH.23562.087

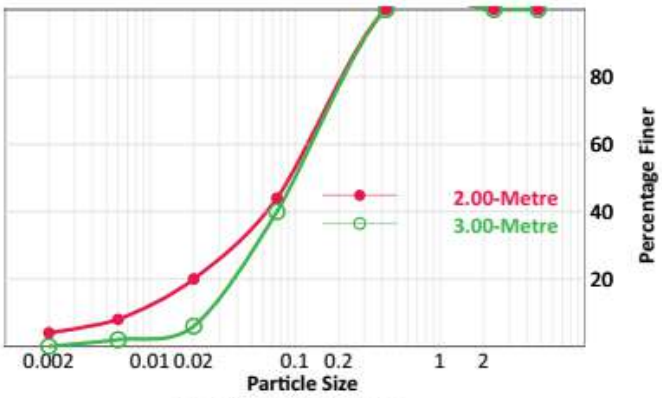


BH- P102-CH.23588.287



APPENDIX-D
PLOT 2: GRAIN SIZE DISTRIBUTION PLOTS

BH- P102-CH.23588.287



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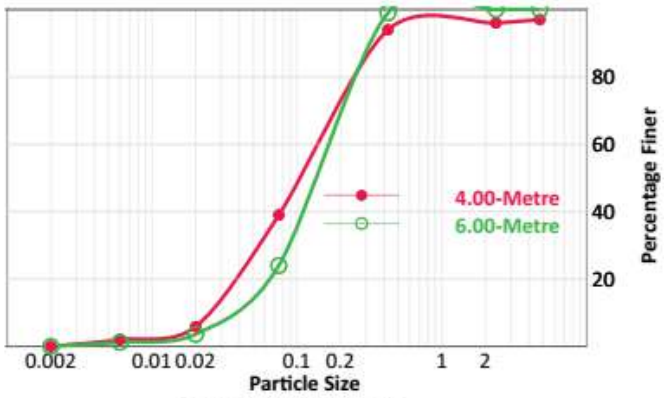
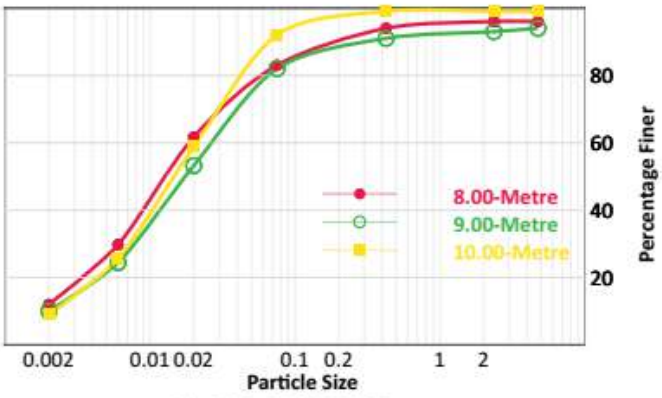


BH- P102-CH.23588.287



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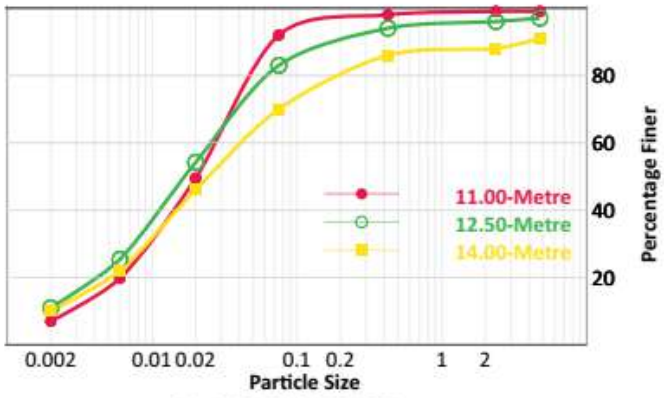
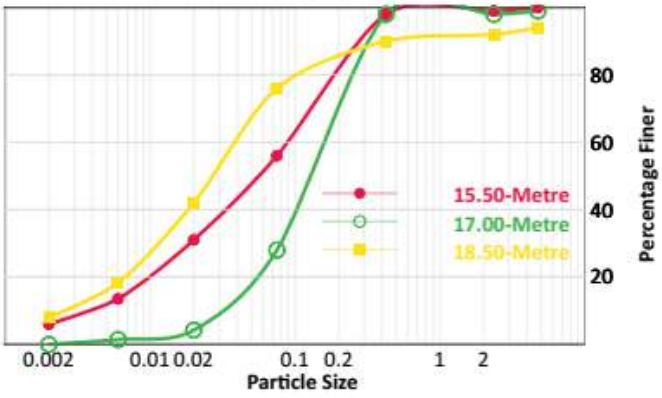
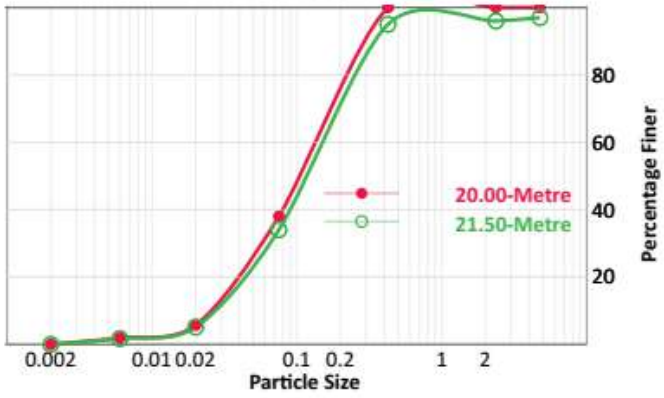


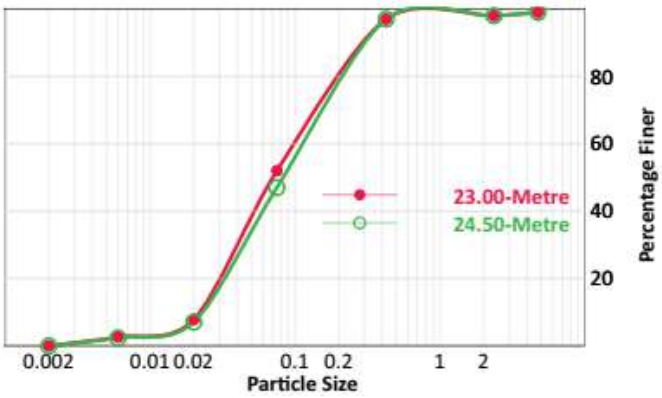
BH- P102-CH.23588.287



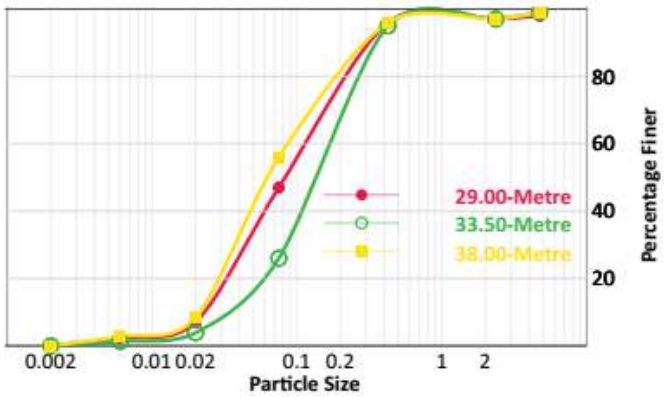
BH- P102-CH.23588.287



BH- P102-CH.23588.287

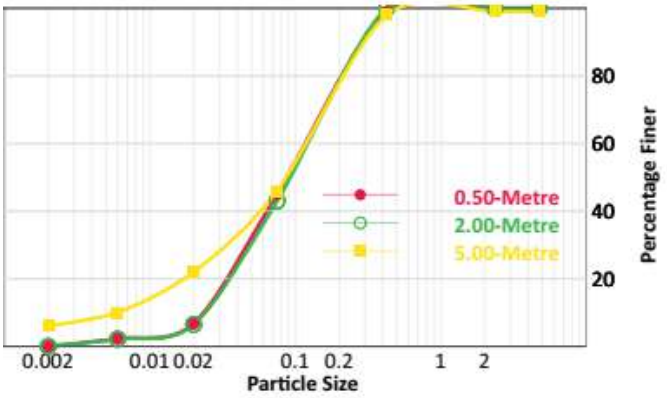


BH- P102-CH.23588.287



APPENDIX-D
PLOT 3: GRAIN SIZE DISTRIBUTION PLOTS

BH- P103-CH.23614.487



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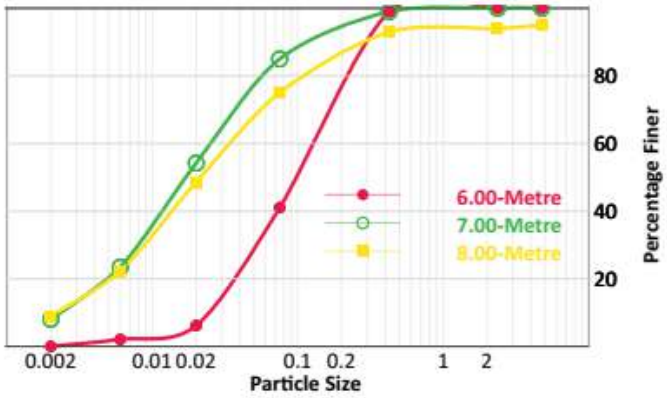

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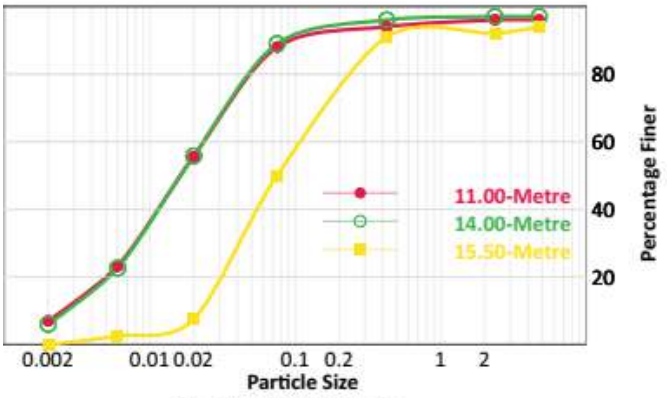

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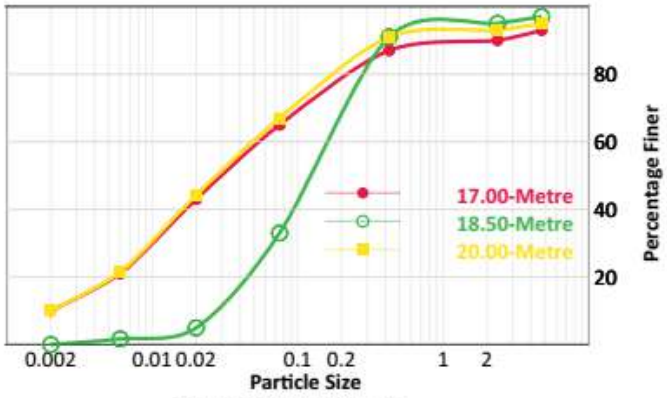
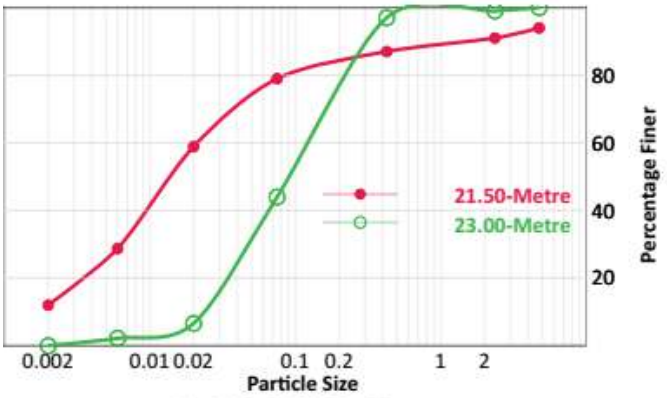


BH- P103-CH.23614.487



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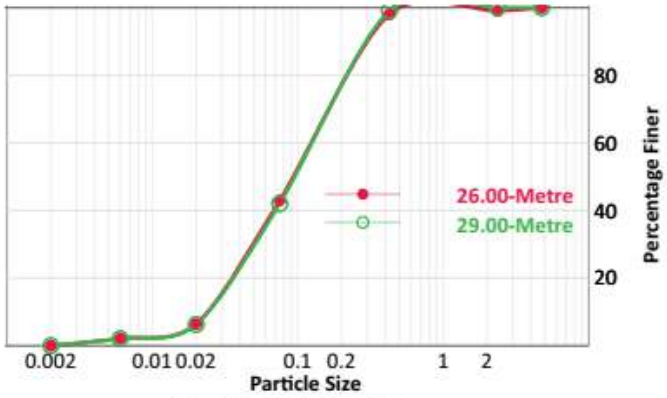

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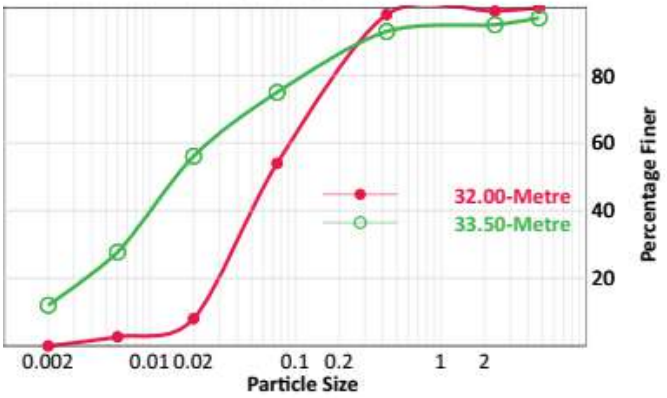

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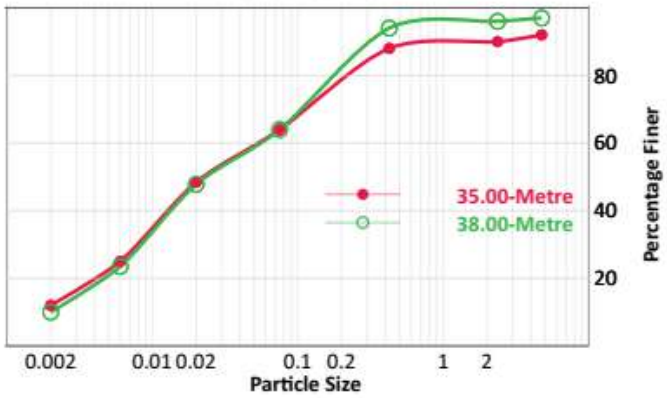
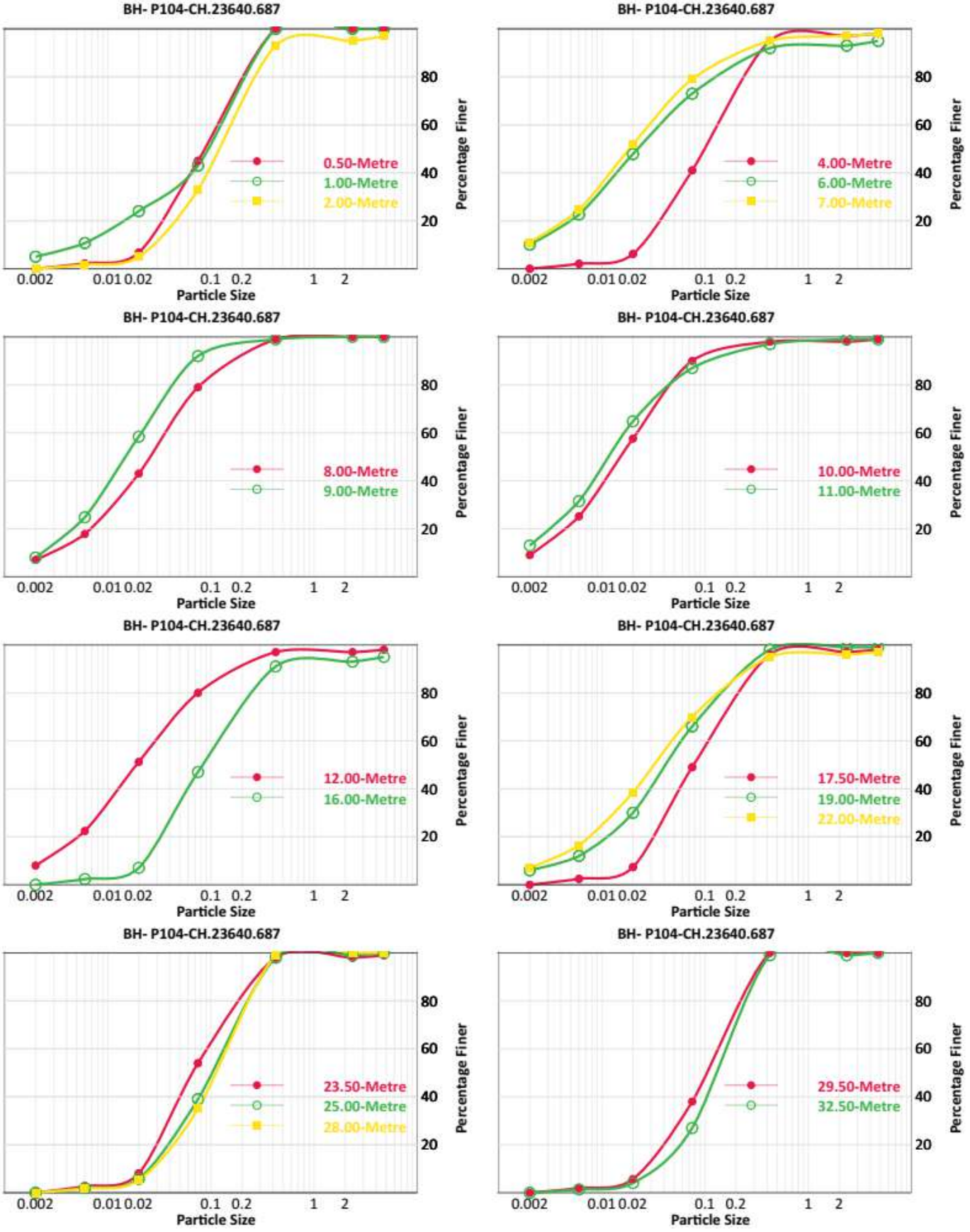
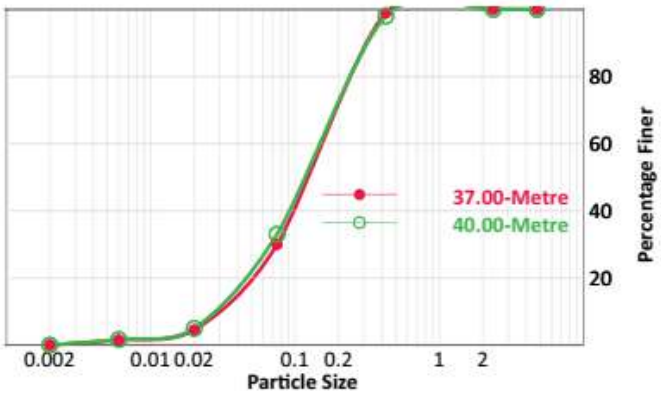


APPENDIX-D
PLOT 4: GRAIN SIZE DISTRIBUTION PLOTS

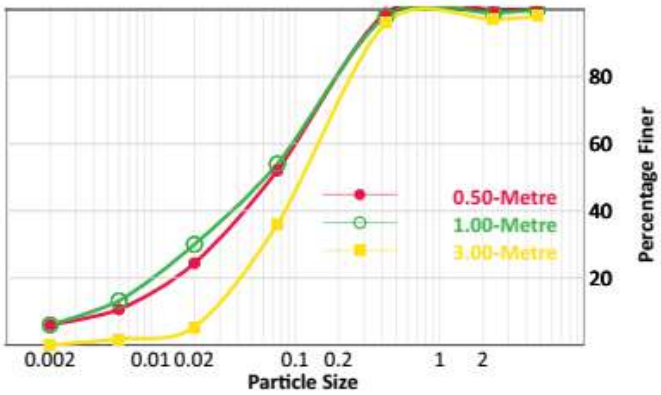


APPENDIX-D
PLOT 5: GRAIN SIZE DISTRIBUTION PLOTS

BH- P104-CH.23640.687



BH- P105-CH.23666.887



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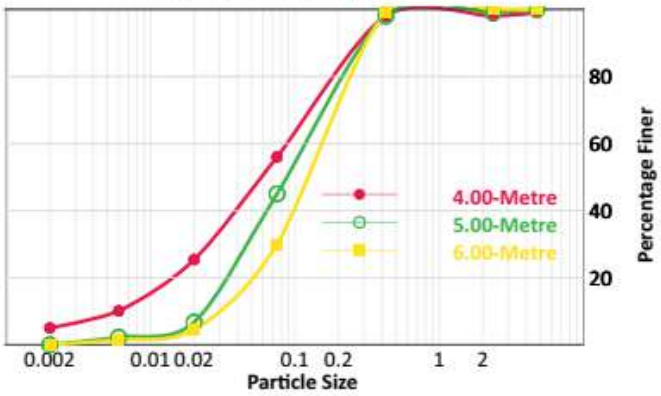

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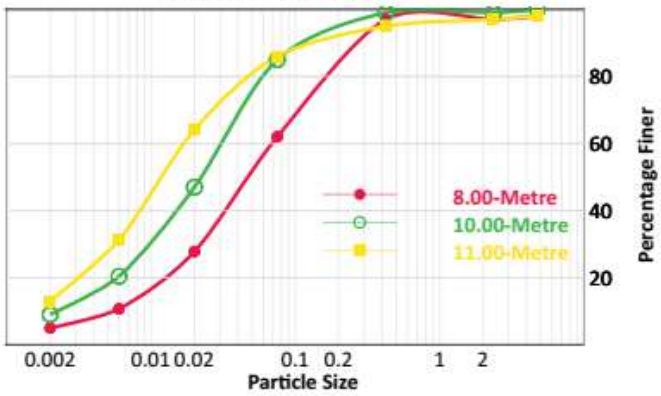
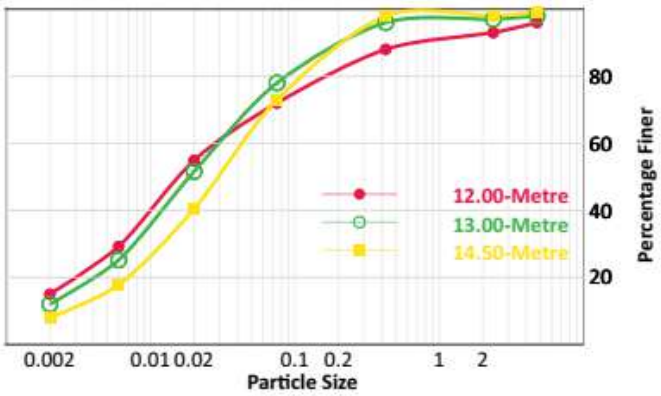
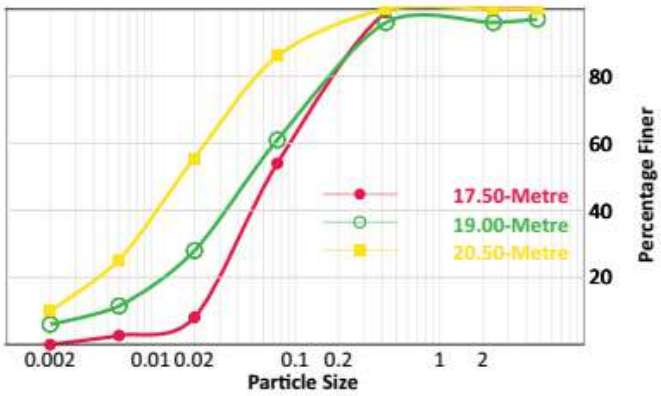


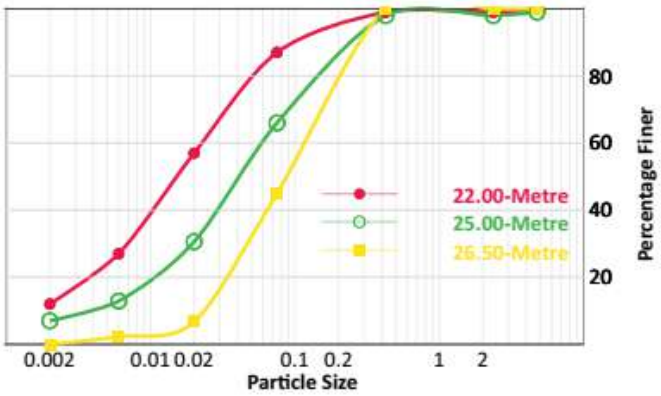
BH- P105-CH.23666.887



BH- P105-CH.23666.887



BH- P105-CH.23666.887



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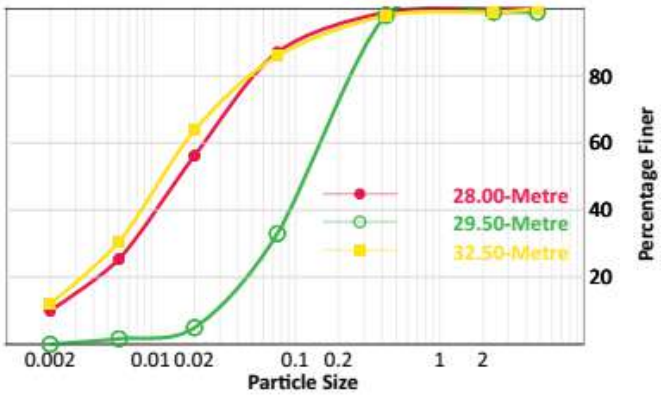
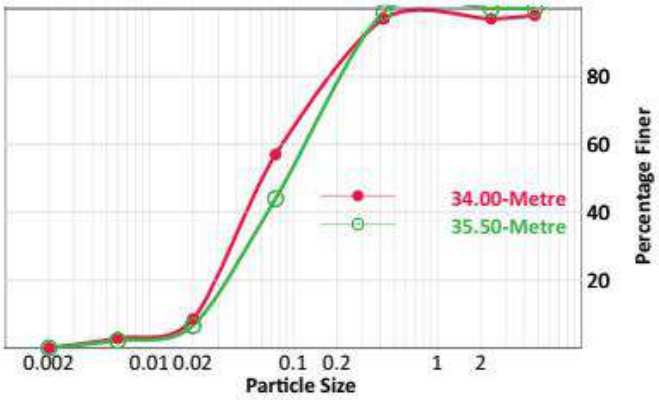


APPENDIX-D
PLOT 6: GRAIN SIZE DISTRIBUTION PLOTS

BH- P105-CH.23666.887



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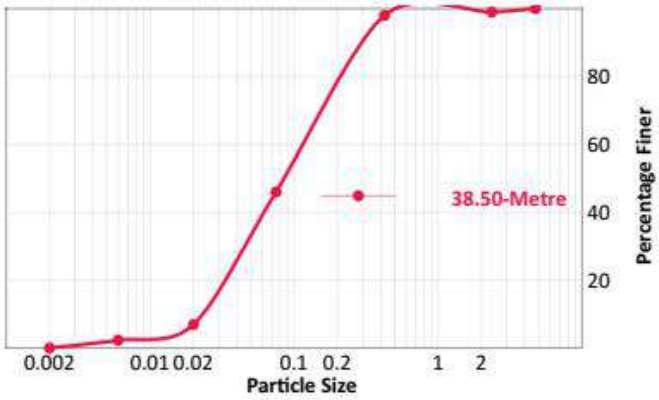
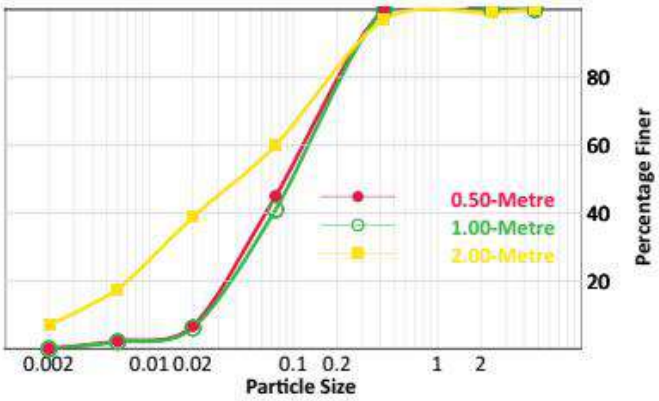


BH- P106-CH.23693.087



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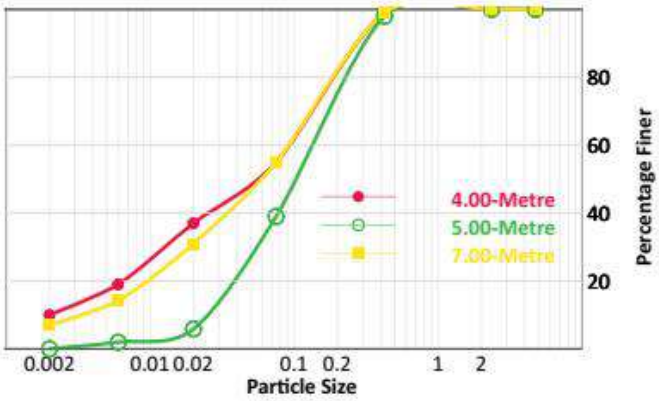
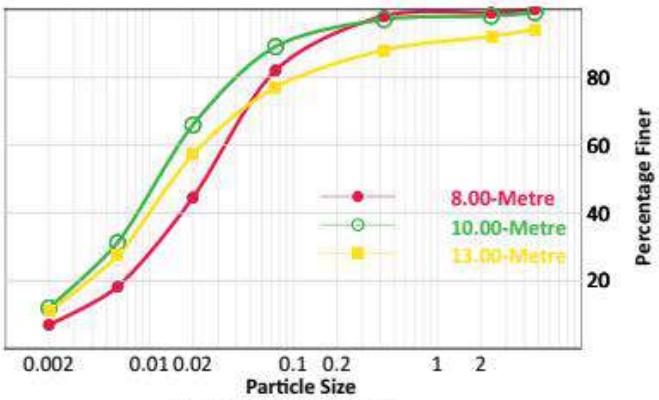


BH- P106-CH.23693.087



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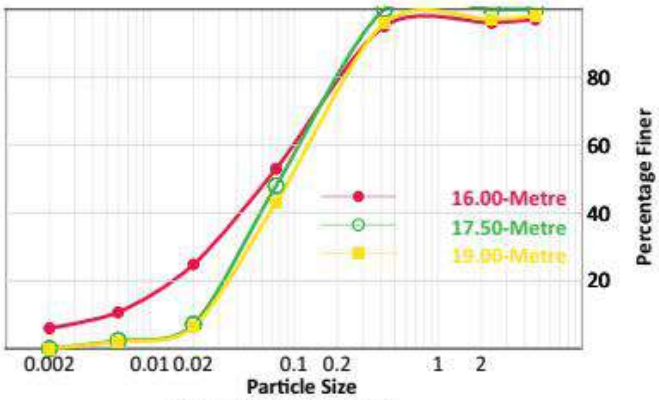

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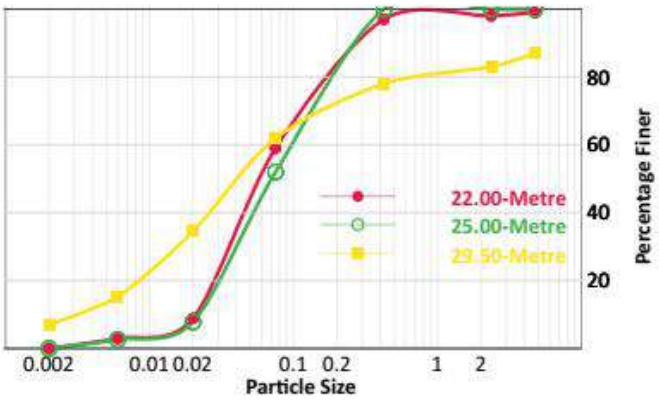

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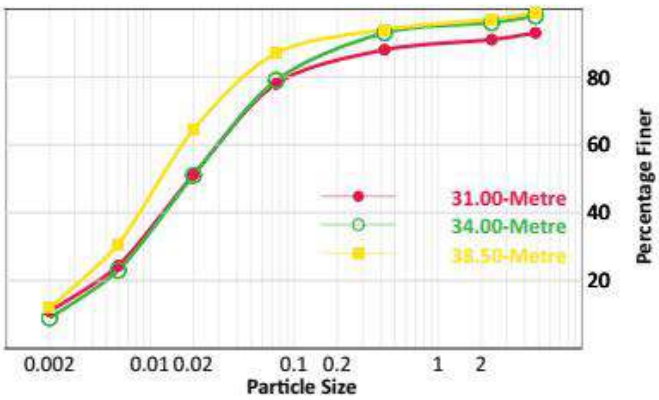
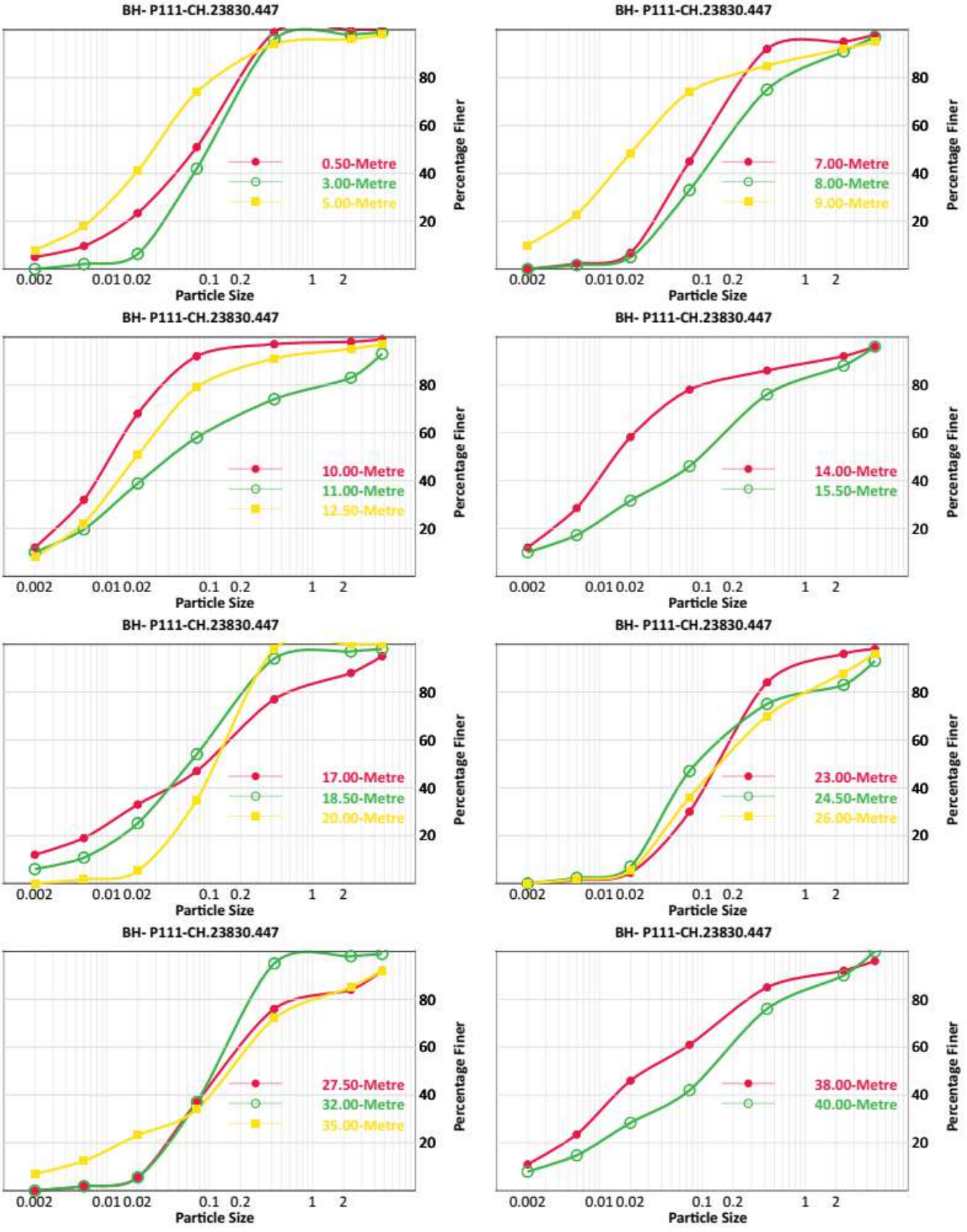
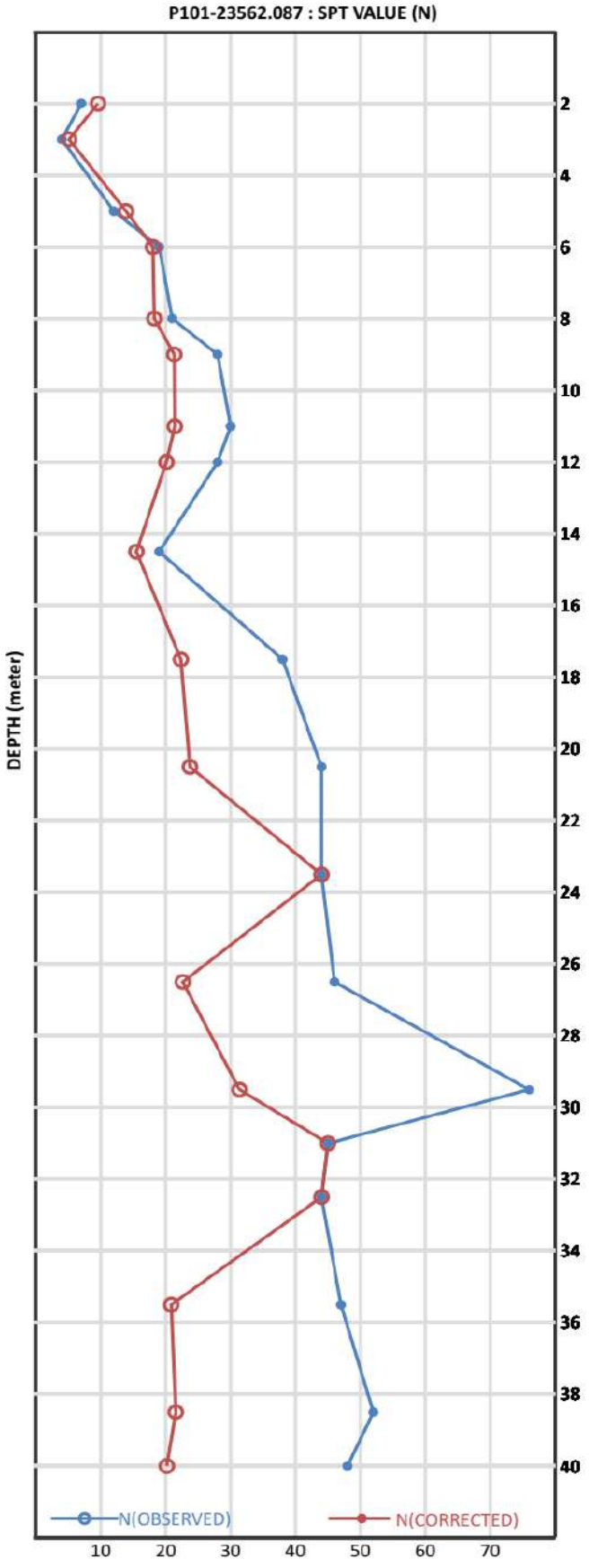
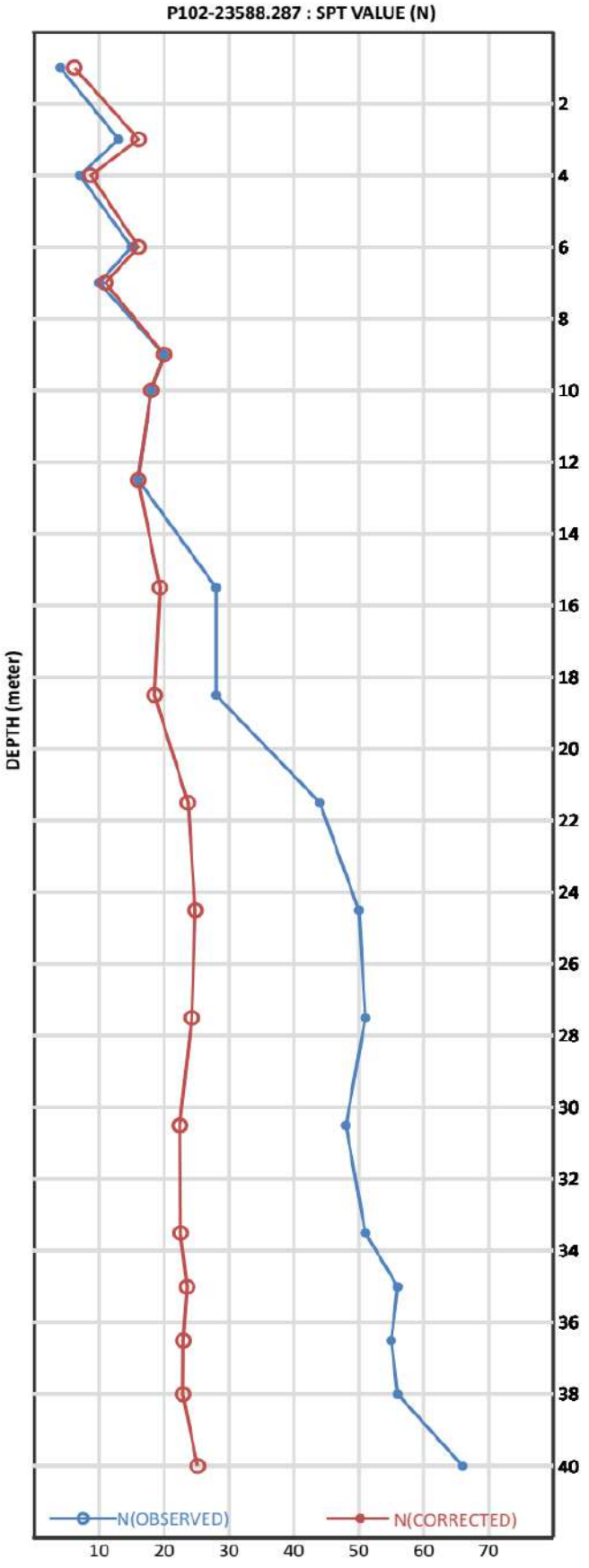


APPENDIX-D
PLOT 7: GRAIN SIZE DISTRIBUTION PLOTS

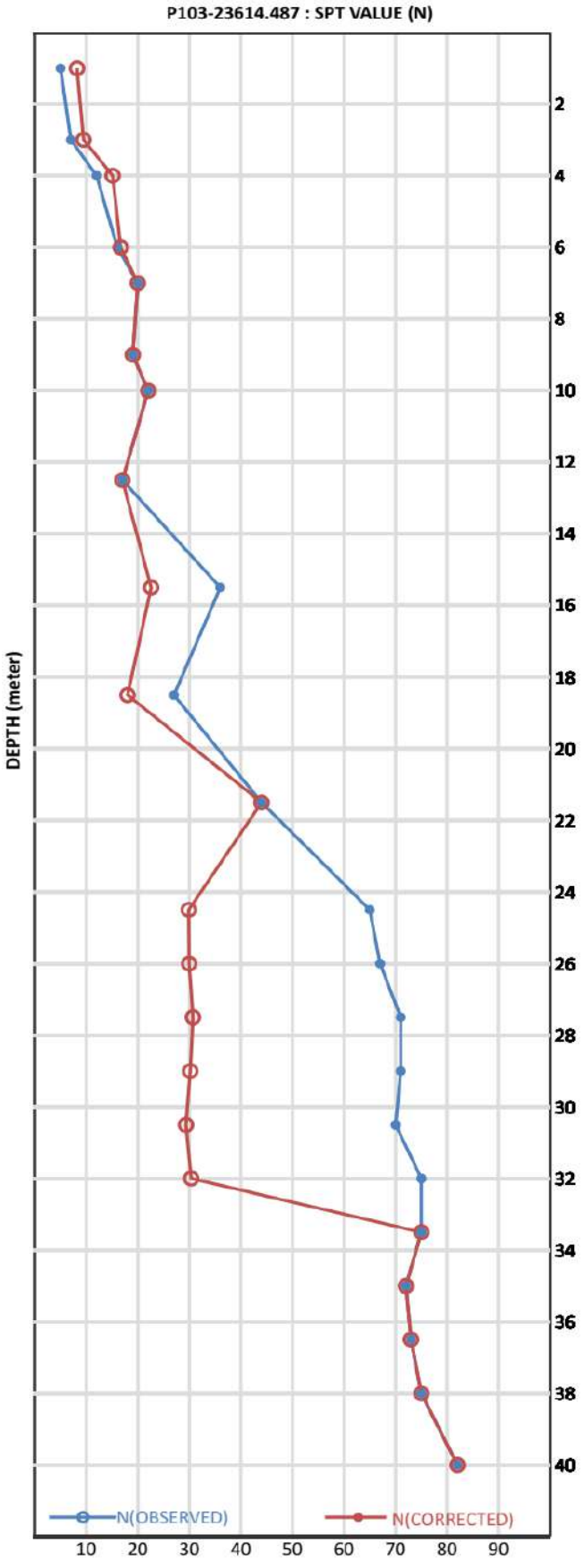


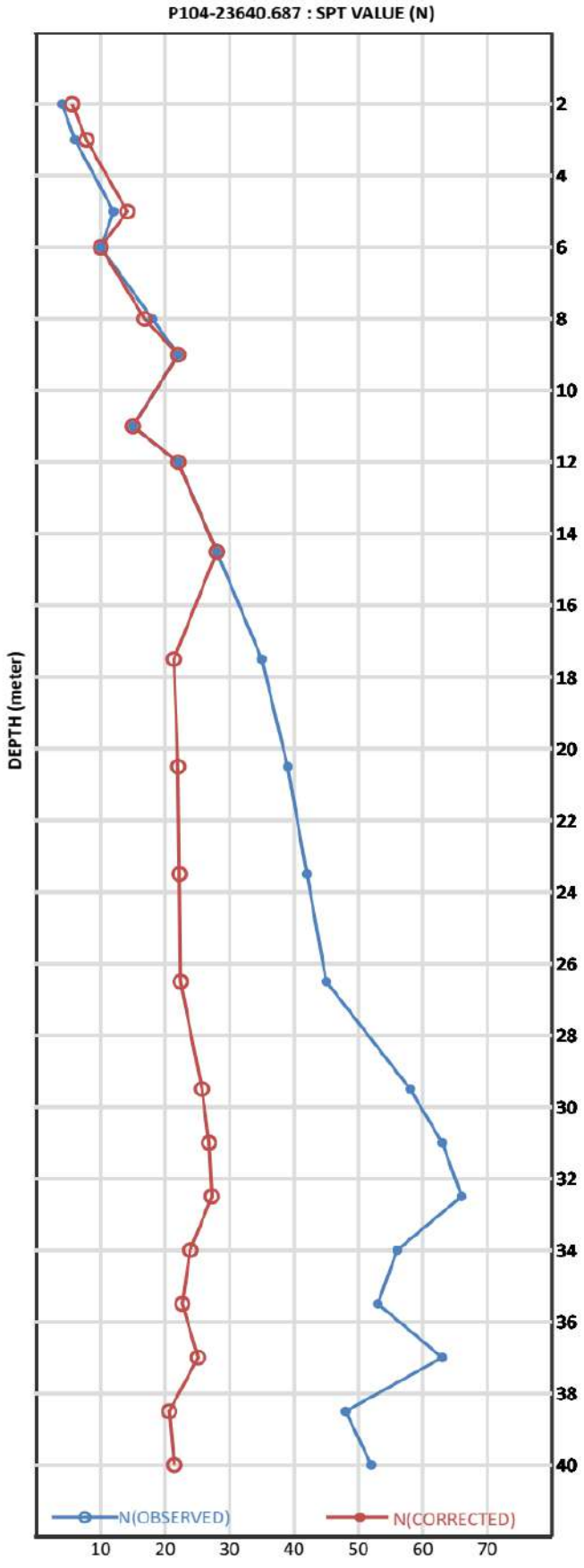
APPENDIX-E
PLOT 1: RECORDED SPT Vs CORRECTED SPT



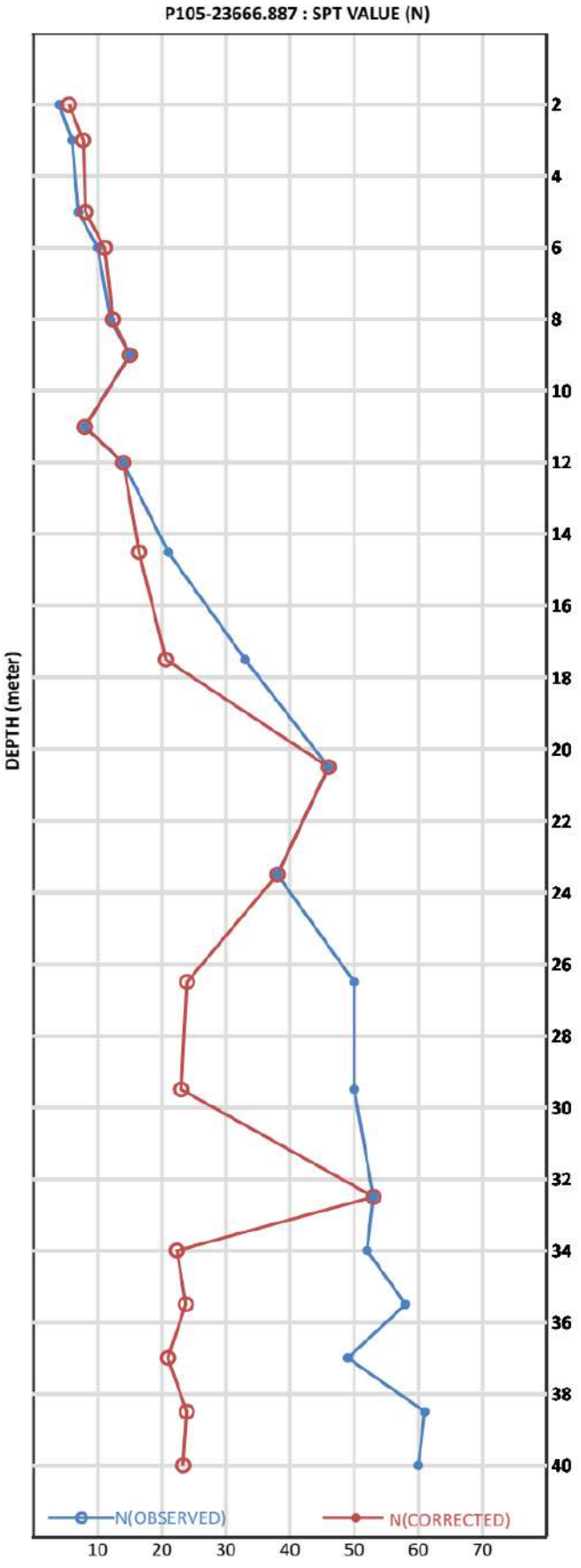


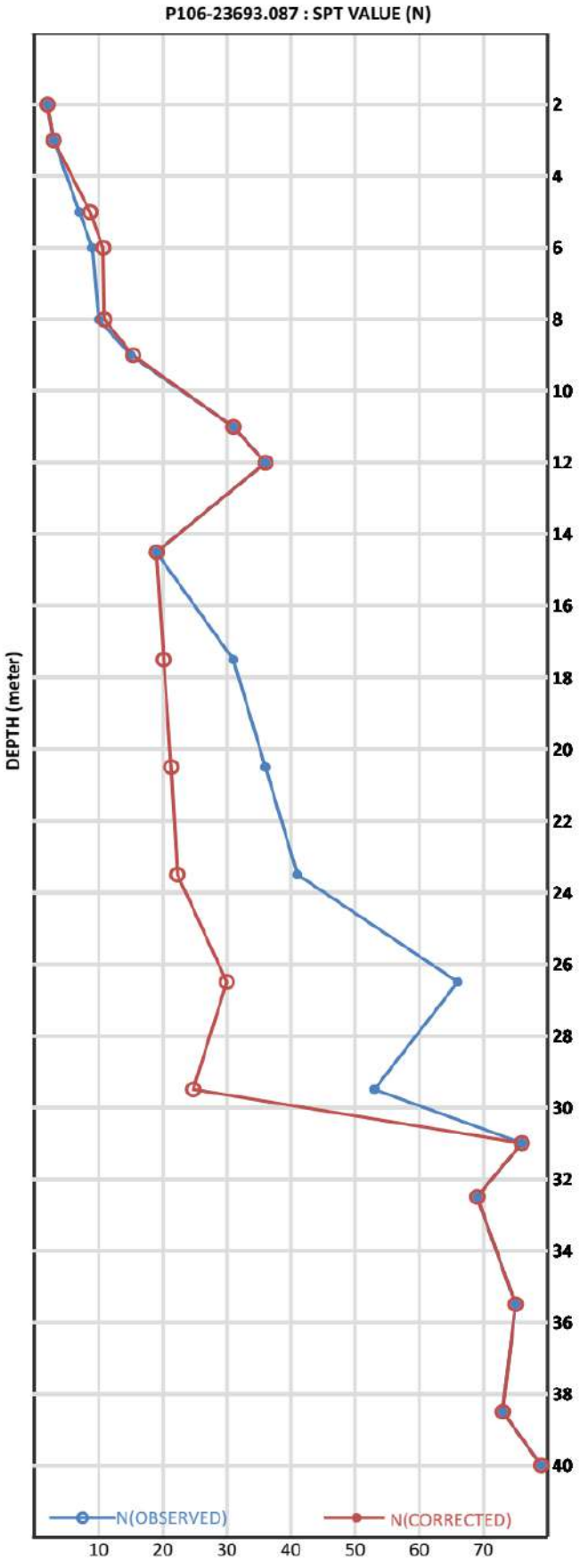
APPENDIX-E
PLOT 2: RECORDED SPT Vs CORRECTED SPT



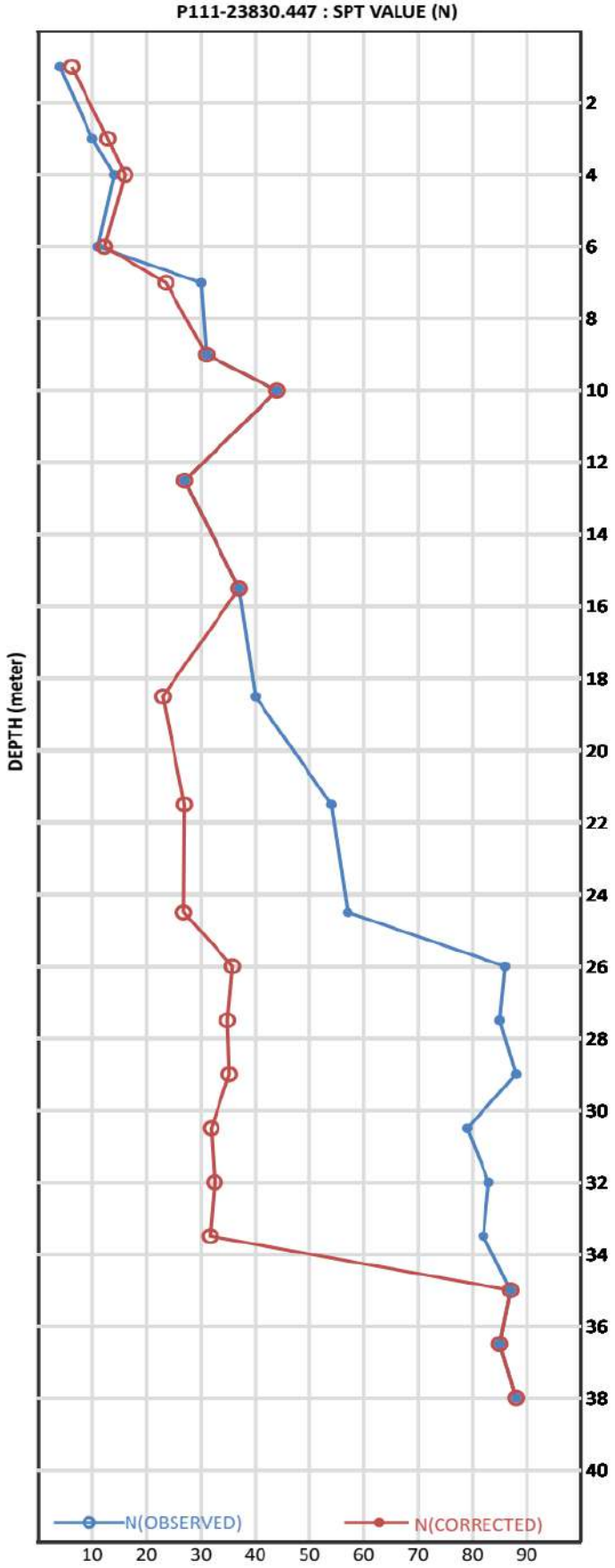


APPENDIX-E
PLOT 3: RECORDED SPT Vs CORRECTED SPT

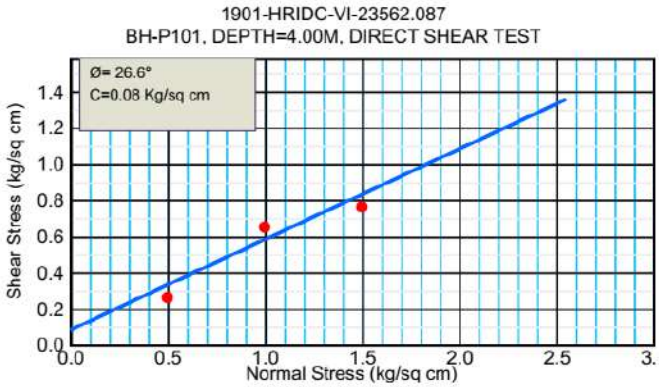


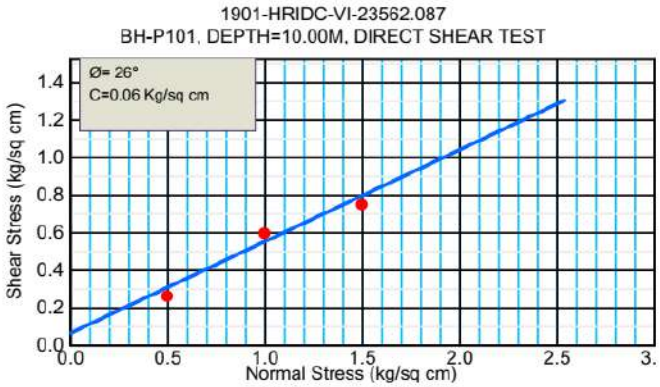


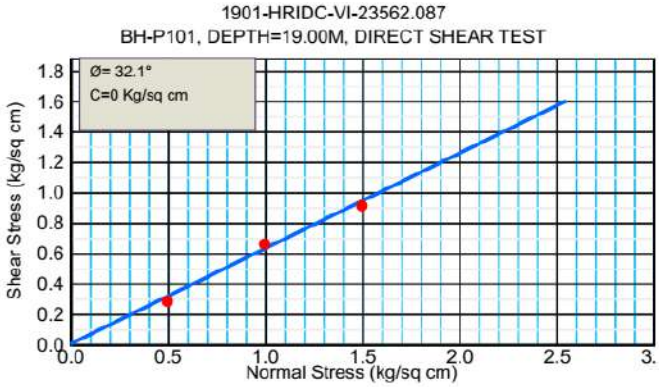
APPENDIX-E
PLOT 4: RECORDED SPT Vs CORRECTED SPT

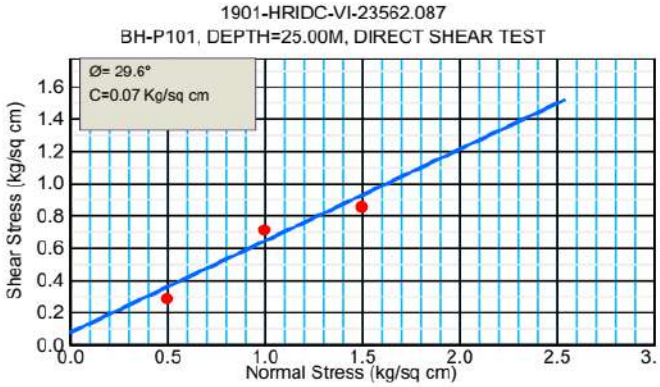


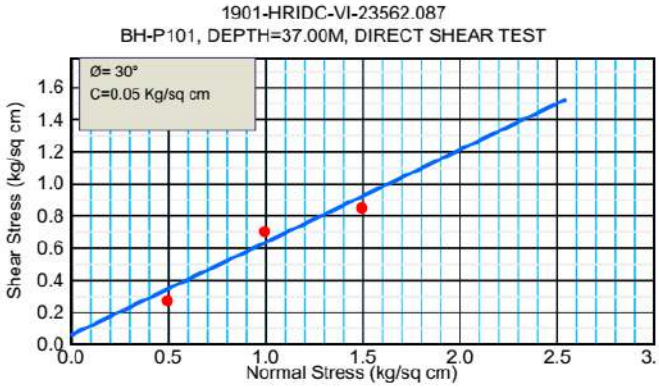
APPENDIX-F
GRAPH 1: DST GRAPH

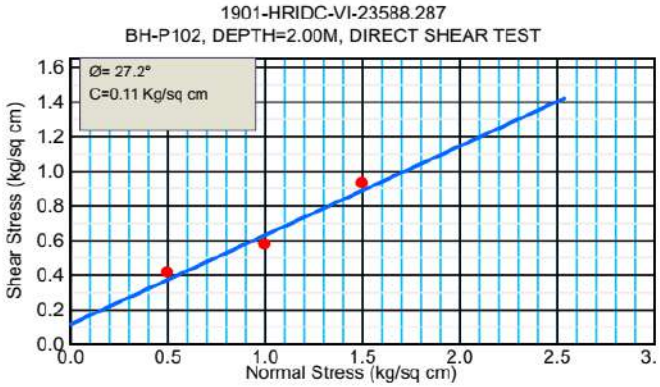


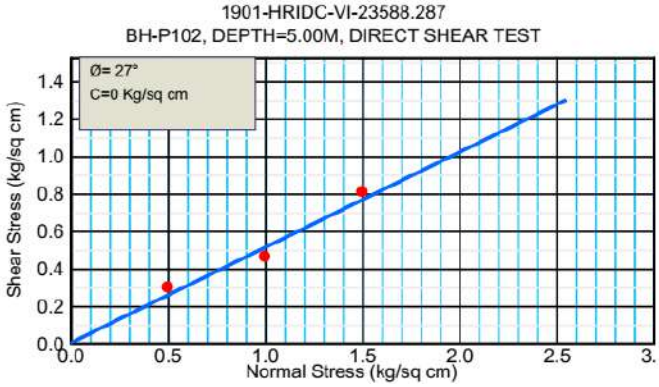


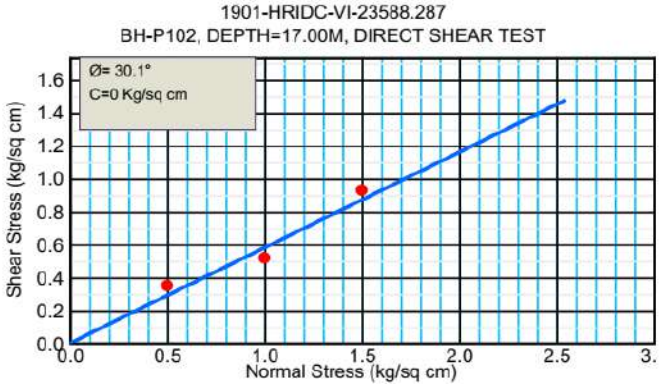






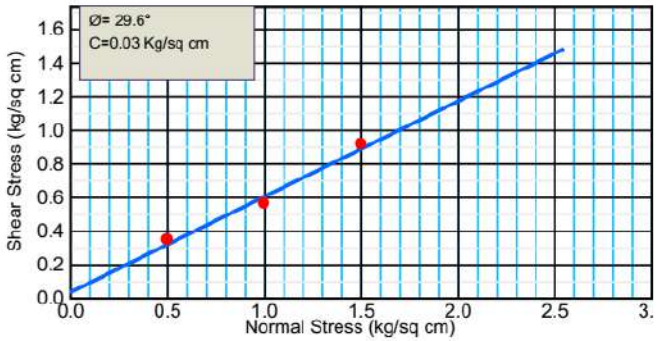




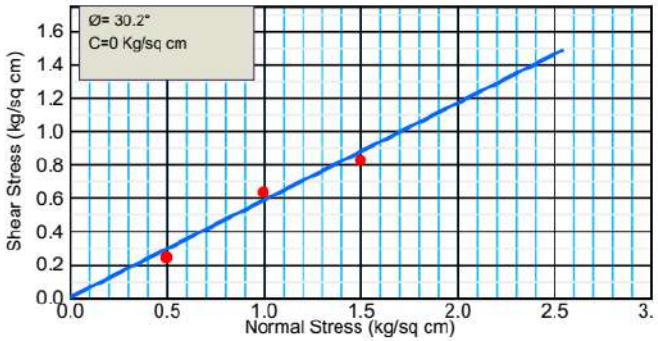


APPENDIX-F
GRAPH 2: DST GRAPH

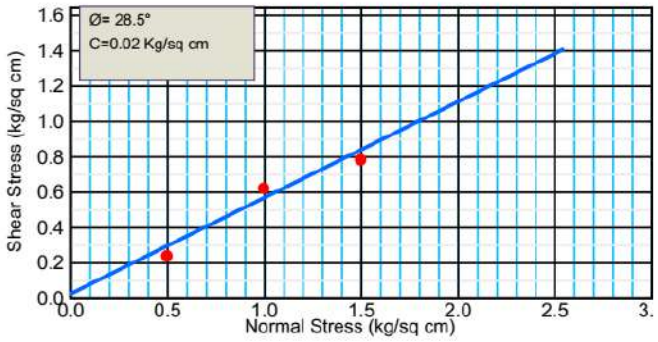
1901-HRIDC-VI-23588.287
BH-P102, DEPTH=23.00M, DIRECT SHEAR TEST



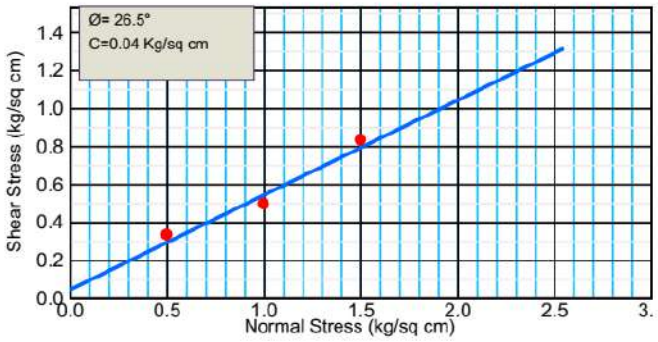
1901-HRIDC-VI-23588.287
BH-P102, DEPTH=32.00M, DIRECT SHEAR TEST



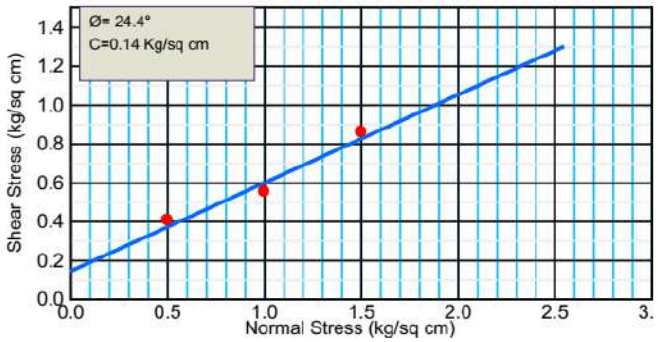
1901-HRIDC-VI-23614.487
BH-P103, DEPTH=2.00M, DIRECT SHEAR TEST



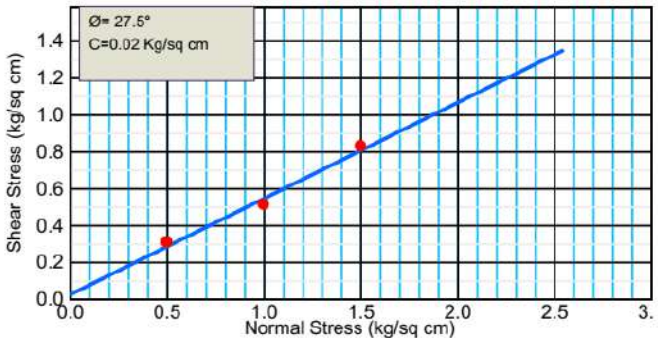
1901-HRIDC-VI-23614.487
BH-P103, DEPTH=5.00M, DIRECT SHEAR TEST



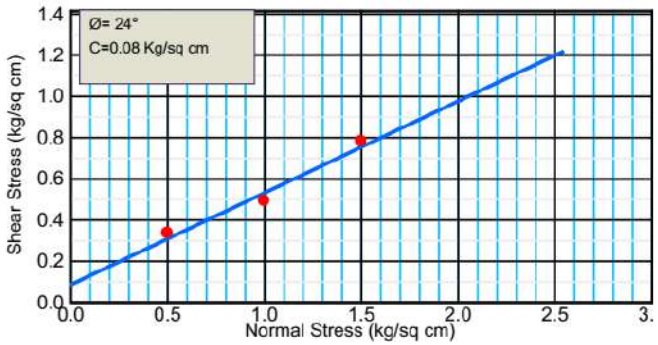
1901-HRIDC-VI-23614.487
BH-P103, DEPTH=11.00M, DIRECT SHEAR TEST



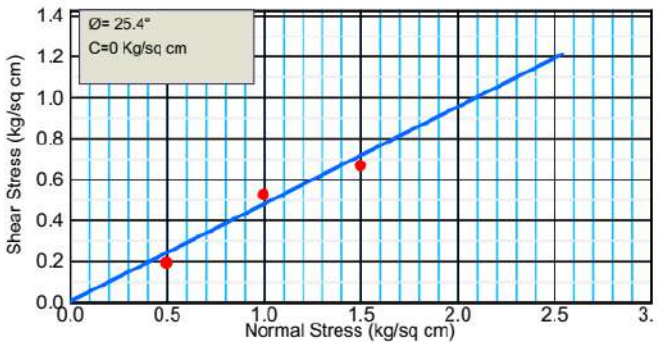
1901-HRIDC-VI-23614.487
BH-P103, DEPTH=23.00M, DIRECT SHEAR TEST



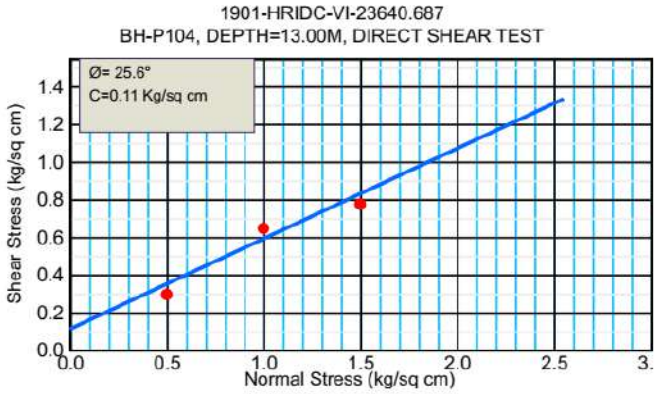
1901-HRIDC-VI-23640.687
BH-P104, DEPTH=1.00M, DIRECT SHEAR TEST

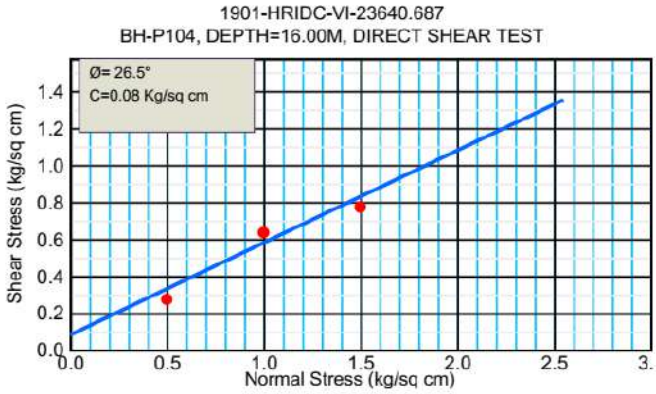


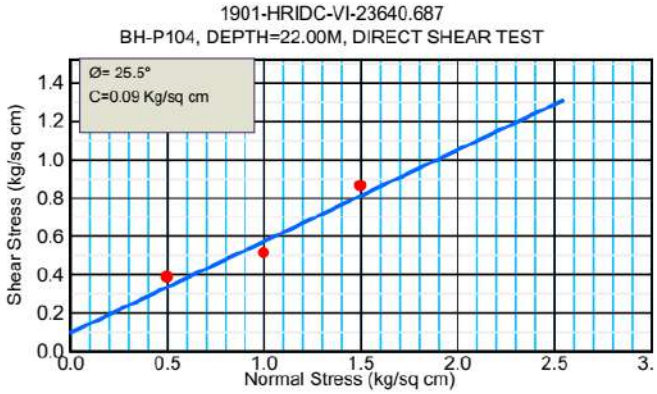
1901-HRIDC-VI-23640.687
BH-P104, DEPTH=4.00M, DIRECT SHEAR TEST

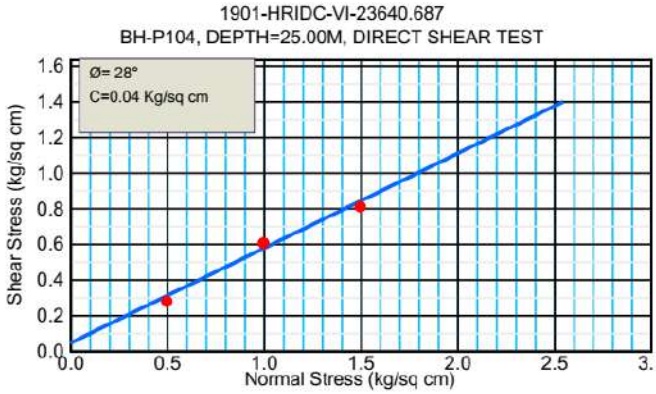


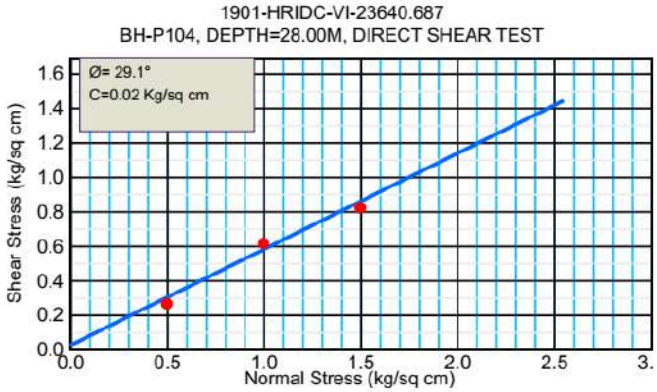
APPENDIX-F
GRAPH 3: DST GRAPH

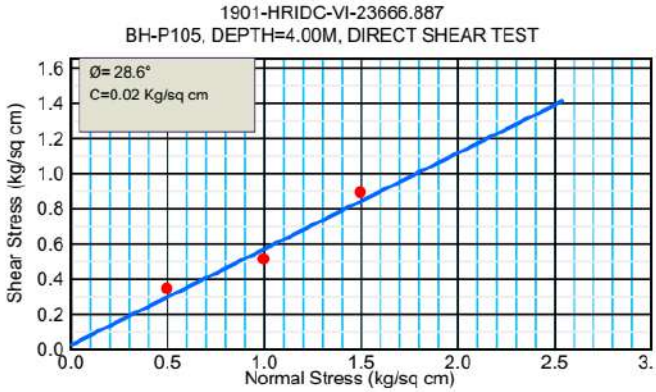


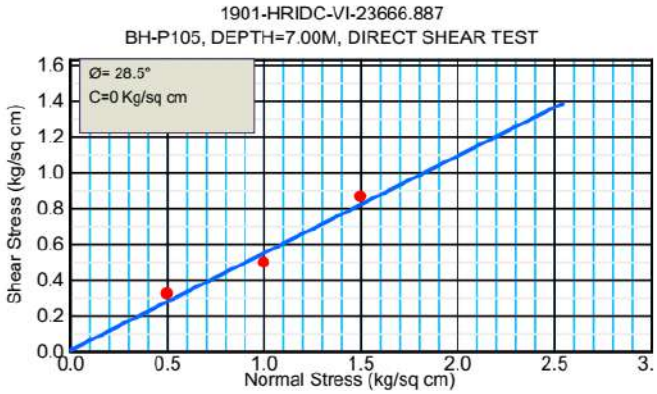


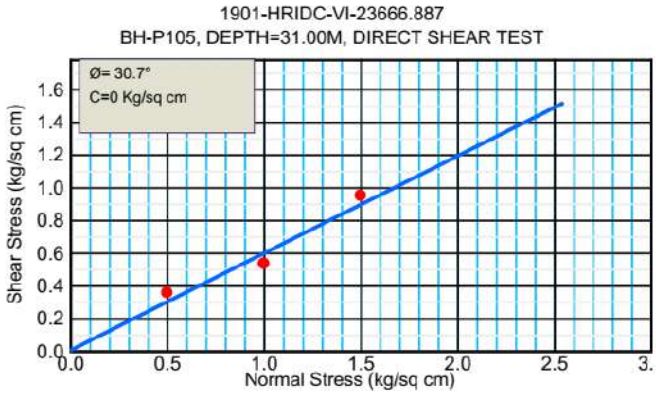






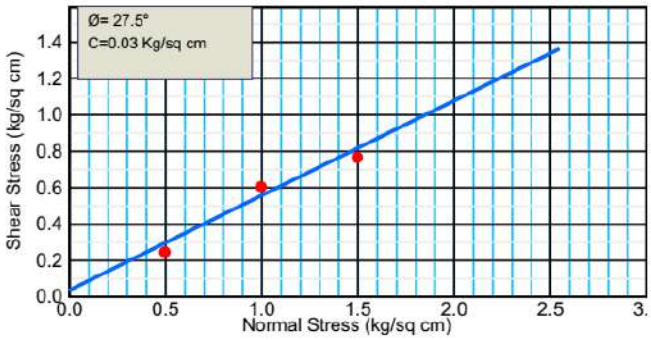




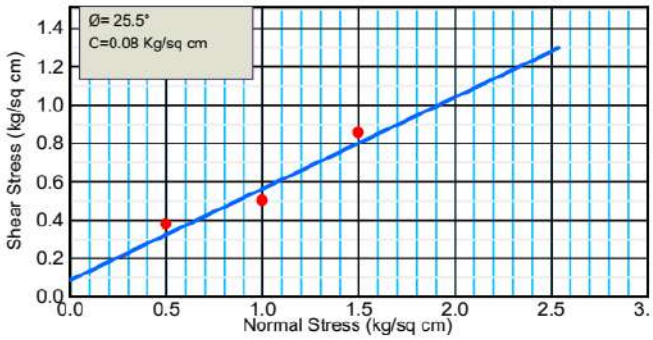


APPENDIX-F
GRAPH 4: DST GRAPH

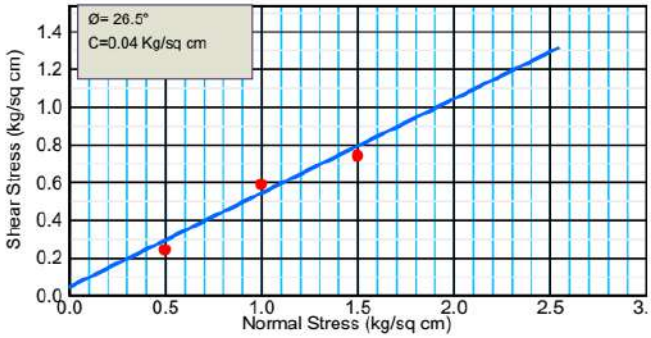
1901-HRIDC-VI-23693.087
BH-P106, DEPTH=1.00M, DIRECT SHEAR TEST



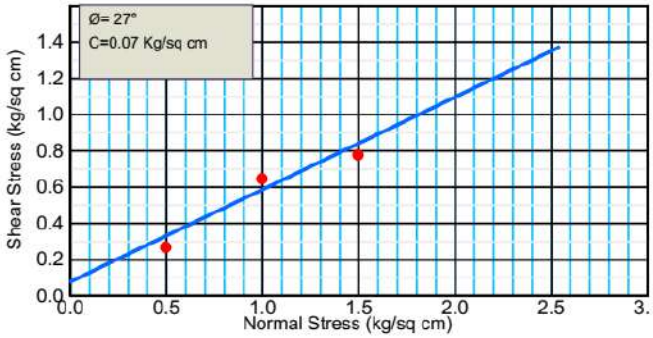
1901-HRIDC-VI-23693.087
BH-P106, DEPTH=16.00M, DIRECT SHEAR TEST



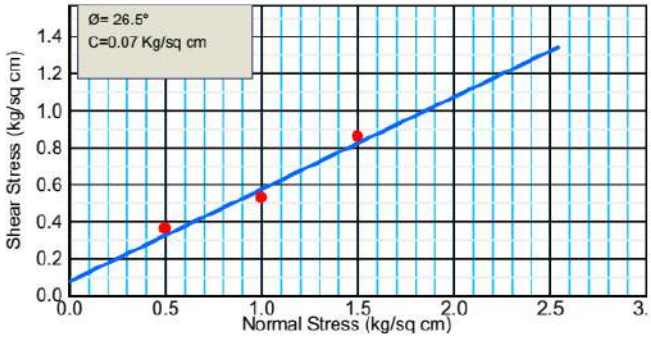
1901-HRIDC-VI-23693.087
BH-P106, DEPTH=19.00M, DIRECT SHEAR TEST



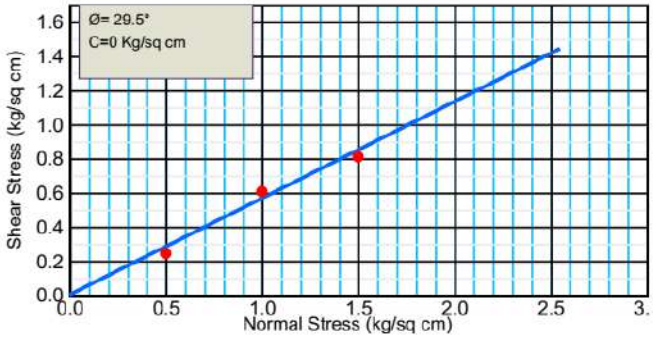
1901-HRIDC-VI-23693.087
BH-P106, DEPTH=25.00M, DIRECT SHEAR TEST



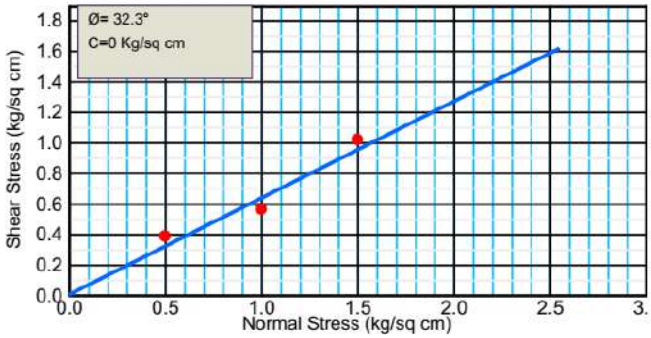
1901-HRIDC-VI-23830.447
BH-P111, DEPTH=2.00M, DIRECT SHEAR TEST



1901-HRIDC-VI-23830.447
BH-P111, DEPTH=8.00M, DIRECT SHEAR TEST

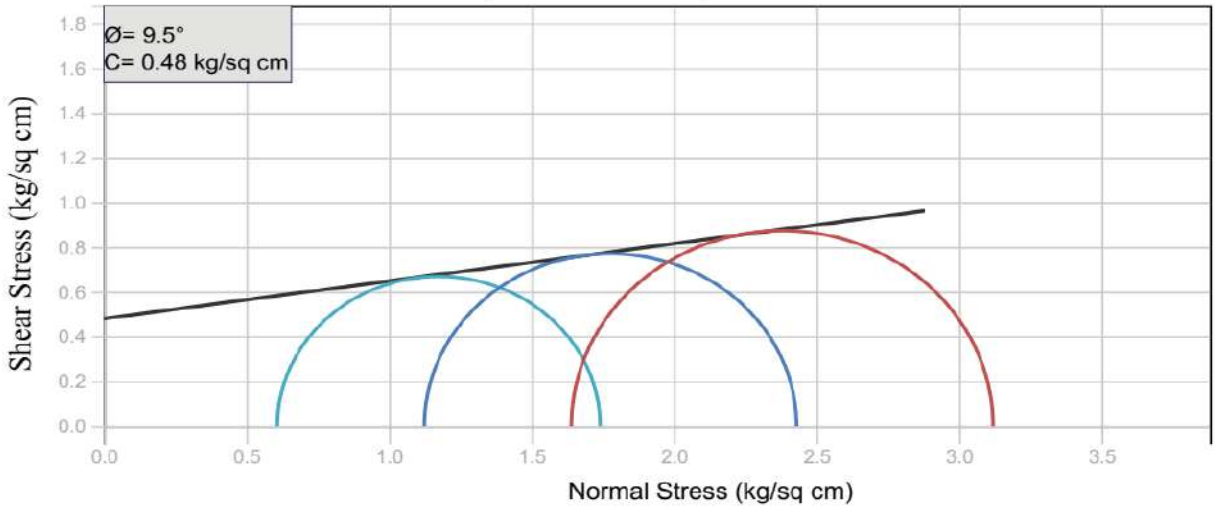


1901-HRIDC-VI-23830.447
BH-P111, DEPTH=23.00M, DIRECT SHEAR TEST

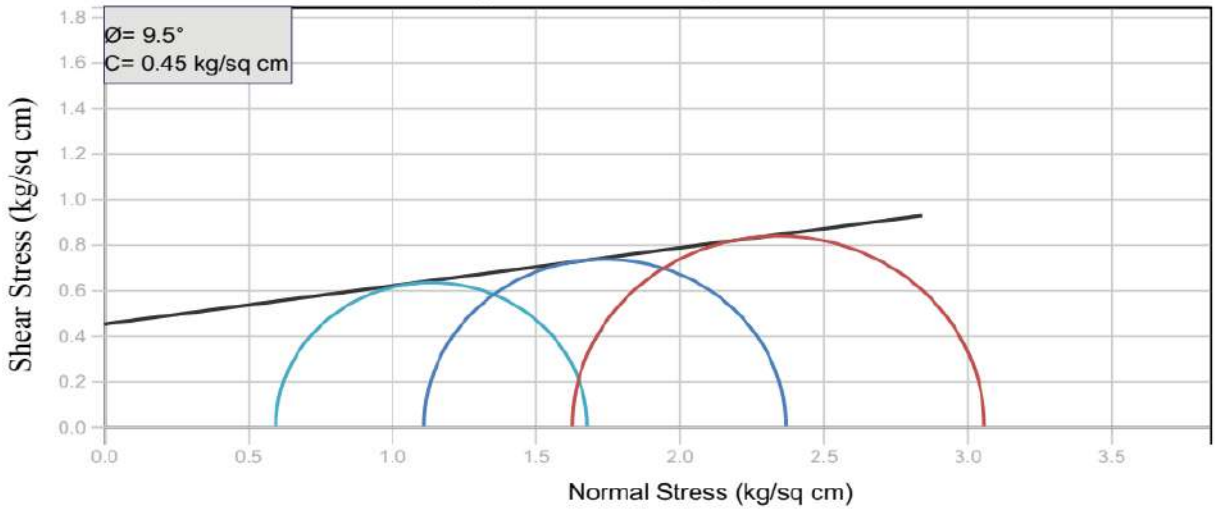


APPENDIX-G
GRAPH 1: UU GRAPH

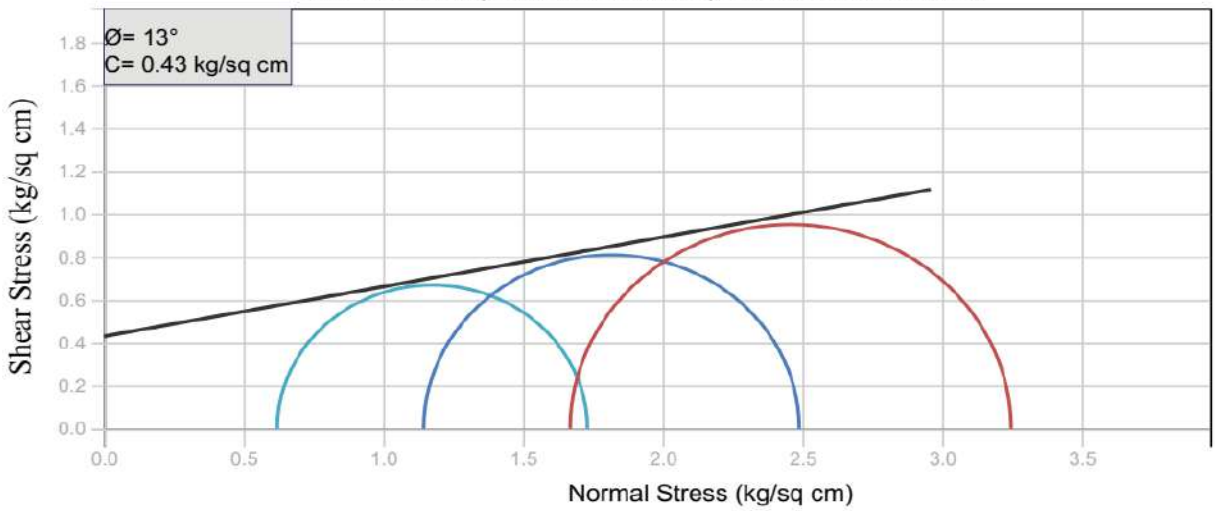
1901-HRIDC-VI-23562.087
BH-NO.P101, DEPTH-7.00M, TRIAXIAL GRAPH



1901-HRIDC-VI-23562.087
BH-NO.P101, DEPTH-13.00M, TRIAXIAL GRAPH

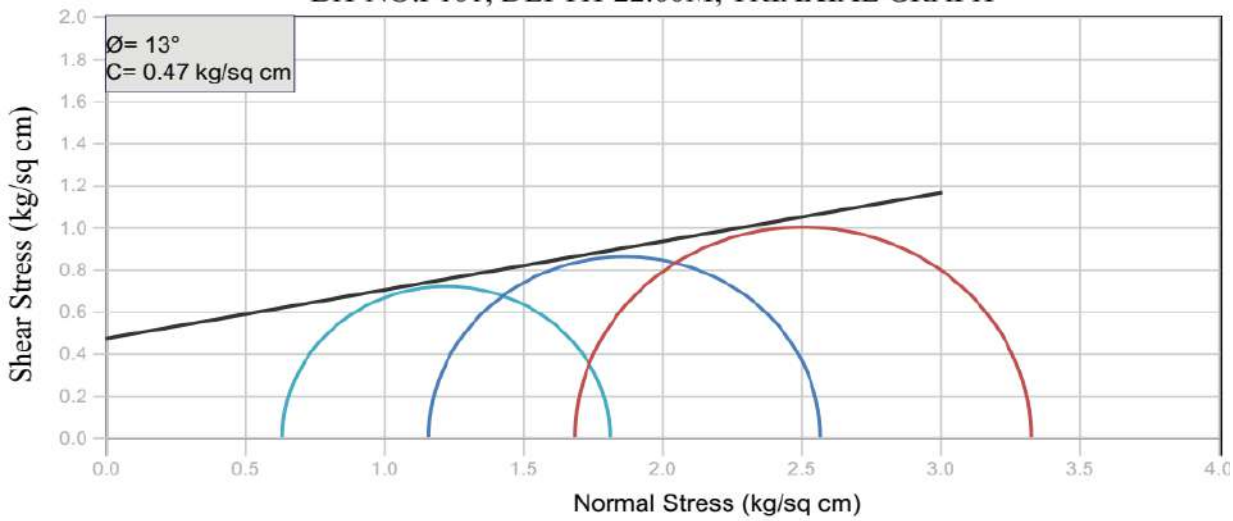


1901-HRIDC-VI-23562.087
BH-NO.P101, DEPTH-16.00M, TRIAXIAL GRAPH

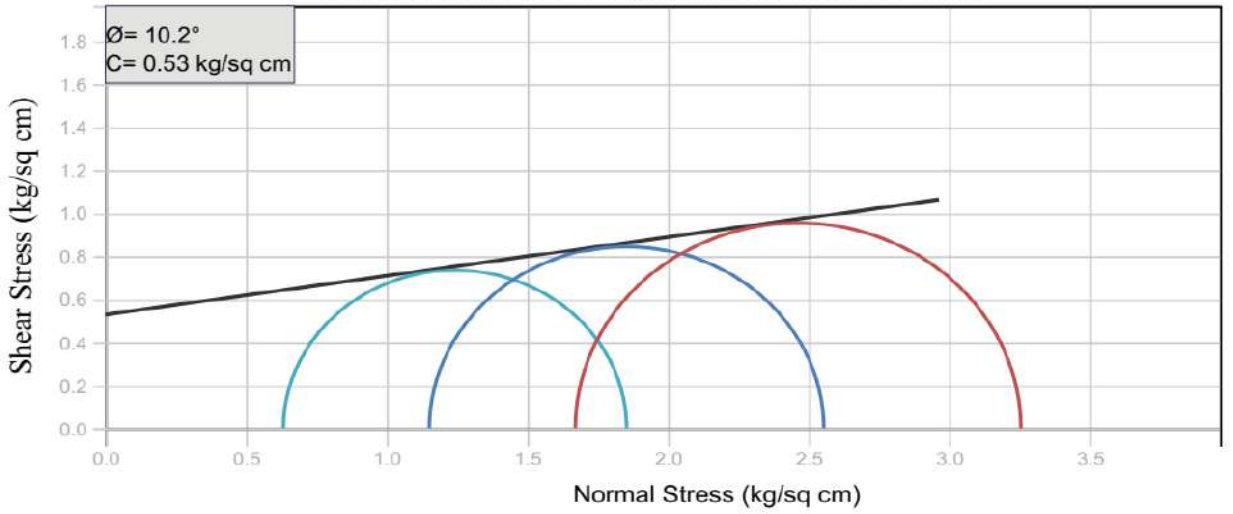


APPENDIX-G
GRAPH 2: UU GRAPH

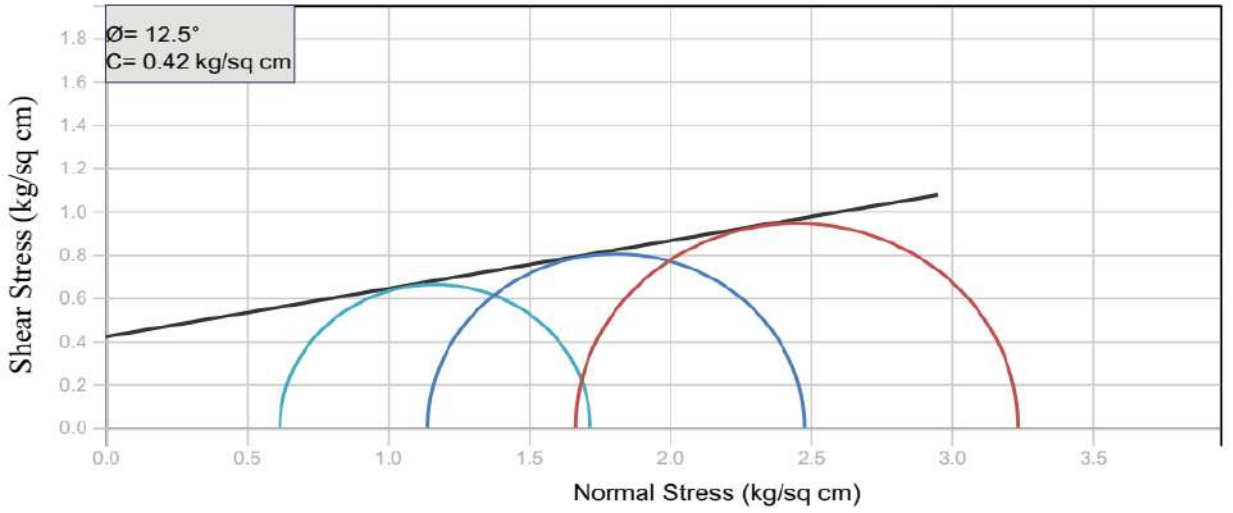
1901-HRIDC-VI-23562.087
BH-NO.P101, DEPTH-22.00M, TRIAXIAL GRAPH



1901-HRIDC-VI-23588.287
BH-NO.P102, DEPTH-8.00M, TRIAXIAL GRAPH

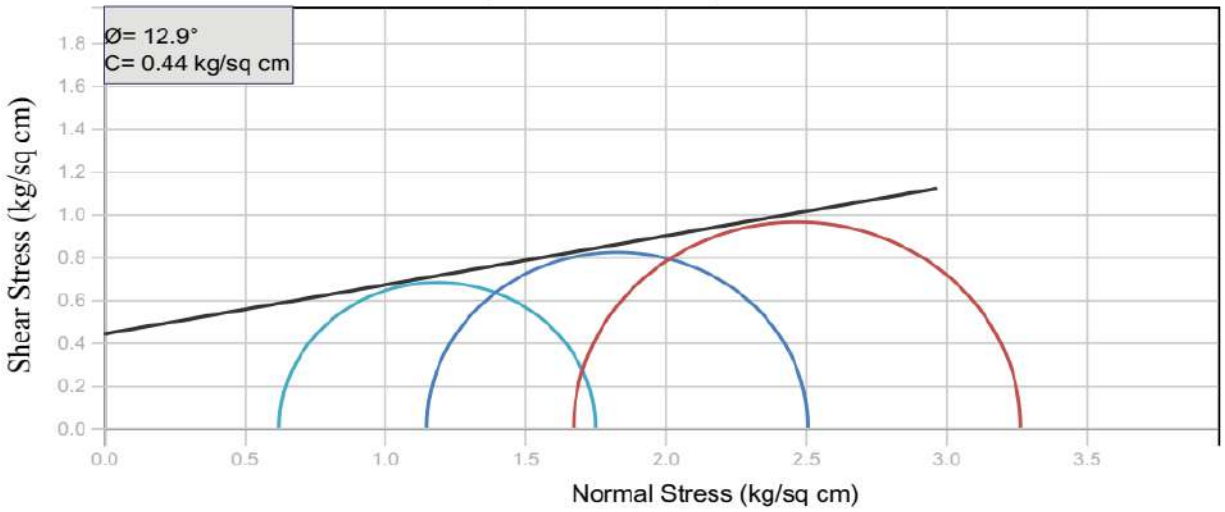


1901-HRIDC-VI-23588.287
BH-NO.P102, DEPTH-11.00M, TRIAXIAL GRAPH

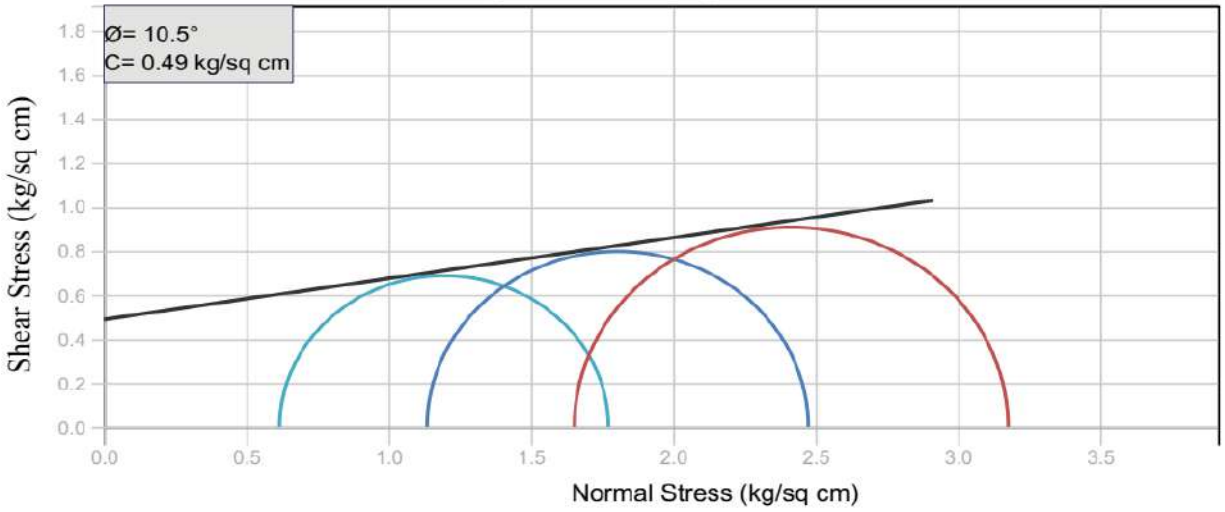


APPENDIX-G
GRAPH 3: UU GRAPH

1901-HRIDC-VI-23588.287
BH-NO.P102, DEPTH-14.00M, TRIAXIAL GRAPH



1901-HRIDC-VI-23614.487
BH-NO.P103, DEPTH-8.00M, TRIAXIAL GRAPH



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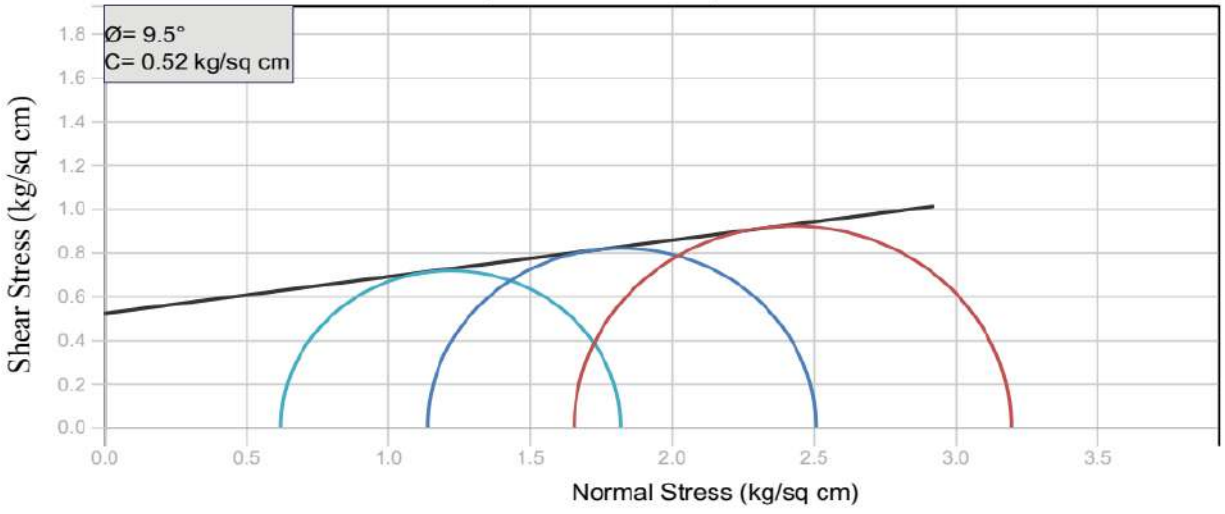
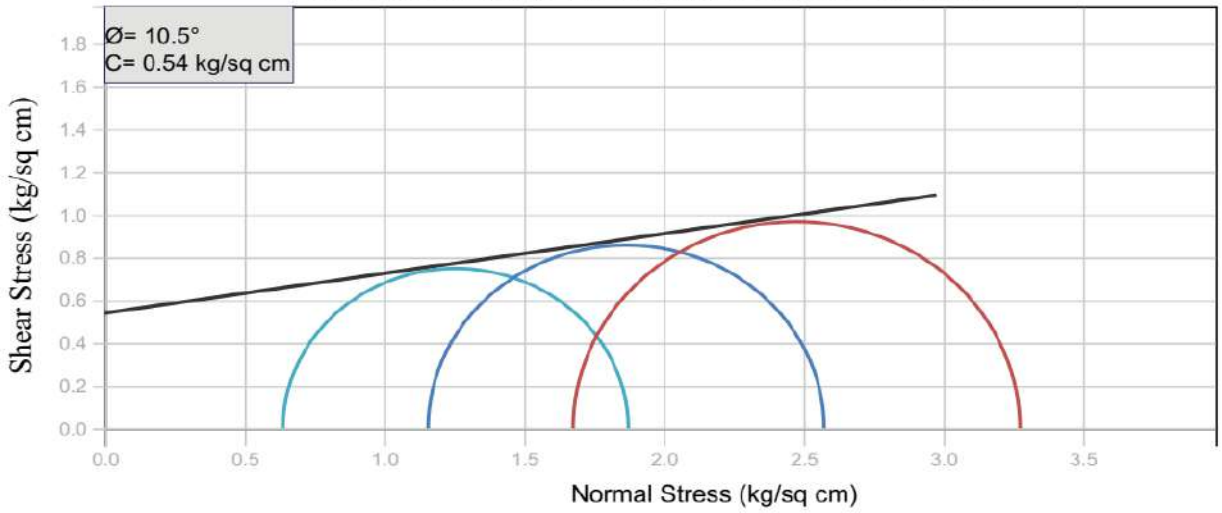
BH-NO.P103, DEPTH-14.00M, TRIAXIAL GRAPH

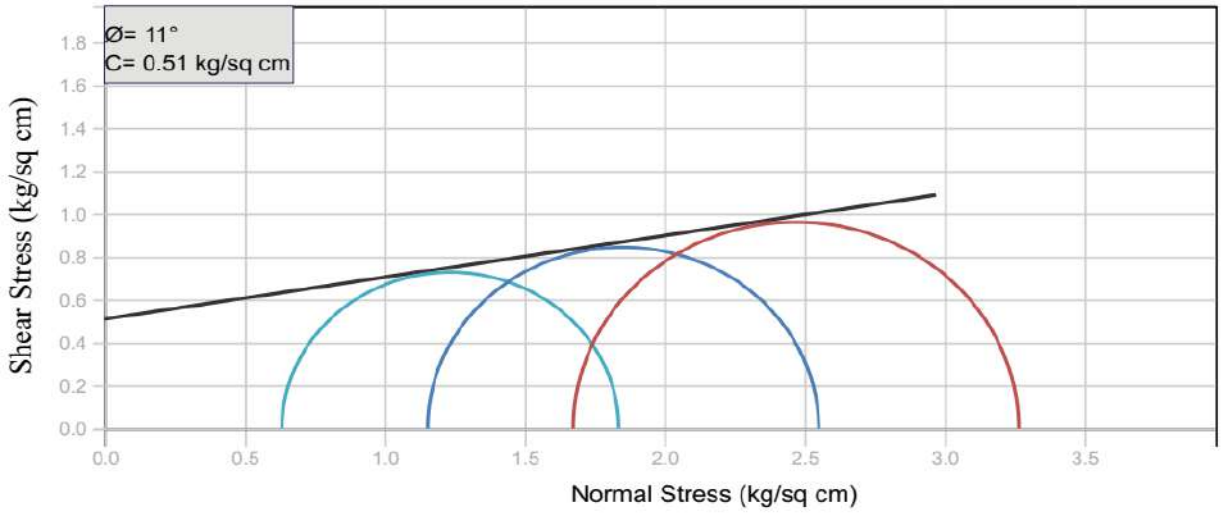


APPENDIX-G
GRAPH 4: UU GRAPH

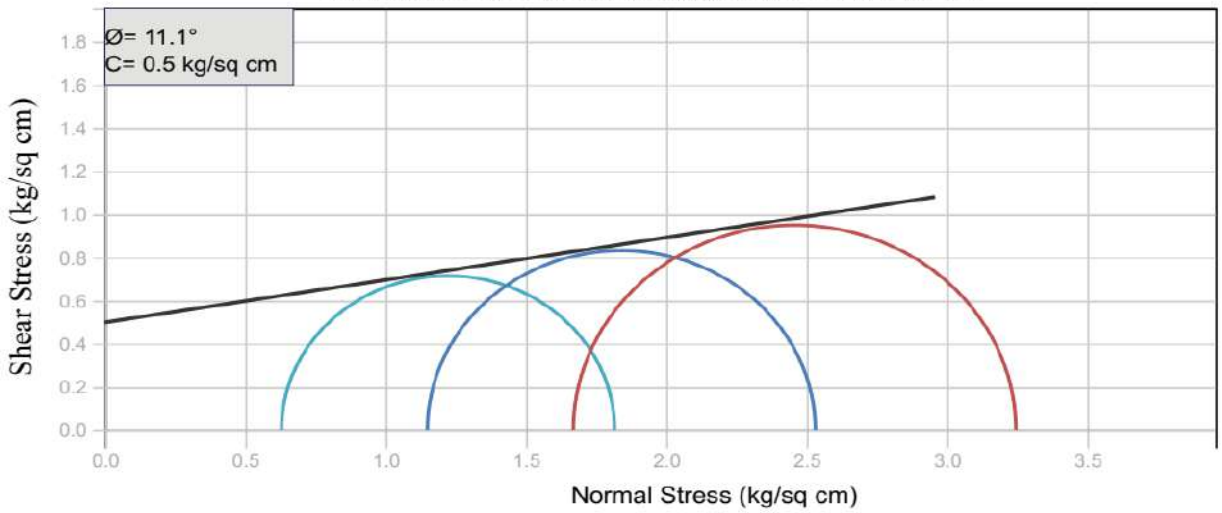
1901-HRIDC-VI-23614.487
BH-NO.P103, DEPTH-17.00M, TRIAXIAL GRAPH



1901-HRIDC-VI-23614.487
BH-NO.P103, DEPTH-20.00M, TRIAXIAL GRAPH

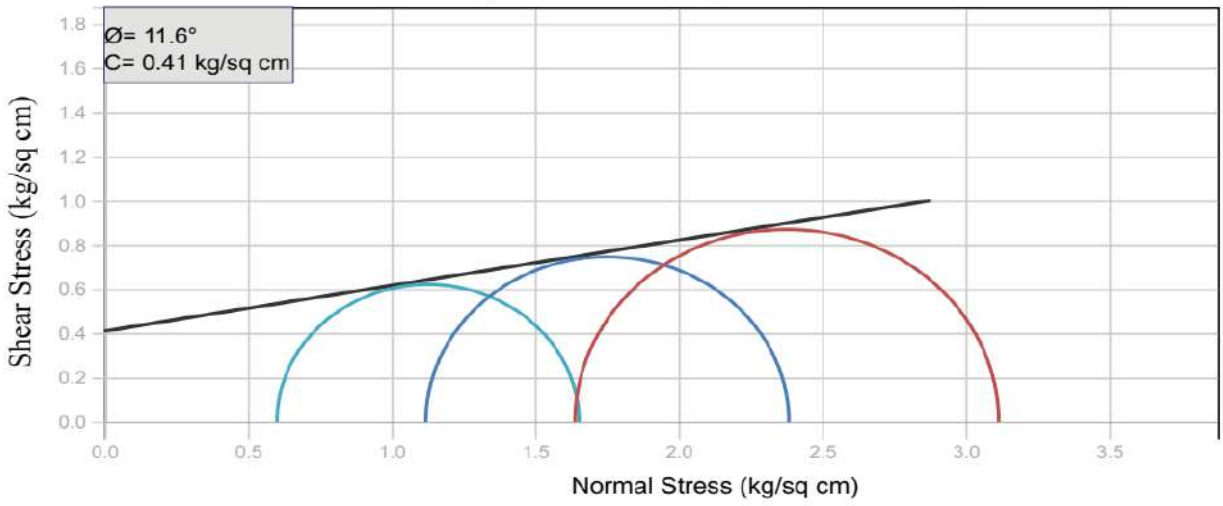


1901-HRIDC-VI-23640.687
BH-NO.P104, DEPTH-7.00M, TRIAXIAL GRAPH

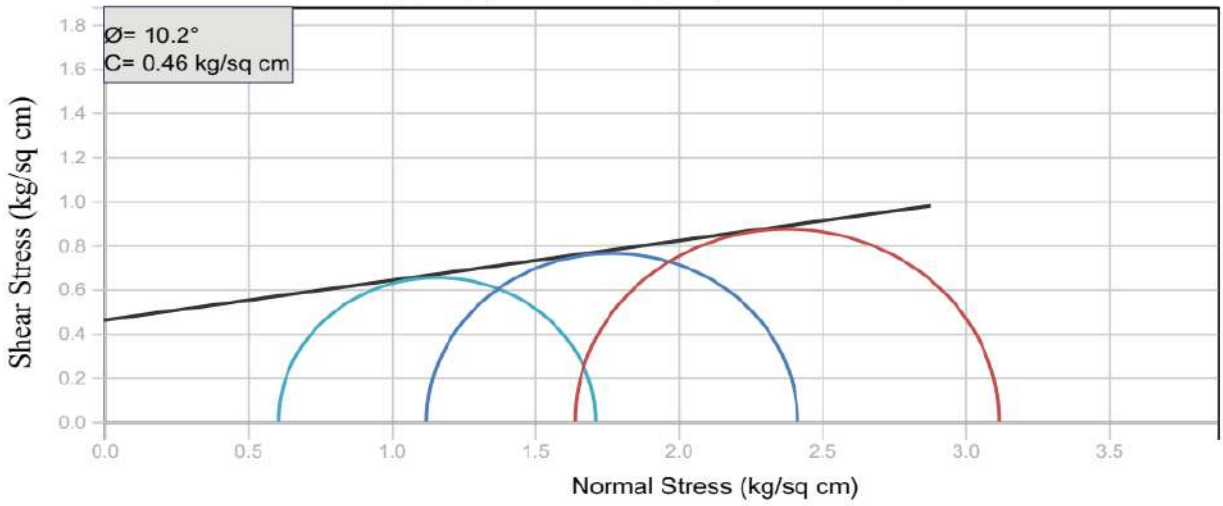


APPENDIX-G
GRAPH 5: UU GRAPH

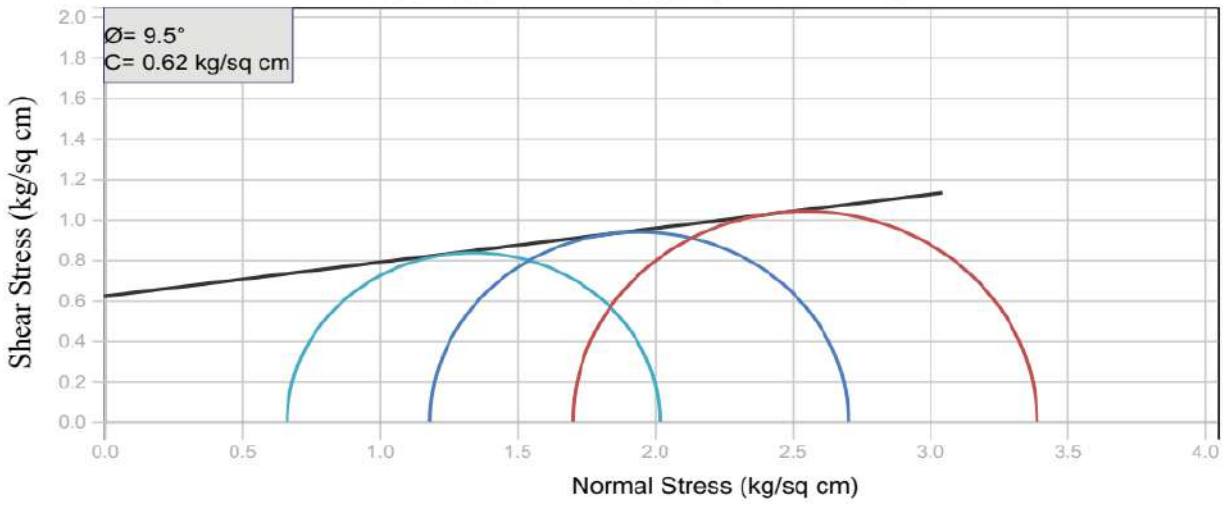
1901-HRIDC-VI-23640.687
BH-NO.P104, DEPTH-10.00M, TRIAXIAL GRAPH



1901-HRIDC-VI-23666.887
BH-NO.P105, DEPTH-10.00M, TRIAXIAL GRAPH

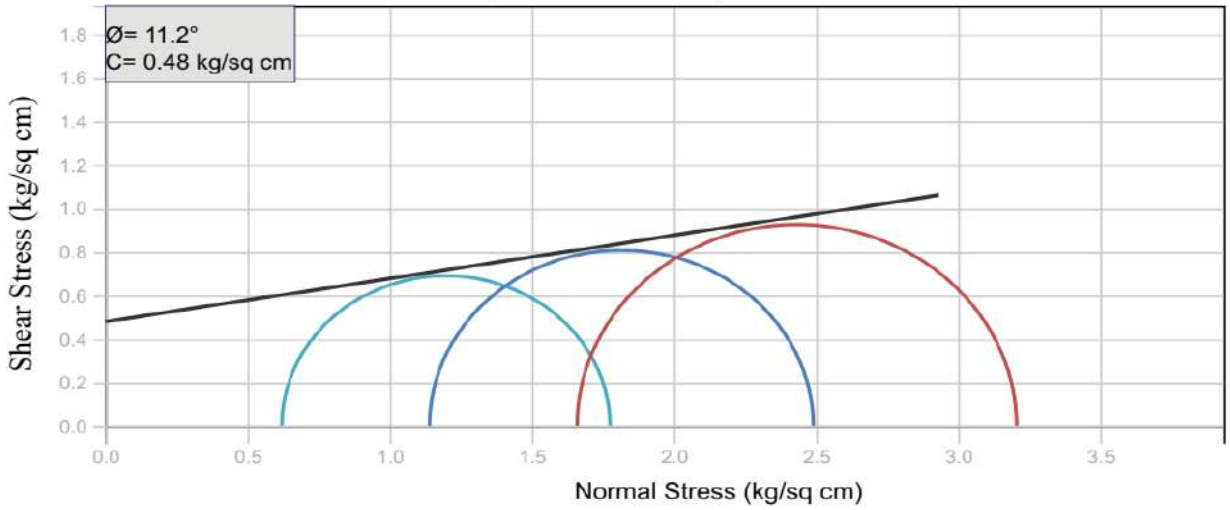


1901-HRIDC-VI-23666.887
BH-NO.P105, DEPTH-13.00M, TRIAXIAL GRAPH

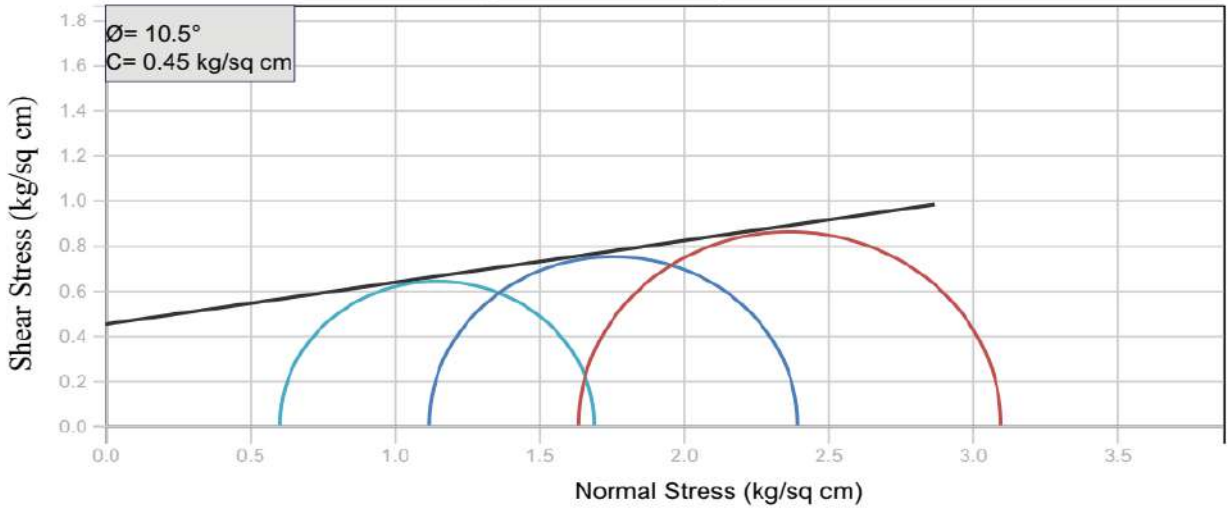


APPENDIX-G
GRAPH 6: UU GRAPH

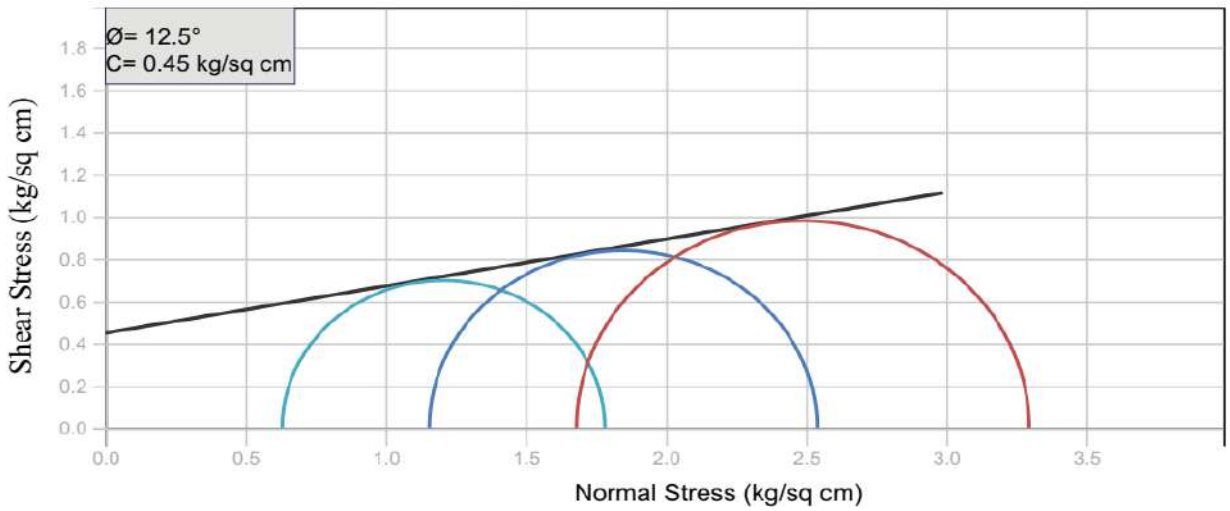
1901-HRIDC-VI-23666.887
BH-NO.P105, DEPTH-22.00M, TRIAXIAL GRAPH



1901-HRIDC-VI-23666.887
BH-NO.P105, DEPTH-25.00M, TRIAXIAL GRAPH

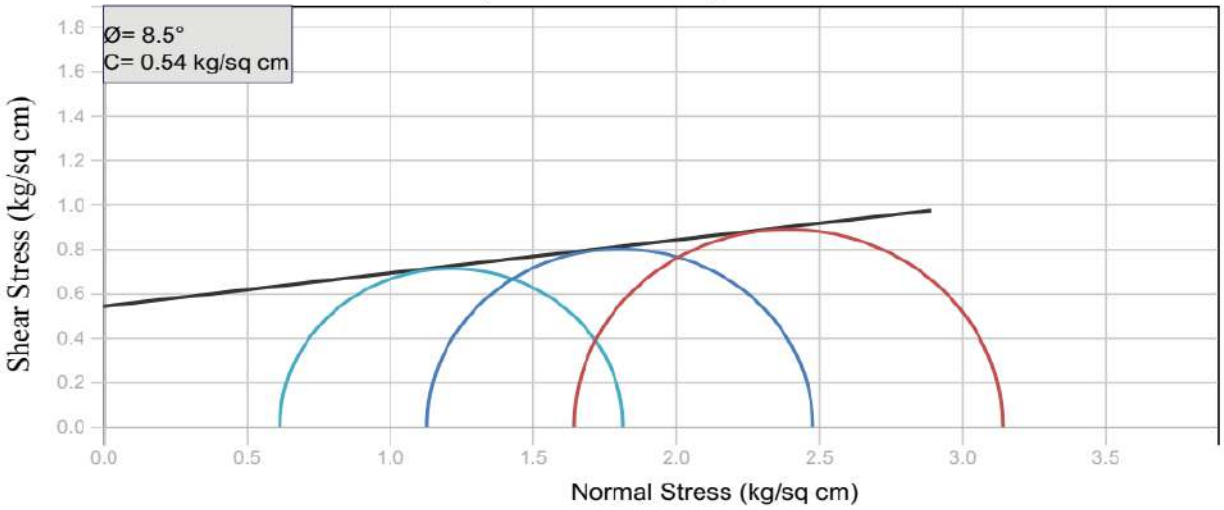


1901-HRIDC-VI-23693.087
BH-NO.P106, DEPTH-4.00M, TRIAXIAL GRAPH

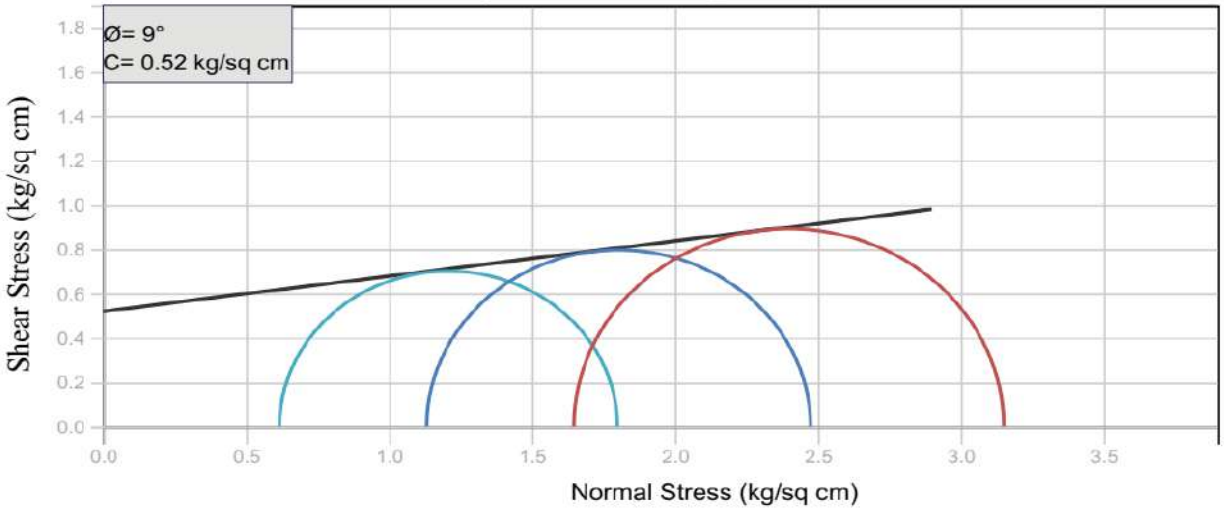


APPENDIX-G
GRAPH 7: UU GRAPH

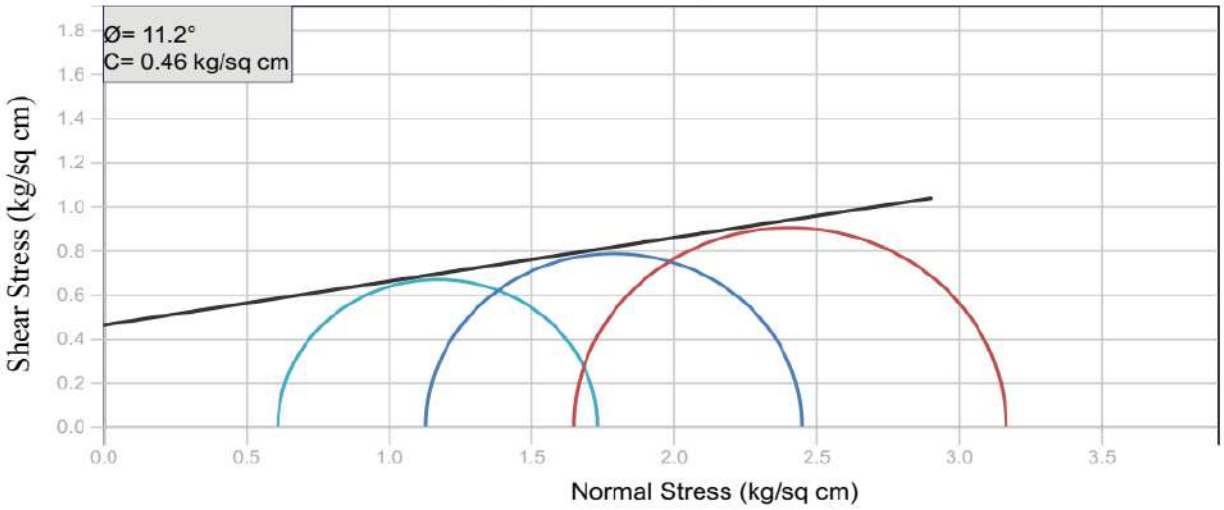
1901-HRIDC-VI-23693.087
BH-NO.P106, DEPTH-10.00M, TRIAXIAL GRAPH



1901-HRIDC-VI-23693.087
BH-NO.P106, DEPTH-13.00M, TRIAXIAL GRAPH

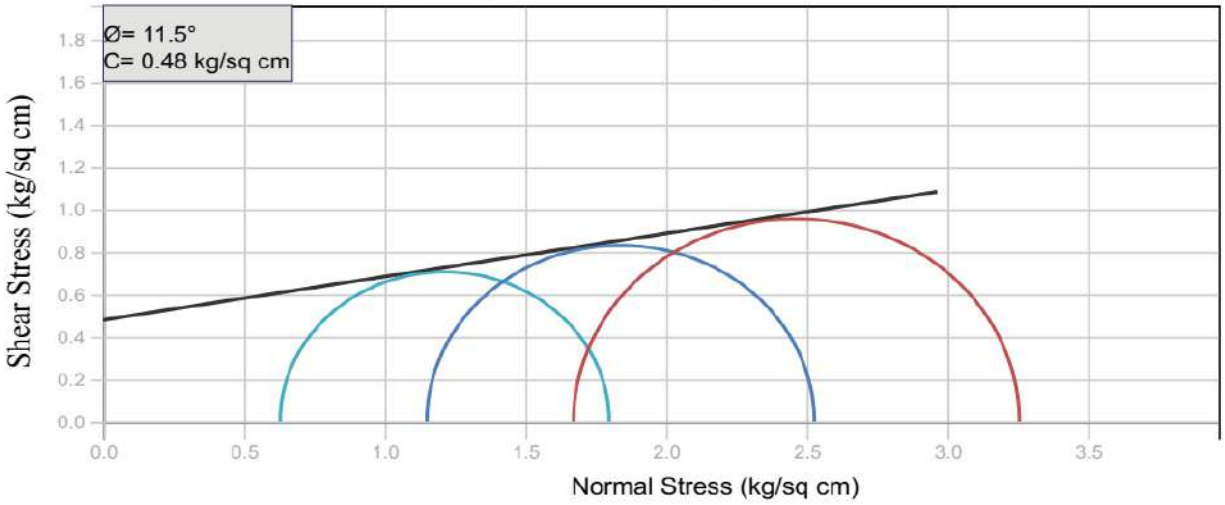


1901-HRIDC-VI-23830.447
BH-NO.P111, DEPTH-5.00M, TRIAXIAL GRAPH

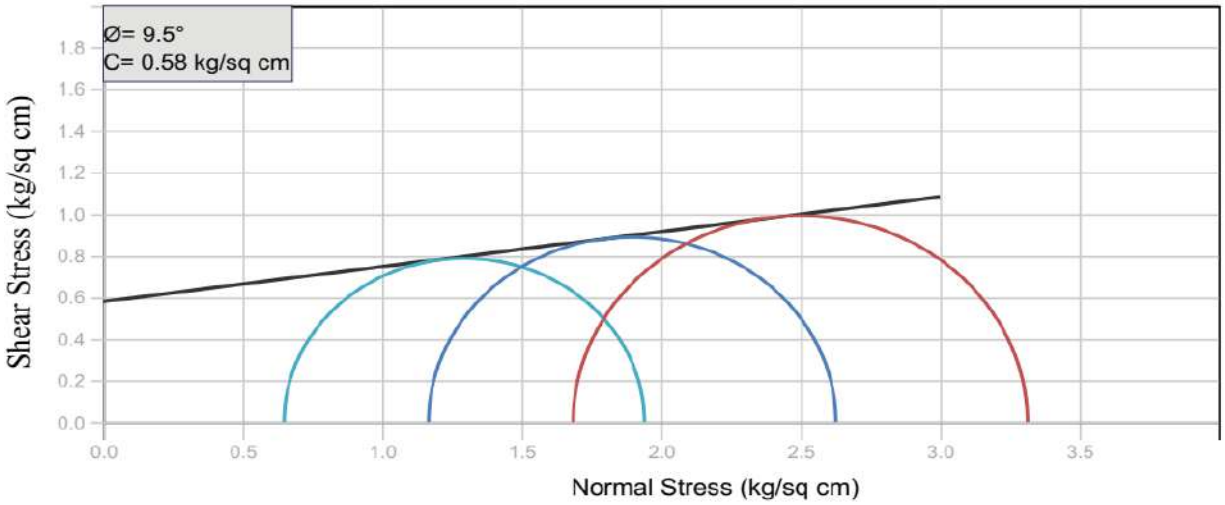


APPENDIX-G
GRAPH 8: UU GRAPH

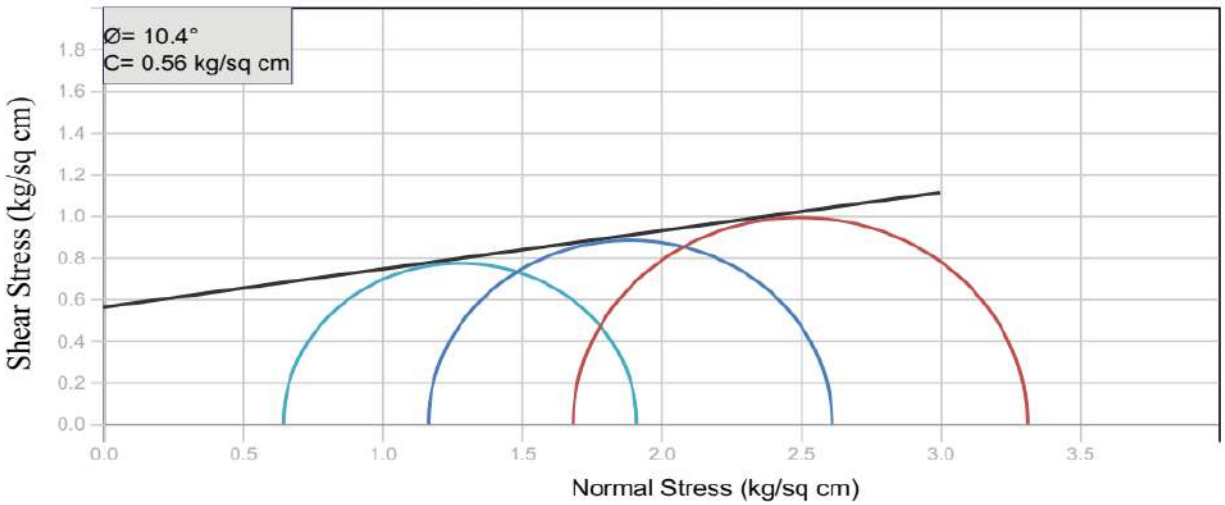
1901-HRIDC-VI-23830.447
BH-NO.P111, DEPTH-11.00M, TRIAXIAL GRAPH



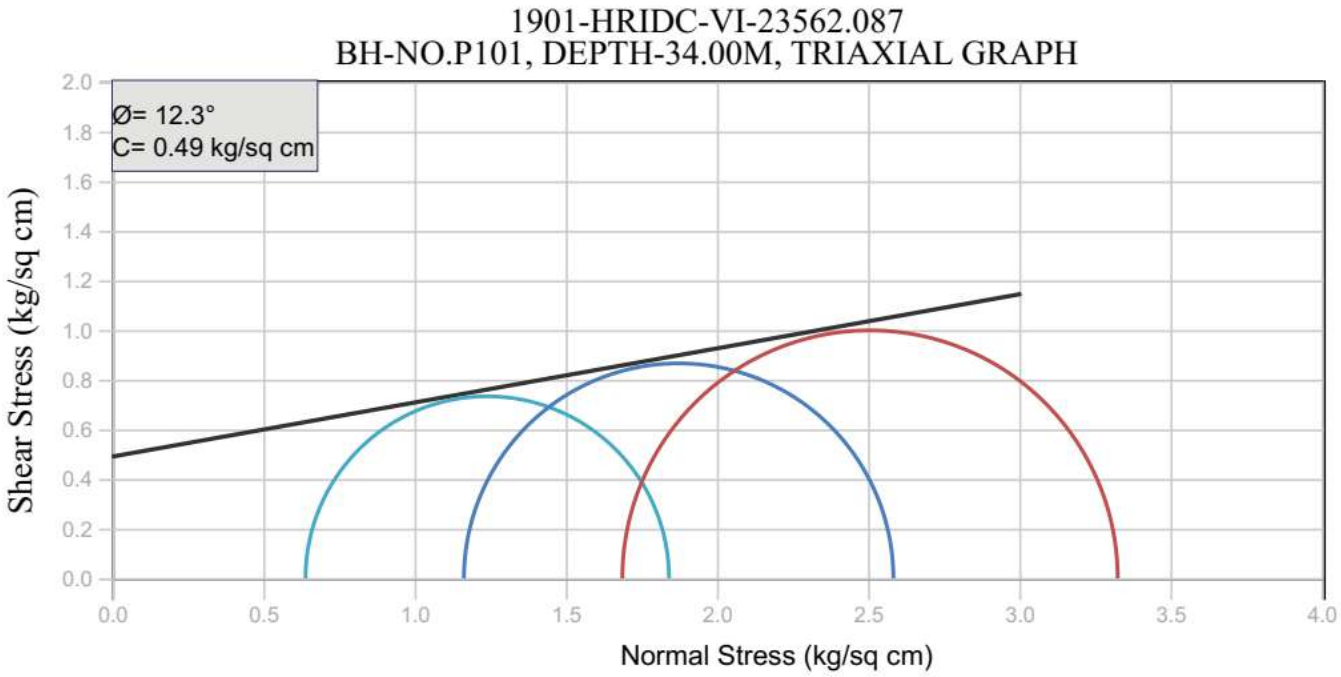
1901-HRIDC-VI-23830.447
BH-NO.P111, DEPTH-14.00M, TRIAXIAL GRAPH

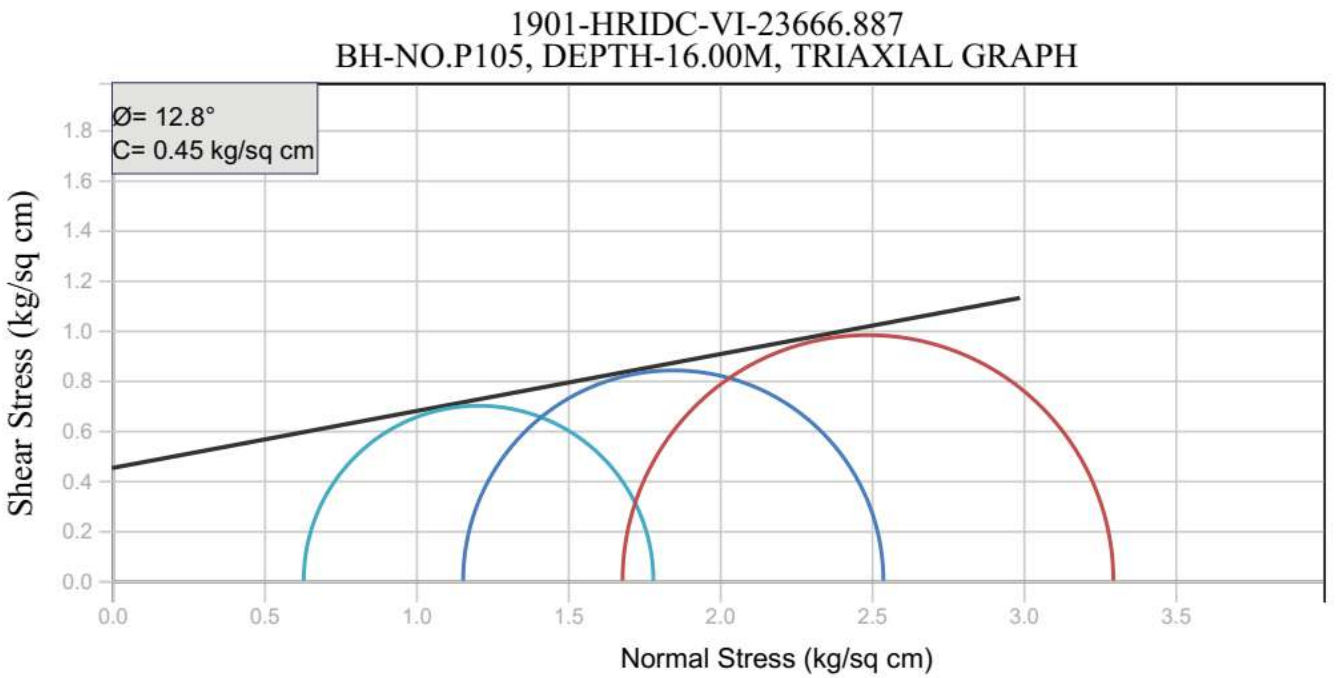


1901-HRIDC-VI-23830.447
BH-NO.P111, DEPTH-17.00M, TRIAXIAL GRAPH

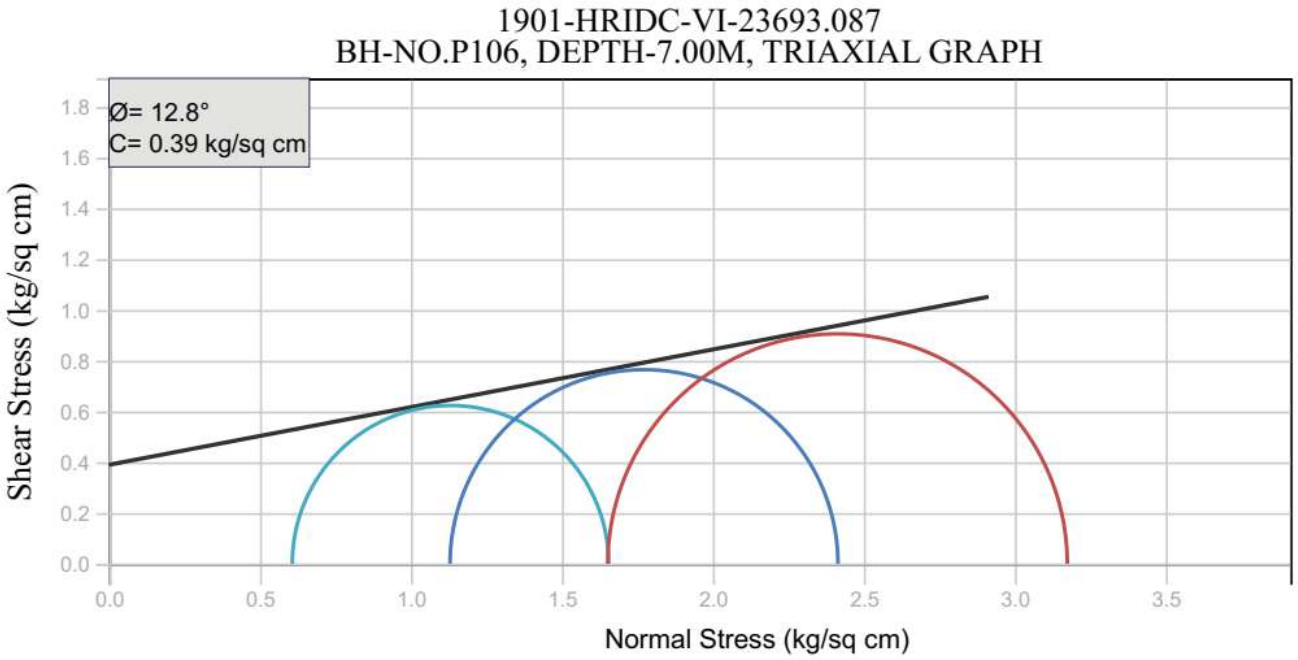


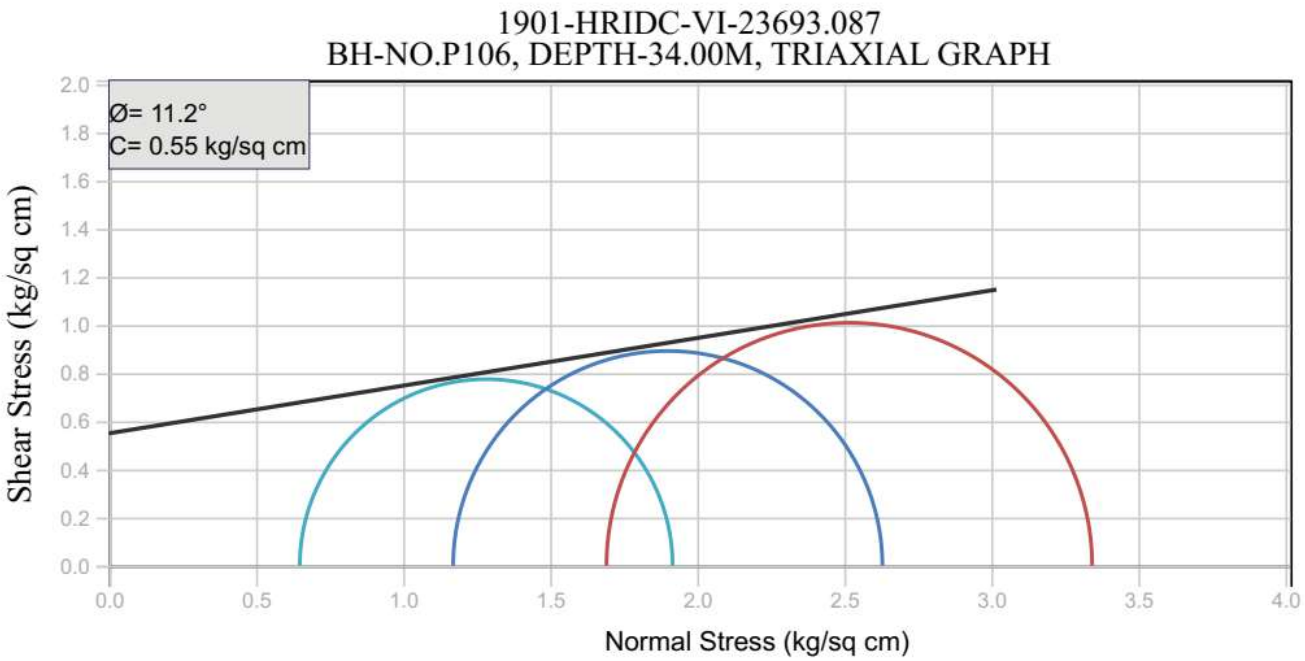
APPENDIX-G
GRAPH 9: RUU GRAPH





APPENDIX-G
GRAPH 10: RUU GRAPH





APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
BORE NO: P101, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	20.30	10.30	28.33	1.57	23.3	23.3	1.0	19.17	0	0	1.0	0.0	0	3.0	24.8	0	10.30	9.86	10.66	30.9	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.50	20.30	10.30	36.05	3.14	24.8	24.8	1.0	52.35	0	0	1.0	0.0	0	4.0	26.6	8	9.58	13.60	14.57	41.2	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	5.00	4.50	1.00	2.50	19.58	9.58	45.99	3.14	26.6	26.6	1.0	72.38	0	8	1.0	25.1	0	5.0	26.3	0	9.58	12.93	13.88	50.8	568.0	568.0	29.5	29.5	**227.20**	**9.82**
5.00	6.00	5.50	1.00	3.50	19.58	9.58	55.57	3.14	26.3	26.3	1.0	86.32	86.32	0	1.0	0.0	0.00	6.0	9.5	48	9.58	2.38	1.14	60.4	456.6	542.9	41.3	127.6	**217.17**	**42.52**
6.00	7.00	6.50	1.00	4.50	19.58	9.58	65.15	3.14	9.5	9.5	1.0	34.26	120.58	48	1.0	150.9	150.86	7.0	9.5	48	10.61	2.38	1.14	69.9	475.0	746.4	53.0	324.5	**298.57**	**108.16**
7.00	8.00	7.50	1.00	5.50	20.61	10.61	75.25	3.14	9.5	9.5	1.0	39.57	160.16	48	1.0	150.9	301.71	8.0	26.0	6	10.61	12.25	13.18	80.6	872.8	1334.7	64.8	526.7	**533.87**	**175.56**
8.00	9.00	8.50	1.00	6.50	20.61	10.61	85.86	3.14	26.0	26.0	1.0	131.60	291.76	6	1.0	18.9	320.57	9.0	26.0	6	10.40	12.25	13.18	91.2	973.8	1586.2	76.6	688.9	**634.47**	**229.65**
9.00	11.00	10.00	2.00	8.50	20.40	10.40	101.56	6.29	26.0	26.0	1.0	311.36	603.12	6	1.0	37.7	358.29	11.0	9.5	45	10.40	2.38	1.14	112.0	532.2	1493.7	100.2	1061.6	**597.46**	**353.86**
11.00	12.00	11.50	1.00	9.50	20.40	10.40	117.16	3.14	9.5	9.5	1.0	61.62	664.74	45	1.0	141.4	499.71	12.0	9.5	45	10.53	2.38	1.14	122.4	551.8	1716.2	112.0	1276.4	**686.48**	**425.47**
12.00	14.50	13.25	2.50	12.00	20.53	10.53	135.52	7.86	9.5	9.5	1.0	178.19	842.93	45	1.0	353.6	853.29	14.5	9.5	45	10.53	2.38	1.14	148.7	601.0	2297.2	141.4	1837.6	**918.88**	**612.55**
14.50	16.00	15.25	1.50	13.50	20.53	10.53	135.52	4.71	9.5	9.5	1.0	106.91	949.84	45	1.0	212.1	1065.43	16.0	13.0	43	10.55	3.35	2.08	148.7	704.0	2719.3	159.1	2174.4	**1087.72**	**724.79**
16.00	17.50	16.75	1.50	15.00	20.55	10.55	135.52	4.71	13.0	13.0	1.0	147.50	1097.34	43	1.0	202.7	1268.14	17.5	13.0	43	10.55	3.35	2.08	148.7	704.0	3069.5	176.8	2542.3	**1227.81**	**847.42**
17.50	19.00	18.25	1.50	16.50	20.55	10.55	135.52	4.71	13.0	13.0	1.0	147.50	1244.84	43	1.0	202.7	1470.86	19.0	32.1	0	8.89	31.84	33.16	148.7	3835.3	6551.0	194.5	2910.2	**2620.39**	**970.05**
19.00	20.50	19.75	1.50	18.00	18.89	8.89	135.52	4.71	32.1	32.1	1.1	442.86	1687.70	0	1.0	0.0	1470.86	20.5	32.1	0	8.89	31.84	33.16	148.7	3835.3	6993.8	212.1	3370.7	**2797.53**	**1123.57**
20.50	22.00	21.25	1.50	19.50	18.89	8.89	135.52	4.71	32.1	32.1	1.1	442.86	2130.55	0	1.0	0.0	1470.86	22.0	13.0	47	9.71	3.35	2.08	148.7	731.6	4333.1	229.8	3831.2	**1733.22**	**1277.08**
22.00	23.50	22.75	1.50	21.00	19.71	9.71	135.52	4.71	13.0	13.0	1.0	147.50	2278.05	47	1.0	221.6	1692.43	23.5	13.0	47	9.71	3.35	2.08	148.7	731.6	4702.1	247.5	4218.0	**1880.85**	**1405.99**
23.50	25.00	24.25	1.50	22.50	19.71	9.71	135.52	4.71	13.0	13.0	1.0	147.50	2425.55	47	1.0	221.6	1914.00	25.0	29.6	0	10.05	20.36	21.48	148.7	2463.2	6802.7	265.2	4604.7	**2721.10**	**1534.91**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
25.00	26.50	25.75	1.50	24.00	20.05	10.05	135.52	4.71	29.6	29.6	1.0	362.94	2788.49	0	1.0	0.0	1914.00	26.5	29.0	0	10.05	19.01	20.10	148.7	2299.9	7002.4	282.9	4985.4	**2800.95**	**1661.78**
26.50	27.50	27.00	1.00	25.00	20.05	10.05	135.52	3.14	29.0	29.0	1.0	236.10	3024.59	0	1.0	0.0	1914.00	27.5	29.0	0	10.05	19.01	20.10	148.7	2299.9	7238.5	294.6	5233.2	**2895.39**	**1744.41**
27.50	29.50	28.50	2.00	27.00	20.05	10.05	135.52	6.29	29.0	29.0	1.0	472.19	3496.78	0	1.0	0.0	1914.00	29.5	27.2	0	8.72	14.95	15.95	148.7	1801.6	7212.4	318.2	5729.0	**2884.97**	**1909.67**
29.50	30.00	29.75	0.50	27.50	18.72	8.72	135.52	1.57	27.2	27.2	1.0	109.45	3606.23	0	1.0	0.0	1914.00	30.0	27.2	0	10.43	14.95	15.95	148.7	1812.4	7332.6	324.1	5844.3	**2933.04**	**1948.11**
30.00	31.00	30.50	1.00	28.50	20.43	10.43	135.52	3.14	27.2	27.2	1.0	218.90	3825.13	0	1.0	0.0	1914.00	31.0	12.8	56	10.43	3.29	2.02	148.7	788.8	6527.9	335.9	6075.0	**2611.18**	**2025.01**
31.00	32.50	31.75	1.50	30.00	20.43	10.43	135.52	4.71	12.8	12.8	1.0	145.15	3970.28	56	1.0	264.0	2178.00	32.5	12.8	56	10.43	3.29	2.02	148.7	788.8	6937.1	353.6	6501.9	**2774.84**	**2167.28**
32.50	35.00	33.75	2.50	32.50	20.43	10.43	135.52	7.86	12.8	12.8	1.0	241.92	4212.20	56	1.0	440.0	2618.00	35.0	12.3	49	10.43	3.15	1.88	148.7	721.7	7551.9	383.0	7213.2	**3020.75**	**2404.41**
35.00	35.50	35.25	0.50	33.00	20.43	10.43	135.52	1.57	12.3	12.3	1.0	46.43	4258.63	49	1.0	77.0	2695.00	35.5	30.0	0	10.43	21.26	22.40	148.7	2575.4	9529.0	388.9	7342.6	**3811.62**	**2447.52**
35.50	37.00	36.25	1.50	34.50	20.43	10.43	135.52	4.71	30.0	30.0	1.0	368.86	4627.50	0	1.0	0.0	2695.00	37.0	30.0	0	10.49	21.26	22.40	148.7	2575.9	9898.4	406.6	7729.1	**3959.37**	**2576.37**
37.00	37.50	37.25	0.50	35.00	20.49	10.49	135.52	1.57	30.0	30.0	1.0	122.95	4750.45	0	1.0	0.0	2695.00	37.5	30.0	0	10.49	21.26	22.40	148.7	2575.9	10021.4	412.5	7858.0	**4008.55**	**2619.32**
37.50	38.50	38.00	1.00	36.00	20.49	10.49	135.52	3.14	30.0	30.0	1.0	245.91	4996.36	0	1.0	0.0	2695.00	38.5	30.0	0	10.49	21.26	22.40	148.7	2575.9	10267.3	424.3	8115.6	**4106.92**	**2705.22**
38.50	40.00	39.25	1.50	37.50	20.49	10.49	135.52	4.71	30.0	30.0	1.0	368.86	5365.23	0	1.0	0.0	2695.00	40.0	30.0	0	10.49	21.26	22.40	148.7	2575.9	10636.2	442.0	8502.2	**4254.46**	**2834.06**
BORE NO: P102, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.64	9.64	26.51	1.57	27.2	27.2	1.0	21.41	0	11	1.0	17.3	0	3.0	24.8	0	9.64	9.86	10.66	28.9	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.50	19.64	9.64	33.74	3.14	24.8	24.8	1.0	49.00	0	0	1.0	0.0	0	4.0	27.0	0	8.85	14.50	15.49	38.6	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	6.00	5.00	2.00	3.50	18.85	8.85	47.41	6.29	27.0	27.0	1.0	151.84	0	0	1.0	0.0	0	6.0	27.2	0	8.85	14.95	15.95	56.3	0	0.0	41.3	41.3	**0.00**	**13.75**
6.00	7.00	6.50	1.00	4.50	18.85	8.85	60.69	3.14	27.2	27.2	1.0	98.02	0	0	1.0	0.0	0	7.0	27.2	0	8.85	14.95	15.95	65.1	0	0.0	53.0	53.0	**0.00**	**17.68**
7.00	8.00	7.50	1.00	5.50	18.85	8.85	69.54	3.14	27.2	27.2	1.0	112.31	0	0	1.0	0.0	0	8.0	10.2	53	9.55	2.53	1.28	74.0	526.5	526.5	64.8	64.8	**210.61**	**21.61**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
8.00	9.00	8.50	1.00	6.50	19.55	9.55	78.74	3.14	10.2	10.2	1.0	44.52	44.52	53	1.0	166.6	166.57	9.0	10.2	53	9.55	2.53	1.28	83.5	545.5	756.6	76.6	287.7	**302.64**	**95.90**
9.00	10.00	9.50	1.00	7.50	19.55	9.55	88.29	3.14	10.2	10.2	1.0	49.92	94.45	53	1.0	166.6	333.14	10.0	12.5	42	9.55	3.20	1.94	93.1	538.5	966.1	88.4	516.0	**386.45**	**171.99**
10.00	11.00	10.50	1.00	8.50	19.55	9.55	97.84	3.14	12.5	12.5	1.0	68.17	162.62	42	1.0	132.0	465.14	11.0	12.5	42	9.92	3.20	1.94	102.6	562.9	1190.6	100.2	727.9	**476.24**	**242.65**
11.00	12.50	11.75	1.50	10.00	19.92	9.92	110.05	4.71	12.5	12.5	1.0	115.02	277.63	42	1.0	198.0	663.14	12.5	12.5	44	10.00	3.20	1.94	117.5	614.5	1555.3	117.9	1058.6	**622.12**	**352.88**
12.50	15.50	14.00	3.00	13.00	20.00	10.00	132.49	9.43	12.5	12.5	1.0	276.94	554.57	44	1.0	414.9	1078.00	15.5	12.9	44	10.00	3.32	2.05	117.5	625.7	2258.3	153.2	1785.8	**903.33**	**595.26**
15.50	17.00	16.25	1.50	14.50	20.00	10.00	132.49	4.71	12.9	12.9	1.0	143.05	697.62	44	1.0	207.4	1285.43	17.0	29.7	0	10.63	20.58	21.71	117.5	1990.8	3973.9	170.9	2153.9	**1589.55**	**717.98**
17.00	18.50	17.75	1.50	16.00	20.63	10.63	132.49	4.71	29.7	29.7	1.0	356.26	1053.89	0	1.0	0.0	1285.43	18.5	10.8	45	10.63	2.71	1.45	117.5	574.0	2913.3	188.6	2527.9	**1165.32**	**842.63**
18.50	20.00	19.25	1.50	17.50	20.63	10.63	132.49	4.71	10.8	10.8	1.0	119.15	1173.03	45	1.0	212.1	1497.57	20.0	30.5	0	10.63	23.78	24.96	117.5	2299.3	4969.9	206.3	2876.9	**1987.96**	**958.95**
20.00	21.50	20.75	1.50	19.00	20.63	10.63	132.49	4.71	30.5	30.5	1.0	377.11	1550.15	0	1.0	0.0	1497.57	21.5	31.2	0	10.34	27.30	28.55	117.5	2636.5	5684.3	223.9	3271.6	**2273.71**	**1090.55**
21.50	23.00	22.25	1.50	20.50	20.34	10.34	132.49	4.71	31.2	31.2	1.1	400.96	1951.11	0	1.0	0.0	1497.57	23.0	29.6	3	10.34	20.36	21.48	117.5	1987.9	5436.5	241.6	3690.3	**2174.61**	**1230.10**
23.00	24.50	23.75	1.50	22.00	20.34	10.34	132.49	4.71	29.6	29.6	1.0	354.82	2305.93	3	1.0	14.1	1511.71	24.5	29.0	0	10.34	19.01	20.10	117.5	1836.3	5653.9	259.3	4076.9	**2261.58**	**1358.98**
24.50	27.50	26.00	3.00	25.00	20.34	10.34	132.49	9.43	29.0	29.0	1.0	692.44	2998.37	0	1.0	0.0	1511.71	27.5	29.0	0	10.64	19.01	20.10	117.5	1838.7	6348.7	294.6	4804.7	**2539.50**	**1601.58**
27.50	30.00	28.75	2.50	27.50	20.64	10.64	132.49	7.86	29.0	29.0	1.0	577.03	3575.40	0	1.0	0.0	1511.71	30.0	28.2	0	10.64	17.21	18.25	117.5	1664.7	6751.8	324.1	5411.2	**2700.71**	**1803.74**
30.00	30.50	30.25	0.50	28.00	20.64	10.64	132.49	1.57	28.2	28.2	1.0	111.64	3687.04	0	1.0	0.0	1511.71	30.5	28.2	0	10.64	17.21	18.25	117.5	1664.7	6863.4	330.0	5528.8	**2745.36**	**1842.92**
30.50	32.50	31.50	2.00	30.00	20.64	10.64	132.49	6.29	28.2	28.2	1.0	446.54	4133.58	0	1.0	0.0	1511.71	32.5	30.2	0	10.64	22.27	23.43	117.5	2153.5	7798.8	353.6	5998.9	**3119.50**	**1999.62**
32.50	33.50	33.00	1.00	31.00	20.64	10.64	132.49	3.14	30.2	30.2	1.0	244.77	4378.35	0	1.0	0.0	1511.71	33.5	32.7	0	10.64	34.86	36.24	117.5	3369.6	9259.7	365.4	6255.4	**3703.86**	**2085.14**
33.50	35.00	34.25	1.50	32.50	20.64	10.64	132.49	4.71	32.7	32.7	1.1	455.12	4833.46	0	1.0	0.0	1511.71	35.0	32.2	0	10.64	32.34	33.68	117.5	3126.4	9471.5	383.0	6728.2	**3788.62**	**2242.74**
35.00	36.50	35.75	1.50	34.00	20.64	10.64	132.49	4.71	32.2	32.2	1.1	436.60	5270.06	0	1.0	0.0	1511.71	36.5	32.2	0	8.88	32.34	33.68	117.5	3103.1	9884.9	400.7	7182.5	**3953.94**	**2394.16**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
36.50	37.50	37.00	1.00	35.00	18.88	8.88	132.49	3.14	32.2	32.2	1.1	291.06	5561.12	0	1.0	0.0	1511.71	37.5	32.2	0	8.88	32.34	33.68	117.5	3103.1	10175.9	412.5	7485.3	**4070.37**	**2495.11**
37.50	38.00	37.75	0.50	35.50	18.88	8.88	132.49	1.57	32.2	32.2	1.1	145.53	5706.65	0	1.0	0.0	1511.71	38.0	25.2	10	8.93	10.45	11.34	117.5	1075.2	8293.6	418.4	7636.8	**3317.43**	**2545.59**
38.00	40.00	39.00	2.00	37.50	18.93	8.93	132.49	6.29	25.2	25.2	1.0	391.88	6098.54	10	1.0	62.9	1574.57	40.0	25.2	10	8.93	10.45	11.34	117.5	1075.2	8748.3	442.0	8115.1	**3499.33**	**2705.02**
BORE NO: P103, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	20.00	10.00	27.50	1.57	24.3	24.3	1.0	19.51	0	0	1.0	0.0	0	3.0	26.5	4	10.00	13.38	14.34	30.0	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.50	20.00	10.00	35.00	3.14	26.5	26.5	1.0	54.84	0	4	1.0	12.6	0	4.0	26.5	4	10.00	13.38	14.34	40.0	505.1	505.1	17.7	17.7	**202.02**	**5.89**
4.00	5.00	4.50	1.00	2.50	20.00	10.00	45.00	3.14	26.5	26.5	1.0	70.51	70.51	4	1.0	12.6	12.57	5.0	26.5	4	10.10	13.38	14.34	50.0	610.7	693.8	29.5	112.5	**277.53**	**37.52**
5.00	6.00	5.50	1.00	3.50	20.10	10.10	55.05	3.14	26.5	26.5	1.0	86.26	156.78	4	1.0	12.6	25.14	6.0	26.5	4	10.10	13.38	14.34	60.1	716.9	898.8	41.3	223.2	**359.52**	**74.39**
6.00	7.00	6.50	1.00	4.50	20.10	10.10	65.15	3.14	26.5	26.5	1.0	102.09	258.86	4	1.0	12.6	37.71	7.0	10.5	49	10.60	2.62	1.36	70.2	496.5	793.1	53.0	349.6	**317.24**	**116.54**
7.00	9.00	8.00	2.00	6.50	20.60	10.60	80.80	6.29	10.5	10.5	1.0	94.13	352.99	49	1.0	308.0	345.71	9.0	10.5	49	10.60	2.62	1.36	91.4	540.1	1238.8	76.6	775.3	**495.53**	**258.44**
9.00	10.00	9.50	1.00	7.50	20.60	10.60	96.70	3.14	10.5	10.5	1.0	56.33	409.32	49	1.0	154.0	499.71	10.0	24.4	14	9.77	9.57	10.22	102.0	905.0	1814.1	88.4	997.4	**725.63**	**332.48**
10.00	12.50	11.25	2.50	10.00	19.77	9.77	114.21	7.86	24.4	24.4	1.0	407.07	816.39	14	1.0	110.0	609.71	12.5	24.4	14	10.59	9.57	10.22	126.4	1092.0	2518.1	117.9	1544.0	**1007.22**	**514.65**
12.50	15.50	14.00	3.00	13.00	20.59	10.59	142.31	9.43	24.4	24.4	1.0	608.66	1425.05	14	1.0	132.0	741.71	15.5	27.9	0	10.59	16.53	17.56	126.4	1715.1	3881.9	153.2	2320.0	**1552.75**	**773.33**
15.50	17.00	16.25	1.50	14.50	20.59	10.59	142.31	4.71	27.9	27.9	1.0	355.22	1780.27	0	1.0	0.0	741.71	17.0	10.5	54	10.69	2.62	1.36	126.4	647.5	3169.5	170.9	2692.9	**1267.81**	**897.63**
17.00	18.50	17.75	1.50	16.00	20.69	10.69	142.31	4.71	10.5	10.5	1.0	124.34	1904.61	54	1.0	254.6	996.29	18.5	28.6	0	10.69	18.11	19.17	126.4	1879.2	4780.0	188.6	3089.5	**1912.02**	**1029.82**
18.50	20.00	19.25	1.50	17.50	20.69	10.69	142.31	4.71	28.6	28.6	1.0	365.78	2270.39	0	1.0	0.0	996.29	20.0	11.0	51	10.40	2.76	1.51	126.4	641.4	3908.0	206.3	3472.9	**1563.21**	**1157.64**
20.00	21.50	20.75	1.50	19.00	20.40	10.40	142.31	4.71	11.0	11.0	1.0	130.41	2400.80	51	1.0	240.4	1236.71	21.5	11.0	51	10.40	2.76	1.51	126.4	641.4	4278.9	223.9	3861.4	**1711.55**	**1287.15**
21.50	23.00	22.25	1.50	20.50	20.40	10.40	142.31	4.71	11.0	11.0	1.0	130.41	2531.21	51	1.0	240.4	1477.14	23.0	27.5	2	9.57	15.63	16.64	126.4	1629.3	5637.6	241.6	4250.0	**2255.05**	**1416.65**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
23.00	24.50	23.75	1.50	22.00	19.57	9.57	142.31	4.71	27.5	27.5	1.0	349.24	2880.45	2	1.0	9.4	1486.57	24.5	31.0	0	9.57	26.30	27.53	126.4	2715.7	7082.7	259.3	4626.3	**2833.08**	**1542.10**
24.50	26.00	25.25	1.50	23.50	19.57	9.57	142.31	4.71	31.0	31.0	1.1	423.27	3303.72	0	1.0	0.0	1486.57	26.0	31.2	0	9.57	27.30	28.55	126.4	2819.6	7609.9	277.0	5067.3	**3043.96**	**1689.08**
26.00	27.50	26.75	1.50	25.00	19.57	9.57	142.31	4.71	31.2	31.2	1.1	430.68	3734.40	0	1.0	0.0	1486.57	27.5	31.2	0	9.13	27.30	28.55	126.4	2814.7	8035.6	294.6	5515.6	**3214.26**	**1838.54**
27.50	29.00	28.25	1.50	26.50	19.13	9.13	142.31	4.71	31.2	31.2	1.1	430.68	4165.09	0	1.0	0.0	1486.57	29.0	31.4	0	8.63	28.31	29.58	126.4	2912.6	8564.3	312.3	5964.0	**3425.71**	**1987.99**
29.00	30.00	29.50	1.00	27.50	18.63	8.63	142.31	3.14	31.4	31.4	1.1	292.12	4457.21	0	1.0	0.0	1486.57	30.0	31.4	0	8.63	28.31	29.58	126.4	2912.6	8856.4	324.1	6267.9	**3542.55**	**2089.29**
30.00	30.50	30.25	0.50	28.00	18.63	8.63	142.31	1.57	31.4	31.4	1.1	146.06	4603.27	0	1.0	0.0	1486.57	30.5	31.4	0	8.99	28.31	29.58	126.4	2916.8	9006.6	330.0	6419.8	**3602.65**	**2139.95**
30.50	32.00	31.25	1.50	29.50	18.99	8.99	142.31	4.71	31.4	31.4	1.1	438.18	5041.44	0	1.0	0.0	1486.57	32.0	27.0	18	8.97	14.50	15.49	126.4	1622.6	8150.6	347.7	6875.7	**3260.24**	**2291.90**
32.00	32.50	32.25	0.50	30.00	18.97	8.97	142.31	1.57	27.0	27.0	1.0	113.95	5155.39	18	1.0	28.3	1514.86	32.5	27.0	18	8.97	14.50	15.49	126.4	1622.6	8292.8	353.6	7023.8	**3317.13**	**2341.27**
32.50	33.50	33.00	1.00	31.00	18.97	8.97	142.31	3.14	27.0	27.0	1.0	227.89	5383.28	18	1.0	56.6	1571.43	33.5	12.5	60	8.72	3.20	1.94	126.4	749.2	7703.9	365.4	7320.1	**3081.56**	**2440.02**
33.50	35.00	34.25	1.50	32.50	18.72	8.72	142.31	4.71	12.5	12.5	1.0	148.73	5532.01	60	1.0	282.9	1854.29	35.0	14.0	60	8.82	3.65	2.36	126.4	795.0	8181.3	383.0	7769.3	**3272.54**	**2589.78**
35.00	36.50	35.75	1.50	34.00	18.82	8.82	142.31	4.71	14.0	14.0	1.0	167.27	5699.28	60	1.0	282.9	2137.14	36.5	14.0	60	8.34	3.65	2.36	126.4	794.6	8631.0	400.7	8237.1	**3452.41**	**2745.71**
36.50	37.50	37.00	1.00	35.00	18.34	8.34	142.31	3.14	14.0	14.0	1.0	111.51	5810.80	60	1.0	188.6	2325.71	37.5	18.0	60	8.34	5.42	4.29	126.4	976.3	9112.9	412.5	8549.0	**3645.14**	**2849.67**
37.50	38.00	37.75	0.50	35.50	18.34	8.34	142.31	1.57	18.0	18.0	1.0	72.66	5883.46	60	1.0	94.3	2420.00	38.0	18.0	60	8.72	5.42	4.29	126.4	977.0	9280.4	418.4	8721.9	**3712.18**	**2907.28**
38.00	40.00	39.00	2.00	37.50	18.72	8.72	142.31	6.29	18.0	18.0	1.0	290.65	6174.11	60	1.0	377.1	2797.14	40.0	18.0	125	8.72	5.42	4.29	126.4	1436.6	10407.9	442.0	9413.2	**4163.15**	**3137.74**
BORE NO: P104, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.80	9.80	26.95	1.57	25.8	25.8	1.0	20.47	0	0	1.0	0.0	0	3.0	25.4	0	9.03	10.90	11.80	29.4	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	5.00	4.00	2.00	2.50	19.03	9.03	38.43	6.29	25.4	25.4	1.0	114.70	0	0	1.0	0.0	0	5.0	24.6	0	9.03	9.71	10.44	47.5	399.2	399.2	29.5	29.5	**159.68**	**9.82**
5.00	6.00	5.50	1.00	3.50	19.03	9.03	51.98	3.14	24.6	24.6	1.0	74.79	74.79	0	1.0	0.0	0.00	6.0	11.1	50	11.01	2.79	1.53	56.5	484.2	559.0	41.3	116.0	**223.59**	**38.68**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
6.00	8.00	7.00	2.00	5.50	21.01	11.01	67.50	6.29	11.1	11.1	1.0	83.24	158.03	50	1.0	314.3	314.29	8.0	11.6	41	11.01	2.94	1.68	78.5	478.6	950.9	64.8	537.1	**380.35**	**179.05**
8.00	9.00	8.50	1.00	6.50	21.01	11.01	84.02	3.14	11.6	11.6	1.0	54.20	212.23	41	1.0	128.9	443.14	9.0	11.6	41	10.35	2.94	1.68	89.5	503.6	1158.9	76.6	732.0	**463.58**	**243.99**
9.00	11.00	10.00	2.00	8.50	20.35	10.35	99.87	6.29	11.6	11.6	1.0	128.86	341.09	41	1.0	257.7	700.86	11.0	6.2	86	10.35	1.79	0.63	110.2	765.4	1807.3	100.2	1142.1	**722.94**	**380.71**
11.00	12.00	11.50	1.00	9.50	20.35	10.35	115.40	3.14	6.2	6.2	1.0	39.40	380.49	86	1.0	270.3	971.14	12.0	10.0	84	9.88	2.47	1.22	120.6	832.7	2184.4	112.0	1463.6	**873.74**	**487.87**
12.00	14.50	13.25	2.50	12.00	19.88	9.88	132.92	7.86	10.0	10.0	1.0	184.15	564.64	84	1.0	660.0	1631.14	14.5	10.0	42	9.88	2.47	1.22	145.3	583.7	2779.4	141.4	2337.2	**1111.78**	**779.07**
14.50	16.00	15.25	1.50	13.50	19.88	9.88	132.92	4.71	10.0	10.0	1.0	110.49	675.13	42	1.0	198.0	1829.14	16.0	27.7	0	10.15	16.08	17.10	145.3	1903.6	4407.9	159.1	2663.4	**1763.14**	**887.79**
16.00	17.50	16.75	1.50	15.00	20.15	10.15	132.92	4.71	27.7	27.7	1.0	328.98	1004.11	0	1.0	0.0	1829.14	17.5	27.4	0	10.15	15.40	16.41	145.3	1823.7	4657.0	176.8	3010.0	**1862.79**	**1003.35**
17.50	19.00	18.25	1.50	16.50	20.15	10.15	132.92	4.71	27.4	27.4	1.0	324.81	1328.92	0	1.0	0.0	1829.14	19.0	15.3	43	10.15	4.09	2.81	145.3	781.9	3939.9	194.5	3352.5	**1575.97**	**1117.51**
19.00	20.50	19.75	1.50	18.00	20.15	10.15	132.92	4.71	15.3	15.3	1.0	171.42	1500.35	43	1.0	202.7	2031.86	20.5	25.5	9	9.81	11.13	12.03	145.3	1379.9	4912.1	212.1	3744.3	**1964.86**	**1248.12**
20.50	23.50	22.00	3.00	21.00	19.81	9.81	132.92	9.43	25.5	25.5	1.0	597.77	2098.12	9	1.0	84.9	2116.71	23.5	20.7	44	9.81	6.90	6.16	145.3	1122.9	5337.7	247.5	4462.3	**2135.09**	**1487.44**
23.50	25.00	24.25	1.50	22.50	19.81	9.81	132.92	4.71	20.7	20.7	1.0	236.78	2334.90	44	1.0	207.4	2324.14	25.0	29.6	0	10.07	20.36	21.48	145.3	2408.7	7067.8	265.2	4924.2	**2827.11**	**1641.41**
25.00	26.50	25.75	1.50	24.00	20.07	10.07	132.92	4.71	29.6	29.6	1.0	355.97	2690.87	0	1.0	0.0	2324.14	26.5	29.6	0	10.07	20.36	21.48	145.3	2408.7	7423.7	282.9	5297.9	**2969.50**	**1765.96**
26.50	27.50	27.00	1.00	25.00	20.07	10.07	132.92	3.14	29.6	29.6	1.0	237.31	2928.18	0	1.0	0.0	2324.14	27.5	29.1	2	9.71	19.23	20.33	145.3	2286.9	7539.3	294.6	5547.0	**3015.70**	**1848.99**
27.50	29.50	28.50	2.00	27.00	19.71	9.71	132.92	6.29	29.1	29.1	1.0	465.03	3393.21	2	1.0	12.6	2336.71	29.5	31.3	0	9.71	27.81	29.06	145.3	3284.9	9014.8	318.2	6048.1	**3605.94**	**2016.05**
29.50	30.00	29.75	0.50	27.50	19.71	9.71	132.92	1.57	31.3	31.3	1.1	135.25	3528.47	0	1.0	0.0	2336.71	30.0	31.7	0	9.71	29.82	31.11	145.3	3522.7	9387.9	324.1	6189.3	**3755.16**	**2063.10**
30.00	31.00	30.50	1.00	28.50	19.71	9.71	132.92	3.14	31.7	31.7	1.1	279.94	3808.40	0	1.0	0.0	2336.71	31.0	31.9	0	9.71	30.83	32.14	145.3	3641.6	9786.8	335.9	6481.0	**3914.70**	**2160.34**
31.00	32.50	31.75	1.50	30.00	19.71	9.71	132.92	4.71	31.9	31.9	1.1	427.09	4235.50	0	1.0	0.0	2336.71	32.5	32.5	0	9.09	33.85	35.22	145.3	3989.8	10562.0	353.6	6925.8	**4224.79**	**2308.59**
32.50	34.00	33.25	1.50	31.50	19.09	9.09	132.92	4.71	32.5	32.5	1.1	449.10	4684.60	0	1.0	0.0	2336.71	34.0	32.5	0	9.26	33.85	35.22	145.3	3992.1	11013.4	371.3	7392.6	**4405.38**	**2464.19**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
34.00	35.00	34.50	1.00	32.50	19.26	9.26	132.92	3.14	32.5	32.5	1.1	299.40	4984.00	0	1.0	0.0	2336.71	35.0	32.0	0	9.26	31.33	32.65	145.3	3695.3	11016.0	383.0	7703.8	**4406.41**	**2567.92**
35.00	35.50	35.25	0.50	33.00	19.26	9.26	132.92	1.57	32.0	32.0	1.1	143.57	5127.57	0	1.0	0.0	2336.71	35.5	33.2	0	9.28	37.38	38.80	145.3	4408.0	11872.3	388.9	7853.2	**4748.90**	**2617.74**
35.50	37.00	36.25	1.50	34.50	19.28	9.28	132.92	4.71	33.2	33.2	1.2	475.66	5603.23	0	1.0	0.0	2336.71	37.0	32.6	0	9.22	34.36	35.73	145.3	4050.9	11990.9	406.6	8346.6	**4796.35**	**2782.18**
37.00	37.50	37.25	0.50	35.00	19.22	9.22	132.92	1.57	32.6	32.6	1.1	150.95	5754.18	0	1.0	0.0	2336.71	37.5	30.5	0	9.22	23.78	24.96	145.3	2804.5	10895.4	412.5	8503.4	**4358.15**	**2834.46**
37.50	38.50	38.00	1.00	36.00	19.22	9.22	132.92	3.14	30.5	30.5	1.0	252.22	6006.40	0	1.0	0.0	2336.71	38.5	30.7	0	9.29	24.79	25.99	145.3	2923.9	11267.0	424.3	8767.4	**4506.81**	**2922.47**
38.50	40.00	39.25	1.50	37.50	19.29	9.29	132.92	4.71	30.7	30.7	1.0	385.08	6391.49	0	1.0	0.0	2336.71	40.0	30.7	0	9.29	24.79	25.99	145.3	2923.9	11652.1	442.0	9170.2	**4660.84**	**3056.72**
BORE NO: P105, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.67	9.67	26.59	1.57	12.7	12.7	1.0	9.42	0	23	1.0	36.1	0	3.0	25.4	0	9.67	10.90	11.80	29.0	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.50	19.67	9.67	33.85	3.14	25.4	25.4	1.0	50.51	0	0	1.0	0.0	0	4.0	28.6	2	10.25	18.11	19.17	38.7	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	5.00	4.50	1.00	2.50	20.25	10.25	43.81	3.14	28.6	28.6	1.0	75.06	0	2	1.0	6.3	0	5.0	28.5	0	10.25	17.88	18.94	48.9	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.50	20.25	10.25	54.06	3.14	28.5	28.5	1.0	92.24	0	0	1.0	0.0	0	6.0	28.5	0	9.37	17.88	18.94	59.2	0	0.0	41.3	41.3	**0.00**	**13.75**
6.00	8.00	7.00	2.00	5.50	19.37	9.37	68.55	6.29	28.5	28.5	1.0	233.95	0	0	1.0	0.0	0	8.0	10.2	46	9.37	2.53	1.28	77.9	0	0.0	64.8	64.8	**0.00**	**21.61**
8.00	9.00	8.50	1.00	6.50	19.37	9.37	82.61	3.14	10.2	10.2	1.0	46.71	0	46	1.0	144.6	0	9.0	14.3	23	9.37	3.74	2.45	87.3	0	0.0	76.6	76.6	**0.00**	**25.54**
9.00	10.00	9.50	1.00	7.50	19.37	9.37	91.98	3.14	14.3	14.3	1.0	73.68	0	23	1.0	72.3	0	10.0	6.8	24	10.08	1.89	0.73	96.7	0	0.0	88.4	88.4	**0.00**	**29.46**
10.00	11.00	10.50	1.00	8.50	20.08	10.08	101.70	3.14	6.8	6.8	1.0	38.11	0	24	1.0	75.4	0	11.0	9.5	62	10.08	2.38	1.14	106.7	0	0.0	100.2	100.2	**0.00**	**33.39**
11.00	12.00	11.50	1.00	9.50	20.08	10.08	111.78	3.14	9.5	9.5	1.0	58.79	0	62	1.0	194.9	0	12.0	11.9	55	10.08	3.03	1.76	116.8	0	0.0	112.0	112.0	**0.00**	**37.32**
12.00	13.00	12.50	1.00	10.50	20.08	10.08	121.86	3.14	11.9	11.9	1.0	80.71	0	55	1.0	172.9	0	13.0	9.4	54	9.96	2.36	1.13	126.9	0	0.0	123.8	123.8	**0.00**	**41.25**
13.00	14.50	13.75	1.50	12.00	19.96	9.96	134.37	4.71	9.4	9.4	1.0	104.87	0	54	1.0	254.6	0	14.5	12.8	45	9.66	3.29	2.02	141.8	692.7	692.7	141.4	141.4	**277.09**	**47.14**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
14.50	17.50	16.00	3.00	15.00	19.66	9.66	134.37	9.43	12.8	12.8	1.0	287.84	287.84	45	1.0	424.3	424.29	17.5	20.7	39	9.66	6.90	6.16	141.8	1068.6	1780.7	176.8	888.9	**712.28**	**296.30**
17.50	19.00	18.25	1.50	16.50	19.66	9.66	134.37	4.71	20.7	20.7	1.0	239.36	527.20	39	1.0	183.9	608.14	19.0	19.5	48	9.66	6.13	5.12	141.8	1042.5	2177.8	194.5	1329.8	**871.12**	**443.27**
19.00	20.50	19.75	1.50	18.00	19.66	9.66	134.37	4.71	19.5	19.5	1.0	224.32	751.52	48	1.0	226.3	834.43	20.5	11.2	48	10.50	2.82	1.56	141.8	660.5	2246.4	212.1	1798.1	**898.57**	**599.36**
20.50	23.50	22.00	3.00	21.00	20.50	10.50	134.37	9.43	11.2	11.2	1.0	250.86	1002.38	48	1.0	452.6	1287.00	23.5	11.2	48	10.50	2.82	1.56	141.8	660.5	2949.8	247.5	2536.9	**1179.94**	**845.63**
23.50	25.00	24.25	1.50	22.50	20.50	10.50	134.37	4.71	11.2	11.2	1.0	125.43	1127.80	48	1.0	226.3	1513.29	25.0	10.5	45	10.64	2.62	1.36	141.8	615.6	3256.7	265.2	2906.3	**1302.66**	**968.76**
25.00	26.50	25.75	1.50	24.00	20.64	10.64	134.37	4.71	10.5	10.5	1.0	117.40	1245.21	45	1.0	212.1	1725.43	26.5	29.2	0	10.64	19.46	20.56	141.8	2254.4	5225.1	282.9	3253.5	**2090.03**	**1084.50**
26.50	27.50	27.00	1.00	25.00	20.64	10.64	134.37	3.14	29.2	29.2	1.0	236.02	1481.23	0	1.0	0.0	1725.43	27.5	29.2	0	10.64	19.46	20.56	141.8	2254.4	5461.1	294.6	3501.3	**2184.44**	**1167.10**
27.50	28.00	27.75	0.50	25.50	20.64	10.64	134.37	1.57	29.2	29.2	1.0	118.01	1599.24	0	1.0	0.0	1725.43	28.0	11.0	48	11.02	2.76	1.51	141.8	654.0	3978.7	300.5	3625.2	**1591.46**	**1208.40**
28.00	29.50	28.75	1.50	27.00	21.02	11.02	134.37	4.71	11.0	11.0	1.0	123.13	1722.37	48	1.0	226.3	1951.71	29.5	30.0	0	11.02	21.26	22.40	141.8	2466.3	6140.3	318.2	3992.3	**2456.14**	**1330.77**
29.50	30.00	29.75	0.50	27.50	21.02	11.02	134.37	1.57	30.0	30.0	1.0	121.91	1844.28	0	1.0	0.0	1951.71	30.0	30.7	0	10.82	24.79	25.99	141.8	2872.7	6668.7	324.1	4120.1	**2667.49**	**1373.37**
30.00	32.50	31.25	2.50	30.00	20.82	10.82	134.37	7.86	30.7	30.7	1.0	648.81	2493.09	0	1.0	0.0	1951.71	32.5	10.3	55	10.82	2.56	1.31	141.8	679.6	5124.4	353.6	4798.4	**2049.75**	**1599.46**
32.50	34.00	33.25	1.50	31.50	20.82	10.82	134.37	4.71	10.3	10.3	1.0	115.12	2608.20	55	1.0	259.3	2211.00	34.0	25.2	15	10.82	10.45	11.34	141.8	1318.9	6138.1	371.3	5190.5	**2455.25**	**1730.15**
34.00	35.00	34.50	1.00	32.50	20.82	10.82	134.37	3.14	25.2	25.2	1.0	198.72	2806.93	15	1.0	47.1	2258.14	35.0	26.0	15	8.76	12.25	13.18	141.8	1516.9	6581.9	383.0	5448.1	**2632.77**	**1816.03**
35.00	35.50	35.25	0.50	33.00	18.76	8.76	134.37	1.57	26.0	26.0	1.0	102.99	2909.91	15	1.0	23.6	2281.71	35.5	28.0	0	8.72	16.76	17.79	141.8	1928.3	7119.9	388.9	5580.6	**2847.97**	**1860.19**
35.50	37.00	36.25	1.50	34.50	18.72	8.72	134.37	4.71	28.0	28.0	1.0	336.82	3246.73	0	1.0	0.0	2281.71	37.0	28.0	0	8.62	16.76	17.79	141.8	1927.6	7456.0	406.6	5935.0	**2982.42**	**1978.35**
37.00	37.50	37.25	0.50	35.00	18.62	8.62	134.37	1.57	28.0	28.0	1.0	112.27	3359.00	0	1.0	0.0	2281.71	37.5	29.4	0	8.62	19.91	21.02	141.8	2289.9	7930.6	412.5	6053.2	**3172.24**	**2017.74**
37.50	38.50	38.00	1.00	36.00	18.62	8.62	134.37	3.14	29.4	29.4	1.0	237.96	3596.96	0	1.0	0.0	2281.71	38.5	29.0	0	8.85	19.01	20.10	141.8	2188.2	8066.9	424.3	6303.0	**3226.74**	**2100.99**
38.50	40.00	39.25	1.50	37.50	18.85	8.85	134.37	4.71	29.0	29.0	1.0	351.13	3948.09	0	1.0	0.0	2281.71	40.0	29.0	0	8.85	19.01	20.10	141.8	2188.2	8418.0	442.0	6671.8	**3367.20**	**2223.92**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
BORE NO: P106, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.00	9.00	24.75	1.57	14.0	14.0	1.0	9.70	9.70	9	1.0	14.1	14.14	3.0	12.5	45	8.20	3.20	1.94	27.0	392.4	416.3	5.9	29.7	**166.50**	**9.91**
3.00	5.00	4.00	2.00	2.50	18.20	8.20	35.20	6.29	12.5	12.5	1.0	49.05	58.75	45	1.0	282.9	297.00	5.0	24.9	0	8.20	9.93	10.77	43.4	373.2	729.0	29.5	385.2	**291.60**	**128.40**
5.00	6.00	5.50	1.00	3.50	18.20	8.20	47.50	3.14	24.9	24.9	1.0	69.30	128.04	0	1.0	0.0	297.00	6.0	24.9	0	8.20	9.93	10.77	51.6	437.2	862.2	41.3	466.3	**344.90**	**155.43**
6.00	7.00	6.50	1.00	4.50	18.20	8.20	55.70	3.14	24.9	24.9	1.0	81.26	209.30	0	1.0	0.0	297.00	7.0	12.8	39	9.81	3.29	2.02	59.8	438.2	944.5	53.0	559.3	**377.81**	**186.45**
7.00	8.00	7.50	1.00	5.50	19.81	9.81	64.71	3.14	12.8	12.8	1.0	46.20	255.51	39	1.0	122.6	419.57	8.0	8.6	47	9.81	2.22	1.00	69.6	457.5	1132.6	64.8	739.9	**453.05**	**246.63**
8.00	9.00	8.50	1.00	6.50	19.81	9.81	74.52	3.14	8.6	8.6	1.0	35.42	290.92	47	1.0	147.7	567.29	9.0	8.6	47	9.81	2.22	1.00	79.4	474.6	1332.8	76.6	934.8	**533.14**	**311.61**
9.00	10.00	9.50	1.00	7.50	19.81	9.81	84.33	3.14	8.6	8.6	1.0	40.08	331.00	47	1.0	147.7	715.00	10.0	8.5	54	10.60	2.20	0.99	89.2	540.2	1586.2	88.4	1134.4	**634.49**	**378.13**
10.00	11.00	10.50	1.00	8.50	20.60	10.60	94.53	3.14	8.5	8.5	1.0	44.40	375.41	54	1.0	169.7	884.71	11.0	9.0	52	10.60	2.29	1.07	99.8	551.8	1811.9	100.2	1360.3	**724.76**	**453.43**
11.00	12.00	11.50	1.00	9.50	20.60	10.60	105.13	3.14	9.0	9.0	1.0	52.33	427.74	52	1.0	163.4	1048.14	12.0	9.8	74	10.47	2.43	1.19	110.4	739.4	2215.2	112.0	1587.8	**886.10**	**529.28**
12.00	14.50	13.25	2.50	12.00	20.47	10.47	123.52	7.86	9.8	9.8	1.0	167.63	595.37	74	1.0	581.4	1629.57	14.5	9.8	74	10.47	2.43	1.19	136.6	789.4	3014.4	141.4	2366.4	**1205.75**	**788.79**
14.50	16.00	15.25	1.50	13.50	20.47	10.47	123.52	4.71	9.8	9.8	1.0	100.58	695.95	74	1.0	348.9	1978.43	16.0	21.2	38	9.80	7.26	6.71	136.6	1074.2	3748.6	159.1	2833.5	**1499.43**	**944.50**
16.00	17.50	16.75	1.50	15.00	19.80	9.80	123.52	4.71	21.2	21.2	1.0	225.86	921.81	38	1.0	179.1	2157.57	17.5	26.5	4	9.19	13.38	14.34	136.6	1515.9	4595.3	176.8	3256.2	**1838.12**	**1085.39**
17.50	20.50	19.00	3.00	18.00	19.19	9.19	123.52	9.43	26.5	26.5	1.0	580.64	1502.45	4	1.0	37.7	2195.29	20.5	28.4	0	9.19	17.66	18.71	136.6	1962.7	5660.4	212.1	3909.9	**2264.17**	**1303.29**
20.50	22.00	21.25	1.50	19.50	19.19	9.19	123.52	4.71	28.4	28.4	1.0	314.85	1817.30	0	1.0	0.0	2195.29	22.0	18.5	44	9.19	5.64	4.57	136.6	933.2	4945.8	229.8	4242.4	**1978.32**	**1414.14**
22.00	23.50	22.75	1.50	21.00	19.19	9.19	123.52	4.71	18.5	18.5	1.0	194.83	2012.13	44	1.0	207.4	2402.71	23.5	27.0	7	9.80	14.50	15.49	136.6	1665.9	6080.7	247.5	4662.3	**2432.28**	**1554.12**
23.50	26.50	25.00	3.00	24.00	19.80	9.80	123.52	9.43	27.0	27.0	1.0	593.39	2605.52	7	1.0	66.0	2468.71	26.5	27.0	0	9.80	14.50	15.49	136.6	1616.4	6690.6	282.9	5357.1	**2676.24**	**1785.70**
26.50	27.50	27.00	1.00	25.00	19.80	9.80	123.52	3.14	27.0	27.0	1.0	197.80	2803.32	0	1.0	0.0	2468.71	27.5	27.0	0	9.80	14.50	15.49	136.6	1616.4	6888.4	294.6	5566.7	**2755.36**	**1855.56**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
27.50	29.50	28.50	2.00	27.00	19.80	9.80	123.52	6.29	27.0	27.0	1.0	395.59	3198.91	0	1.0	0.0	2468.71	29.5	17.3	40	8.34	5.07	3.91	136.6	840.0	6507.6	318.2	5985.8	**2603.06**	**1995.28**
29.50	30.00	29.75	0.50	27.50	18.34	8.34	123.52	1.57	17.3	17.3	1.0	60.46	3259.37	40	1.0	62.9	2531.57	30.0	17.0	40	10.15	4.92	3.75	136.6	826.3	6617.2	324.1	6115.0	**2646.90**	**2038.35**
30.00	31.00	30.50	1.00	28.50	20.15	10.15	123.52	3.14	17.0	17.0	1.0	118.68	3378.05	40	1.0	125.7	2657.29	31.0	11.2	55	10.15	2.82	1.56	136.6	698.1	6733.5	335.9	6371.2	**2693.39**	**2123.74**
31.00	32.50	31.75	1.50	30.00	20.15	10.15	123.52	4.71	11.2	11.2	1.0	115.30	3493.35	55	1.0	259.3	2916.57	32.5	11.2	55	10.15	2.82	1.56	136.6	698.1	7108.1	353.6	6763.5	**2843.22**	**2254.50**
32.50	35.00	33.75	2.50	32.50	20.15	10.15	123.52	7.86	11.2	11.2	1.0	192.16	3685.51	55	1.0	432.1	3348.71	35.0	10.5	55	10.15	2.62	1.36	136.6	675.3	7709.5	383.0	7417.3	**3083.79**	**2472.42**
35.00	35.50	35.25	0.50	33.00	20.15	10.15	123.52	1.57	10.5	10.5	1.0	35.97	3721.49	55	1.0	86.4	3435.14	35.5	10.5	55	10.15	2.62	1.36	136.6	675.3	7831.9	388.9	7545.6	**3132.75**	**2515.19**
35.50	37.50	36.50	2.00	35.00	20.15	10.15	123.52	6.29	10.5	10.5	1.0	143.90	3865.38	55	1.0	345.7	3780.86	37.5	10.5	55	8.76	2.62	1.36	136.6	674.5	8320.8	412.5	8058.7	**3328.30**	**2686.25**
37.50	38.50	38.00	1.00	36.00	18.76	8.76	123.52	3.14	10.5	10.5	1.0	71.95	3937.33	55	1.0	172.9	3953.71	38.5	10.0	60	8.61	2.47	1.22	136.6	693.5	8584.6	424.3	8315.3	**3433.83**	**2771.78**
38.50	40.00	39.25	1.50	37.50	18.61	8.61	123.52	4.71	10.0	10.0	1.0	102.67	4040.01	60	1.0	282.9	4236.57	40.0	10.0	60	8.61	2.47	1.22	136.6	693.5	8970.1	442.0	8718.5	**3588.04**	**2906.18**
BORE NO: P111, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	20.04	10.04	27.61	1.57	26.5	26.5	1.0	21.63	21.63	7	1.0	11.0	11.00	3.0	25.9	0	10.04	12.03	12.95	30.1	335.7	368.3	5.9	38.5	**147.34**	**12.84**
3.00	4.00	3.50	1.00	1.50	20.04	10.04	35.14	3.14	25.9	25.9	1.0	53.63	75.26	0	1.0	0.0	11.00	4.0	25.9	0	10.04	12.03	12.95	40.2	430.6	516.8	17.7	103.9	**206.74**	**34.65**
4.00	5.00	4.50	1.00	2.50	20.04	10.04	45.18	3.14	25.9	25.9	1.0	68.95	144.21	0	1.0	0.0	11.00	5.0	11.1	37	9.65	2.79	1.53	50.2	377.6	532.8	29.5	184.7	**213.14**	**61.56**
5.00	6.00	5.50	1.00	3.50	19.65	9.65	55.03	3.14	11.1	11.1	1.0	33.93	178.14	37	1.0	116.3	127.29	6.0	11.2	46	9.65	2.82	1.56	59.9	464.0	769.4	41.3	346.7	**307.75**	**115.56**
6.00	7.00	6.50	1.00	4.50	19.65	9.65	64.68	3.14	11.2	11.2	1.0	40.25	218.38	46	1.0	144.6	271.86	7.0	29.5	0	9.81	20.13	21.25	69.5	1181.3	1671.6	53.0	543.3	**668.63**	**181.09**
7.00	9.00	8.00	2.00	6.50	19.81	9.81	79.31	6.29	29.5	29.5	1.0	282.05	500.43	0	1.0	0.0	271.86	9.0	13.0	48	9.81	3.35	2.08	89.1	582.0	1354.3	76.6	848.9	**541.72**	**282.97**
9.00	10.00	9.50	1.00	7.50	19.81	9.81	94.03	3.14	13.0	13.0	1.0	68.22	568.66	48	1.0	150.9	422.71	10.0	11.0	50	10.14	2.76	1.51	98.9	574.4	1565.8	88.4	1079.8	**626.32**	**359.92**
10.00	12.50	11.25	2.50	10.00	20.14	10.14	111.61	7.86	11.0	11.0	1.0	170.45	739.11	50	1.0	392.9	815.57	12.5	9.5	58	10.47	2.38	1.14	124.3	647.2	2201.9	117.9	1672.5	**880.77**	**557.51**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
12.50	15.50	14.00	3.00	13.00	20.47	10.47	139.99	9.43	9.5	9.5	1.0	220.87	959.98	58	1.0	546.9	1362.43	15.5	10.4	56	10.30	2.59	1.33	124.3	654.1	2976.5	153.2	2475.6	**1190.59**	**825.21**
15.50	18.50	17.00	3.00	16.00	20.30	10.30	139.99	9.43	10.4	10.4	1.0	242.24	1202.22	56	1.0	528.0	1890.43	18.5	23.0	46	10.30	8.56	8.68	124.3	1196.3	4288.9	188.6	3281.2	**1715.58**	**1093.74**
18.50	20.00	19.25	1.50	17.50	20.30	10.30	139.99	4.71	23.0	23.0	1.0	280.12	1482.34	46	1.0	216.9	2107.29	20.0	32.3	0	10.30	32.85	34.19	124.3	3345.7	6935.3	206.3	3795.9	**2774.12**	**1265.29**
20.00	21.50	20.75	1.50	19.00	20.30	10.30	139.99	4.71	32.3	32.3	1.1	465.17	1947.51	0	1.0	0.0	2107.29	21.5	32.3	0	10.68	32.85	34.19	124.3	3350.8	7405.6	223.9	4278.7	**2962.23**	**1426.24**
21.50	24.50	23.00	3.00	22.00	20.68	10.68	139.99	9.43	32.3	32.3	1.1	930.33	2877.84	0	1.0	0.0	2107.29	24.5	30.4	0	10.68	23.27	24.45	124.3	2375.3	7360.4	259.3	5244.4	**2944.17**	**1748.14**
24.50	26.00	25.25	1.50	23.50	20.68	10.68	139.99	4.71	30.4	30.4	1.0	394.92	3272.76	0	1.0	0.0	2107.29	26.0	32.5	0	10.68	33.85	35.22	124.3	3453.5	8833.5	277.0	5657.0	**3533.40**	**1885.67**
26.00	27.50	26.75	1.50	25.00	20.68	10.68	139.99	4.71	32.5	32.5	1.1	472.97	3745.73	0	1.0	0.0	2107.29	27.5	32.3	0	8.04	32.85	34.19	124.3	3315.3	9168.3	294.6	6147.7	**3667.34**	**2049.22**
27.50	29.00	28.25	1.50	26.50	18.04	8.04	139.99	4.71	32.3	32.3	1.1	465.17	4210.90	0	1.0	0.0	2107.29	29.0	32.3	0	8.40	32.85	34.19	124.3	3320.2	9638.3	312.3	6630.5	**3855.34**	**2210.17**
29.00	30.00	29.50	1.00	27.50	18.40	8.40	139.99	3.14	32.3	32.3	1.1	310.11	4521.01	0	1.0	0.0	2107.29	30.0	32.3	0	8.40	32.85	34.19	124.3	3320.2	9948.5	324.1	6952.4	**3979.38**	**2317.47**
30.00	30.50	30.25	0.50	28.00	18.40	8.40	139.99	1.57	32.3	32.3	1.1	155.06	4676.07	0	1.0	0.0	2107.29	30.5	32.3	0	8.39	32.85	34.19	124.3	3320.0	10103.4	330.0	7113.4	**4041.35**	**2371.12**
30.50	32.00	31.25	1.50	29.50	18.39	8.39	139.99	4.71	32.3	32.3	1.1	465.17	5141.24	0	1.0	0.0	2107.29	32.0	32.3	0	9.03	32.85	34.19	124.3	3328.6	10577.1	347.7	7596.2	**4230.85**	**2532.07**
32.00	32.50	32.25	0.50	30.00	19.03	9.03	139.99	1.57	32.3	32.3	1.1	155.06	5296.29	0	1.0	0.0	2107.29	32.5	32.3	0	9.03	32.85	34.19	124.3	3328.6	10732.2	353.6	7757.1	**4292.88**	**2585.72**
32.50	33.50	33.00	1.00	31.00	19.03	9.03	139.99	3.14	32.3	32.3	1.1	310.11	5606.40	0	1.0	0.0	2107.29	33.5	32.3	0	8.99	32.85	34.19	124.3	3328.1	11041.8	365.4	8079.0	**4416.71**	**2693.01**
33.50	35.00	34.25	1.50	32.50	18.99	8.99	139.99	4.71	32.3	32.3	1.1	465.17	6071.57	0	1.0	0.0	2107.29	35.0	32.9	0	8.83	35.87	37.27	124.3	3631.7	11810.6	383.0	8561.9	**4724.24**	**2853.96**
35.00	36.50	35.75	1.50	34.00	18.83	8.83	139.99	4.71	32.9	32.9	1.1	488.83	6560.40	0	1.0	0.0	2107.29	36.5	32.9	0	8.85	35.87	37.27	124.3	3632.0	12299.7	400.7	9068.4	**4919.89**	**3022.80**
36.50	37.50	37.00	1.00	35.00	18.85	8.85	139.99	3.14	32.9	32.9	1.1	325.89	6886.29	0	1.0	0.0	2107.29	37.5	32.9	0	8.85	35.87	37.27	124.3	3632.0	12625.6	412.5	9406.1	**5050.24**	**3135.36**
37.50	38.00	37.75	0.50	35.50	18.85	8.85	139.99	1.57	32.9	32.9	1.1	162.94	7049.23	0	1.0	0.0	2107.29	38.0	19.5	45	8.66	6.13	5.12	124.3	934.6	10091.1	418.4	9574.9	**4036.45**	**3191.64**
38.00	40.00	39.00	2.00	37.50	18.66	8.66	139.99	6.29	19.5	19.5	1.0	311.59	7360.82	45	1.0	282.9	2390.14	40.0	19.0	45	8.61	5.87	4.84	124.3	907.6	10658.6	442.0	10192.9	**4263.42**	**3397.64**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 1.13 m^2

Layers (m)										Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	N_γ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
BORE NO: P101 CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	20.30	10.30	28.33	1.89	23.3	23.3	1.0	23.00	0	0	1.0	0.0	0	3.0	24.8	0	10.30	9.86	10.66	30.9	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.50	20.30	10.30	36.05	3.77	24.8	24.8	1.0	62.82	0	0	1.0	0.0	0	4.0	26.6	8	9.58	13.60	14.57	41.2	0	0.0	25.5	25.5	**0.00**	**8.49**
4.00	5.00	4.50	1.00	2.50	19.58	9.58	45.99	3.77	26.6	26.6	1.0	86.86	0	8	1.0	30.2	0	5.0	26.3	0	9.58	12.93	13.88	50.8	833.0	833.0	42.4	42.4	**333.19**	**14.14**
5.00	6.00	5.50	1.00	3.50	19.58	9.58	55.57	3.77	26.3	26.3	1.0	103.58	103.58	0	1.0	0.0	0.00	6.0	9.5	48	9.58	2.38	1.14	60.4	658.7	762.3	59.4	163.0	**304.93**	**54.33**
6.00	7.00	6.50	1.00	4.50	19.58	9.58	65.15	3.77	9.5	9.5	1.0	41.12	144.70	48	1.0	181.0	181.03	7.0	9.5	48	10.61	2.38	1.14	69.9	685.3	1011.1	76.4	402.1	**404.43**	**134.03**
7.00	8.00	7.50	1.00	5.50	20.61	10.61	75.25	3.77	9.5	9.5	1.0	47.49	192.19	48	1.0	181.0	362.06	8.0	26.0	6	10.61	12.25	13.18	80.6	1272.7	1826.9	93.3	647.6	**730.76**	**215.86**
8.00	9.00	8.50	1.00	6.50	20.61	10.61	85.86	3.77	26.0	26.0	1.0	157.93	350.11	6	1.0	22.6	384.69	9.0	26.0	6	10.40	12.25	13.18	91.2	1417.9	2152.6	110.3	845.1	**861.06**	**281.70**
9.00	11.00	10.00	2.00	8.50	20.40	10.40	101.56	7.54	26.0	26.0	1.0	373.63	723.74	6	1.0	45.3	429.94	11.0	9.5	45	10.40	2.38	1.14	112.0	767.8	1921.5	144.3	1297.9	**768.59**	**432.65**
11.00	12.00	11.50	1.00	9.50	20.40	10.40	117.16	3.77	9.5	9.5	1.0	73.94	797.68	45	1.0	169.7	599.66	12.0	9.5	45	10.53	2.38	1.14	122.4	795.9	2193.2	161.2	1558.6	**877.29**	**519.52**
12.00	14.50	13.25	2.50	12.00	20.53	10.53	135.52	9.43	9.5	9.5	1.0	213.83	1011.51	45	1.0	424.3	1023.94	14.5	9.5	45	10.53	2.38	1.14	148.7	866.8	2902.2	203.7	2239.1	**1160.89**	**746.37**
14.50	16.00	15.25	1.50	13.50	20.53	10.53	156.58	5.66	9.5	9.5	1.0	148.23	1159.74	45	1.0	254.6	1278.51	16.0	13.0	43	10.55	3.35	2.08	164.5	1076.2	3514.4	229.1	2667.4	**1405.77**	**889.12**
16.00	17.50	16.75	1.50	15.00	20.55	10.55	172.39	5.66	13.0	13.0	1.0	225.15	1384.90	43	1.0	243.3	1521.77	17.5	13.0	43	10.55	3.35	2.08	180.3	1136.2	4042.8	254.6	3161.2	**1617.13**	**1053.75**
17.50	19.00	18.25	1.50	16.50	20.55	10.55	172.39	5.66	13.0	13.0	1.0	225.15	1610.05	43	1.0	243.3	1765.03	19.0	32.1	0	8.89	31.84	33.16	180.3	6695.2	10070.3	280.0	3655.1	**4028.11**	**1218.37**
19.00	20.50	19.75	1.50	18.00	18.89	8.89	172.39	5.66	32.1	32.1	1.1	676.01	2286.06	0	1.0	0.0	1765.03	20.5	32.1	0	8.89	31.84	33.16	180.3	6695.2	10746.3	305.5	4356.6	**4298.52**	**1452.19**
20.50	22.00	21.25	1.50	19.50	18.89	8.89	172.39	5.66	32.1	32.1	1.1	676.01	2962.07	0	1.0	0.0	1765.03	22.0	13.0	47	9.71	3.35	2.08	180.3	1175.7	5902.8	330.9	5058.0	**2361.12**	**1686.01**
22.00	23.50	22.75	1.50	21.00	19.71	9.71	172.39	5.66	13.0	13.0	1.0	225.15	3187.22	47	1.0	265.9	2030.91	23.5	13.0	47	9.71	3.35	2.08	180.3	1175.7	6393.8	356.4	5574.5	**2557.53**	**1858.18**
23.50	25.00	24.25	1.50	22.50	19.71	9.71	172.39	5.66	13.0	13.0	1.0	225.15	3412.38	47	1.0	265.9	2296.80	25.0	29.6	0	10.05	20.36	21.48	180.3	4299.8	10008.9	381.9	6091.0	**4003.58**	**2030.34**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 1.13 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
25.00	26.50	25.75	1.50	24.00	20.05	10.05	172.39	5.66	29.6	29.6	1.0	554.02	3966.40	0	1.0	0.0	2296.80	26.5	29.0	0	10.05	19.01	20.10	180.3	4014.7	10277.9	407.3	6670.5	**4111.16**	**2223.50**
26.50	27.50	27.00	1.00	25.00	20.05	10.05	172.39	3.77	29.0	29.0	1.0	360.39	4326.79	0	1.0	0.0	2296.80	27.5	29.0	0	10.05	19.01	20.10	180.3	4014.7	10638.3	424.3	7047.9	**4255.32**	**2349.29**
27.50	29.50	28.50	2.00	27.00	20.05	10.05	172.39	7.54	29.0	29.0	1.0	720.79	5047.57	0	1.0	0.0	2296.80	29.5	27.2	0	8.72	14.95	15.95	180.3	3145.1	10489.5	458.2	7802.6	**4195.79**	**2600.87**
29.50	30.00	29.75	0.50	27.50	18.72	8.72	172.39	1.89	27.2	27.2	1.0	167.07	5214.64	0	1.0	0.0	2296.80	30.0	27.2	0	10.43	14.95	15.95	180.3	3163.6	10675.1	466.7	7978.2	**4270.02**	**2659.39**
30.00	31.00	30.50	1.00	28.50	20.43	10.43	172.39	3.77	27.2	27.2	1.0	334.14	5548.78	0	1.0	0.0	2296.80	31.0	12.8	56	10.43	3.29	2.02	180.3	1256.0	9101.6	483.7	8329.3	**3640.65**	**2776.42**
31.00	32.50	31.75	1.50	30.00	20.43	10.43	172.39	5.66	12.8	12.8	1.0	221.57	5770.36	56	1.0	316.8	2613.60	32.5	12.8	56	10.43	3.29	2.02	180.3	1256.0	9640.0	509.1	8893.1	**3856.00**	**2964.37**
32.50	35.00	33.75	2.50	32.50	20.43	10.43	172.39	9.43	12.8	12.8	1.0	369.29	6139.64	56	1.0	528.0	3141.60	35.0	12.3	49	10.43	3.15	1.88	180.3	1154.0	10435.2	551.6	9832.8	**4174.08**	**3277.60**
35.00	35.50	35.25	0.50	33.00	20.43	10.43	172.39	1.89	12.3	12.3	1.0	70.88	6210.52	49	1.0	92.4	3234.00	35.5	30.0	0	10.43	21.26	22.40	180.3	4495.6	13940.1	560.1	10004.6	**5576.05**	**3334.86**
35.50	37.00	36.25	1.50	34.50	20.43	10.43	172.39	5.66	30.0	30.0	1.0	563.06	6773.58	0	1.0	0.0	3234.00	37.0	30.0	0	10.49	21.26	22.40	180.3	4496.5	14504.1	585.5	10593.1	**5801.63**	**3531.03**
37.00	37.50	37.25	0.50	35.00	20.49	10.49	172.39	1.89	30.0	30.0	1.0	187.69	6961.27	0	1.0	0.0	3234.00	37.5	30.0	0	10.49	21.26	22.40	180.3	4496.5	14691.8	594.0	10789.3	**5876.71**	**3596.42**
37.50	38.50	38.00	1.00	36.00	20.49	10.49	172.39	3.77	30.0	30.0	1.0	375.37	7336.64	0	1.0	0.0	3234.00	38.5	30.0	0	10.49	21.26	22.40	180.3	4496.5	15067.1	611.0	11181.6	**6026.86**	**3727.20**
38.50	40.00	39.25	1.50	37.50	20.49	10.49	172.39	5.66	30.0	30.0	1.0	563.06	7899.70	0	1.0	0.0	3234.00	40.0	30.0	0	10.49	21.26	22.40	180.3	4496.5	15630.2	636.4	11770.1	**6252.08**	**3923.38**
BORE NO: P102, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.64	9.64	26.51	1.89	27.2	27.2	1.0	25.69	0	11	1.0	20.7	0	3.0	24.8	0	9.64	9.86	10.66	28.9	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.50	19.64	9.64	33.74	3.77	24.8	24.8	1.0	58.80	0	0	1.0	0.0	0	4.0	27.0	0	8.85	14.50	15.49	38.6	0	0.0	25.5	25.5	**0.00**	**8.49**
4.00	6.00	5.00	2.00	3.50	18.85	8.85	47.41	7.54	27.0	27.0	1.0	182.21	0	0	1.0	0.0	0	6.0	27.2	0	8.85	14.95	15.95	56.3	0	0.0	59.4	59.4	**0.00**	**19.80**
6.00	7.00	6.50	1.00	4.50	18.85	8.85	60.69	3.77	27.2	27.2	1.0	117.62	0	0	1.0	0.0	0	7.0	27.2	0	8.85	14.95	15.95	65.1	0	0.0	76.4	76.4	**0.00**	**25.46**
7.00	8.00	7.50	1.00	5.50	18.85	8.85	69.54	3.77	27.2	27.2	1.0	134.78	0	0	1.0	0.0	0	8.0	10.2	53	9.55	2.53	1.28	74.0	759.6	759.6	93.3	93.3	**303.83**	**31.11**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 1.13 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	N_γ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
8.00	9.00	8.50	1.00	6.50	19.55	9.55	78.74	3.77	10.2	10.2	1.0	53.43	53.43	53	1.0	199.9	199.89	9.0	10.2	53	9.55	2.53	1.28	83.5	786.9	1040.2	110.3	363.6	**416.09**	**121.21**
9.00	10.00	9.50	1.00	7.50	19.55	9.55	88.29	3.77	10.2	10.2	1.0	59.91	113.34	53	1.0	199.9	399.77	10.0	12.5	42	9.55	3.20	1.94	93.1	777.6	1290.7	127.3	640.4	**516.27**	**213.46**
10.00	11.00	10.50	1.00	8.50	19.55	9.55	97.84	3.77	12.5	12.5	1.0	81.80	195.14	42	1.0	158.4	558.17	11.0	12.5	42	9.92	3.20	1.94	102.6	812.7	1566.0	144.3	897.6	**626.40**	**299.19**
11.00	12.50	11.75	1.50	10.00	19.92	9.92	110.05	5.66	12.5	12.5	1.0	138.02	333.16	42	1.0	237.6	795.77	12.5	12.5	44	10.00	3.20	1.94	117.5	887.1	2016.0	169.7	1298.6	**806.41**	**432.88**
12.50	15.50	14.00	3.00	13.00	20.00	10.00	132.49	11.31	12.5	12.5	1.0	332.33	665.49	44	1.0	497.8	1293.60	15.5	12.9	44	10.00	3.32	2.05	147.5	1016.1	2975.2	220.6	2179.7	**1190.08**	**726.57**
15.50	17.00	16.25	1.50	14.50	20.00	10.00	154.99	5.66	12.9	12.9	1.0	200.81	866.30	44	1.0	248.9	1542.51	17.0	29.7	0	10.63	20.58	21.71	162.5	3940.9	6349.7	246.1	2654.9	**2539.90**	**884.97**
17.00	18.50	17.75	1.50	16.00	20.63	10.63	170.46	5.66	29.7	29.7	1.0	550.04	1416.34	0	1.0	0.0	1542.51	18.5	10.8	45	10.63	2.71	1.45	162.5	966.0	3924.9	271.5	3230.4	**1569.95**	**1076.80**
18.50	20.00	19.25	1.50	17.50	20.63	10.63	170.46	5.66	10.8	10.8	1.0	183.96	1600.30	45	1.0	254.6	1797.09	20.0	30.5	0	10.63	23.78	24.96	162.5	4551.7	7949.1	297.0	3694.4	**3179.62**	**1231.46**
20.00	21.50	20.75	1.50	19.00	20.63	10.63	170.46	5.66	30.5	30.5	1.0	582.24	2182.53	0	1.0	0.0	1797.09	21.5	31.2	0	10.34	27.30	28.55	162.5	5220.2	9199.8	322.5	4302.1	**3679.94**	**1434.03**
21.50	23.00	22.25	1.50	20.50	20.34	10.34	170.46	5.66	31.2	31.2	1.1	619.06	2801.60	0	1.0	0.0	1797.09	23.0	29.6	3	10.34	20.36	21.48	162.5	3924.2	8522.9	347.9	4946.6	**3409.15**	**1648.87**
23.00	24.50	23.75	1.50	22.00	20.34	10.34	170.46	5.66	29.6	29.6	1.0	547.82	3349.41	3	1.0	17.0	1814.06	24.5	29.0	0	10.34	19.01	20.10	162.5	3635.5	8799.0	373.4	5536.8	**3519.60**	**1845.61**
24.50	27.50	26.00	3.00	25.00	20.34	10.34	170.46	11.31	29.0	29.0	1.0	1069.07	4418.49	0	1.0	0.0	1814.06	27.5	29.0	0	10.64	19.01	20.10	162.5	3639.6	9872.2	424.3	6656.8	**3948.87**	**2218.94**
27.50	30.00	28.75	2.50	27.50	20.64	10.64	170.46	9.43	29.0	29.0	1.0	890.90	5309.38	0	1.0	0.0	1814.06	30.0	28.2	0	10.64	17.21	18.25	162.5	3295.1	10418.5	466.7	7590.2	**4167.42**	**2530.05**
30.00	30.50	30.25	0.50	28.00	20.64	10.64	170.46	1.89	28.2	28.2	1.0	172.36	5481.74	0	1.0	0.0	1814.06	30.5	28.2	0	10.64	17.21	18.25	162.5	3295.1	10590.9	475.2	7771.0	**4236.36**	**2590.33**
30.50	32.50	31.50	2.00	30.00	20.64	10.64	170.46	7.54	28.2	28.2	1.0	689.43	6171.16	0	1.0	0.0	1814.06	32.5	30.2	0	10.64	22.27	23.43	162.5	4262.9	12248.1	509.1	8494.4	**4899.25**	**2831.45**
32.50	33.50	33.00	1.00	31.00	20.64	10.64	170.46	3.77	30.2	30.2	1.0	377.91	6549.07	0	1.0	0.0	1814.06	33.5	32.7	0	10.64	34.86	36.24	162.5	6670.7	15033.9	526.1	8889.2	**6013.55**	**2963.08**
33.50	35.00	34.25	1.50	32.50	20.64	10.64	170.46	5.66	32.7	32.7	1.1	702.67	7251.74	0	1.0	0.0	1814.06	35.0	32.2	0	10.64	32.34	33.68	162.5	6189.2	15255.0	551.6	9617.4	**6101.99**	**3205.79**
35.00	36.50	35.75	1.50	34.00	20.64	10.64	170.46	5.66	32.2	32.2	1.1	674.07	7925.81	0	1.0	0.0	1814.06	36.5	32.2	0	8.88	32.34	33.68	162.5	6148.9	15888.8	577.0	10316.9	**6355.52**	**3438.97**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 1.13 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
36.50	37.50	37.00	1.00	35.00	18.88	8.88	170.46	3.77	32.2	32.2	1.1	449.38	8375.19	0	1.0	0.0	1814.06	37.5	32.2	0	8.88	32.34	33.68	162.5	6148.9	16338.2	594.0	10783.3	**6535.27**	**3594.42**
37.50	38.00	37.75	0.50	35.50	18.88	8.88	170.46	1.89	32.2	32.2	1.1	224.69	8599.88	0	1.0	0.0	1814.06	38.0	25.2	10	8.93	10.45	11.34	162.5	2091.8	12505.8	602.5	11016.4	**5002.31**	**3672.14**
38.00	40.00	39.00	2.00	37.50	18.93	8.93	170.46	7.54	25.2	25.2	1.0	605.04	9204.92	10	1.0	75.4	1889.49	40.0	25.2	10	8.93	10.45	11.34	162.5	2091.8	13186.2	636.4	11730.8	**5274.50**	**3910.28**
BORE NO: P103, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	20.00	10.00	27.50	1.89	24.3	24.3	1.0	23.41	0	0	1.0	0.0	0	3.0	26.5	4	10.00	13.38	14.34	30.0	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.50	20.00	10.00	35.00	3.77	26.5	26.5	1.0	65.81	0	4	1.0	15.1	0	4.0	26.5	4	10.00	13.38	14.34	40.0	743.5	743.5	25.5	25.5	**297.40**	**8.49**
4.00	5.00	4.50	1.00	2.50	20.00	10.00	45.00	3.77	26.5	26.5	1.0	84.62	84.62	4	1.0	15.1	15.09	5.0	26.5	4	10.10	13.38	14.34	50.0	895.8	995.5	42.4	142.1	**398.21**	**47.38**
5.00	6.00	5.50	1.00	3.50	20.10	10.10	55.05	3.77	26.5	26.5	1.0	103.51	188.13	4	1.0	15.1	30.17	6.0	26.5	4	10.10	13.38	14.34	60.1	1048.7	1267.0	59.4	277.7	**506.80**	**92.57**
6.00	7.00	6.50	1.00	4.50	20.10	10.10	65.15	3.77	26.5	26.5	1.0	122.51	310.64	4	1.0	15.1	45.26	7.0	10.5	49	10.60	2.62	1.36	70.2	716.6	1072.5	76.4	432.3	**429.01**	**144.09**
7.00	9.00	8.00	2.00	6.50	20.60	10.60	80.80	7.54	10.5	10.5	1.0	112.96	423.59	49	1.0	369.6	414.86	9.0	10.5	49	10.60	2.62	1.36	91.4	779.4	1617.8	110.3	948.8	**647.14**	**316.25**
9.00	10.00	9.50	1.00	7.50	20.60	10.60	96.70	3.77	10.5	10.5	1.0	67.59	491.19	49	1.0	184.8	599.66	10.0	24.4	14	9.77	9.57	10.22	102.0	1314.6	2405.4	127.3	1218.1	**962.16**	**406.04**
10.00	12.50	11.25	2.50	10.00	19.77	9.77	114.21	9.43	24.4	24.4	1.0	488.49	979.67	14	1.0	132.0	731.66	12.5	24.4	14	10.59	9.57	10.22	126.4	1584.7	3296.0	169.7	1881.0	**1318.39**	**627.01**
12.50	15.50	14.00	3.00	13.00	20.59	10.59	142.31	11.31	24.4	24.4	1.0	730.39	1710.06	14	1.0	158.4	890.06	15.5	27.9	0	10.59	16.53	17.56	158.2	3085.0	5685.1	220.6	2820.7	**2274.04**	**940.25**
15.50	17.00	16.25	1.50	14.50	20.59	10.59	166.14	5.66	27.9	27.9	1.0	497.63	2207.69	0	1.0	0.0	890.06	17.0	10.5	54	10.69	2.62	1.36	174.1	1075.2	4173.0	246.1	3343.8	**1669.18**	**1114.61**
17.00	18.50	17.75	1.50	16.00	20.69	10.69	182.10	5.66	10.5	10.5	1.0	190.93	2398.62	54	1.0	305.5	1195.54	18.5	28.6	0	10.69	18.11	19.17	174.1	3705.5	7299.6	271.5	3865.7	**2919.85**	**1288.57**
18.50	20.00	19.25	1.50	17.50	20.69	10.69	182.10	5.66	28.6	28.6	1.0	561.66	2960.28	0	1.0	0.0	1195.54	20.0	11.0	51	10.40	2.76	1.51	174.1	1074.4	5230.2	297.0	4452.8	**2092.07**	**1484.27**
20.00	21.50	20.75	1.50	19.00	20.40	10.40	182.10	5.66	11.0	11.0	1.0	200.24	3160.52	51	1.0	288.5	1484.06	21.5	11.0	51	10.40	2.76	1.51	174.1	1074.4	5718.9	322.5	4967.0	**2287.57**	**1655.68**
21.50	23.00	22.25	1.50	20.50	20.40	10.40	182.10	5.66	11.0	11.0	1.0	200.24	3360.76	51	1.0	288.5	1772.57	23.0	27.5	2	9.57	15.63	16.64	174.1	3206.9	8340.2	347.9	5481.2	**3336.09**	**1827.08**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 1.13 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
23.00	24.50	23.75	1.50	22.00	19.57	9.57	182.10	5.66	27.5	27.5	1.0	536.26	3897.02	2	1.0	11.3	1783.89	24.5	31.0	0	9.57	26.30	27.53	174.1	5358.3	11039.2	373.4	6054.3	**4415.66**	**2018.09**
24.50	26.00	25.25	1.50	23.50	19.57	9.57	182.10	5.66	31.0	31.0	1.1	649.93	4546.95	0	1.0	0.0	1783.89	26.0	31.2	0	9.57	27.30	28.55	174.1	5563.3	11894.2	398.8	6729.7	**4757.67**	**2243.22**
26.00	27.50	26.75	1.50	25.00	19.57	9.57	182.10	5.66	31.2	31.2	1.1	661.31	5208.26	0	1.0	0.0	1783.89	27.5	31.2	0	9.13	27.30	28.55	174.1	5554.8	12547.0	424.3	7416.4	**5018.79**	**2472.15**
27.50	29.00	28.25	1.50	26.50	19.13	9.13	182.10	5.66	31.2	31.2	1.1	661.31	5869.58	0	1.0	0.0	1783.89	29.0	31.4	0	8.63	28.31	29.58	174.1	5749.6	13403.0	449.7	8103.2	**5361.21**	**2701.07**
29.00	30.00	29.50	1.00	27.50	18.63	8.63	182.10	3.77	31.4	31.4	1.1	448.55	6318.13	0	1.0	0.0	1783.89	30.0	31.4	0	8.63	28.31	29.58	174.1	5749.6	13851.6	466.7	8568.7	**5540.63**	**2856.24**
30.00	30.50	30.25	0.50	28.00	18.63	8.63	182.10	1.89	31.4	31.4	1.1	224.27	6542.40	0	1.0	0.0	1783.89	30.5	31.4	0	8.99	28.31	29.58	174.1	5756.8	14083.1	475.2	8801.5	**5633.23**	**2933.83**
30.50	32.00	31.25	1.50	29.50	18.99	8.99	182.10	5.66	31.4	31.4	1.1	672.82	7215.23	0	1.0	0.0	1783.89	32.0	27.0	18	8.97	14.50	15.49	174.1	3134.3	12133.4	500.7	9499.8	**4853.35**	**3166.59**
32.00	32.50	32.25	0.50	30.00	18.97	8.97	182.10	1.89	27.0	27.0	1.0	174.96	7390.19	18	1.0	33.9	1817.83	32.5	27.0	18	8.97	14.50	15.49	174.1	3134.3	12342.3	509.1	9717.2	**4936.91**	**3239.05**
32.50	33.50	33.00	1.00	31.00	18.97	8.97	182.10	3.77	27.0	27.0	1.0	349.93	7740.12	18	1.0	67.9	1885.71	33.5	12.5	60	8.72	3.20	1.94	174.1	1253.5	10879.3	526.1	10151.9	**4351.73**	**3383.98**
33.50	35.00	34.25	1.50	32.50	18.72	8.72	182.10	5.66	12.5	12.5	1.0	228.38	7968.49	60	1.0	339.4	2225.14	35.0	14.0	60	8.82	3.65	2.36	174.1	1344.0	11537.7	551.6	10745.2	**4615.07**	**3581.74**
35.00	36.50	35.75	1.50	34.00	18.82	8.82	182.10	5.66	14.0	14.0	1.0	256.85	8225.34	60	1.0	339.4	2564.57	36.5	14.0	60	8.34	3.65	2.36	174.1	1343.3	12133.2	577.0	11366.9	**4853.27**	**3788.98**
36.50	37.50	37.00	1.00	35.00	18.34	8.34	182.10	3.77	14.0	14.0	1.0	171.23	8396.57	60	1.0	226.3	2790.86	37.5	18.0	60	8.34	5.42	4.29	174.1	1702.0	12889.4	594.0	11781.4	**5155.78**	**3927.14**
37.50	38.00	37.75	0.50	35.50	18.34	8.34	182.10	1.89	18.0	18.0	1.0	111.57	8508.14	60	1.0	113.1	2904.00	38.0	18.0	60	8.72	5.42	4.29	174.1	1703.1	13115.3	602.5	12014.6	**5246.11**	**4004.88**
38.00	40.00	39.00	2.00	37.50	18.72	8.72	182.10	7.54	18.0	18.0	1.0	446.29	8954.43	60	1.0	452.6	3356.57	40.0	18.0	125	8.72	5.42	4.29	174.1	2365.0	14676.0	636.4	12947.4	**5870.40**	**4315.81**
BORE NO: P104, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.80	9.80	26.95	1.89	25.8	25.8	1.0	24.57	0	0	1.0	0.0	0	3.0	25.4	0	9.03	10.90	11.80	29.4	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	5.00	4.00	2.00	2.50	19.03	9.03	38.43	7.54	25.4	25.4	1.0	137.64	0	0	1.0	0.0	0	5.0	24.6	0	9.03	9.71	10.44	47.5	585.5	585.5	42.4	42.4	**234.21**	**14.14**
5.00	6.00	5.50	1.00	3.50	19.03	9.03	51.98	3.77	24.6	24.6	1.0	89.74	89.74	0	1.0	0.0	0.00	6.0	11.1	50	11.01	2.79	1.53	56.5	699.2	788.9	59.4	149.1	**315.56**	**49.71**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 1.13 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. N_γ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	N_γ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
6.00	8.00	7.00	2.00	5.50	21.01	11.01	67.50	7.54	11.1	11.1	1.0	99.89	189.63	50	1.0	377.1	377.14	8.0	11.6	41	11.01	2.94	1.68	78.5	691.2	1258.0	93.3	660.1	**503.20**	**220.04**
8.00	9.00	8.50	1.00	6.50	21.01	11.01	84.02	3.77	11.6	11.6	1.0	65.04	254.68	41	1.0	154.6	531.77	9.0	11.6	41	10.35	2.94	1.68	89.5	727.1	1513.6	110.3	896.8	**605.42**	**298.92**
9.00	11.00	10.00	2.00	8.50	20.35	10.35	99.87	7.54	11.6	11.6	1.0	154.63	409.31	41	1.0	309.3	841.03	11.0	6.2	86	10.35	1.79	0.63	110.2	1102.9	2353.2	144.3	1394.6	**941.30**	**464.86**
11.00	12.00	11.50	1.00	9.50	20.35	10.35	115.40	3.77	6.2	6.2	1.0	47.28	456.59	86	1.0	324.3	1165.37	12.0	10.0	84	9.88	2.47	1.22	120.6	1200.5	2822.4	161.2	1783.2	**1128.98**	**594.40**
12.00	14.50	13.25	2.50	12.00	19.88	9.88	132.92	9.43	10.0	10.0	1.0	220.98	677.57	84	1.0	792.0	1957.37	14.5	10.0	42	9.88	2.47	1.22	145.3	841.8	3476.8	203.7	2838.6	**1390.71**	**946.20**
14.50	16.00	15.25	1.50	13.50	19.88	9.88	152.68	5.66	10.0	10.0	1.0	152.30	829.87	42	1.0	237.6	2194.97	16.0	27.7	0	10.15	16.08	17.10	160.1	3030.4	6055.3	229.1	3254.0	**2422.11**	**1084.65**
16.00	17.50	16.75	1.50	15.00	20.15	10.15	167.70	5.66	27.7	27.7	1.0	498.09	1327.95	0	1.0	0.0	2194.97	17.5	27.4	0	10.15	15.40	16.41	175.3	3168.7	6691.6	254.6	3777.5	**2676.64**	**1259.17**
17.50	19.00	18.25	1.50	16.50	20.15	10.15	167.70	5.66	27.4	27.4	1.0	491.77	1819.72	0	1.0	0.0	2194.97	19.0	15.3	43	10.15	4.09	2.81	175.3	1268.1	5282.8	280.0	4294.7	**2113.10**	**1431.57**
19.00	20.50	19.75	1.50	18.00	20.15	10.15	167.70	5.66	15.3	15.3	1.0	259.54	2079.26	43	1.0	243.3	2438.23	20.5	25.5	9	9.81	11.13	12.03	175.3	2378.7	6896.2	305.5	4823.0	**2758.47**	**1607.66**
20.50	23.50	22.00	3.00	21.00	19.81	9.81	167.70	11.31	25.5	25.5	1.0	905.03	2984.29	9	1.0	101.8	2540.06	23.5	20.7	44	9.81	6.90	6.16	175.3	1858.5	7382.9	356.4	5880.7	**2953.14**	**1960.25**
23.50	25.00	24.25	1.50	22.50	19.81	9.81	167.70	5.66	20.7	20.7	1.0	358.49	3342.78	44	1.0	248.9	2788.97	25.0	29.6	0	10.07	20.36	21.48	175.3	4185.1	10316.9	381.9	6513.6	**4126.75**	**2171.20**
25.00	26.50	25.75	1.50	24.00	20.07	10.07	167.70	5.66	29.6	29.6	1.0	538.95	3881.73	0	1.0	0.0	2788.97	26.5	29.6	0	10.07	20.36	21.48	175.3	4185.1	10855.8	407.3	7078.0	**4342.33**	**2359.34**
26.50	27.50	27.00	1.00	25.00	20.07	10.07	167.70	3.77	29.6	29.6	1.0	359.30	4241.03	0	1.0	0.0	2788.97	27.5	29.1	2	9.71	19.23	20.33	175.3	3969.3	10999.3	424.3	7454.3	**4399.72**	**2484.76**
27.50	29.50	28.50	2.00	27.00	19.71	9.71	167.70	7.54	29.1	29.1	1.0	704.07	4945.09	2	1.0	15.1	2804.06	29.5	31.3	0	9.71	27.81	29.06	175.3	5707.5	13456.7	458.2	8207.4	**5382.66**	**2735.79**
29.50	30.00	29.75	0.50	27.50	19.71	9.71	167.70	1.89	31.3	31.3	1.1	204.77	5149.86	0	1.0	0.0	2804.06	30.0	31.7	0	9.71	29.82	31.11	175.3	6120.7	14074.6	466.7	8420.6	**5629.85**	**2806.88**
30.00	31.00	30.50	1.00	28.50	19.71	9.71	167.70	3.77	31.7	31.7	1.1	423.83	5573.69	0	1.0	0.0	2804.06	31.0	31.9	0	9.71	30.83	32.14	175.3	6327.3	14705.1	483.7	8861.4	**5882.02**	**2953.81**
31.00	32.50	31.75	1.50	30.00	19.71	9.71	167.70	5.66	31.9	31.9	1.1	646.62	6220.32	0	1.0	0.0	2804.06	32.5	32.5	0	9.09	33.85	35.22	175.3	6932.3	15956.7	509.1	9533.5	**6382.66**	**3177.84**
32.50	34.00	33.25	1.50	31.50	19.09	9.09	167.70	5.66	32.5	32.5	1.1	679.95	6900.27	0	1.0	0.0	2804.06	34.0	32.5	0	9.26	33.85	35.22	175.3	6936.3	16640.7	534.6	10238.9	**6656.27**	**3412.98**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 1.13 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
34.00	35.00	34.50	1.00	32.50	19.26	9.26	167.70	3.77	32.5	32.5	1.1	453.30	7353.57	0	1.0	0.0	2804.06	35.0	32.0	0	9.26	31.33	32.65	175.3	6420.6	16578.3	551.6	10709.2	**6631.30**	**3569.73**
35.00	35.50	35.25	0.50	33.00	19.26	9.26	167.70	1.89	32.0	32.0	1.1	217.37	7570.94	0	1.0	0.0	2804.06	35.5	33.2	0	9.28	37.38	38.80	175.3	7658.9	18033.9	560.1	10935.1	**7213.55**	**3645.02**
35.50	37.00	36.25	1.50	34.50	19.28	9.28	167.70	5.66	33.2	33.2	1.2	720.15	8291.09	0	1.0	0.0	2804.06	37.0	32.6	0	9.22	34.36	35.73	175.3	7038.5	18133.7	585.5	11680.7	**7253.47**	**3893.55**
37.00	37.50	37.25	0.50	35.00	19.22	9.22	167.70	1.89	32.6	32.6	1.1	228.53	8519.63	0	1.0	0.0	2804.06	37.5	30.5	0	9.22	23.78	24.96	175.3	4872.8	16196.5	594.0	11917.7	**6478.60**	**3972.56**
37.50	38.50	38.00	1.00	36.00	19.22	9.22	167.70	3.77	30.5	30.5	1.0	381.87	8901.50	0	1.0	0.0	2804.06	38.5	30.7	0	9.29	24.79	25.99	175.3	5080.3	16785.9	611.0	12316.5	**6714.34**	**4105.51**
38.50	40.00	39.25	1.50	37.50	19.29	9.29	167.70	5.66	30.7	30.7	1.0	583.02	9484.52	0	1.0	0.0	2804.06	40.0	30.7	0	9.29	24.79	25.99	175.3	5080.3	17368.9	636.4	12925.0	**6947.55**	**4308.34**
BORE NO: P105, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.67	9.67	26.59	1.89	12.7	12.7	1.0	11.30	0	23	1.0	43.4	0	3.0	25.4	0	9.67	10.90	11.80	29.0	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.50	19.67	9.67	33.85	3.77	25.4	25.4	1.0	60.61	0	0	1.0	0.0	0	4.0	28.6	2	10.25	18.11	19.17	38.7	0	0.0	25.5	25.5	**0.00**	**8.49**
4.00	5.00	4.50	1.00	2.50	20.25	10.25	43.81	3.77	28.6	28.6	1.0	90.07	0	2	1.0	7.5	0	5.0	28.5	0	10.25	17.88	18.94	48.9	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.50	20.25	10.25	54.06	3.77	28.5	28.5	1.0	110.69	0	0	1.0	0.0	0	6.0	28.5	0	9.37	17.88	18.94	59.2	0	0.0	59.4	59.4	**0.00**	**19.80**
6.00	8.00	7.00	2.00	5.50	19.37	9.37	68.55	7.54	28.5	28.5	1.0	280.74	0	0	1.0	0.0	0	8.0	10.2	46	9.37	2.53	1.28	77.9	0	0.0	93.3	93.3	**0.00**	**31.11**
8.00	9.00	8.50	1.00	6.50	19.37	9.37	82.61	3.77	10.2	10.2	1.0	56.05	0	46	1.0	173.5	0	9.0	14.3	23	9.37	3.74	2.45	87.3	0	0.0	110.3	110.3	**0.00**	**36.77**
9.00	10.00	9.50	1.00	7.50	19.37	9.37	91.98	3.77	14.3	14.3	1.0	88.42	0	23	1.0	86.7	0	10.0	6.8	24	10.08	1.89	0.73	96.7	0	0.0	127.3	127.3	**0.00**	**42.43**
10.00	11.00	10.50	1.00	8.50	20.08	10.08	101.70	3.77	6.8	6.8	1.0	45.74	0	24	1.0	90.5	0	11.0	9.5	62	10.08	2.38	1.14	106.7	0	0.0	144.3	144.3	**0.00**	**48.09**
11.00	12.00	11.50	1.00	9.50	20.08	10.08	111.78	3.77	9.5	9.5	1.0	70.55	0	62	1.0	233.8	0	12.0	11.9	55	10.08	3.03	1.76	116.8	0	0.0	161.2	161.2	**0.00**	**53.74**
12.00	13.00	12.50	1.00	10.50	20.08	10.08	121.86	3.77	11.9	11.9	1.0	96.85	0	55	1.0	207.4	0	13.0	9.4	54	9.96	2.36	1.13	126.9	0	0.0	178.2	178.2	**0.00**	**59.40**
13.00	14.50	13.75	1.50	12.00	19.96	9.96	134.37	5.66	9.4	9.4	1.0	125.84	0	54	1.0	305.5	0	14.5	12.8	45	9.66	3.29	2.02	141.8	999.7	999.7	203.7	203.7	**399.89**	**67.89**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 1.13 m^2

Layers (m)										Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	N_γ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
14.50	17.50	16.00	3.00	15.00	19.66	9.66	156.33	11.31	12.8	12.8	1.0	401.85	401.85	45	1.0	509.1	509.14	17.5	20.7	39	9.66	6.90	6.16	170.8	1771.9	2682.9	254.6	1165.6	**1073.14**	**388.52**
17.50	19.00	18.25	1.50	16.50	19.66	9.66	156.33	5.66	20.7	20.7	1.0	334.18	736.03	39	1.0	220.6	729.77	19.0	19.5	48	9.66	6.13	5.12	170.8	1707.8	3173.7	280.0	1745.8	**1269.46**	**581.94**
19.00	20.50	19.75	1.50	18.00	19.66	9.66	156.33	5.66	19.5	19.5	1.0	313.18	1049.21	48	1.0	271.5	1001.31	20.5	11.2	48	10.50	2.82	1.56	170.8	1045.5	3096.0	305.5	2356.0	**1238.40**	**785.34**
20.50	23.50	22.00	3.00	21.00	20.50	10.50	156.33	11.31	11.2	11.2	1.0	350.22	1399.43	48	1.0	543.1	1544.40	23.5	11.2	48	10.50	2.82	1.56	170.8	1045.5	3989.3	356.4	3300.2	**1595.73**	**1100.08**
23.50	25.00	24.25	1.50	22.50	20.50	10.50	156.33	5.66	11.2	11.2	1.0	175.11	1574.55	48	1.0	271.5	1815.94	25.0	10.5	45	10.64	2.62	1.36	170.8	973.9	4364.4	381.9	3772.3	**1745.74**	**1257.45**
25.00	26.50	25.75	1.50	24.00	20.64	10.64	156.33	5.66	10.5	10.5	1.0	163.91	1738.46	45	1.0	254.6	2070.51	26.5	29.2	0	10.64	19.46	20.56	170.8	3909.1	7718.1	407.3	4216.3	**3087.25**	**1405.43**
26.50	27.50	27.00	1.00	25.00	20.64	10.64	156.33	3.77	29.2	29.2	1.0	329.51	2067.96	0	1.0	0.0	2070.51	27.5	29.2	0	10.64	19.46	20.56	170.8	3909.1	8047.6	424.3	4562.8	**3219.05**	**1520.92**
27.50	28.00	27.75	0.50	25.50	20.64	10.64	156.33	1.89	29.2	29.2	1.0	164.75	2232.72	0	1.0	0.0	2070.51	28.0	11.0	48	11.02	2.76	1.51	170.8	1034.2	5337.5	432.8	4736.0	**2134.99**	**1578.67**
28.00	29.50	28.75	1.50	27.00	21.02	11.02	156.33	5.66	11.0	11.0	1.0	171.91	2404.63	48	1.0	271.5	2342.06	29.5	30.0	0	11.02	21.26	22.40	170.8	4276.4	9023.1	458.2	5204.9	**3609.24**	**1734.97**
29.50	30.00	29.75	0.50	27.50	21.02	11.02	156.33	1.89	30.0	30.0	1.0	170.20	2574.82	0	1.0	0.0	2342.06	30.0	30.7	0	10.82	24.79	25.99	170.8	4981.2	9898.1	466.7	5383.6	**3959.25**	**1794.53**
30.00	32.50	31.25	2.50	30.00	20.82	10.82	156.33	9.43	30.7	30.7	1.0	905.81	3480.63	0	1.0	0.0	2342.06	32.5	10.3	55	10.82	2.56	1.31	170.8	1064.1	6886.8	509.1	6331.8	**2754.71**	**2110.61**
32.50	34.00	33.25	1.50	31.50	20.82	10.82	156.33	5.66	10.3	10.3	1.0	160.72	3641.35	55	1.0	311.1	2653.20	34.0	25.2	15	10.82	10.45	11.34	170.8	2255.8	8550.3	534.6	6829.2	**3420.14**	**2276.38**
34.00	35.00	34.50	1.00	32.50	20.82	10.82	156.33	3.77	25.2	25.2	1.0	277.44	3918.79	15	1.0	56.6	2709.77	35.0	26.0	15	8.76	12.25	13.18	170.8	2599.1	9227.6	551.6	7180.1	**3691.06**	**2393.38**
35.00	35.50	35.25	0.50	33.00	18.76	8.76	156.33	1.89	26.0	26.0	1.0	143.78	4062.57	15	1.0	28.3	2738.06	35.5	28.0	0	8.72	16.76	17.79	170.8	3343.7	10144.3	560.1	7360.7	**4057.74**	**2453.56**
35.50	37.00	36.25	1.50	34.50	18.72	8.72	156.33	5.66	28.0	28.0	1.0	470.23	4532.81	0	1.0	0.0	2738.06	37.0	28.0	0	8.62	16.76	17.79	170.8	3342.5	10613.4	585.5	7856.4	**4245.35**	**2618.79**
37.00	37.50	37.25	0.50	35.00	18.62	8.62	156.33	1.89	28.0	28.0	1.0	156.74	4689.55	0	1.0	0.0	2738.06	37.5	29.4	0	8.62	19.91	21.02	170.8	3970.7	11398.3	594.0	8021.6	**4559.32**	**2673.87**
37.50	38.50	38.00	1.00	36.00	18.62	8.62	156.33	3.77	29.4	29.4	1.0	332.22	5021.77	0	1.0	0.0	2738.06	38.5	29.0	0	8.85	19.01	20.10	170.8	3794.3	11554.2	611.0	8370.8	**4621.67**	**2790.27**
38.50	40.00	39.25	1.50	37.50	18.85	8.85	156.33	5.66	29.0	29.0	1.0	490.22	5511.99	0	1.0	0.0	2738.06	40.0	29.0	0	8.85	19.01	20.10	170.8	3794.3	12044.4	636.4	8886.5	**4817.76**	**2962.16**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)										Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)								Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	N_γ	q	Qb					
BORE NO: P106, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.00	9.00	24.75	1.89	14.0	14.0	1.0	11.64	11.64	9	1.0	17.0	16.97	3.0	12.5	45	8.20	3.20	1.94	27.0	566.9	595.5	8.5	37.1	**238.19**	**12.36**
3.00	5.00	4.00	2.00	2.50	18.20	8.20	35.20	7.54	12.5	12.5	1.0	58.86	70.50	45	1.0	339.4	356.40	5.0	24.9	0	8.20	9.93	10.77	43.4	547.5	974.4	42.4	469.3	**389.74**	**156.44**
5.00	6.00	5.50	1.00	3.50	18.20	8.20	47.50	3.77	24.9	24.9	1.0	83.16	153.65	0	1.0	0.0	356.40	6.0	24.9	0	8.20	9.93	10.77	51.6	639.6	1149.6	59.4	569.5	**459.85**	**189.82**
6.00	7.00	6.50	1.00	4.50	18.20	8.20	55.70	3.77	24.9	24.9	1.0	97.51	251.16	0	1.0	0.0	356.40	7.0	12.8	39	9.81	3.29	2.02	59.8	633.3	1240.9	76.4	683.9	**496.34**	**227.98**
7.00	8.00	7.50	1.00	5.50	19.81	9.81	64.71	3.77	12.8	12.8	1.0	55.44	306.61	39	1.0	147.1	503.49	8.0	8.6	47	9.81	2.22	1.00	69.6	660.0	1470.1	93.3	903.4	**588.02**	**301.15**
8.00	9.00	8.50	1.00	6.50	19.81	9.81	74.52	3.77	8.6	8.6	1.0	42.50	349.11	47	1.0	177.3	680.74	9.0	8.6	47	9.81	2.22	1.00	79.4	684.6	1714.4	110.3	1140.2	**685.78**	**380.06**
9.00	10.00	9.50	1.00	7.50	19.81	9.81	84.33	3.77	8.6	8.6	1.0	48.10	397.20	47	1.0	177.3	858.00	10.0	8.5	54	10.60	2.20	0.99	89.2	779.1	2034.3	127.3	1382.5	**813.72**	**460.83**
10.00	11.00	10.50	1.00	8.50	20.60	10.60	94.53	3.77	8.5	8.5	1.0	53.28	450.49	54	1.0	203.7	1061.66	11.0	9.0	52	10.60	2.29	1.07	99.8	795.8	2308.0	144.3	1656.4	**923.19**	**552.13**
11.00	12.00	11.50	1.00	9.50	20.60	10.60	105.13	3.77	9.0	9.0	1.0	62.80	513.28	52	1.0	196.1	1257.77	12.0	9.8	74	10.47	2.43	1.19	110.4	1066.1	2837.2	161.2	1932.3	**1134.86**	**644.09**
12.00	14.50	13.25	2.50	12.00	20.47	10.47	123.52	9.43	9.8	9.8	1.0	201.16	714.44	74	1.0	697.7	1955.49	14.5	9.8	74	10.47	2.43	1.19	136.6	1138.2	3808.1	203.7	2873.6	**1523.24**	**957.86**
14.50	16.00	15.25	1.50	13.50	20.47	10.47	144.46	5.66	9.8	9.8	1.0	141.16	855.60	74	1.0	418.6	2374.11	16.0	21.2	38	9.80	7.26	6.71	152.3	1683.4	4913.1	229.1	3458.8	**1965.23**	**1152.94**
16.00	17.50	16.75	1.50	15.00	19.80	9.80	159.66	5.66	21.2	21.2	1.0	350.34	1205.94	38	1.0	215.0	2589.09	17.5	26.5	4	9.19	13.38	14.34	167.0	2658.0	6453.1	254.6	4049.6	**2581.23**	**1349.87**
17.50	20.50	19.00	3.00	18.00	19.19	9.19	159.66	11.31	26.5	26.5	1.0	900.66	2106.60	4	1.0	45.3	2634.34	20.5	28.4	0	9.19	17.66	18.71	167.0	3453.1	8194.1	305.5	5046.4	**3277.62**	**1682.14**
20.50	22.00	21.25	1.50	19.50	19.19	9.19	159.66	5.66	28.4	28.4	1.0	488.37	2594.96	0	1.0	0.0	2634.34	22.0	18.5	44	9.19	5.64	4.57	167.0	1542.7	6772.0	330.9	5560.2	**2708.79**	**1853.42**
22.00	23.50	22.75	1.50	21.00	19.19	9.19	159.66	5.66	18.5	18.5	1.0	302.21	2897.18	44	1.0	248.9	2883.26	23.5	27.0	7	9.80	14.50	15.49	167.0	2915.0	8695.4	356.4	6136.8	**3478.16**	**2045.61**
23.50	26.50	25.00	3.00	24.00	19.80	9.80	159.66	11.31	27.0	27.0	1.0	920.43	3817.60	7	1.0	79.2	2962.46	26.5	27.0	0	9.80	14.50	15.49	167.0	2843.7	9623.7	407.3	7187.4	**3849.50**	**2395.79**
26.50	27.50	27.00	1.00	25.00	19.80	9.80	159.66	3.77	27.0	27.0	1.0	306.81	4124.41	0	1.0	0.0	2962.46	27.5	27.0	0	9.80	14.50	15.49	167.0	2843.7	9930.5	424.3	7511.2	**3972.22**	**2503.72**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 1.13 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
27.50	29.50	28.50	2.00	27.00	19.80	9.80	159.66	7.54	27.0	27.0	1.0	613.62	4738.03	0	1.0	0.0	2962.46	29.5	17.3	40	8.34	5.07	3.91	167.0	1387.8	9088.3	458.2	8158.7	**3635.31**	**2719.57**
29.50	30.00	29.75	0.50	27.50	18.34	8.34	159.66	1.89	17.3	17.3	1.0	93.77	4831.80	40	1.0	75.4	3037.89	30.0	17.0	40	10.15	4.92	3.75	167.0	1363.6	9233.3	466.7	8336.4	**3693.30**	**2778.80**
30.00	31.00	30.50	1.00	28.50	20.15	10.15	159.66	3.77	17.0	17.0	1.0	184.09	5015.90	40	1.0	150.9	3188.74	31.0	11.2	55	10.15	2.82	1.56	167.0	1104.2	9308.9	483.7	8688.3	**3723.55**	**2896.11**
31.00	32.50	31.75	1.50	30.00	20.15	10.15	159.66	5.66	11.2	11.2	1.0	178.84	5194.74	55	1.0	311.1	3499.89	32.5	11.2	55	10.15	2.82	1.56	167.0	1104.2	9798.9	509.1	9203.8	**3919.54**	**3067.92**
32.50	35.00	33.75	2.50	32.50	20.15	10.15	159.66	9.43	11.2	11.2	1.0	298.07	5492.81	55	1.0	518.6	4018.46	35.0	10.5	55	10.15	2.62	1.36	167.0	1064.0	10575.2	551.6	10062.8	**4230.09**	**3354.28**
35.00	35.50	35.25	0.50	33.00	20.15	10.15	159.66	1.89	10.5	10.5	1.0	55.80	5548.61	55	1.0	103.7	4122.17	35.5	10.5	55	10.15	2.62	1.36	167.0	1064.0	10734.7	560.1	10230.8	**4293.90**	**3410.28**
35.50	37.50	36.50	2.00	35.00	20.15	10.15	159.66	7.54	10.5	10.5	1.0	223.20	5771.81	55	1.0	414.9	4537.03	37.5	10.5	55	8.76	2.62	1.36	167.0	1062.7	11371.5	594.0	10902.8	**4548.61**	**3634.28**
37.50	38.50	38.00	1.00	36.00	18.76	8.76	159.66	3.77	10.5	10.5	1.0	111.60	5883.42	55	1.0	207.4	4744.46	38.5	10.0	60	8.61	2.47	1.22	167.0	1084.8	11712.7	611.0	11238.8	**4685.08**	**3746.28**
38.50	40.00	39.25	1.50	37.50	18.61	8.61	159.66	5.66	10.0	10.0	1.0	159.26	6042.68	60	1.0	339.4	5083.89	40.0	10.0	60	8.61	2.47	1.22	167.0	1084.8	12211.4	636.4	11763.0	**4884.56**	**3921.00**
BORE NO: P111, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	20.04	10.04	27.61	1.89	26.5	26.5	1.0	25.96	25.96	7	1.0	13.2	13.20	3.0	25.9	0	10.04	12.03	12.95	30.1	498.1	537.3	8.5	47.6	**214.92**	**15.88**
3.00	4.00	3.50	1.00	1.50	20.04	10.04	35.14	3.77	25.9	25.9	1.0	64.35	90.31	0	1.0	0.0	13.20	4.0	25.9	0	10.04	12.03	12.95	40.2	634.8	738.3	25.5	129.0	**295.31**	**42.99**
4.00	5.00	4.50	1.00	2.50	20.04	10.04	45.18	3.77	25.9	25.9	1.0	82.74	173.05	0	1.0	0.0	13.20	5.0	11.1	37	9.65	2.79	1.53	50.2	545.5	731.7	42.4	228.7	**292.69**	**76.23**
5.00	6.00	5.50	1.00	3.50	19.65	9.65	55.03	3.77	11.1	11.1	1.0	40.71	213.76	37	1.0	139.5	152.74	6.0	11.2	46	9.65	2.82	1.56	59.9	669.8	1036.3	59.4	425.9	**414.52**	**141.97**
6.00	7.00	6.50	1.00	4.50	19.65	9.65	64.68	3.77	11.2	11.2	1.0	48.30	262.06	46	1.0	173.5	326.23	7.0	29.5	0	9.81	20.13	21.25	69.5	1724.7	2313.0	76.4	664.7	**925.19**	**221.55**
7.00	9.00	8.00	2.00	6.50	19.81	9.81	79.31	7.54	29.5	29.5	1.0	338.46	600.52	0	1.0	0.0	326.23	9.0	13.0	48	9.81	3.35	2.08	89.1	840.4	1767.2	110.3	1037.1	**706.86**	**345.69**
9.00	10.00	9.50	1.00	7.50	19.81	9.81	94.03	3.77	13.0	13.0	1.0	81.87	682.39	48	1.0	181.0	507.26	10.0	11.0	50	10.14	2.76	1.51	98.9	828.9	2018.5	127.3	1316.9	**807.41**	**438.98**
10.00	12.50	11.25	2.50	10.00	20.14	10.14	111.61	9.43	11.0	11.0	1.0	204.54	886.93	50	1.0	471.4	978.69	12.5	9.5	58	10.47	2.38	1.14	124.3	933.4	2799.0	169.7	2035.3	**1119.60**	**678.44**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 1.13 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	N_γ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
12.50	15.50	14.00	3.00	13.00	20.47	10.47	139.99	11.31	9.5	9.5	1.0	265.04	1151.97	58	1.0	656.2	1634.91	15.5	10.4	56	10.30	2.59	1.33	155.7	1035.4	3822.3	220.6	3007.5	**1528.91**	**1002.50**
15.50	18.50	17.00	3.00	16.00	20.30	10.30	171.14	11.31	10.4	10.4	1.0	355.38	1507.35	56	1.0	633.6	2268.51	18.5	23.0	46	10.30	8.56	8.68	155.7	2037.0	5812.9	271.5	4047.4	**2325.14**	**1349.14**
18.50	20.00	19.25	1.50	17.50	20.30	10.30	171.14	5.66	23.0	23.0	1.0	410.96	1918.31	46	1.0	260.2	2528.74	20.0	32.3	0	10.30	32.85	34.19	155.7	6024.9	10471.9	297.0	4744.1	**4188.78**	**1581.35**
20.00	21.50	20.75	1.50	19.00	20.30	10.30	171.14	5.66	32.3	32.3	1.1	682.43	2600.75	0	1.0	0.0	2528.74	21.5	32.3	0	10.68	32.85	34.19	155.7	6033.7	11163.2	322.5	5451.9	**4465.28**	**1817.32**
21.50	24.50	23.00	3.00	22.00	20.68	10.68	171.14	11.31	32.3	32.3	1.1	1364.87	3965.61	0	1.0	0.0	2528.74	24.5	30.4	0	10.68	23.27	24.45	155.7	4277.1	10771.5	373.4	6867.7	**4308.59**	**2289.24**
24.50	26.00	25.25	1.50	23.50	20.68	10.68	171.14	5.66	30.4	30.4	1.0	579.38	4544.99	0	1.0	0.0	2528.74	26.0	32.5	0	10.68	33.85	35.22	155.7	6218.6	13292.3	398.8	7472.6	**5316.94**	**2490.85**
26.00	27.50	26.75	1.50	25.00	20.68	10.68	171.14	5.66	32.5	32.5	1.1	693.89	5238.88	0	1.0	0.0	2528.74	27.5	32.3	0	8.04	32.85	34.19	155.7	5972.4	13740.1	424.3	8191.9	**5496.02**	**2730.64**
27.50	29.00	28.25	1.50	26.50	18.04	8.04	171.14	5.66	32.3	32.3	1.1	682.43	5921.31	0	1.0	0.0	2528.74	29.0	32.3	0	8.40	32.85	34.19	155.7	5980.8	14430.8	449.7	8899.8	**5772.34**	**2966.60**
29.00	30.00	29.50	1.00	27.50	18.40	8.40	171.14	3.77	32.3	32.3	1.1	454.96	6376.27	0	1.0	0.0	2528.74	30.0	32.3	0	8.40	32.85	34.19	155.7	5980.8	14885.8	466.7	9371.7	**5954.32**	**3123.91**
30.00	30.50	30.25	0.50	28.00	18.40	8.40	171.14	1.89	32.3	32.3	1.1	227.48	6603.74	0	1.0	0.0	2528.74	30.5	32.3	0	8.39	32.85	34.19	155.7	5980.6	15113.0	475.2	9607.7	**6045.22**	**3202.56**
30.50	32.00	31.25	1.50	29.50	18.39	8.39	171.14	5.66	32.3	32.3	1.1	682.43	7286.18	0	1.0	0.0	2528.74	32.0	32.3	0	9.03	32.85	34.19	155.7	5995.4	15810.3	500.7	10315.6	**6324.13**	**3438.53**
32.00	32.50	32.25	0.50	30.00	19.03	9.03	171.14	1.89	32.3	32.3	1.1	227.48	7513.66	0	1.0	0.0	2528.74	32.5	32.3	0	9.03	32.85	34.19	155.7	5995.4	16037.8	509.1	10551.5	**6415.12**	**3517.18**
32.50	33.50	33.00	1.00	31.00	19.03	9.03	171.14	3.77	32.3	32.3	1.1	454.96	7968.61	0	1.0	0.0	2528.74	33.5	32.3	0	8.99	32.85	34.19	155.7	5994.5	16491.8	526.1	11023.5	**6596.73**	**3674.49**
33.50	35.00	34.25	1.50	32.50	18.99	8.99	171.14	5.66	32.3	32.3	1.1	682.43	8651.04	0	1.0	0.0	2528.74	35.0	32.9	0	8.83	35.87	37.27	155.7	6541.6	17721.4	551.6	11731.4	**7088.56**	**3910.45**
35.00	36.50	35.75	1.50	34.00	18.83	8.83	171.14	5.66	32.9	32.9	1.1	717.15	9368.19	0	1.0	0.0	2528.74	36.5	32.9	0	8.85	35.87	37.27	155.7	6542.1	18439.1	577.0	12474.0	**7375.62**	**4157.99**
36.50	37.50	37.00	1.00	35.00	18.85	8.85	171.14	3.77	32.9	32.9	1.1	478.10	9846.30	0	1.0	0.0	2528.74	37.5	32.9	0	8.85	35.87	37.27	155.7	6542.1	18917.2	594.0	12969.0	**7566.87**	**4323.01**
37.50	38.00	37.75	0.50	35.50	18.85	8.85	171.14	1.89	32.9	32.9	1.1	239.05	10085.35	0	1.0	0.0	2528.74	38.0	19.5	45	8.66	6.13	5.12	155.7	1568.8	14182.9	602.5	13216.6	**5673.16**	**4405.52**
38.00	40.00	39.00	2.00	37.50	18.66	8.66	171.14	7.54	19.5	19.5	1.0	457.13	10542.47	45	1.0	339.4	2868.17	40.0	19.0	45	8.61	5.87	4.84	155.7	1520.2	14930.8	636.4	14047.1	**5972.33**	**4682.36**

APPENDIX-H

TABLE 3: COMPUTATION OF LATERAL PILE LOAD CAPACITY (Dia. 1000 mm)

Bore No.	Dia. of pile (m)	Cut-off length (m)	Scour depth (m)	Concrete Grade	Young's Modulus (kN/m^2)	Moment of Inertia (m^4)	Average SPT	Modulus of sub grade (k_1)	Stiffness Factor (T)	Cantilever length	L_1/T	L_f/T	Permissible deflection (m)	Depth of Fixity (m)	Allowable Load capacity of pile(kN)
P101	1.00	2.50	0.00	35	29580399	0.0491	19	2696	3.52	2.50	0.71	2.12	0.005	7.47	88
P102	1.00	2.50	0.00	35	29580399	0.0491	18	2552	3.56	5.50	1.55	2.00	0.005	7.11	43
P103	1.00	2.50	0.00	35	29580399	0.0491	18	2552	3.56	1.50	0.42	2.17	0.005	7.71	112
P104	1.00	2.50	0.00	35	29580399	0.0491	15	2120	3.69	2.50	0.68	2.13	0.005	7.86	78
P105	1.00	2.50	0.00	35	29580399	0.0491	24	3416	3.35	12.00	3.58	1.89	0.005	6.34	14
P106	1.00	2.50	0.00	35	29580399	0.0491	7	800	4.49	0.00	0.00	2.23	0.005	10.00	87
P111	1.00	2.50	0.00	35	29580399	0.0491	13	1832	3.80	0.00	0.00	2.23	0.005	8.47	143

APPENDIX-H

TABLE 4: COMPUTATION OF LATERAL PILE LOAD CAPACITY (Dia. 1200 mm)

Bore No.	Dia. of pile (m)	Cut-off length (m)	Scour depth (m)	Concrete Grade	Young's Modulus (kN/m^2)	Moment of Inertia (m^4)	Average SPT	Modulus of sub grade (k_1)	Stiffness Factor (T)	Cantilever length	L_1/T	L_f/T	Permissible deflection (m)	Depth of Fixity (m)	Allowable Load capacity of pile(kN)
P101	1.20	2.50	0.00	35	29580399	0.1018	19	2696	4.07	2.50	0.61	2.14	0.005	8.70	129
P102	1.20	2.50	0.00	35	29580399	0.1018	18	2552	4.11	5.50	1.34	2.03	0.005	8.35	68
P103	1.20	2.50	0.00	35	29580399	0.1018	18	2552	4.11	1.50	0.36	2.18	0.005	8.95	158
P104	1.20	2.50	0.00	35	29580399	0.1018	16	2264	4.21	2.50	0.59	2.14	0.005	9.02	118
P105	1.20	2.50	0.00	35	29580399	0.1018	25	3560	3.85	12.00	3.12	1.90	0.005	7.32	25
P106	1.20	2.50	0.00	35	29580399	0.1018	8	1000	4.96	0.00	0.00	2.23	0.005	11.07	133
P111	1.20	2.50	0.00	35	29580399	0.1018	16	2264	4.21	0.00	0.00	2.23	0.005	9.40	218

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
P101	0.50	ML	53	7	10.15	5.00	5.15	1.00	0.306	1.70	11.90	5.00	1.20	19.28	0.21	1.00	0.246	0.805	Liquefiable
	1.00	SM-SC	50	7	20.30	10.00	10.30	0.99	0.305	1.70	11.90	5.00	1.20	19.28	0.21	1.00	0.246	0.808	Liquefiable
	2.00	SM-SC	50	7	40.60	20.00	20.60	0.98	0.303	1.70	11.90	5.00	1.20	19.28	0.21	1.00	0.246	0.814	Liquefiable
	3.00	SM	40	4	60.90	30.00	30.90	0.98	0.300	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.564	Liquefiable
	4.00	ML	52	4	81.20	40.00	41.20	0.97	0.298	1.56	6.23	5.00	1.20	12.48	0.14	1.00	0.162	0.543	Liquefiable
	5.00	SM	47	12	98.00	50.00	48.00	0.96	0.306	1.44	17.32	5.00	1.20	25.78	0.31	1.00	0.368	1.200	Non-liquefiable
	6.00	CL-ML	78	19	117.60	60.00	57.60	0.95	0.304	1.32	25.03	5.00	1.20	35.04	0.52	1.00	-	-	Non-liquefiable
	7.00	ML	85	19	137.20	70.00	67.20	0.95	0.301	1.22	23.18	5.00	1.20	32.81	0.52	1.00	0.620	2.058	Non-liquefiable
	8.00	ML	85	21	164.80	80.00	84.80	0.94	0.285	1.09	22.80	5.00	1.20	32.37	0.52	1.00	0.620	2.179	Non-liquefiable
	9.00	ML	81	28	185.40	90.00	95.40	0.93	0.282	1.02	28.67	5.00	1.20	39.40	0.52	1.00	0.620	2.197	Non-liquefiable
	11.00	CL	92	30	226.60	110.00	116.60	0.88	0.267	0.93	27.78	5.00	1.20	38.34	0.52	1.00	-	-	Non-liquefiable
	12.00	CL	92	28	244.80	120.00	124.80	0.85	0.261	0.90	25.06	5.00	1.20	35.08	0.52	1.00	-	-	Non-liquefiable
	14.50	CL-ML	87	19	295.80	145.00	150.80	0.79	0.241	0.81	15.47	5.00	1.20	23.57	0.27	1.00	-	-	Non-liquefiable
	16.00	SM-SC	48	19	328.00	160.00	168.00	0.75	0.227	0.77	14.66	5.00	1.20	22.59	0.25	0.81	0.243	1.069	Non-liquefiable
	17.50	SM-SC	48	38	358.75	175.00	183.75	0.71	0.215	0.74	28.03	5.00	1.20	38.64	0.52	0.78	0.487	2.261	Non-liquefiable
	19.00	SM	41	38	389.50	190.00	199.50	0.67	0.203	0.71	26.90	5.00	1.20	37.28	0.52	0.86	0.535	2.633	Non-liquefiable
	20.50	SM	41	44	387.45	205.00	182.45	0.63	0.208	0.74	32.57	5.00	1.20	44.09	0.52	0.88	0.545	2.625	Non-liquefiable
	22.00	CI	69	44	415.80	220.00	195.80	0.59	0.194	0.71	31.44	5.00	1.20	42.73	0.52	0.85	-	-	Non-liquefiable

APPENDIX-H

TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	23.50	CI	69	44	462.95	235.00	227.95	0.56	0.177	0.66	29.14	5.00	1.20	39.97	0.52	0.82	-	-	Non-liquefiable
	25.00	ML	57	44	492.50	250.00	242.50	0.56	0.177	0.64	28.26	5.00	1.20	38.91	0.52	0.76	0.472	2.660	Non-liquefiable
	26.50	ML	57	46	532.65	265.00	267.65	0.56	0.174	0.61	28.12	5.00	1.20	38.74	0.52	0.74	0.458	2.633	Non-liquefiable
	29.50	ML	51	76	592.95	295.00	297.95	0.56	0.174	0.58	44.03	5.00	1.20	57.84	0.52	0.71	0.443	2.547	Non-liquefiable
	31.00	CL	56	45	623.10	310.00	313.10	0.56	0.174	0.57	25.43	5.00	1.20	35.52	0.52	0.70	-	-	Non-liquefiable
	32.50	CL	56	44	653.25	325.00	328.25	0.56	0.174	0.55	24.29	5.00	1.20	34.14	0.52	0.69	-	-	Non-liquefiable
	35.50	SM	50	47	713.55	355.00	358.55	0.56	0.174	0.53	24.82	5.00	1.20	34.79	0.52	0.64	0.398	2.289	Non-liquefiable
	37.00	CL-ML	53	47	754.80	370.00	384.80	0.56	0.171	0.51	23.96	5.00	1.20	33.75	0.52	0.61	-	-	Non-liquefiable
	38.50	CL-ML	53	52	789.25	385.00	404.25	0.56	0.171	0.50	25.86	5.00	1.20	36.04	0.52	0.60	-	-	Non-liquefiable
	40.00	CL-ML	57	48	820.00	400.00	420.00	0.56	0.171	0.49	23.42	5.00	1.20	33.11	0.52	0.59	-	-	Non-liquefiable
P102	0.50	SM	49	4	9.80	5.00	4.80	1.00	0.317	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.534	Liquefiable
	1.00	SM-SC	45	4	19.60	10.00	9.60	0.99	0.316	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.536	Liquefiable
	3.00	SM	40	13	58.80	30.00	28.80	0.98	0.311	1.70	22.10	5.00	1.20	31.52	0.52	1.00	0.620	1.993	Non-liquefiable
	4.00	SM	39	7	78.40	40.00	38.40	0.97	0.309	1.61	11.30	5.00	1.20	18.56	0.20	1.00	0.236	0.765	Liquefiable
	6.00	SM	24	15	117.60	60.00	57.60	0.95	0.304	1.32	19.76	4.18	1.11	26.07	0.31	1.00	0.375	1.235	Non-liquefiable
	7.00	SM	24	10	132.30	70.00	62.30	0.95	0.314	1.27	12.67	4.18	1.11	18.21	0.19	1.00	0.232	0.739	Liquefiable
	8.00	CL	83	10	151.20	80.00	71.20	0.94	0.311	1.19	11.85	5.00	1.20	19.22	0.21	1.00	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	9.00	CL	82	20	176.40	90.00	86.40	0.93	0.297	1.08	21.52	5.00	1.20	30.82	0.52	1.00	-	-	Non-liquefiable
	10.00	CL	92	18	196.00	100.00	96.00	0.91	0.289	1.02	18.37	5.00	1.20	27.05	0.34	1.00	-	-	Non-liquefiable
	11.00	ML	92	18	215.60	110.00	105.60	0.88	0.280	0.97	17.52	5.00	1.20	26.02	0.31	1.00	0.374	1.334	Non-liquefiable
	12.50	CL	83	16	248.75	125.00	123.75	0.84	0.263	0.90	14.38	5.00	1.20	22.26	0.25	1.00	-	-	Non-liquefiable
	15.50	CL-ML	56	28	308.45	155.00	153.45	0.76	0.238	0.81	22.60	5.00	1.20	32.12	0.52	0.87	-	-	Non-liquefiable
	17.00	SM	28	28	340.00	170.00	170.00	0.72	0.225	0.77	21.48	4.56	1.14	29.00	0.41	0.84	0.411	1.829	Non-liquefiable
	18.50	CL	76	28	381.10	185.00	196.10	0.68	0.206	0.71	19.99	5.00	1.20	28.99	0.41	0.80	-	-	Non-liquefiable
	20.00	SM	38	28	412.00	200.00	212.00	0.64	0.194	0.69	19.23	5.00	1.20	28.08	0.37	0.78	0.347	1.786	Non-liquefiable
	21.50	SM	34	44	442.90	215.00	227.90	0.60	0.182	0.66	29.15	4.93	1.19	39.56	0.52	0.76	0.473	2.598	Non-liquefiable
	23.00	ML	52	44	473.80	230.00	243.80	0.56	0.170	0.64	28.18	5.00	1.20	38.82	0.52	0.72	0.450	2.648	Non-liquefiable
	24.50	SM	47	50	497.35	245.00	252.35	0.56	0.172	0.63	31.48	5.00	1.20	42.77	0.52	0.72	0.444	2.579	Non-liquefiable
	27.50	SM	47	51	558.25	275.00	283.25	0.56	0.172	0.59	30.30	5.00	1.20	41.36	0.52	0.69	0.426	2.474	Non-liquefiable
	30.50	SM	47	48	619.15	305.00	314.15	0.56	0.172	0.56	27.08	5.00	1.20	37.50	0.52	0.66	0.410	2.383	Non-liquefiable
	33.50	SM	26	51	680.05	335.00	345.05	0.56	0.172	0.54	27.46	4.39	1.12	35.21	0.52	0.63	0.391	2.271	Non-liquefiable
	35.00	SM	26	56	721.00	350.00	371.00	0.56	0.170	0.52	29.07	4.39	1.12	37.03	0.52	0.61	0.381	2.242	Non-liquefiable
	36.50	SM	26	55	751.90	365.00	386.90	0.56	0.170	0.51	27.96	4.39	1.12	35.78	0.52	0.60	0.375	2.207	Non-liquefiable
	38.00	ML	56	56	782.80	380.00	402.80	0.56	0.170	0.50	27.90	5.00	1.20	38.48	0.52	0.60	0.369	2.175	Non-liquefiable
	40.00	ML	56	66	824.00	400.00	424.00	0.56	0.170	0.49	32.05	5.00	1.20	43.46	0.52	0.58	0.362	2.133	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden (N_1)$_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content (N_1)$_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
P103	0.50	SM	45	5	10.00	5.00	5.00	1.00	0.311	1.70	8.50	5.00	1.20	15.20	0.16	1.00	0.193	0.622	Liquefiable
	1.00	SM	45	5	20.00	10.00	10.00	0.99	0.310	1.70	8.50	5.00	1.20	15.20	0.16	1.00	0.193	0.624	Liquefiable
	3.00	SM	43	7	60.00	30.00	30.00	0.98	0.305	1.70	11.90	5.00	1.20	19.28	0.21	1.00	0.246	0.808	Liquefiable
	4.00	SM	43	12	80.00	40.00	40.00	0.97	0.302	1.58	18.97	5.00	1.20	27.77	0.36	1.00	0.431	1.426	Non-liquefiable
	5.00	SM-SC	46	12	100.00	50.00	50.00	0.96	0.300	1.41	16.97	5.00	1.20	25.36	0.30	1.00	0.357	1.190	Non-liquefiable
	6.00	SM	41	16	120.60	60.00	60.60	0.95	0.296	1.28	20.55	5.00	1.20	29.66	0.45	1.00	0.532	1.795	Non-liquefiable
	7.00	CL	85	20	140.70	70.00	70.70	0.95	0.294	1.19	23.79	5.00	1.20	33.54	0.52	1.00	-	-	Non-liquefiable
	9.00	CL	75	19	180.90	90.00	90.90	0.93	0.289	1.05	19.93	5.00	1.20	28.91	0.41	1.00	-	-	Non-liquefiable
	10.00	CL	75	22	206.00	100.00	106.00	0.91	0.275	0.97	21.37	5.00	1.20	30.64	0.52	1.00	-	-	Non-liquefiable
	12.50	CL	88	17	257.50	125.00	132.50	0.84	0.255	0.87	14.77	5.00	1.20	22.72	0.25	1.00	-	-	Non-liquefiable
	15.50	SM	50	36	306.90	155.00	151.90	0.76	0.240	0.81	29.21	5.00	1.20	40.05	0.52	0.87	0.539	2.248	Non-liquefiable
	17.00	CL	65	36	350.20	170.00	180.20	0.72	0.218	0.74	26.82	5.00	1.20	37.18	0.52	0.80	-	-	Non-liquefiable
	18.50	SM	33	27	382.95	185.00	197.95	0.68	0.205	0.71	19.19	4.88	1.18	27.52	0.35	0.77	0.327	1.592	Non-liquefiable
	20.00	CL	67	27	414.00	200.00	214.00	0.64	0.193	0.68	18.46	5.00	1.20	27.15	0.34	0.80	-	-	Non-liquefiable
	21.50	CL	79	44	438.60	215.00	223.60	0.60	0.184	0.67	29.43	5.00	1.20	40.31	0.52	0.79	-	-	Non-liquefiable
	23.00	SM	44	44	469.20	230.00	239.20	0.56	0.171	0.65	28.45	5.00	1.20	39.14	0.52	0.79	0.488	2.848	Non-liquefiable
	24.50	SM	44	65	480.20	245.00	235.20	0.56	0.178	0.65	42.38	5.00	1.20	55.86	0.52	0.79	0.490	2.749	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	26.00	SM	43	67	509.60	260.00	249.60	0.56	0.178	0.63	42.41	5.00	1.20	55.89	0.52	0.78	0.482	2.705	Non-liquefiable
	27.50	SM	43	71	539.00	275.00	264.00	0.56	0.178	0.62	43.70	5.00	1.20	57.44	0.52	0.77	0.475	2.663	Non-liquefiable
	29.00	SM	42	71	568.40	290.00	278.40	0.56	0.178	0.60	42.55	5.00	1.20	56.06	0.52	0.75	0.468	2.625	Non-liquefiable
	30.50	SM	42	70	597.80	305.00	292.80	0.56	0.178	0.58	40.91	5.00	1.20	54.09	0.52	0.74	0.462	2.588	Non-liquefiable
	32.00	ML	54	75	627.20	320.00	307.20	0.56	0.178	0.57	42.79	5.00	1.20	56.35	0.52	0.73	0.456	2.554	Non-liquefiable
	33.50	CL	75	75	656.60	335.00	321.60	0.56	0.178	0.56	41.82	5.00	1.20	55.19	0.52	0.73	-	-	Non-liquefiable
	35.00	CL	64	72	686.00	350.00	336.00	0.56	0.178	0.55	39.28	5.00	1.20	52.14	0.52	0.72	-	-	Non-liquefiable
	36.50	CL	64	73	715.40	365.00	350.40	0.56	0.178	0.53	39.00	5.00	1.20	51.80	0.52	0.71	-	-	Non-liquefiable
	38.00	CL	64	75	744.80	380.00	364.80	0.56	0.178	0.52	39.27	5.00	1.20	52.12	0.52	0.70	-	-	Non-liquefiable
	40.00	CL	64	82	784.00	400.00	384.00	0.56	0.178	0.51	41.85	5.00	1.20	55.21	0.52	0.69	-	-	Non-liquefiable
P104	0.50	SM	45	4	9.90	5.00	4.90	1.00	0.314	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.540	Liquefiable
	1.00	SM-SC	43	4	19.80	10.00	9.80	0.99	0.313	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.542	Liquefiable
	2.00	SM	33	4	39.60	20.00	19.60	0.98	0.310	1.70	6.80	4.88	1.18	12.90	0.14	1.00	0.167	0.537	Liquefiable
	3.00	SM	33	6	59.40	30.00	29.40	0.98	0.308	1.70	10.20	4.88	1.18	16.91	0.18	1.00	0.215	0.697	Liquefiable
	5.00	SM	41	12	99.00	50.00	49.00	0.96	0.303	1.43	17.14	5.00	1.20	25.57	0.30	1.00	0.362	1.195	Non-liquefiable
	6.00	CL	73	10	114.00	60.00	54.00	0.95	0.314	1.36	13.61	5.00	1.20	21.33	0.23	1.00	-	-	Non-liquefiable
	8.00	CL-ML	79	18	152.00	80.00	72.00	0.94	0.309	1.18	21.21	5.00	1.20	30.46	0.50	1.00	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	9.00	CL	92	22	189.00	90.00	99.00	0.93	0.277	1.01	22.11	5.00	1.20	31.53	0.52	1.00	-	-	Non-liquefiable
	11.00	CL	87	15	231.00	110.00	121.00	0.88	0.262	0.91	13.64	5.00	1.20	21.36	0.23	1.00	-	-	Non-liquefiable
	12.00	CL	80	22	243.60	120.00	123.60	0.85	0.262	0.90	19.79	5.00	1.20	28.75	0.40	1.00	-	-	Non-liquefiable
	14.50	CL	80	28	294.35	145.00	149.35	0.79	0.242	0.82	22.91	5.00	1.20	32.49	0.52	1.00	-	-	Non-liquefiable
	16.00	SM	47	28	318.40	160.00	158.40	0.75	0.234	0.79	22.25	5.00	1.20	31.70	0.52	0.82	0.507	2.163	Non-liquefiable
	17.50	SM	49	35	353.50	175.00	178.50	0.71	0.218	0.75	26.20	5.00	1.20	36.44	0.52	0.77	0.481	2.201	Non-liquefiable
	19.00	CL-ML	66	35	383.80	190.00	193.80	0.67	0.206	0.72	25.14	5.00	1.20	35.17	0.52	0.75	-	-	Non-liquefiable
	20.50	CL-ML	66	39	414.10	205.00	209.10	0.63	0.194	0.69	26.97	5.00	1.20	37.36	0.52	0.72	-	-	Non-liquefiable
	23.50	ML	54	42	474.70	235.00	239.70	0.56	0.173	0.65	27.13	5.00	1.20	37.55	0.52	0.79	0.489	2.826	Non-liquefiable
	25.00	SM	39	42	495.00	250.00	245.00	0.56	0.176	0.64	26.83	5.00	1.20	37.20	0.52	0.73	0.452	2.560	Non-liquefiable
	26.50	SM	39	45	532.65	265.00	267.65	0.56	0.174	0.61	27.51	5.00	1.20	38.01	0.52	0.71	0.438	2.519	Non-liquefiable
	29.50	SM	38	58	592.95	295.00	297.95	0.56	0.174	0.58	33.60	5.00	1.20	45.32	0.52	0.73	0.452	2.600	Non-liquefiable
	31.00	SM	38	63	610.70	310.00	300.70	0.56	0.177	0.58	36.33	5.00	1.20	48.60	0.52	0.73	0.451	2.541	Non-liquefiable
	32.50	SM	27	66	640.25	325.00	315.25	0.56	0.177	0.56	37.17	4.48	1.13	46.49	0.52	0.72	0.445	2.506	Non-liquefiable
	34.00	SM	27	56	669.80	340.00	329.80	0.56	0.177	0.55	30.84	4.48	1.13	39.33	0.52	0.71	0.439	2.474	Non-liquefiable
	35.50	SM	27	53	699.35	355.00	344.35	0.56	0.177	0.54	28.56	4.48	1.13	36.76	0.52	0.70	0.433	2.443	Non-liquefiable
	37.00	SM	30	63	728.90	370.00	358.90	0.56	0.177	0.53	33.25	4.71	1.15	43.09	0.52	0.69	0.428	2.414	Non-liquefiable
	38.50	SM	30	48	758.45	385.00	373.45	0.56	0.177	0.52	24.84	4.71	1.15	33.38	0.52	0.68	0.423	2.386	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	40.00	SM	33	52	788.00	400.00	388.00	0.56	0.177	0.51	26.40	4.88	1.18	36.02	0.52	0.69	0.427	2.408	Non-liquefiable
P105	0.50	CL-ML	52	4	9.85	5.00	4.85	1.00	0.316	1.70	6.80	5.00	1.20	13.16	0.14	1.00	-	-	Non-liquefiable
	2.00	CL-ML	54	4	39.40	20.00	19.40	0.98	0.312	1.70	6.80	5.00	1.20	13.16	0.14	1.00	-	-	Non-liquefiable
	3.00	SM	36	6	59.10	30.00	29.10	0.98	0.310	1.70	10.20	5.00	1.20	17.24	0.18	1.00	0.219	0.707	Liquefiable
	4.00	CL-ML	56	6	78.80	40.00	38.80	0.97	0.307	1.61	9.63	5.00	1.20	16.56	0.18	1.00	-	-	Non-liquefiable
	5.00	SM	45	7	101.00	50.00	51.00	0.96	0.297	1.40	9.80	5.00	1.20	16.76	0.18	1.00	0.213	0.716	Liquefiable
	6.00	SM	30	10	121.20	60.00	61.20	0.95	0.295	1.28	12.78	4.71	1.15	19.46	0.21	1.00	0.249	0.845	Liquefiable
	8.00	ML	62	12	161.60	80.00	81.60	0.94	0.290	1.11	13.28	5.00	1.20	20.94	0.23	1.00	0.271	0.935	Liquefiable
	9.00	ML	62	15	174.60	90.00	84.60	0.93	0.300	1.09	16.31	5.00	1.20	24.57	0.28	1.00	0.338	1.128	Non-liquefiable
	10.00	CL	85	15	194.00	100.00	94.00	0.91	0.292	1.03	15.47	5.00	1.20	23.57	0.27	1.00	-	-	Non-liquefiable
	11.00	CL	86	8	221.10	110.00	111.10	0.88	0.273	0.95	7.59	5.00	1.20	14.11	0.15	1.00	-	-	Non-liquefiable
	12.00	CI	72	14	241.20	120.00	121.20	0.85	0.265	0.91	12.72	5.00	1.20	20.26	0.22	1.00	-	-	Non-liquefiable
	13.00	ML	78	14	261.30	130.00	131.30	0.83	0.257	0.87	12.22	5.00	1.20	19.66	0.21	1.00	0.252	0.981	Liquefiable
	14.50	ML	73	21	290.00	145.00	145.00	0.79	0.245	0.83	17.44	5.00	1.20	25.93	0.31	1.00	0.372	1.513	Non-liquefiable
	17.50	ML	54	33	350.00	175.00	175.00	0.71	0.221	0.76	24.95	5.00	1.20	34.93	0.52	0.85	0.528	2.393	Non-liquefiable
	19.00	CL-ML	61	33	374.30	190.00	184.30	0.67	0.211	0.74	24.31	5.00	1.20	34.17	0.52	0.84	-	-	Non-liquefiable
	20.50	CL	86	46	403.85	205.00	198.85	0.63	0.199	0.71	32.62	5.00	1.20	44.14	0.52	0.82	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	23.50	CL	87	38	462.95	235.00	227.95	0.56	0.177	0.66	25.17	5.00	1.20	35.20	0.52	0.74	-	-	Non-liquefiable
	25.00	ML	66	38	512.50	250.00	262.50	0.56	0.171	0.62	23.45	5.00	1.20	33.14	0.52	0.71	0.441	2.585	Non-liquefiable
	26.50	SM	45	50	545.90	265.00	280.90	0.56	0.170	0.60	29.83	5.00	1.20	40.80	0.52	0.69	0.430	2.536	Non-liquefiable
	28.00	CL	87	50	576.80	280.00	296.80	0.56	0.170	0.58	29.02	5.00	1.20	39.83	0.52	0.66	-	-	Non-liquefiable
	29.50	SM	33	50	619.50	295.00	324.50	0.56	0.167	0.56	27.76	4.88	1.18	37.62	0.52	0.64	0.397	2.378	Non-liquefiable
	32.50	CL	86	53	682.50	325.00	357.50	0.56	0.167	0.53	28.03	5.00	1.20	38.64	0.52	0.57	-	-	Non-liquefiable
	34.00	ML	57	52	707.20	340.00	367.20	0.56	0.168	0.52	27.14	5.00	1.20	37.56	0.52	0.56	0.350	2.080	Non-liquefiable
	35.50	SM	44	58	738.40	355.00	383.40	0.56	0.168	0.51	29.62	5.00	1.20	40.55	0.52	0.55	0.343	2.041	Non-liquefiable
	37.00	SM	44	49	769.60	370.00	399.60	0.56	0.168	0.50	24.51	5.00	1.20	34.41	0.52	0.54	0.337	2.004	Non-liquefiable
	38.50	SM	46	61	800.80	385.00	415.80	0.56	0.168	0.49	29.91	5.00	1.20	40.90	0.52	0.53	0.331	1.970	Non-liquefiable
	40.00	SM	46	60	832.00	400.00	432.00	0.56	0.168	0.48	28.87	5.00	1.20	39.64	0.52	0.53	0.326	1.937	Non-liquefiable
P106	0.50	SM	45	2	9.50	5.00	4.50	0.56	0.184	1.70	3.40	5.00	1.20	9.08	0.11	2.03	0.255	1.382	Non-liquefiable
	2.00	CL	60	2	38.00	20.00	18.00	0.56	0.184	1.70	3.40	5.00	1.20	9.08	0.11	1.48	-	-	Non-liquefiable
	3.00	CL	60	3	57.00	30.00	27.00	0.56	0.184	1.70	5.10	5.00	1.20	11.12	0.12	1.35	-	-	Non-liquefiable
	5.00	SM	39	7	95.00	50.00	45.00	0.56	0.184	1.49	10.43	5.00	1.20	17.52	0.19	1.05	0.233	1.264	Non-liquefiable
	6.00	SM	39	9	109.20	60.00	49.20	0.56	0.194	1.43	12.83	5.00	1.20	20.40	0.22	1.04	0.274	1.414	Non-liquefiable
	7.00	CL-ML	55	9	127.40	70.00	57.40	0.56	0.194	1.32	11.88	5.00	1.20	19.26	0.21	1.13	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	8.00	CL-ML	82	10	158.40	80.00	78.40	0.56	0.176	1.13	11.29	5.00	1.20	18.55	0.20	1.06	-	-	Non-liquefiable
	9.00	CL-ML	82	15	178.20	90.00	88.20	0.56	0.176	1.06	15.97	5.00	1.20	24.17	0.28	1.03	-	-	Non-liquefiable
	10.00	CL	89	15	198.00	100.00	98.00	0.56	0.176	1.01	15.15	5.00	1.20	23.18	0.26	1.01	-	-	Non-liquefiable
	11.00	CL	89	31	226.60	110.00	116.60	0.56	0.170	0.93	28.71	5.00	1.20	39.45	0.52	0.94	-	-	Non-liquefiable
	12.00	CL	89	36	247.20	120.00	127.20	0.56	0.170	0.89	31.92	5.00	1.20	43.30	0.52	0.91	-	-	Non-liquefiable
	14.50	CL	77	19	298.70	145.00	153.70	0.56	0.170	0.81	15.33	5.00	1.20	23.39	0.26	0.87	-	-	Non-liquefiable
	16.00	ML	53	19	328.00	160.00	168.00	0.56	0.171	0.77	14.66	5.00	1.20	22.59	0.25	0.84	0.251	1.473	Non-liquefiable
	17.50	SM	48	31	346.50	175.00	171.50	0.56	0.176	0.76	23.67	5.00	1.20	33.41	0.52	0.83	0.517	2.932	Non-liquefiable
	20.50	SM	43	36	405.90	205.00	200.90	0.56	0.176	0.71	25.40	5.00	1.20	35.48	0.52	0.85	0.526	2.978	Non-liquefiable
	22.00	ML	59	36	422.40	220.00	202.40	0.56	0.182	0.70	25.30	5.00	1.20	35.37	0.52	0.85	0.525	2.878	Non-liquefiable
	23.50	ML	59	41	451.20	235.00	216.20	0.56	0.182	0.68	27.88	5.00	1.20	38.46	0.52	0.83	0.516	2.833	Non-liquefiable
	26.50	ML	52	66	508.80	265.00	243.80	0.56	0.182	0.64	42.27	5.00	1.20	55.72	0.52	0.75	0.466	2.555	Non-liquefiable
	29.50	CL-ML	62	53	584.10	295.00	289.10	0.56	0.176	0.59	31.17	5.00	1.20	42.41	0.52	0.71	-	-	Non-liquefiable
	31.00	CL	78	76	613.80	310.00	303.80	0.56	0.176	0.57	43.60	5.00	1.20	57.32	0.52	0.70	-	-	Non-liquefiable
	32.50	CL	78	69	643.50	325.00	318.50	0.56	0.176	0.56	38.66	5.00	1.20	51.40	0.52	0.69	-	-	Non-liquefiable
	35.50	CL	79	75	702.90	355.00	347.90	0.56	0.176	0.54	40.21	5.00	1.20	53.25	0.52	0.67	-	-	Non-liquefiable
	38.50	CL	87	73	773.85	385.00	388.85	0.56	0.174	0.51	37.02	5.00	1.20	49.42	0.52	0.64	-	-	Non-liquefiable
	40.00	CL	87	79	804.00	400.00	404.00	0.56	0.174	0.50	39.30	5.00	1.20	52.16	0.52	0.64	-	-	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
P111	0.50	CL-ML	51	4	10.00	5.00	5.00	1.00	0.311	1.70	6.80	5.00	1.20	13.16	0.14	1.00	-	-	Non-liquefiable
	1.00	CL-ML	51	4	20.00	10.00	10.00	0.99	0.310	1.70	6.80	5.00	1.20	13.16	0.14	1.00	-	-	Non-liquefiable
	3.00	SM	42	10	60.00	30.00	30.00	0.98	0.305	1.70	17.00	5.00	1.20	25.40	0.30	1.00	0.358	1.174	Non-liquefiable
	4.00	SM	42	14	80.00	40.00	40.00	0.97	0.302	1.58	22.14	5.00	1.20	31.56	0.52	1.00	0.620	2.051	Non-liquefiable
	5.00	CL	74	14	100.00	50.00	50.00	0.96	0.300	1.41	19.80	5.00	1.20	28.76	0.40	1.00	-	-	Non-liquefiable
	6.00	CL	74	11	118.20	60.00	58.20	0.95	0.302	1.31	14.42	5.00	1.20	22.30	0.25	1.00	-	-	Non-liquefiable
	7.00	SM	45	30	137.90	70.00	67.90	0.95	0.300	1.21	36.41	5.00	1.20	48.69	0.52	1.00	0.620	2.068	Non-liquefiable
	9.00	CL	74	31	177.30	90.00	87.30	0.93	0.295	1.07	33.18	5.00	1.20	44.81	0.52	1.00	-	-	Non-liquefiable
	10.00	CL	92	44	198.00	100.00	98.00	0.91	0.286	1.01	44.45	5.00	1.20	58.34	0.52	1.00	-	-	Non-liquefiable
	12.50	CL	79	27	247.50	125.00	122.50	0.84	0.265	0.90	24.39	5.00	1.20	34.27	0.52	1.00	-	-	Non-liquefiable
	15.50	SC	46	37	311.55	155.00	156.55	0.76	0.236	0.80	29.57	5.00	1.20	40.49	0.52	0.87	0.541	2.292	Non-liquefiable
	18.50	CL-ML	54	40	379.25	185.00	194.25	0.68	0.207	0.72	28.70	5.00	1.20	39.44	0.52	0.79	-	-	Non-liquefiable
	20.00	SM	35	40	406.00	200.00	206.00	0.64	0.197	0.70	27.87	5.00	1.20	38.44	0.52	0.78	0.481	2.443	Non-liquefiable
	21.50	SM	35	54	436.45	215.00	221.45	0.60	0.184	0.67	36.29	5.00	1.20	48.54	0.52	0.76	0.469	2.541	Non-liquefiable
	24.50	SM	47	57	497.35	245.00	252.35	0.56	0.172	0.63	35.88	5.00	1.20	48.06	0.52	0.68	0.422	2.451	Non-liquefiable
	26.00	SM	36	86	538.20	260.00	278.20	0.56	0.169	0.60	51.56	5.00	1.20	66.87	0.52	0.65	0.405	2.398	Non-liquefiable
	27.50	SM	37	85	569.25	275.00	294.25	0.56	0.169	0.58	49.55	5.00	1.20	64.46	0.52	0.64	0.396	2.342	Non-liquefiable

APPENDIX-H

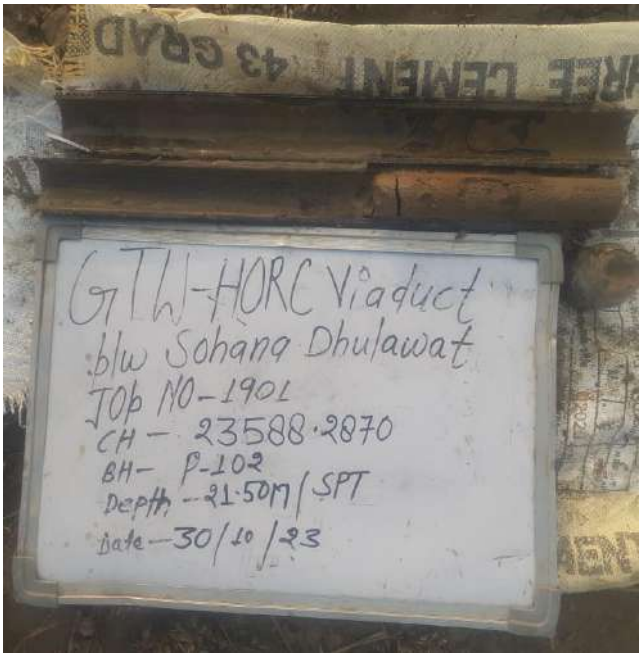
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	29.00	SM	37	88	600.30	290.00	310.30	0.56	0.169	0.57	49.96	5.00	1.20	64.95	0.52	0.62	0.387	2.291	Non-liquefiable
	30.50	SM	37	79	631.35	305.00	326.35	0.56	0.169	0.55	43.73	5.00	1.20	57.48	0.52	0.61	0.379	2.243	Non-liquefiable
	32.00	SM	37	83	662.40	320.00	342.40	0.56	0.169	0.54	44.86	5.00	1.20	58.83	0.52	0.60	0.372	2.199	Non-liquefiable
	33.50	SM	37	82	693.45	335.00	358.45	0.56	0.169	0.53	43.31	5.00	1.20	56.97	0.52	0.59	0.365	2.157	Non-liquefiable
	35.00	SC	34	87	724.50	350.00	374.50	0.56	0.169	0.52	44.96	4.93	1.19	58.35	0.52	0.58	0.358	2.119	Non-liquefiable
	36.50	SC	34	85	755.55	365.00	390.55	0.56	0.169	0.51	43.01	4.93	1.19	56.04	0.52	0.57	0.352	2.082	Non-liquefiable
	38.00	CL	61	88	786.60	380.00	406.60	0.56	0.169	0.50	43.64	5.00	1.20	57.37	0.52	0.56	-	-	Non-liquefiable
	40.00	SC	42	100	828.00	400.00	428.00	0.56	0.169	0.48	48.34	5.00	1.20	63.00	0.52	0.55	0.339	2.004	Non-liquefiable

APPENDIX-I
SITE PHOTOGRAPHS

UDS sample at depth 7.00 m



SPT sample at depth 21.50 m

SPT sample at depth 26.00 m

SPT at depth 36.50 m

APPENDIX-I
SITE PHOTOGRAPHS

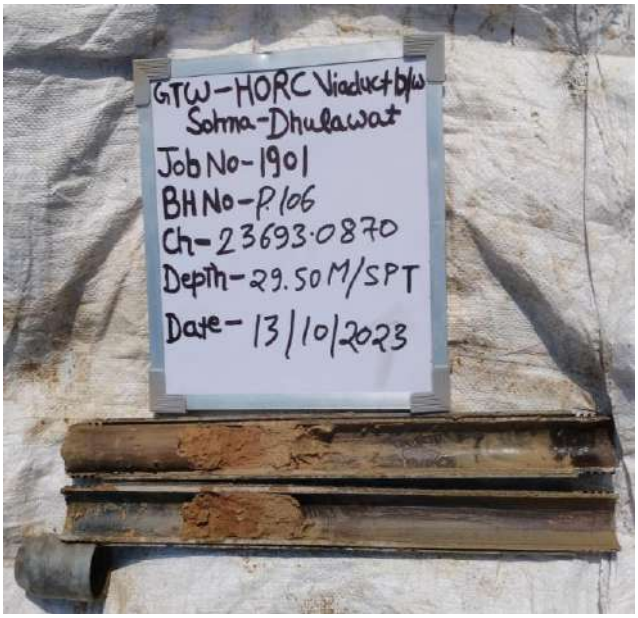
SPT sample at depth 11.00 m

UDS sample at depth 4.00 m

SPT at depth 11.00 m

SPT at depth 14.50m

APPENDIX-I
SITE PHOTOGRAPHS



SPT sample at depth 29.50 m

UDS at depth 11.00m

SPT sample at depth 32.00 m

APPENDIX-J
LABORATORY PHOTOGRAPHS

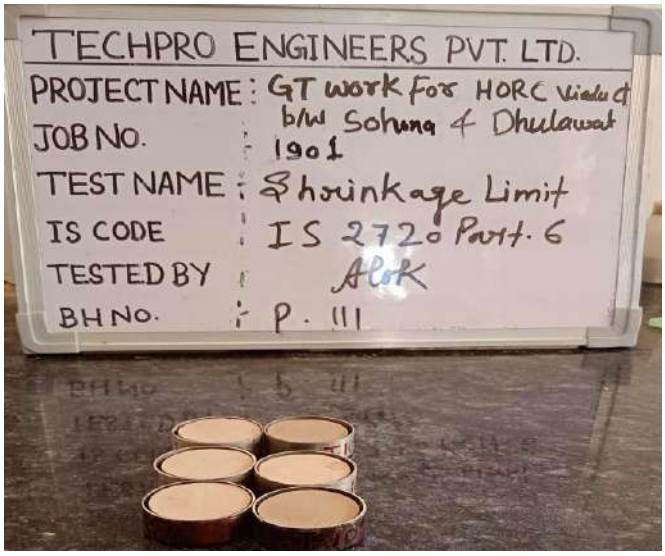
Water content test

Free Swell Index Test

Atterberg's limit test

APPENDIX-J
LABORATORY PHOTOGRAPHS

UCS of soil test



Shrinkage limit test

Direct Shear Test

Tri-axial Test

APPENDIX-K
CHART 1: FIELD BORELOG CHARTS (P 101)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW FOR HORC Viaduct Btw Sohana Dhulawat stations			Project Code:	1901
Coordinate:	N: 3120498.173	E: 700986.455		Location/ Chainage:	23562.0870
Method of Drilling:	Percussion	Drilling Equipment:	Manual/ Horizontally	Bore No.:	P-101
Casing Lowered (M):	21.50M Bentonite Used: NA	Standard Sampler :	Yes	Barrel Type :	NA
Ground Elevation:	R.L-193.949	Date: From 28/10/23 to 30/10/23		Water Table (M):	1.30

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
28/10/23	0.00	0.50	0.50	D	SX	collected				—	—	—	—	—	—	Non cohesive soil
"	1.00	1.45	0.45	U	"	Received				—	—	—	—	—	—	do
"	2.00	2.45	0.45	DP	"	2	3	4	7	—	—	—	—	—	—	do
"	3.00	3.45	0.45	DP	"	2	2	2	4	—	—	—	—	—	—	do
"	4.00	4.45	0.45	U10	"	Skipped				—	—	—	—	—	—	Non cohesive soil
"	5.00	5.45	0.45	DP	"	4	5	7	12	—	—	—	—	—	—	do
"	6.00	6.45	0.45	DP	"	6	8	11	19	—	—	—	—	—	—	do
"	7.00	7.45	0.45	U	"	Received				—	—	—	—	—	—	Non cohesive soil
"	8.00	8.45	0.45	DP	"	9	8	13	21	—	—	—	—	—	—	do
"	9.00	9.45	0.45	DP	"	8	12	16	28	—	—	—	—	—	—	do
"	10.00	10.45	0.45	U	"	Received				—	—	—	—	—	—	do
"	11.00	11.45	0.45	DP	"	8	13	17	30	—	—	—	—	—	—	do
"	12.00	12.45	0.45	DP	"	7	12	16	28	—	—	—	—	—	—	do
"	13.00	13.45	0.45	U	"	Received				—	—	—	—	—	—	do
"	14.00	14.45	0.45	DP	"	5	7	12	19	—	—	—	—	—	—	Cohesive soil with Gravel
"	16.00	16.45	0.45	U	"	Received				—	—	—	—	—	—	do
"	17.00	17.45	0.45	DP	"	8	15	23	38	—	—	—	—	—	—	do
"	19.00	19.45	0.45	U	"	Received				—	—	—	—	—	—	do
"	20.00	20.45	0.45	DP	"	14	20	24	44	—	—	—	—	—	—	do
"	22.00	22.45	0.45	U	"	Received				—	—	—	—	—	—	Non cohesive soil with Gravel
"	23.00	23.45	0.45	DP	"	13	21	23	44	—	—	—	—	—	—	do
29/10/23	25.00	25.45	0.45	U10	"	Skipped				—	—	—	—	—	—	do
"	26.00	26.45	0.45	DP	"	11	21	25	46	—	—	—	—	—	—	do
"	28.00	28.45	0.45	U10	"	Skipped				—	—	—	—	—	—	do

Supervisor Lables

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

E - in - C

APPENDIX-K
CHART 2: FIELD BORELOG CHARTS (P 101)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW FOR HORC Viaduct B/w Sohana Dhulawat station			Project Code:	1901
Coordinate:	N: 3120498.173	E: 700986.455		Location/ Chainage:	23562-0870
Method of Drilling:	Percussion	Drilling Equipment:	manual Auger wash	Bore No.:	P-101
Casing Lowered (M):	21.5m	Bentonite Used: NA	Standard Sampler: Yes	Barrel Type:	NA
Ground Elevation:	R.L-193.949	Date: From 28/10/23 to 30/10/23		Water Table (M):	1.30

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
28-10-23	2930	2945	0.45	DP	SX	14	28	48	76	—	—	—	—	—	—	Non cohesive soil with Gravel
"	3240	3245	0.45	U/DP	"	13	21	24	45	—	—	—	—	—	—	do
"	3250	3295	0.45	DP	"	18	21	23	44	—	—	—	—	—	—	do
"	3400	3445	0.45	U	"	Skipped				—	—	—	—	—	—	do
"	3550	3595	0.45	DP	"	15	23	24	47	—	—	—	—	—	—	do
"	3700	3745	0.45	U	"	Skipped				—	—	—	—	—	—	do
30-10-23	3850	3895	0.45	DP	"	12	24	28	52	—	—	—	—	—	—	-do-
"	4000	4045	0.45	DP	"	16	23	25	48	—	—	—	—	—	—	-do-

Supervisor Lobdev

E - In - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 3: FIELD BORELOG CHARTS (P 102)

TECHPRO ENGINEERS PVT. LTD. — **BORE/ DRILL LOG**

Doc No:	GT/ 003
Date of Issue:	01.04.2018
Rev. No.:	R03
Rev. Date.:	28.12.2021

Project Name: GTW-HORC Viaduct Btw Sohana Dhulawat Station — Project Code: 1901

Coordinate: N: 3120524.371 E: 700986.81 — Location/ Chainage: 23588.2870

Method of Drilling: Percussion — Drilling Equipment: Manual Powerwinch — Bore No.: P 102

Casing Lowered (M): 24.00 — Bentonite Used: NO — Standard Sampler: Yes — Barrel Type: N/A

Ground Elevation: R.L-194.023 — Date: From 29/10/23 to 9/10/23 — Water Table (M): 1.00

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
29/10	0.00	0.50	0.50	DS	SX	Received										NON Cohesive Soil
23	1.00	1.45	0.45	DP	"	1	2	2	4							-do-
"	2.00	2.45	0.45	U	"	Received										-do-
"	3.00	3.45	0.45	DP	"	3	5	8	13							-do-
"	4.00	4.45	0.45	DP	"	3	3	4	7							-do-
"	5.00	5.45	0.45	U	"	Slipped										-do-
"	6.00	6.45	0.45	DP	"	4	6	9	15							-do-
"	7.00	7.45	0.45	DP	"	4	4	6	10							NON cohesive Soil
"	8.00	8.45	0.45	U	"	Received										-do-
"	9.00	9.45	0.45	DP	"	7	9	11	20							-do-
"	10.00	10.45	0.45	DP	"	7	8	10	18							-do-
"	11.00	11.45	0.45	U	"	Received										-do-
"	12.50	12.95	0.45	DP	"	5	7	9	16							-do-
"	14.00	14.45	0.45	U	"	Received										-do-
"	15.50	15.95	0.45	DP	"	7	13	15	28							-do-
"	17.00	17.45	0.45	U	"	Slipped										-do-
"	18.50	18.95	0.45	DP	"	10	12	16	28							-do-
31/10	20.00	20.45	0.45	U	"	Slipped										-do-
33	21.50	21.95	0.45	DP	"	15	21	23	44							NON cohesive soil
"	23.00	23.45	0.45	U	"	Slipped										-do-
1/11	24.50	24.95	0.45	DP	"	14	22	28	50							-do-
33	26.00	26.45	0.45	U	"	Slipped										-do-
"	27.50	27.95	0.45	DP	"	18	21	30	51							-do-
"	29.00	29.45	0.45	U	"	Slipped										-do-

Nitesh
Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 4: FIELD BORELOG CHARTS (P 102)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW-HORC Viaduct b/w Sohana Dhulawat station			Project Code:	1901
Coordinate:	N: 3120524.371	E: 700986.81		Location/ Chainage:	23588.2870
Method of Drilling:	Percssion	Drilling Equipment	Manual Powerwinch	Bore No.:	P102
Casing Lowered (M):	24.00	Bentonite Used:	NO	Standard Sampler :	Yes	Barrel Type :	N/A
Ground Elevation:	R.L-194.023	Date: From 29/10/23 to 2/10/23		Water Table (M):	1.00

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
1/10/23	30.50	30.95	0.45	DP	SX	16	20	28	48							NON cohesivie soil
"	32.00	32.45	0.45	U	"	Skipped										—do—
"	33.50	33.95	0.45	DP	"	17	22	29	51							—do—
"	35.00	35.45	0.45	DP	"	19	23	33	56							—do—
2/10/23	36.50	36.95	0.45	DP	"	19	24	31	55							—do—
"	38.00	38.45	0.45	DP	"	20	26	30	56							—do—
"	40.00	40.45	0.45	DP	"	20	30	36	66							—do—

Nitesh
Supervisor

Techpro Engineers Kanpur

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E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 5: FIELD BORELOG CHARTS (P 103)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GT. For HORC Viaduct Scheme Dhulawat Station			Project Code:	1901
Coordinate:	N: 3120550.568	E: 700987.165		Location/ Chainage:	23614.68870
Method of Drilling:	Percussion	Drilling Equipment:	Compressor	Bore No.:	R-103
Casing Lowered (M):	27.00 Bentonite Used: NA	Standard Sampler:	Yes.	Barrel Type:	NA
Ground Elevation:	R.L-194.05	Date: From 11/10/23 to 17/10/23		Water Table (M):	0.50m

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
11/10/23	0.00	0.50	0.50	D	SX	collected										Non cohesive soil
"	1.00	1.45	0.45	DP	"	1	2	3	5							do
"	2.00	2.45	0.45	U	"	Received										do
"	3.00	3.45	0.45	DP	"	2	3	4	7							Non cohesive soil
"	4.00	4.45	0.45	DP	"	4	5	7	12							do
"	5.00	5.45	0.45	U	"	Received										do
"	6.00	6.45	0.45	DP	"	5	7	9	16							Cohesive soil
"	7.00	7.45	0.45	DP	"	6	9	11	20							do
"	8.00	8.45	0.45	U	"	Received										do
"	9.00	9.45	0.45	DP	"	5	8	11	19							do
"	10.00	10.45	0.45	DP	"	5	9	13	22							do
"	11.00	11.45	0.45	U	"	Received										cohesive soil
"	12.50	12.95	0.45	DP	"	7	8	9	17							do
"	14.00	14.45	0.45	U	"	Received										do
"	15.50	15.95	0.45	DP	"	11	16	20	36							Non cohesive soil
"	17.00	17.45	0.45	U	"	Received										cohesive soil
"	18.50	18.95	0.45	DP	"	8	12	15	27							Non cohesive soil.
12/10/23	20.00	20.45	0.45	U	"	Received										cohesive soil.
"	21.50	21.45	0.45	DP	"	9	19	25	44							cohesive soil with Gravel
"	23.00	23.45	0.45	U	"	Received										Cohesive soil.
"	24.50	24.95	0.45	DP	"	10	23	42	65							Non cohesive soil.
"	26.00	26.45	0.45	WDP	"	10	24	43	67							Non cohesive soil with Gravel
"	27.50	27.95	0.45	DP	"	13	26	45	71							do
"	29.00	29.45	0.45	WDP	"	13	25	46	71							do

Techpro Engineers Pvt. Ltd. Gurgaon

Supervisor E-in-C

Abbreviation Used: U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 6: FIELD BORELOG CHARTS (P 103)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GTI/003
		Date of Issue:	01.04.2018
		Rev. No:	R03
		Rev. Date:	28.12.2021

Project Name:	GIT For HORC Viaduct between Sohana Dhulawat Station					Project Code:	1901
Coordinate:	N: 3120550.568	E: 700987.165			Location/ Chainage:	23614.4870	
Method of Drilling:	Percussion		Drilling Equipment:	Rotary Rig		Bore No.:	P-103
Casing Lowered (M):	27.00	Bentonite Used: NA	Standard Sampler:	Yes.		Barrel Type:	NA
Ground Elevation:	RL-194.05	Date: From 11/10/23 to 13/10/23				Water Table (M):	0.50 M

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
	30.00	30.45	0.45	DP	SX	14	25	45	70							Non cohesive soil with Gravel
13/10	32.00	32.45	0.45	DP	"	16	28	47	75							do
"	33.50	33.95	0.45	DP	"	16	28	47	75							Cohesive soil with Gravel
"	35.00	35.45	0.45	DP	"	15	26	46	72							do
"	36.50	36.95	0.45	DP	"	16	27	46	73							do
"	38.00	38.45	0.45	DP	"	17	28	47	75							do
"	40.00	40.45	0.45	DP	"	19	34	48	82							Cohesive soil with Gravel

Techpro Engineers Pvt. Ltd. Haryana

Supervisor

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

For E In - C

APPENDIX-K
CHART 7: FIELD BORELOG CHARTS (P 104)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW for Horc viaduct B/W Sohana Dhulawat Station			Project Code:	
Coordinate:	N: 3120576.766	E: 700987.521		Location/ Chainage:	23640.6870
Method of Drilling:	Percussion	Drilling Equipment	Autotrip Powerwinch	Bore No.:	P. 104
Casing Lowered (M):	18	Bentonite Used: NO	Standard Sampler : Yes	Barrel Type :	NA
Ground Elevation:	R.L-194.067	Date: From 30/10/23 to 2/11/23		Water Table (M):	1.30

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
30/10/23	0.00	0.50	0.50	DS	Sx	Collected				-	-	-	-	-	-	Non Cohesive Soil
"	1.00	1.45	0.45	U	"	Received				-	-	-	-	-	-	- do -
"	2.00	2.45	0.45	DP	"	2	2	2	4	-	-	-	-	-	-	- do -
"	3.00	3.45	0.45	DP	"	2	2	4	6	-	-	-	-	-	-	- do -
"	4.00	4.45	0.45	U	"	Slipped				-	-	-	-	-	-	- do -
"	5.00	5.45	0.45	DP	"	3	5	7	12	-	-	-	-	-	-	- do -
"	6.00	6.45	0.45	DP	"	3	3	7	10	-	-	-	-	-	-	- do -
"	7.00	7.45	0.45	U	"	Received				-	-	-	-	-	-	Cohesive Soil with
"	8.00	8.45	0.45	DP	"	7	8	10	18	-	-	-	-	-	-	- do - Gravel
"	9.00	9.45	0.45	DP	"	6	10	12	22	-	-	-	-	-	-	- do -
31/10/23	10.00	10.45	0.45	U	"	Received				-	-	-	-	-	-	- do -
"	11.00	11.45	0.45	DP	"	5	6	9	15	-	-	-	-	-	-	Non Cohesive Soil
"	12.00	12.45	0.45	DP	"	6	9	13	22	-	-	-	-	-	-	- do -
"	13.00	13.45	0.45	U	"	Received				-	-	-	-	-	-	- do -
"	14.50	14.95	0.45	DP	"	6	12	16	28	-	-	-	-	-	-	- do -
"	16.00	16.45	0.45	U	"	Received				-	-	-	-	-	-	- do -
"	17.50	17.95	0.45	DP	"	8	15	20	35	-	-	-	-	-	-	Non Cohesive Soil
"	19.00	19.45	0.45	U	"	Slipped				-	-	-	-	-	-	- do -
"	20.50	20.95	0.45	DP	"	10	16	23	39	-	-	-	-	-	-	- do -
"	22.00	22.45	0.45	U	"	Received				-	-	-	-	-	-	Non Cohesive Soil
"	23.50	23.95	0.45	DP	"	13	18	24	42	-	-	-	-	-	-	with Gravel
1/11/23	25.00	25.45	0.45	U	"	Received				-	-	-	-	-	-	- do -
"	26.50	26.95	0.45	DP	"	13	15	30	45	-	-	-	-	-	-	- do -
"	28.00	28.45	0.45	U	"	Received				-	-	-	-	-	-	- do -

Supervisor Lalev

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

S.E. E - in - C

APPENDIX-K
CHART 8: FIELD BORELOG CHARTS (P 104)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW to Horc Viaduct B/W Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 3120576.766	E: 700987.521		Location/ Chainage:	93640.6870
Method of Drilling:	Percussion	Drilling Equipment	Autotrip Powerwinch	Bore No.:	P. 104
Casing Lowered (M):	18	Bentonite Used: NO	Standard Sampler : Yes	Barrel Type :	NA
Ground Elevation:	R.L-194.067	Date: From 30/10/23 to 2/11/23		Water Table (M):	1.20

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
01/11/23	29.50	29.95	0.45	DP	Sx	13	27	31	58	—	—	—	—	—	—	Non Cohesive Soil
"	31.00	31.45	0.45	DP	"	18	31	32	63	—	—	—	—	—	—	with gravel
"	32.50	32.95	0.45	DP	"	13	28	38	66	—	—	—	—	—	—	- do -
2/11/23	34.00	34.45	0.45	DP	"	14	24	32	56	—	—	—	—	—	—	Non Cohesive Soil
"	35.50	35.95	0.45	DP	"	13	18	35	53	—	—	—	—	—	—	- do -
"	37.00	37.45	0.45	DP	"	18	28	35	63	—	—	—	—	—	—	- do -
"	38.50	38.95	0.45	DP	"	12	19	29	48	—	—	—	—	—	—	- do -
"	40.00	40.45	0.45	DP	"	17	21	31	52	—	—	—	—	—	—	- do -

Supervisor Lakhev

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Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 9: FIELD BORELOG CHARTS (P 105)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTG for Horc Viaduct B/W Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 3120602.953	E: 700987.876		Location/ Chainage:	93666.8870
Method of Drilling:	Percussion	Drilling Equipment	Rotary Percussion	Bore No.:	P.105
Casing Lowered (M):	20.00	Bentonite Used:	No	Standard Sampler :	Yes	Barrel Type :	NA
Ground Elevation:	R.L - 193.916	Date: From	30/10/23 to 02/11/23	Water Table (M):	1.20

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
30/10/23	0.00	0.50	0.50	DP	9"	Collected										Non Cohesive Soil
	1.00	1.45	0.45	U	"	Slipped										- do -
	2.00	2.45	0.45	DP	"	2	2	2	4							- do -
	3.00	3.45	0.45	DP	"	2	3	3	6							- do -
	4.00	4.45	0.45	U	"	Received										Non Cohesive Soil.
	5.00	5.45	0.45	DP	"	3	3	4	7							with gravel
	6.00	6.45	0.45	DP	"	3	4	6	10							- do -
	7.00	7.45	0.45	U	"	Slipped										- do -
	8.00	8.45	0.45	DP	"	3	5	7	12							- do -
31/10/23	9.00	9.45	0.45	DP	"	4	6	9	15							- do -
	10.00	10.45	0.45	U	"	Received										- do -
	11.00	11.45	0.45	DP	"	3	4	4	8							Non Cohesive Soil with
	12.00	12.45	0.45	DP	"	4	6	8	14							- do - Gravel
	13.00	13.45	0.45	U	"	Received										- do -
	14.50	14.95	0.45	DP	"	9	9	12	21							- do -
	16.00	16.45	0.45	U	"	Slipped										- do -
	17.50	17.95	0.45	DP	"	9	14	19	33							- do -
	19.00	19.45	0.45	U	"	Slipped										- do -
	20.50	20.95	0.45	DP	"	13	20	26	46							- do -
	22.00	22.45	0.45	U	"	Received										- do -
	23.50	23.95	0.45	DP	"	8	15	23	38							- do -
	25.00	25.45	0.45	U	"	Received										- do -
1/11/23	26.50	26.95	0.45	DP	"	18	25	25	50							Non Cohesive Soil
	28.00	28.45	0.45	U	"	Received										- do -

Supervisor Lobby

E - In - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 10: FIELD BORELOG CHARTS (P 105)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW for HORC Viaduct B/W Sohana-Dhulawat Station			Project Code:	1901
Coordinate:	N: 312060 2.953	E: 70098 7.876		Location/ Chainage:	93666.8870
Method of Drilling:	Percussion	Drilling Equipment	Auto trip Rig 200mm inch	Bore No.:	P. 105
Casing Lowered (M):	90.00 Bentonite Used:	NO	Standard Sampler :	Yes	Barrel Type : NA
Ground Elevation:	R.L-193.916	Date: From 30/10/23 to 2/11/23			Water Table (M): 1.30

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
1/11/23	29.50	29.95	0.45	DP	9x	15	24	26	50	-						Non Cohesive Soil
〃	31.00	31.45	0.45	〃	〃	Received										- do -
〃	32.50	32.95	0.45	DP	〃	11	21	32	53							- do -
〃	34.00	34.45	0.45	DP	〃	14	24	28	52							- do -
2/11/23	35.50	35.95	0.45	DP	〃	18	28	30	58							- do -
〃	37.00	37.45	0.45	DP	〃	13	21	28	49							- do -
〃	38.50	38.95	0.45	DP	〃	17	26	35	61							- do -
〃	40.00	40.45	0.45	DP	〃	18	28	32	60							- do -

Supervisor Lobby

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

E-in-C

APPENDIX-K
CHART 11: FIELD BORELOG CHARTS (P 106)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name: GT work for Horc viaduct B/w Sohana & Dhulawat Station				Project Code:	1901
Coordinate:	N: 3120629.123	E: 700988.231		Location/ Chainage:	23693.0870
Method of Drilling:	Percussion	Drilling Equipment:	Powerwind	Bore No.:	P-106
Casing Lowered (M):	20 m	Bentonite Used:	No	Standard Sampler:	Yes	Barrel Type:	N/A
Ground Elevation:	R.L-194.696	Date: From 11/10/2023 to 13/10/2023		Water Table (M):	0.60 m

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
11/10/23	00	0.50	0.50	DS	SX	Collect				—	—	—	—	—	—	Noncohesive Soil
"	1.00	1.45	0.45	U	—	Received				—	—	—	—	—	—	— do —
"	2.00	2.45	0.45	DP	—	1	1	1	2	—	—	—	—	—	—	— do —
12/10/23	3.00	3.45	0.45	DP	—	1	1	2	3	—	—	—	—	—	—	cohesive Soil
"	4.00	4.45	0.45	U	—	Received				—	—	—	—	—	—	— do —
"	5.00	5.45	0.45	DP	—	2	2	5	7	—	—	—	—	—	—	— do —
"	6.00	6.45	0.45	DP	—	2	3	6	9	—	—	—	—	—	—	Non cohesive Soil
"	7.00	7.45	0.45	U	—	Silpped				—	—	—	—	—	—	— do / DS collect
"	8.00	8.45	0.45	DP	—	4	4	6	10	—	—	—	—	—	—	— do —
"	9.00	9.45	0.45	DP	—	3	6	9	15	—	—	—	—	—	—	Non cohesive soil with
"	10.00	10.45	0.45	U	—	Received				—	—	—	—	—	—	Gravels / cohesive Soil
"	11.00	11.45	0.45	DP	—	8	13	18	31	—	—	—	—	—	—	cohesive soil
"	12.00	12.45	0.45	DP	—	10	15	21	36	—	—	—	—	—	—	— do —
"	13.00	13.45	0.45	U	—	Received				—	—	—	—	—	—	cohesive soil with gravel
"	14.50	14.95	0.45	DP	—	5	9	10	19	—	—	—	—	—	—	— do —
"	16.00	16.45	0.45	U	—	Received				—	—	—	—	—	—	Non cohesive Soil with gra
"	17.50	17.95	0.45	DP	—	8	14	17	31	—	—	—	—	—	—	— do —
"	19.00	19.45	0.45	U	—	Received				—	—	—	—	—	—	Non cohesive soil ~~with~~
"	20.50	20.95	0.45	DP	—	12	16	20	36	—	—	—	—	—	—	— do —
"	22.00	22.45	0.45	U	—	Silpped				—	—	—	—	—	—	— do / DS collect
"	23.50	23.95	0.45	DP	—	13	18	23	41	—	—	—	—	—	—	— do —
"	25.00	25.45	0.45	U	—	Received				—	—	—	—	—	—	— do —
"	26.50	26.95	0.45	DP	—	15	27	39	66	—	—	—	—	—	—	Non cohesive Soil
13/10/23	28.00	28.45	0.45	U	—	Silpped				—	—	—	—	—	—	— do —

Supervisor

Techpro Engineers Pvt. Ltd. Rajpur

E-in-C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 12: FIELD BORELOG CHARTS (P 106)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date:	28.12.2021

Project Name:	GT work for Horc viaduct B/w Sohana of Dhulawat station			Project Code:	1901
Coordinate:	N: 3120629.123	E: 700988.131		Location/ Chainage:	23693-0870
Method of Drilling:	Percussion	Drilling Equipment:	Power winch	Bore No.:	P-106
Casing Lowered (M):	20.m	Bentonite Used:	ON	Standard Sampler:	Yes
				Barrel Type:	N/A
Ground Elevation:	R.L- 194.696	Date: From 11/10/2023 to 13/10/2023		Water Table (M):	0.60 m

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
13/10/23	29.50	29.95	0.45	DP	SX	11	22	31	53	—	—	—	—	—	—	cohesive soil with gravel
"	31.00	31.45	0.45	DP	—	14	31	45	76	—	—	—	—	—	—	— do —
"	32.50	32.95	0.45	DP	—	13	29	40	69	—	—	—	—	—	—	cohesive soil with gravels
"	34.00	34.45	0.45	U	—	Silpped				—	—	—	—	—	—	— do —
"	35.50	35.95	0.45	DP		15	32	43	75	—	—	—	—	—	—	— do —
"	37.00	37.45	0.45	U		Silpped				—	—	—	—	—	—	— do —
"	38.50	38.95	0.45	D.P		16	33	40	73	—	—	—	—	—	—	— do —
"	40.00	40.45	0.45	DP		14	35	44	79	—	—	—	—	—	—	cohesive soil

Supervisor

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E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 13: FIELD BORELOG CHARTS (P 111)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	G.I. Work for HORC Viaduct b/w Sohna & Dhulawat Station			Project Code:	1901
Coordinate:	N: 3120766.59	E: 700989.842		Location/ Chainage:	23830.4470
Method of Drilling:	Rotary	Drilling Equipment:	Manual/ Hydraulic	Bore No.:	P-111
Casing Lowered (M):	15.0 Bentonite Used: No	Standard Sampler:	Yes	Barrel Type:	N/A
Ground Elevation:	R.L- 194.745	Date: From 18/10/23 to 21/10/23		Water Table (M):	1.30

Day / Date	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
18/10/23	0.00	0.50	0.50	DS	Sx	Collected										Non-Cohesive Soil.
"	1.00	1.45	0.45	DP	"	1	2	2	4							—do—
19/10/23	2.00	2.45	0.45	U	"	Received.										—do+ Gravel.
"	3.00	3.45	0.45	DP	"	4	5	5	10							—do—
"	4.00	4.45	0.45	DP	"	6	7	7	14							—do—
"	5.00	5.45	0.45	U	"	Received.										Cohesive Soil with Gravel
"	6.00	6.45	0.45	DP	"	4	5	6	11							—do—
"	7.00	7.45	0.45	DP	"	10	14	16	30							—do—
"	8.00	8.45	0.45	U	"	Received.										—do—
"	9.00	9.45	0.45	DP	"	10	13	18	31							—do—
"	10.00	10.45	0.45	DP	"	13	20	24	44							—do—
"	11.00	11.45	0.45	U	"	Received.										—do—
"	12.50	12.95	0.45	DP	"	7	12	15	27							Cohesive Soil
"	14.00	14.45	0.45	U	"	Received.										Cohesive Soil with Gravel
"	15.50	15.95	0.45	DP	"	10	17	20	37							—do—
"	17.00	17.45	0.45	U	"	Received.										—do—
"	18.50	18.95	0.45	DP	"	9	18	22	40							—do—
20/10/23	20.00	20.45	0.45	U	"	Slipped.										Non-Cohesive Soil.
"	21.50	21.95	0.45	DP	"	13	24	30	54							Non Cohesive Soil with Gravel
"	23.00	23.45	0.45	U	"	Slipped.										—do— (DS collected)
"	24.50	24.95	0.45	DP	"	14	26	31	57							Cohesive Soil with Gravel
"	26.00	26.45	0.45	DP	"	16	35	51	86							Non-Cohesive Soil with Gravel
"	27.50	27.95	0.45	DP	"	15	36	49	85							—do—
"	29.00	29.45	0.45	DP	"	16	38	50	88							—do—

Supervisor

Techpro Engineers Pvt. Ltd. Rohtak 21/10/23

S.E. Civil

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 14: FIELD BORELOG CHARTS (P 111)

TECHPRO ENGINEERS PVT. LTD. — **BORE/ DRILL LOG**

Doc No:	GT/ 003
Date of Issue:	01.04.2018
Rev. No.:	R03
Rev. Date.:	28.12.2021

Project Name: G.T. Work for HORC Viaduct b/w Sohna & Dhulawat Station — Project Code: 1901

Coordinate: N: 3130766.59 — E: 700989.842 — Location/ Chainage: 23830-4470

Method of Drilling: Rotary — Drilling Equipment: Manual/ Hydraulic — Bore No.: P-111

Casing Lowered (M): 15.0 — Bentonite Used: No — Standard Sampler: Yes — Barrel Type: N/A

Ground Elevation: R.L-194.745 — Date: From 18/10/23 to 21/10/23 — Water Table (M): 1.30

Day / Date	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
21/10/23	30.50	30.95	0.45	DP	Sl.	14	33	46	79							Cohesive Soil with Gravel
〃	32.00	32.45	0.45	DP	〃	15	36	47	83							Non-Cohesive Soil with Gravel
〃	33.50	33.95	0.45	DP	〃	16	37	45	82							——do——
〃	35.00	35.45	0.45	DP	〃	18	39	48	87							Cohesive Soil with Gravel
〃	36.50	36.95	0.45	DP	〃	17	40	45	85							——do——
〃	38.00	38.45	0.45	DP	〃	16	42	46	88							——do——
〃	40.00	40.30	0.30	DP	〃	37	55	–	R							——do——

Supervisor 21/10/23

Techpro Engineers Pvt. Ltd. Kanpur

Civil Engg.

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

End of Report

Report No: 1901-HORC-VII

Report No.: 1901-HORC-VII

Date: Dec 05th; 2023

GEOTECHNICAL INVESTIGATION REPORT

ULR No.: TC916923000000032P
REVISION-R1

AT THE SITE FOR

HORC VIADUCT BETWEEN SOHANA & DHULAWAT STATIONS OF HARYANA ORBITAL RAIL CORRIDOR (HORC) PROJECT, HARYANA

FROM BOREHOLES P114A to P133A

CLIENT

HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LTD.

Plot No. 143, 5th floor RailTel tower, Sector-44,
Gurugram, Haryana 122003

GENERAL CONSULTANTS

RITES-SMEC JV

Gurugram, Haryana

GEOTECHNICAL CONSULTANTS

TECHPRO ENGINEERS PVT. LTD.

114, RAM GANGA HOUSING SOCIETY, NARAMAU, G T ROAD, KANPUR-209 217, Phone: 9793209918

e-mail: info@techproindia.com

TC-9169

REVISION NOTES

REVISION NO.	DATE	DESCRIPTION
R1	12.12.2023	• Lithological profile added in Appendix-C.

REPORT FORMAT

Report No.	Bore included	Total Number of Bores
1901-HORC-I	A1 to P20	21
1901-HORC-II	P21 to P40	20
1901-HORC-III	P41 to P60	20
1901-HORC-IV	P61 to P80	20
1901-HORC-V	P114A to P133A	20
1901-HORC-VI	P101 to P113	13
1901-HORC-VII	P114A to P133A	20
1901-HORC-VIII	P134A to A2A	16
1901-HORC-IX	P114B to P133B	20
1901-HORC-X	P134B to A2B	16

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Name of Legal Identity : Techpro Engineers Private Limited

Signed for and on behalf of NABL

N. Venkateswaran
Chief Executive Officer

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Dec 05th; 2023

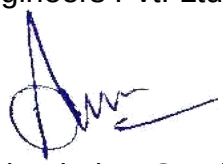
ACKNOWLEDGEMENTS

We are pleased to submit the part-7 of the report of Geotechnical investigation, conducted for the boreholes P114A to P133A for the design of foundations for HORC Viaduct between Sohana & Dhulawat stations of Haryana Orbital Rail Corridor (HORC) project in the state of Haryana, India.

We hereby, convey our sincere thanks to Mr. Neeraj Bhandari (CPM/South) and Mr. Raju Solanki (DGM/C/South), HRIDCL for trust and support during the investigation. We also acknowledge our thanks to Mr. Uma Maheshwara Rao B, DGM/C/West, HRIDCL for awarding the said work to us. We are also grateful Mr. Ravindra Dutta Upadhyay (Geotech Expert), Mr. PS Gautam & Mr. Jitender Parashar, Site Engineer from the RITES- SMEC JV and Mohd. Ishak (Executive/Civil) from HRIDCL, for their help rendered during and prior to the investigation work.

We are also thankful to our staff members for conducting field and laboratory test, preparing sketches, and typing the report.

for Techpro Engineers Pvt. Ltd.



(Arvind K. Garg)
B.Tech. (Civil), M.Tech.
Principal Consultant &
Managing Director

1. INTRODUCTION:

Haryana Rail Infrastructure Development Corporation Ltd. (HRIDC) and Ministry of Railways, Govt. of India has come together to form a new company namely Haryana Orbital Rail Corporation Limited (HORCL), to design and construction of new BG line from Palwal to Sonipat named Haryana Orbital Rail Corridor (HORC), in the state of Haryana, India. In this connection, a Geotechnical investigation has been planned for the design of foundations of Viaduct between Sohana & Dhulawat stations of Haryana Orbital Rail Corridor (HORC) Project in the state of Haryana. The work of conducting the detailed Geotechnical Investigation has been awarded to us by HRIDC, through work order No. HRIDC/HORC/GTI/211/2023-2024/Vol-0 dated 02-09-2023, which includes investigation in field, laboratory testing of disturbed and undisturbed samples, collected from the field, and submission of the geotechnical **investigation** test report.

A geotechnical investigation was carried out, with the locations, planned by the client. Purpose of the investigation is to determine the nature and properties of soil and rock strata across the bore holes and representing them through log sections showing the levels, nature, and properties of various strata up to a sufficient depth below the founding level, proneness of site to artesian conditions, seismic disturbance and other engineering properties of soil and rock strata.

This part -7 of the report includes the detailed methodology of investigation, collection of samples, field and laboratory test result including their interpretation/ analysis, recommendations on the properties of soils and rock required for design of foundation and suggesting suitable type and depth of foundation with allowable bearing capacity for safe and strong foundations for the Bore Hole numbers P114A to P133A.

2. SCOPE OF WORK:

For the design of foundation of viaduct, it is required to determine the allowable bearing capacity together with necessary engineering characteristics of underlying soil & rock strata. In general, the geotechnical investigation has been planned as per IS:1892-2021 and further extended to IS: 1904, IS:2911 (part-1/Sec 2) & IRC 78:2014 for planning the laboratory testing and computing the allowable bearing capacity, hence the scope of work is as follows:

2.1. Mobilisation of all tools & plants along with accessories, materials, labours etc. at site of work for drilling and testing work, including setting up boring and shifting to different bore holes point etc.

2.2. Exploratory drilling of 150 mm diameter bore holes through soil deposits and 75 mm in rock within the proposed alignment upto the required depth.

2.3. Collection of disturbed soil samples at an interval of 3.00 meter in all the bore holes.

2.4. Collection of undisturbed soil samples at every 3.00 m interval or at change of stratum from all the boreholes.

2.5. To conduct Standard Penetration Test (SPT) at an interval of 3.00 m or noticeable change of stratum in soil deposits in all bore holes.

2.6. Collection of rock core samples and preserving them in core boxes.

2.7. To collect ground water sample on completion of bore holes.

2.8. To record the ground water table in all the bore holes.

2.9. Transporting all the disturbed, undisturbed soil and rock core samples collected during the field investigation to our NABL accredited Geotech Engineering laboratory at Kanpur.

2.10. To conduct the laboratory tests on all the soil and rock core samples collected during field investigation for determination of their engineering characteristics.

2.11. To compile of field and laboratory test results, working out the allowable bearing capacity and preparing the report including detailed recommendations and necessary precautions.

3. GEOLOGICAL INFORMATION OF THE REGION:

3.1. Geography:

The project location is in the bordering area of Gurugram and Nuh (recent old name-Mewat), districts in the Indian state of Haryana. The stretch of the alignment of the proposed corridor starts from southmost part of Gurugram in the town of Sohna and ends at Dhulawat, which is a village lying at the north of Nuh district.

Haryana is a state located in the northern part of India. Gurugram is among one

of the districts in Haryana which is also the part of National Capital Region (30km south of New Delhi). It lies at an elevation of 217 m above msl. Sohna is a small town located 25km in the south of Gurugram. Sohna is well known for its hot water springs and famous Shiva temple. Sohna is located in between 28°15' N latitude and 77°40' E longitude at the elevation of 212.14m above msl. Mewat district is located at 28 °12′ N latitude, 77 °3′ E longitude, at the south of Gurugram at an elevation of 199 m above msl. The location is bordered by Rewari district on west and Faridabad & Palwal district on the east.

3.2. Geology:

The Gurugram district is having of almost flat topography, however, in the north-eastern part small isolated hillocks of Precambrian rocks are exposed. Small hill ranges which are part of the Aravali and Mangar Bani ranges exists in the district. The major part of district is underlain by Quaternary alluvium consisting of sand, clay and silt. The alluvial plain is formed by the Sahibi river which is a tributary of River Yamuna. Soils of the Gurgaon district is classified as tropical and brown soils, existing in the north western extreme, northern and north eastern parts of the district and water logged and salt affected soils in the southern parts of the district. The soils are medium textured loamy sand is the average texture in Gurgaon and Sohna blocks.

3.3. Rainfall and Climate:

The area has hot semi-arid type of climate characterising extreme dryness of the air except in the monsoon season. Intense hot summer and cold winters. The total annual rainfall in the region is about 596 mm, of which 75 to 80% is because of the south-west monsoon.

3.4. Seismicity:

The site under consideration exists in the district of Gurugram and Mewat which lies in the Seismic Zone IV (high damage risk zone), as per the current seismic zonation map of India (IS 1893-2016): RA 2021 and have a zone factor of 0.24 for design basis earthquake. The region is surrounded by many in-homogeneities in the form of faults and ridges like Sohna Fault, Moradabad Fault, Delhi-Moradabad Fault, Delhi-Haridwar ridge, junction of Aravalli and Alluvium near Delhi. The Sohna fault line lies between the Delhi ridge and Sohna town and falls between the Arjangarh and

Manesar outcrops. All the developed area in Gurugram comes within 200 km of the fault line. The Sohna fault line is located at the junction between the hard rock terrain of the Aravalli hills and the sandy formation of the Yamuna River and is currently inactive from several years and is capable of a disastrous earthquake.

The project location has been marked in Fig.1 Seismic zone map of India.

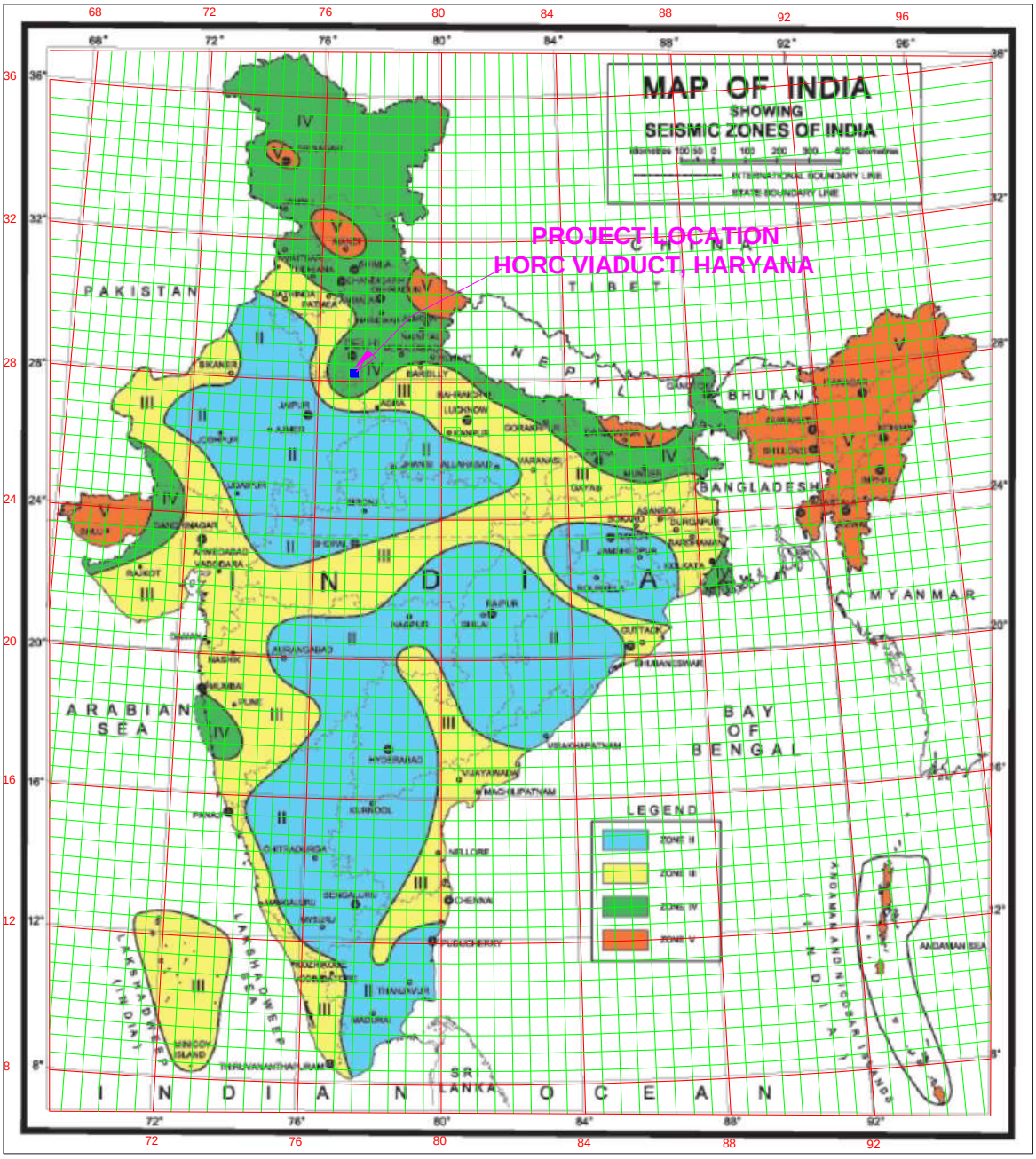


Fig.1: Seismic Zone Map of India

4. FIELD INVES TIGATION:

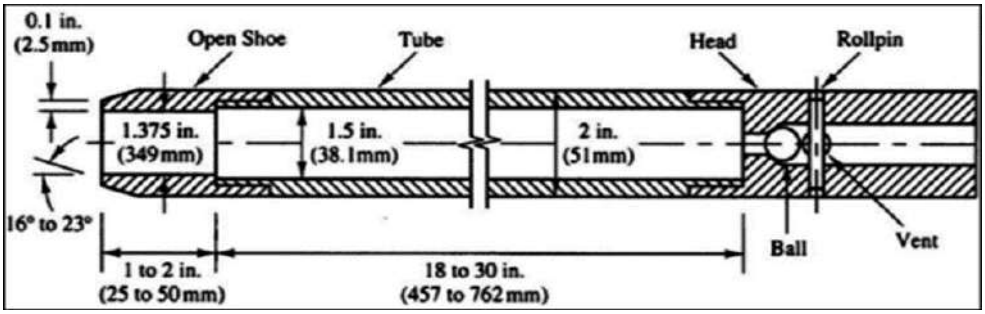
The field investigation work at this site was carried out from Oct

31st; 2023 to Nov 3rd; 2023 and Nov 18th ;2023 to Nov 21st ;2023. The following investigation work was carried out:

4.1. **Twenty** numbers of borehole were proposed to be made at this stretch, out of which two number of **boreholes** (marked as 116A and 120A) of diameter 150 mm in soil were made for conducting Standard Penetration Test and collection of disturbed and undisturbed samples. The boreholes were progressed using power operated winch machine under **percussion** method of drilling. Casing was used to keep the borehole stable and Bentonite was also used as drilling mud to help prevent wall collapse of boreholes at deeper depth. The records of achieved depth of bore holes have been given in Para No. 6, the details of drilled bores along with depth of casing used have been reported in Appendix B. Locations of boreholes have been reported in "TEST LOCATION PLAN" in Appendix A.

4.2. **Standard Penetration Tests** were conducted at 1.00 to 2.00 metre interval upto the depth of 12.00 meter and 3.00 metre interval, beyond 12.00 metre depth, as per the procedure in IS: 2131-1981-(RA: 2021) in all the bore holes. The **standard SPT sampler** (without liner and with no space for liner) and **rope-pulley driven hammer** of standard weight of 63.50 kg have been used to perform the test.

For conducting the test, the bottom of the borehole was properly cleaned, and split spoon sampler was properly seated in position in the borehole. The split spoon sampler resting on the bottom of borehole was allowed to sink under its own weight; then the sampler was allowed to penetrate 15 cm with the blows of the hammer 63.50 kg weight falling free through 75cm, thereafter the split spoon sampler was further driven by another 15 cm. For the 3rd and final drive, the sampler was further allowed to penetrate 15 cm. The number of blows required to get each 15 cm of penetration, was recorded. The first 15 cm of drive is seating drive.



Structure of SPT Sampler

The total blows of penetration for the second and third 15 cm of penetration is termed the penetration resistance N. The N' values are indicative of the compactness/ relative density of cohesion less soils and consistency of cohesive soils.

In case the blows count of SPT in soil (including the number of blows of seating) exceeds 100, the corresponding penetration was recorded and this particular test at that depth stopped. If the total penetration is more than the seating penetration of 15 cm, then breakup of blow counts for 15 cm seating penetration and for remaining portion of penetration is also given.

SPT 'N' values are correlated with non-cohesive stratum as per BS: 5930 (1999) – for sandy strata and with consistency of cohesive stratum.

Correlation For Clay/Plastic Silt		**Correlation For Sand/Non-Plastic Silt**	
Consistency of clays	**Penetration Value**	**Relative Density of sand**	**Penetration Value**
Very Soft	0 to 2 Blows	Very loose	0 to 4 Blows
Soft	3 to 4 Blows	Loose	5 to 10 Blows
Medium Stiff	5 to 8 Blows	Medium	11 to 30 Blows
Stiff	9 to 16 Blows	Dense	31 to 50 Blows
Very Stiff	17 to 32 Blows	Very Dense	Above 50
Hard	Above 32		

In this method, the sampler acts as a probe and the driving energy is supplied by the fall of the drop weight. The values of 'N' depend on the compactness or relative density of the material. In hard formations, the testing is discontinued if 'N' value is found to be more than 100. It is termed as 'Refusal'. Refusal is also recorded when SPT blow count records 50 or more for any of the single drive of 15 cm.

'N' value depends upon degree of saturation and over burden pressure of the formation. Silty fine sand and fine sand below the water table develop pore water pressure depending on the in-situ void ratio which in turn affects the effective stress. This change in effective stress influences the 'N' value considerably.

Depth of overburden affects the SPT values in none to low cohesive soils and hence need correction. The SPT value after the overburden correction, N' is as follows:

$$N' = 0.77x \log (2000/q) \times N$$

Where, q= Overburden Pressure (kN/m^2) and N = observed SPT value

N' is corrected further for dilatancy in case of saturated fine sands and silts for the values of N' greater than 15.

Modified value after dilatancy correction N" = 15+ (N'-15)/2

Soil samples obtained from split spoon sampler were collected in the polythene bags of suitable size. These samples were property sealed, labelled, and carefully transported to the laboratory for testing. The results have been reported in Table 1 and 2 of Appendix B under the title "SUMMARY OF TEST RESULTS".

4.3. **Disturbed soil samples** were collected at 0.50 metre, then at 1.00 to 2.00 metre interval upto the depth of 12.00 meter and 3.00 metre interval, beyond 12.00 metre depth and at significant change of stratum. Soil from cutting edge of SPT samplers and retained in split spoon, used for Standard Penetration Tests was taken as disturbed samples. These samples were placed without delay in adequately sealed polythene bags. Where the collection of disturbed soil samples could not be collected from SPT samples, Shelby tubes were driven and retained soil samples were obtained. The laboratory tests were conducted on the collected soil samples and reported in Table 1 and 2 of Appendix-B under the title "SUMMARY OF TEST RESULTS".

4.4. **Undisturbed soil samples** were collected in accordance with IS: 2132-1986-(RA: 2021) at an interval of 3.00 metre or at change of stratum, starting from the depth of 1.00 or 2.00 m, by using 100 mm dia. and 450 mm long MS tubes provided with sampler head with ball check arrangement. However, the some of the samples could not be extracted due to the partial penetration or slippage during the evacuation.

Moreover, collection of Undisturbed samples in very hard cohesive soils/ dense granular soils/gravels/ cobbles/ pebbles/ boulders, refusal strata is practically not possible and such collected samples will not truly represent the undisturbed conditions.

Immediately after taking undisturbed sample in the tube, the adopter head was removed along with the disturbed material. The visible ends of the samples shall then be trimmed off any wet disturbed soil. The ends will then be coated alternately with four layers of molten wax. More molten wax will then be added to give a total thickness of not less than 25 mm. The laboratory test results have been reported in Table 1 and

2 of Appendix-B.

4.5. The **ground water table** in the borehole was allowed to stabilize and measured after 8, 16, 24 and 48 hours after completion of the bore hole. It was ensured that last two reading were identical. The records of ground water table have been given in Para No.6.

4.6. **Ground water samples** were collected from borehole as per IS: 6935-1973-(RA:2019) for chemical analysis to determine aggressiveness in relation to attack on concrete / reinforcement including determination of pH value.

5. LABORATORY TESTS:

The following laboratory tests were conducted to determine the engineering characteristics of sub-soils:

5.1. **Field moisture contents** were determined by oven drying method as per IS: 2720 (part II)-1973-(RA: 2020). The results have been reported in Table 1 and 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.2. **Bulk density** of soil strata was obtained using Shelby tubes in accordance with IS 2720 (part XXIX)-1975-(RA: 2020). The results have been reported in Table 1 and 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.3. **Mechanical sieve analysis** test was performed in accordance with IS: 2720 (Part IV) – 1985-(RA: 2020), for the purpose of identification by grain size analysis, on coarse part of the soil samples and the results have been reported in Table 1 and 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.4. **Particle size analysis** test by **Hydrometer method** were performed in accordance with IS: 2720 (Part IV) -1985-(RA: 2020) on the part of soil samples obtained after the sieve analysis. The results have been reported in Table 1 and 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.5. **Atterbergs' limits tests** were performed in accordance with IS: 2720 (part V)-1985-(RA: 2020) and results have been reported in Table 1 and 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.6. **Specific gravity tests** were performed in accordance with IS 2720 (part III-sec. 1) -

1980-(RA: 2021) and the results have been reported in Table 1 and 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.7. **Consolidation tests** were performed on cohesive soil samples in accordance with IS: 2720 (part XV)-1965-(RA: 2021). The results have been reported in Table 1 and 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.8. **Direct shear tests** were performed as per IS: 2720 (part XIII)-1986-(RA: 2021), on the undisturbed soil samples obtained during the field investigation. The results and the density of samples have been reported in Table 1 and 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.9. **Tri-axial Compression Test** under Unconsolidated Un-drained (UU) condition as per IS: 2720 (Part-XI)-1993-(RA: 2021) were performed on the selected undisturbed soil samples, obtained during the field investigation. The results have been reported in Table 1 and 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.10. **Unconfined Compressive strength tests** were performed in accordance with IS 2720 (Part-X) -1991-(RA:2020) on selected undisturbed soil samples and the results have been reported in Table 3 of Appendix B.

5.11. **Shrinkage Limit tests** were performed in accordance with IS 2720 (part-VI) -1972-(RA: 2021) and the results have been reported in Table 1 and 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.12. **Free Swell Index** were performed in accordance with IS 2720 (part-XL) -1977-(RA: 2021) and the results have been reported in Table 1 and 2: "SUMMARY OF TEST RESULTS" of Appendix B.

6. GROUND WATER TABLE:

The water table at this site was encountered during the drilling operation up to the depth of investigation.

Borehole No.	Chainage	Global Co-ordinates (UTM format)		Reduced Level (m)	Depth of Borehole (m)	Water table (m)
		Easting	Northing			
P116A	23961.447	700986.631	3120897.53	195.485	40.00	1.90

Borehole No.	Chainage	Global Co-ordinates (UTM format)		Reduced Level (m)	Depth of Borehole (m)	Water table (m)
		Easting	Northing			
P120A	24066.247	700978.032	3121001.95	196.008	40.00	5.00

7. DESCRIPTION OF STRATA:

The classification of soil stratum has been done with the help of soil characteristics obtained in laboratory tests as per IS 1498-1970-(RA:2021). The classification of rock masses has been done based on RMR as per IS: 4464-1985, IS: 13365-1. The detailed nature of the strata has been reported in Table 1: "SUMMARY OF TEST RESULTS" of Appendix-B and represented through Lithological plots in Appendix-C.

The strata exhibited in both the bore holes, is predominantly comprising of inorganic silty clays of low plasticity and inorganic silts of non to low plastic category. Silty sands were encountered at varying depth and thickness.

8. SAFE BEARING CAPACITY COMPUTATIONS:

For the construction of viaducts, deep foundation **(Bored Cast-In-Situ RCC piles)** have been considered for computation of load bearing capacity of the underlying soil strata. The computation of load bearing capacity of bored cast-in-situ RCC piles have been done as per IS 2911 (part-1, section-2)-2010-(RA: 2020) with due consideration of effects of liquefaction.

8.1. Design Parameters:

Factor of safety in Compression	=	2.50
Factor of safety in Tension	=	3.00
Depth of critical water table	=	0.00 m
Diameter of pile	=	1.00 & 1.20 m
Cut off length	=	2.50 m
Type of pile head consider	=	Fixed

8.2. Computation of friction along pile stem:

$$Q_{uf} = \sum K_i . P_{di} . \tan\delta_i . A_{si}$$

where,

Q_{uf} = Ultimate shaft friction (kN/m^2)

K_i = Coefficient of earth pressure at mid-depth of ith layer

P_{di} = Effective overburden pressure at mid-depth of ith layer (kN/m^2)

A_{si} = Surface area of pile stem in i^{th} layer (m^2)

δ_i = Angle of wall friction between pile and soil of ith layer (= ϕ) (degree)

ϕ_i = Angle of internal friction of soil in i^{th} layer (degree)

$\sum$ = Sum of all layers up to i^{th} layer

8.3. Computation of Cohesion along the stem of pile:

$$Q_{uc} = \sum \alpha_i . c_i . A_{si}$$

Where,

c_i = Cohesion in i^{th} layer

A_{si} = Surface area of pile stem in i^{th} layer (m^2)

α_i = Adhesion factor for i^{th} layer of soil depending of consistency of soils

$\sum$ = Sum of cohesion of all layers considered

8.4. Computation of end bearing resistance:

$$Q_{ub} = A_p (c.Nc + q.Nq + 0.5.\ \gamma.B.N\gamma)$$

Where,

A_p = Area of the pile toe (m^2)

c = cohesion of soils at pile toe (kN/m^2)

γ = Effective Unit weight of soils at pile toe (kN/m^3)

B = Diameter of pile (m)

q = Effective overburden pressure at pile toe (kN/m^2)

N_c = Bearing Capacity Factor (Recommended equal to 9)

Nq, $N\gamma$ = Bearing Capacity Factor

8.5. Lateral load capacity of piles in soils:

$$Q_u = 12.E.I.\delta/(L_1+L_f)^3$$

where,

Q_u = Ultimate lateral load capacity of pile (kN)

δ = Permissible deflection (m) = 5 mm

E = Young Modulus of pile material (kN/m^2)

I = Moment of Inertia of the pile cross section (m^4)

L_1 = Cantilever Length of pile (m)

L_f = Length of fixity (m)

Detailed calculations of pile load carrying capacity in compression & uplift in soil have been reported in **Table-1 to 2** of **Appendix-H.**

Pile lateral Load capacity has been given in **Table-3 to 4** of **Appendix-H**.

9. LIQUEFACTION ANALYSIS:

Liquefaction is the sudden loss of shear strength of the loose fine sands due to earthquake-induced vibration under saturated conditions. Liquefaction generally takes place in loose fine sands (fines < 10 %, D_{60}= 0.20 mm to 1.0 mm and C_u between 2 to 5) with N value less than 15. In case of soil strata having N>15, liquefaction of soil will not take place normally.

The present site falls in **seismic zone – IV.** Considering the history of past earthquakes and available seismic data, an earthquake of **magnitude 7.0** having peak ground acceleration **a_{max}= 0.24 g** is considered in the present analysis.

Preliminary assessment of liquefaction potential of foundation strata is made by simplified approach proposed by IS: 1893 (part-1)-2016-(RA: 2021) from the data obtained in Standard Penetration Test.

In this method, cyclic shear stress likely to be induced in the foundation strata by Design Basis Earthquake is first evaluated. Next threshold cyclic shear stress, which is good enough to cause liquefaction, is determined from SPT data and the empirical relations. Finally, comparison of these two stresses is used in the estimation of liquefaction susceptibility of the foundation strata.

Cyclic Stress Ratio (CSR):

The equivalent average of shear stress likely to be induced in the foundation material due to an earthquake is calculated by using the equations

Cyclic Resistance Ratio (CRR):

It expresses capacity of soil to resist liquefaction. CRR is determined using correlation between corrected blow count $(N_1)_{60}$ and CRR for earthquake of magnitude 7.5. $(N_1)_{60}$ is the SPT blow count corrected to an effective overburden pressure of 100 kPa and to hammer energy efficiency of 60 %.

Following variable have been adopted in calculation of N_{60} (SPT value for 60% efficiency)

Energy correction to SPT values:

C_{60} = 1.00 (energy efficiency factor)

Design Earthquake Base:

Earthquake zone	= IV
Magnitude of earthquake	= 7
Seismic Zone factor	= 0.24

Status of Liquefaction:

The value of CSR and CRR are computed at different depth and then the ratio of CRR to CSR to get the factor of safety towards the susceptibility of the stratum towards liquefaction potential.

If factor of safety:

< 1.00 : Stratum is to be considered as liquefiable

> 1.20 : Non-Liquefiable

The detailed calculations of liquefaction, have been reported in **Table-5** of **Appendix-H.**

10. RECOMMENDATIONS:

Keeping in mind, the field test results, laboratory test results and IS codes of practice the following recommendations are hereby made:

10.1. Bored Cast-In-Situ RCC Piles of diameter 1000 and 1200 mm have been adopted for SBC computations of foundation for Viaduct.

10.2. **Cut off length** of piles have been considered as 2.50 m from the existing ground level for the purpose of computation of SBC.

10.3. **Pile length** recommended in the table below, shall be measured **after the cut-off depth.**

10.4. **Allowable load carrying capacity** of pile corresponding to the length and diameter of pile shall be read from the tables below:

10.4.1. For Pile diameter = 1000 mm

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
P116A	25.00	2650	1550	65
	27.50	2700	1800	
	30.00	3550	2050	
	32.50	3800	2300	
	35.00	4000	2550	
P120A	25.00	2650	1650	55
	27.50	2850	1850	
	30.00	3100	2050	
	32.50	3600	2300	
	35.00	3700	2500	

***** *Indicates Grade of Concrete*

10.4.2. For Pile diameter = 1200 mm

Borehole No.	Pile Length (m)	Load carrying Capacity (kN)		
		Compression	Uplift	Lateral Concrete M35*
P116A	25.00	4050	2100	95
	27.50	4000	2450	
	30.00	5600	2850	
	32.50	5950	3200	
	35.00	6300	3600	
P120A	25.00	4050	2150	85
	27.50	4300	2500	
	30.00	4600	2800	
	32.50	5500	3150	
	35.00	5600	3500	

***** *Indicates Grade of Concrete*

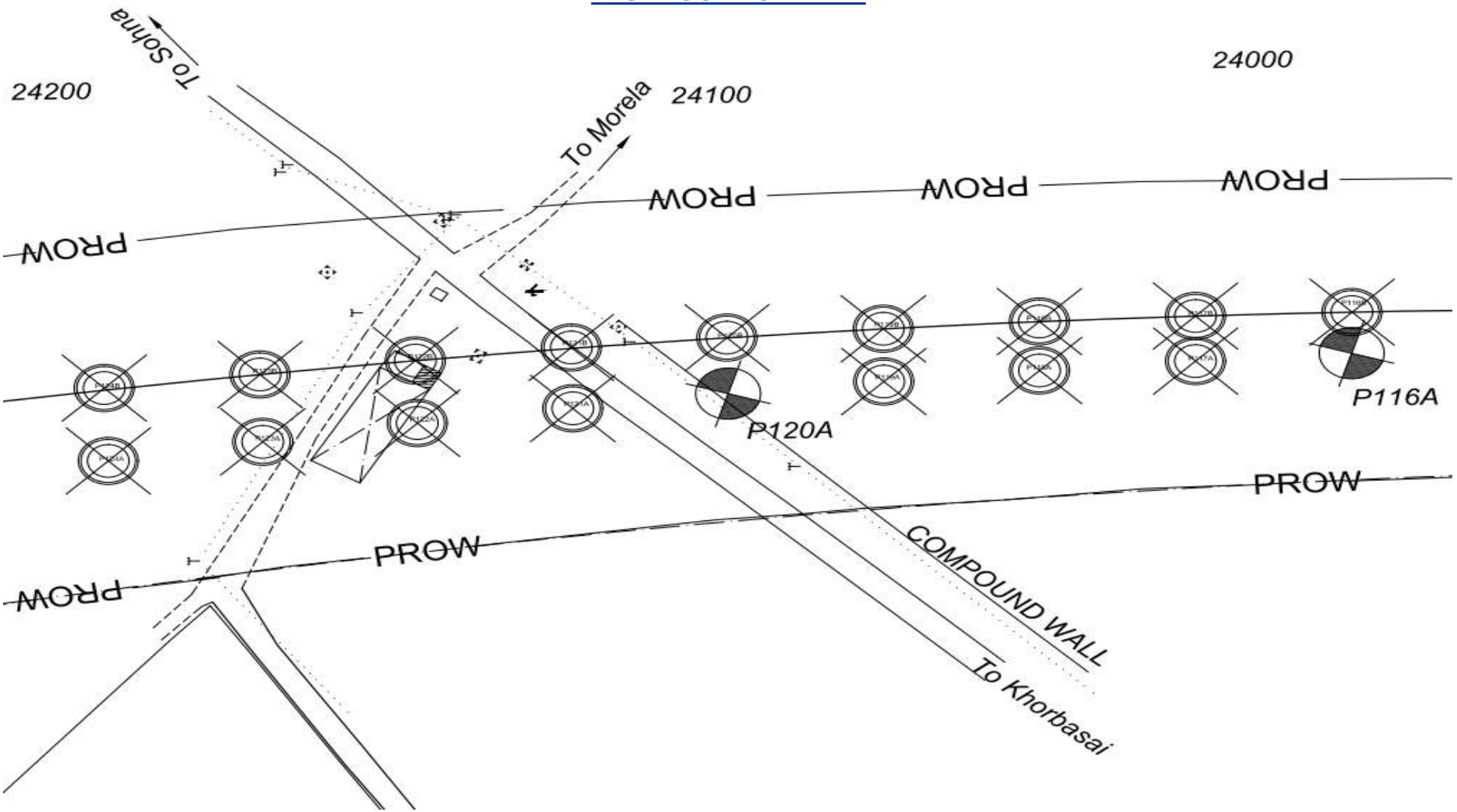
10.5. Liquefaction Potential: All the bore holes have been analysed for Liquefaction potential as per IS: 1893 (part-1)-2016-(RA: 2021) with Seismic Zone IV, earthquake intensity of 7.0 on Richter scale and critical ground water table at existing ground level. Out of which several boreholes show the potential at various depths mentioned in the table below:

Bore No.	**Liquefiable depth zone (meter)**
P116A	Top 4.00 & 5.00 to 6.00
P120A	Top 3.00 & 6.00 to 7.00

for Techpro Engineers Pvt. Ltd.

(Arvind K. Garg)
B.Tech.(Civil), M.Tech.
Principal Consultant &
Managing Director

APPENDIX-A
TEST LOCATION PLAN



APPENDIX "B"

TABLE 1: SUMMARY OF TEST RESULTS

Bore No : P116A	**Ground Elevation : RL 195.485 m**	**Method of drilling :Percussion**	**Depth of Water : 1.90 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 31/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23961.447	**Casing Lowered : 24.00 m**	**Ending Date : 3/11/2023**	**Hammer type: Rope-pulley**

FIELD TEST RESULT										LABORATORY TEST RESULT																														
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen										
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																																Classification of ROCK										Classification of SOIL
	0.50	D	1	-	-	-	-	-	SM	0	0	1	52	47	0	10.69	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-										
	1.00	D	2	1	2	2	4	6.19	-	-	-	-	-	-	-	10.70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										Silty Sands
	2.00	U	3	-	-	-	-	-	SM	1	0	0	53	46	0	10.24	1.96	1.78	Non Plastic			2.62	DST	4.0	27.2	-	0.472	-	-	-	-										
	3.00	D	4	2	3	4	7	8.74	-	-	-	-	-	-	-	18.26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	4.00	D	5	3	4	5	9	10.68	CL-ML	0	0	1	31	63	5	19.54	-	-	25.0	20.5	4.5	-	-	-	-	-	-	-	-	-	-										Inorganic Silty Clays of low plasticity
	5.00	U	6	-	-	-	-	-	ML	5	1	1	23	64	6	20.57	1.94	1.61	24.0	20.0	4.0	2.65	DST	7.0	25.2	0.114	0.646	-	0	20	-										Inorganic Silts of low plasticity
	6.00	D	7	5	11	14	25	21.15	-	-	-	-	-	-	-	19.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	7.00	D	8	6	12	15	27	21.72	CL-ML	3	2	2	37	51	5	20.67	-	-	25.0	20.0	5.0	-	-	-	-	-	-	-	-	-	-										Inorganic Silty Clays of low plasticity
	8.00	D	9	-	-	-	-	-	-	-	-	-	-	-	-	21.02	2.05	1.69	-	-	-	-	RDST	4.0	26.4	-	-	-	-	-	-										
	9.00	D	10	4	7	9	16	15.34	SM-SC	5	2	3	42	44	4	19.56	-	-	24.0	20.0	4.0	-	-	-	-	-	-	-	-	-	-										Silty Sands with clay binder
	10.00	D	11	5	9	10	19	16.52	-	-	-	-	-	-	-	23.58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	11.00	U	12	-	-	-	-	-	CL-ML	1	0	3	8	79	9	23.33	2.02	1.64	28.5	22.0	6.5	2.66	UU	44.0	8.2	-	0.622	-	0	20	-										Inorganic Silty Clays of low plasticity
	12.50	D	13	5	7	9	16	14.13	-	-	-	-	-	-	-	22.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
	14.00	U	14	-	-	-	-	-	CL-ML	3	2	1	12	75	7	19.66	1.99	1.66	27.0	21.0	6.0	2.65	UU	40.0	10.2	-	0.596	-	-	-	-										
	15.50	D	15	8	15	21	36	22.26	ML	5	2	3	27	58	5	18.58	-	-	26.0	22.0	4.0	-	-	-	-	-	-	-	-	-	-										Inorganic Silts of low plasticity
	17.00	U	16	-	-	-	-	-	CL	7	3	2	9	68	11	19.16	2.05	1.72	27.0	20.0	7.0	2.67	UU	53.0	10.5	-	0.552	-	-	16	-										Inorganic clays of low plasticity
	18.50	D	17	16	36	53	89	41.49	SM	0	0	1	54	45	0	20.44	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-										Silty Sands

APPENDIX "B"

TABLE 1: SUMMARY OF TEST RESULTS

Bore No : P116A	**Ground Elevation : RL 195.485 m**	**Method of drilling :Percussion**	**Depth of Water : 1.90 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 31/10/2023**	**SPT Sampler: Standard**
Location / Chainage : 23961.447	**Casing Lowered : 24.00 m**	**Ending Date : 3/11/2023**	**Hammer type: Rope-pulley**

FIELD TEST RESULT										LABORATORY TEST RESULT																														
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen										
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL									
	20.00	D	18	13	24	28	52	26.71	CL-ML	2	1	1	18	70	8	20.82	-	-	28.0	21.5	6.5	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity								
	21.50	D	19	15	26	32	58	28.33	-	-	-	-	-	-	-	20.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	23.00	D	20	11	23	31	54	26.34	CL-ML	0	1	1	32	60	6	24.60	-	-	26.0	20.5	5.5	-	-	-	-	-	-	-	-	-	-									
	24.50	D	21	13	25	35	60	27.91	SM	0	0	0	58	42	0	17.99	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands								
	26.00	D	22	24	32	42	74	32.04	-	-	-	-	-	-	-	19.65	-	-	-	-	-	2.65	-	-	-	-	-	-	-	-	-									
	27.50	D	23	23	30	43	73	31.13	SM	2	1	1	47	49	0	17.64	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-									
	29.00	D	24	26	33	45	78	32.18	ML	4	2	3	40	51	0	16.00	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity								
	30.50	D	25	27	37	43	80	32.22	SM	1	1	1	57	40	0	19.87	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands								
	32.00	D	26	30	34	40	74	29.84	-	-	-	-	-	-	-	19.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	33.50	D	27	29	31	42	73	29.02	SM	0	1	2	52	45	0	21.74	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-									
	35.00	D	28	32	35	44	79	30.27	SM	0	0	0	59	41	0	19.77	-	-	Non Plastic			2.65	-	-	-	-	-	-	-	-	-									
	36.50	D	29	33	36	42	78	29.50	-	-	-	-	-	-	-	18.86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	38.00	D	30	30	32	40	72	27.37	SM	0	0	2	64	34	0	19.42	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-									
	40.00	D	31	28	30	39	69	26.01	-	-	-	-	-	-	-	19.14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"

TABLE 2: SUMMARY OF TEST RESULTS

Bore No : P120A	**Ground Elevation : RL 196.008 m**	**Method of drilling :Percussion**	**Depth of Water : 5.00 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 18/11/2023**	**SPT Sampler: Standard**
Location / Chainage : 24066.247	**Casing Lowered : 21.00 m**	**Ending Date : 21/11/2023**	**Hammer type: Rope-pulley**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	ML	0	0	1	44	55	0	3.81	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	1.00	D	2	2	3	4	7	10.83	-	-	-	-	-	-	-	4.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	2.00	U	3	-	-	-	-	-	SM	4	2	2	47	45	0	11.08	1.96	1.76	Non Plastic			2.65	DST	3.0	26.5	-	0.506	-	-	-	-	Silty Sands											
	3.00	D	4	5	7	8	15	17.70	ML	3	0	1	35	61	0	11.70	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	4.00	D	5	3	5	6	11	11.92	-	-	-	-	-	-	-	11.80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	5.00	U	6	-	-	-	-	-	ML	1	1	0	38	60	0	21.09	1.99	1.64	Non Plastic			2.64	DST	6.0	25.7	-	0.610	-	-	-	-												
	6.00	D	7	4	5	6	11	10.74	ML	0	1	2	30	67	0	19.71	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-												
	7.00	D	8	4	6	8	14	13.26	-	-	-	-	-	-	-	20.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	8.00	U	9	-	-	-	-	-	CL	5	2	2	14	68	9	28.01	2.00	1.56	28.0	20.5	7.5	2.67	UU	44.0	12.3	0.135	0.712	-	10	18	-	Inorganic clays of low plasticity											
	9.00	D	10	5	10	18	28	20.03	CL	2	1	2	10	77	8	27.44	-	-	27.5	20.5	7.0	-	-	-	-	-	-	-	-	-	-												
	10.00	U	11	6	13	20	33	21.88	-	-	-	-	-	-	-	22.40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	11.00	U	12	-	-	-	-	-	CL	6	3	3	9	68	11	22.40	2.06	1.68	29.0	20.5	8.5	2.68	UU	52.0	9.2	-	0.595	-	14	16	-												
	12.50	D	13	6	9	13	22	22.00	-	-	-	-	-	-	-	23.81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	14.00	D	14	-	-	-	-	-	-	-	-	-	-	-	-	22.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	15.50	D	15	10	12	13	25	17.02	CL-ML	7	2	1	22	61	7	18.24	-	-	26.0	21.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	17.00	U	16	-	-	-	-	-	CL	4	2	1	11	73	9	17.63	2.03	1.73	28.0	20.0	8.0	2.67	UU	48.0	11.7	-	0.543	-	-	-	-	Inorganic clays of low plasticity											
	18.50	D	17	12	14	18	32	32.00	-	-	-	-	-	-	-	15.20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

APPENDIX "B"

TABLE 2: SUMMARY OF TEST RESULTS

Bore No : P120A	**Ground Elevation : RL 196.008 m**	**Method of drilling :Percussion**	**Depth of Water : 5.00 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 18/11/2023**	**SPT Sampler: Standard**
Location / Chainage : 24066.247	**Casing Lowered : 21.00 m**	**Ending Date : 21/11/2023**	**Hammer type: Rope-pulley**

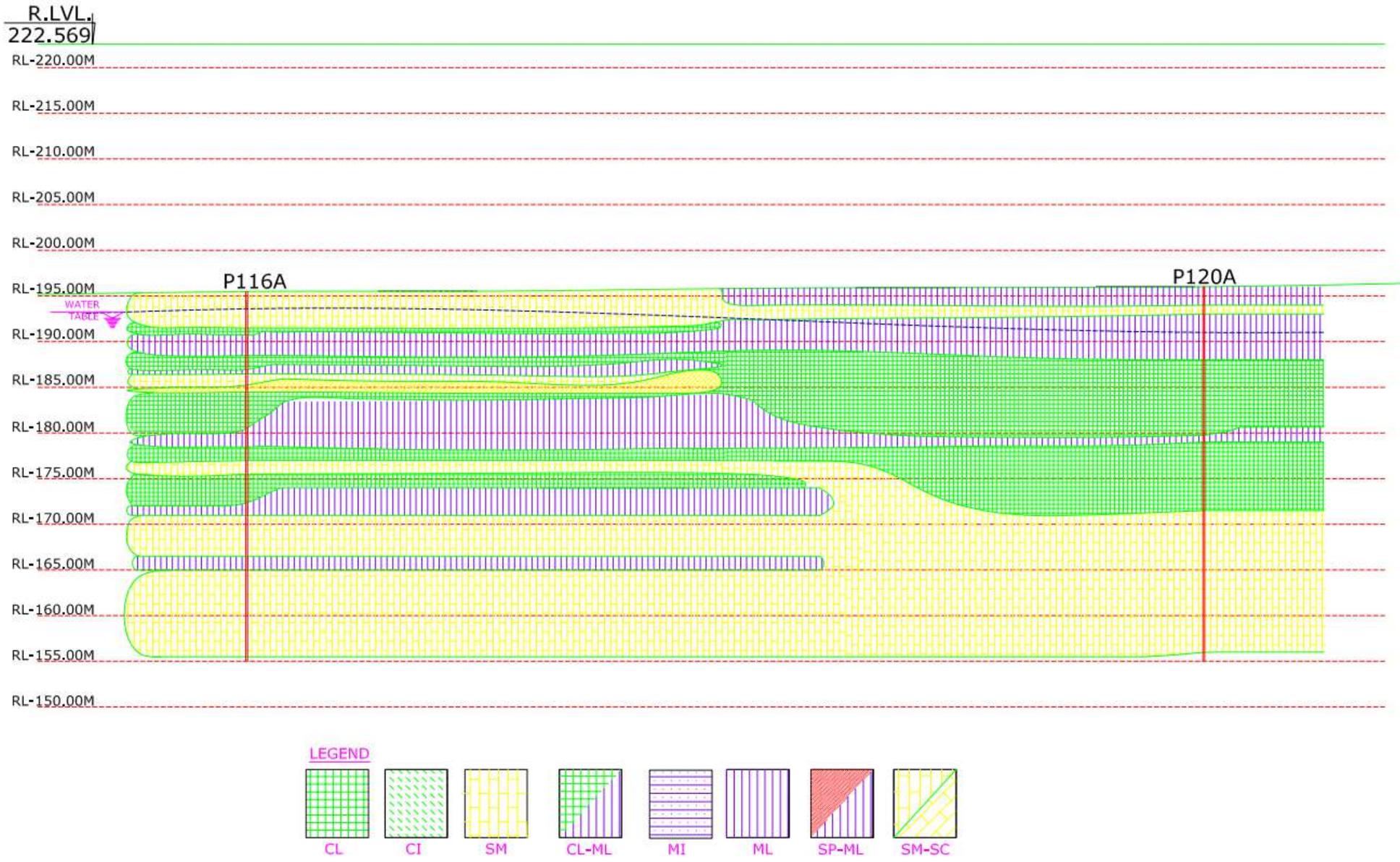
FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	20.00	D	18	-	-	-	-	-	CL	12	4	4	14	56	10	15.43	1.99	1.72	29.0	22.0	7.0	-	RUU	43.0	12.1	-	-	-	-	-	-	Inorganic clays of low plasticity											
	21.50	D	19	13	15	21	36	36.00	CL	3	1	1	6	77	12	18.43	-	-	29.0	19.5	9.5	-	-	-	-	-	-	-	-	-	-												
	23.00	D	20	-	-	-	-	-	-	-	-	-	-	-	-	21.32	2.07	1.71	-	-	-	-	RUU	64.0	8.7	-	-	-	-	-	-												
	24.50	D	21	14	17	23	40	20.23	SM	0	0	0	55	45	0	20.70	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	26.00	D	22	-	-	-	-	-	-	-	-	-	-	-	-	20.13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	27.50	D	23	16	20	25	45	21.17	SM	0	0	1	62	37	0	21.07	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-												
	29.00	U	24	-	-	-	-	-	SM	1	1	0	58	40	0	20.14	1.91	1.59	Non Plastic			2.61	DST	1.0	29.4	-	0.642	-	-	-	-												
	30.50	D	25	17	21	27	48	21.43	SM	0	1	2	55	42	0	20.30	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-												
	32.00	D	26	-	-	-	-	-	-	-	-	-	-	-	-	21.00	2.09	1.73	-	-	-	-	RDST	0.0	28.6	-	-	-	-	-	-												
	33.50	D	27	22	30	36	66	25.67	SM	0	0	1	54	45	0	20.63	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-												
	35.00	D	28	27	33	38	71	26.55	-	-	-	-	-	-	-	18.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	36.50	D	29	29	35	40	75	27.22	SM	4	2	1	44	49	0	17.73	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-												
	38.00	D	30	28	32	42	74	26.58	-	-	-	-	-	-	-	15.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	40.00	D	31	46	56	-	R	-	CL-ML	4	2	2	24	61	7	14.68	-	-	26.0	20.0	6.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX-B
TABLE 3: UCS TEST ON SOIL SAMPLES

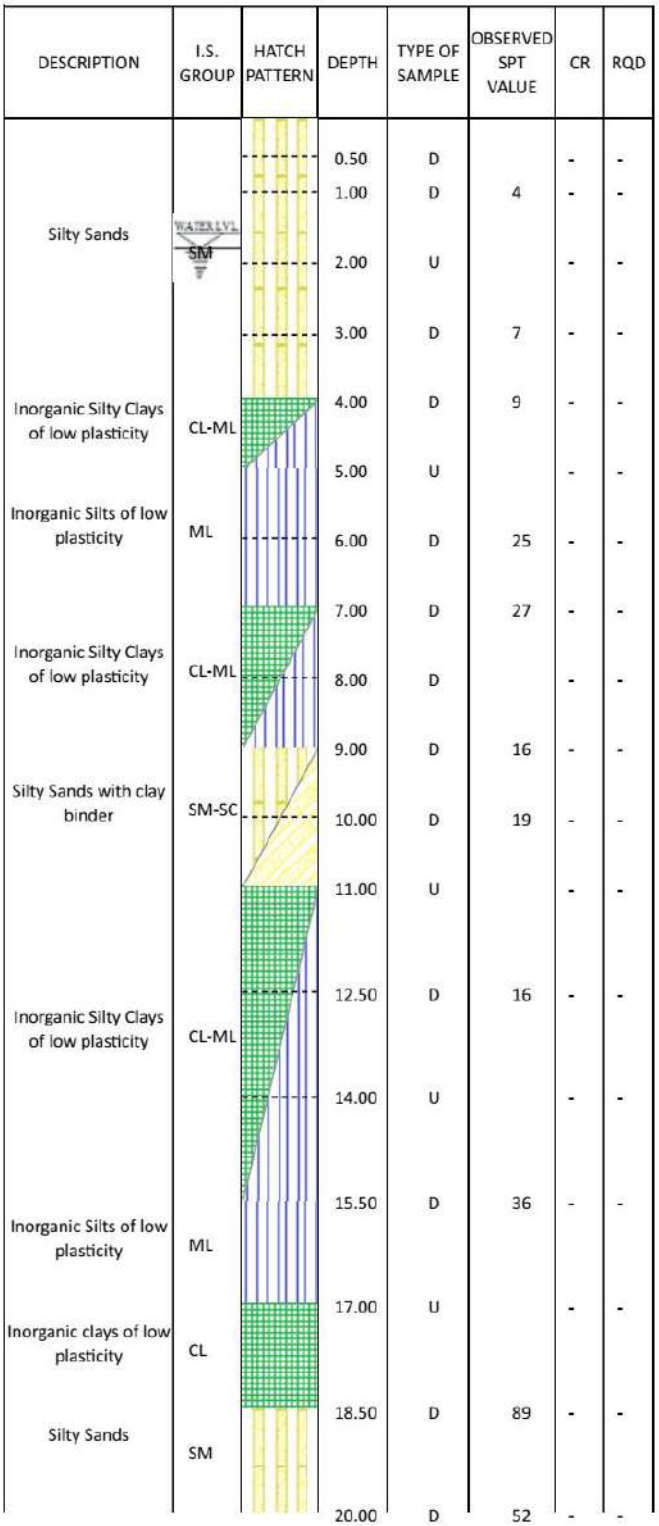
BH No.	DEPTH (m)	UCS (kg/cm²)
P116A	11.00	0.62
	14.00	0.49
	17.00	0.66
P120A	8.00	0.48
	11.00	0.59
	17.00	0.53

APPENDIX-C
PLOT 1: LITHOLOGICAL PROFILE-01



APPENDIX-C
PLOT 2: LITHOLOGICAL PLOTS

BH-P116A-23961.447



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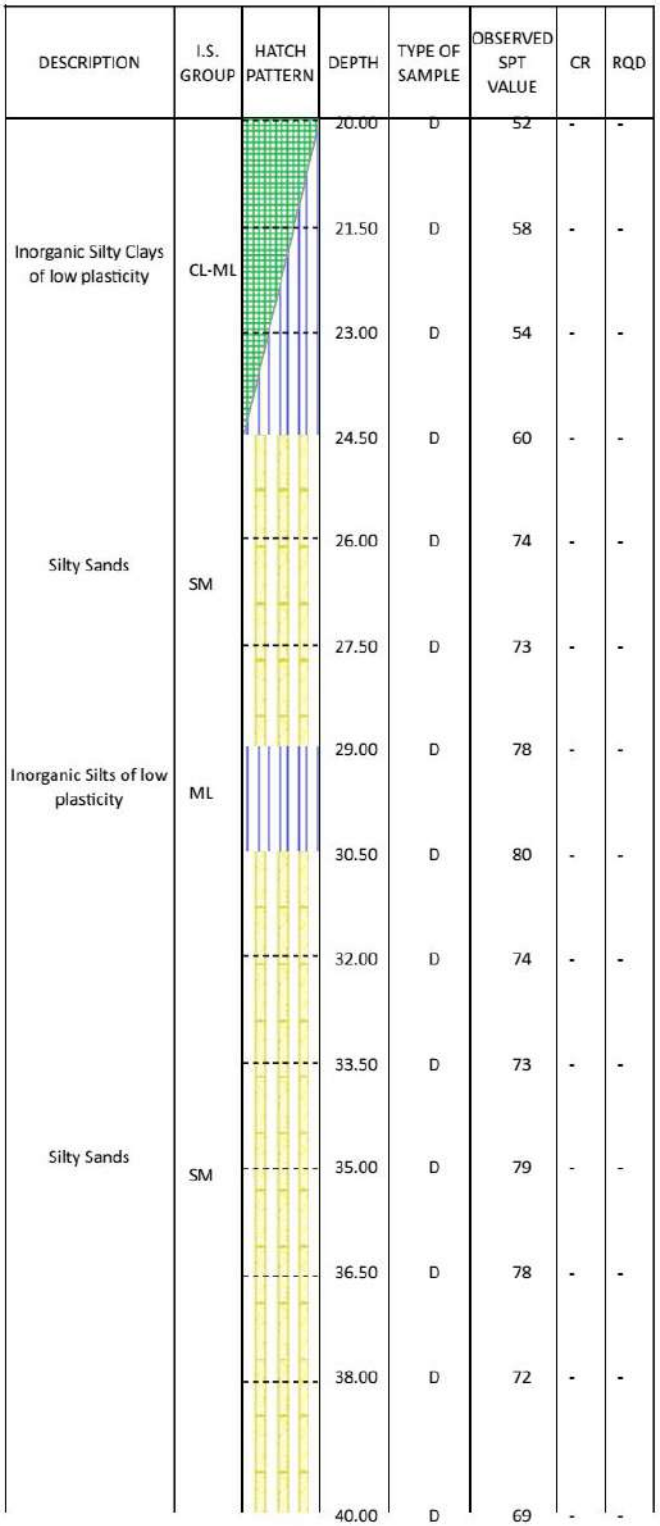
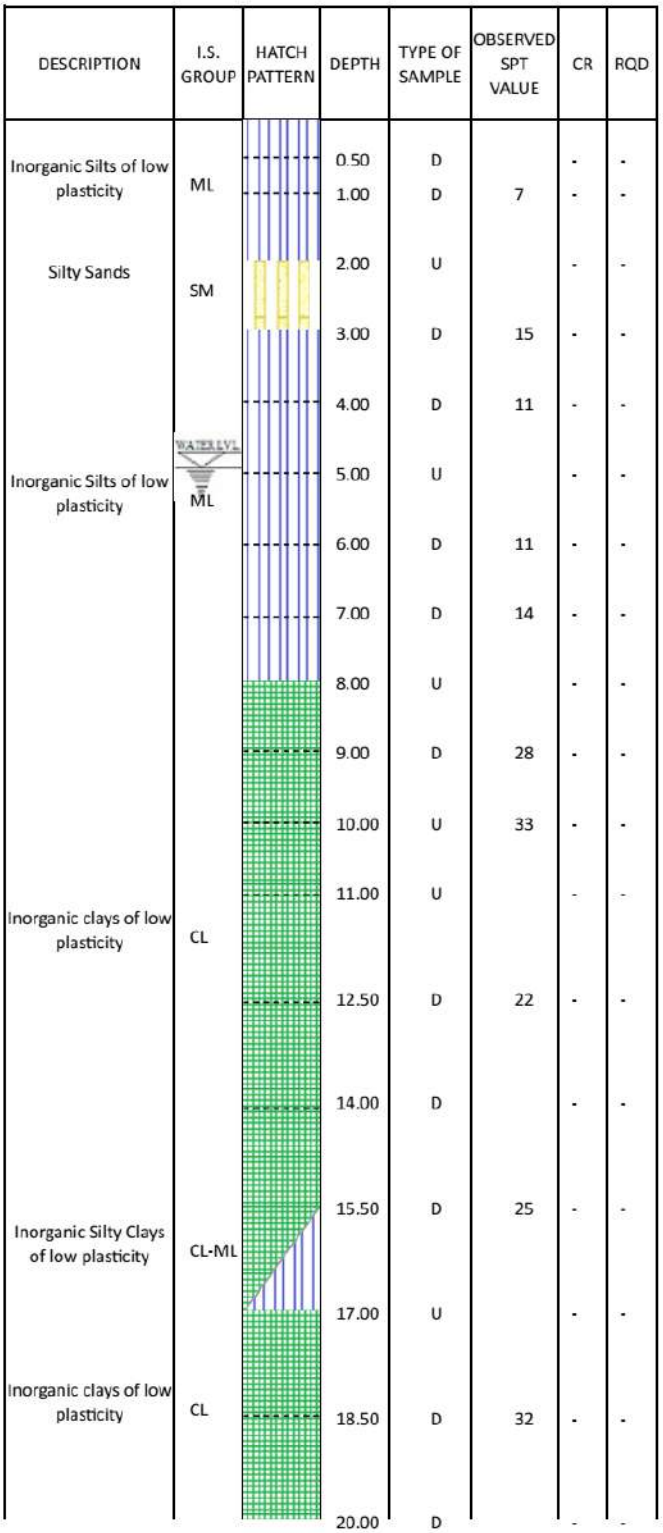


APPENDIX-C
PLOT 3: LITHOLOGICAL PLOTS

BH-P120A-24066.247



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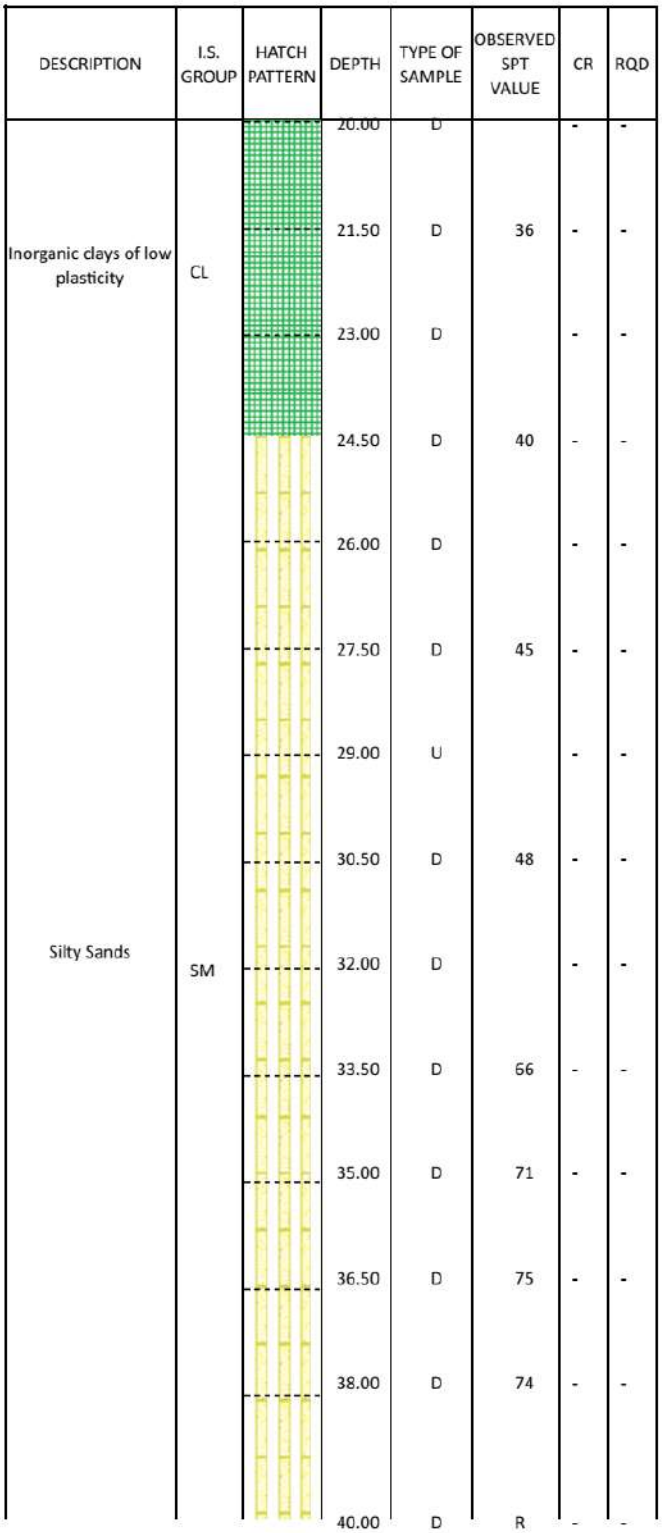
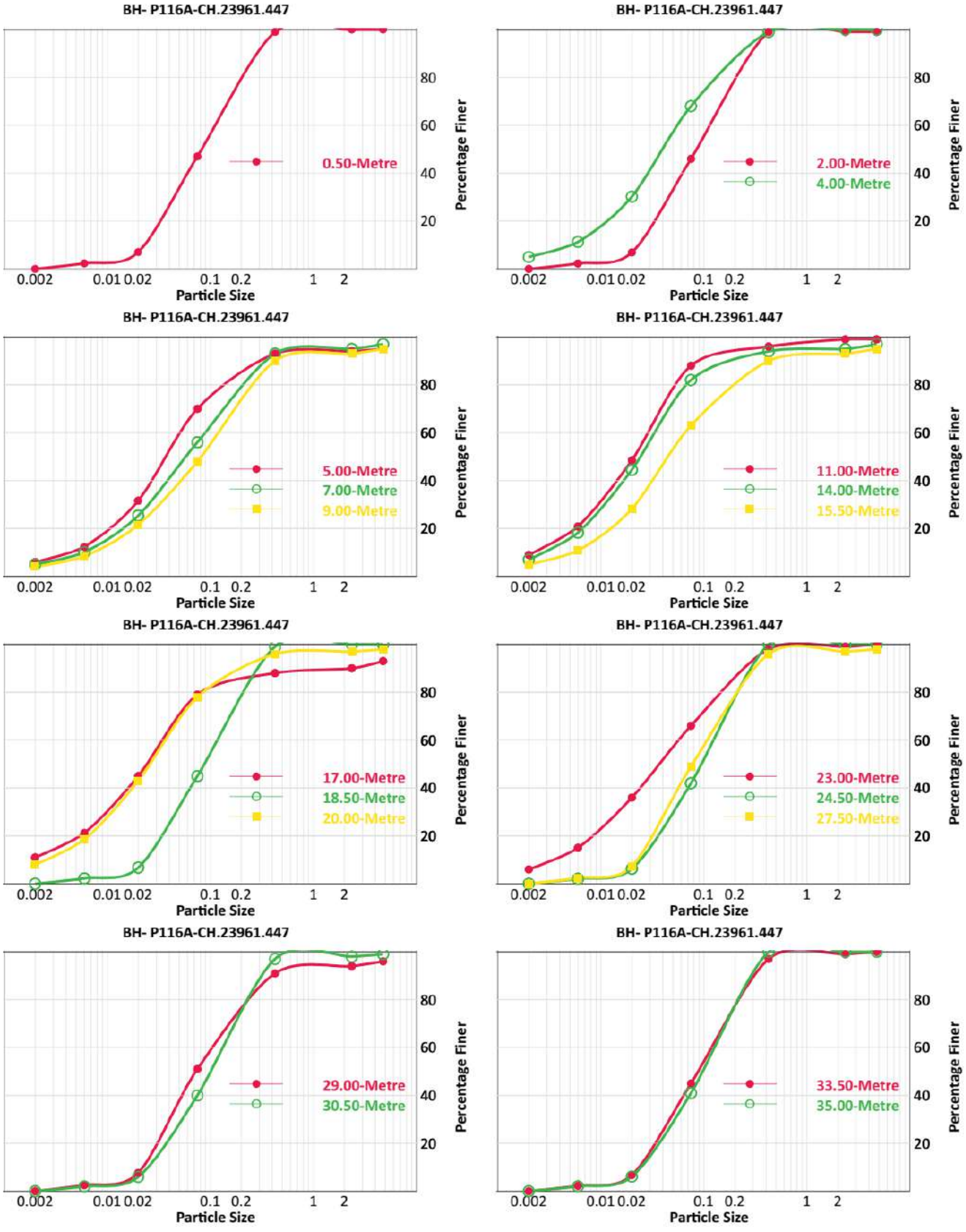
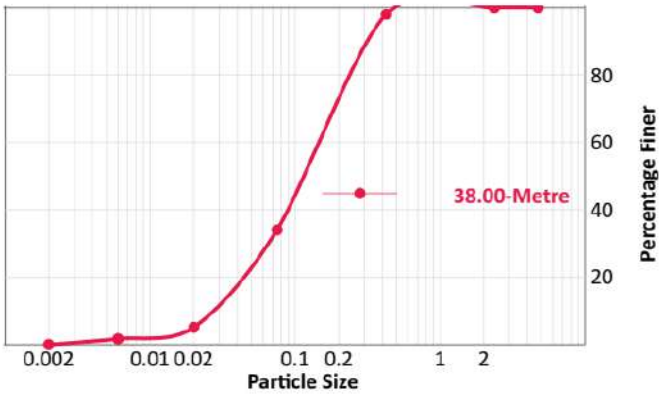


APPENDIX-D
PLOT 1: GRAIN SIZE DISTRIBUTION PLOTS

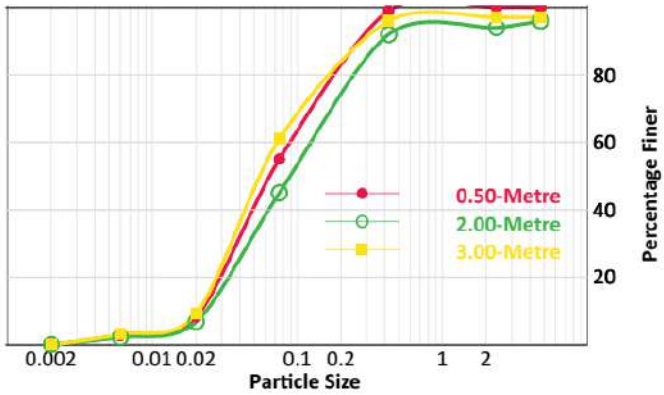


APPENDIX-D
PLOT 2: GRAIN SIZE DISTRIBUTION PLOTS

BH- P116A-CH.23961.447



BH- P120A-CH.24066.247



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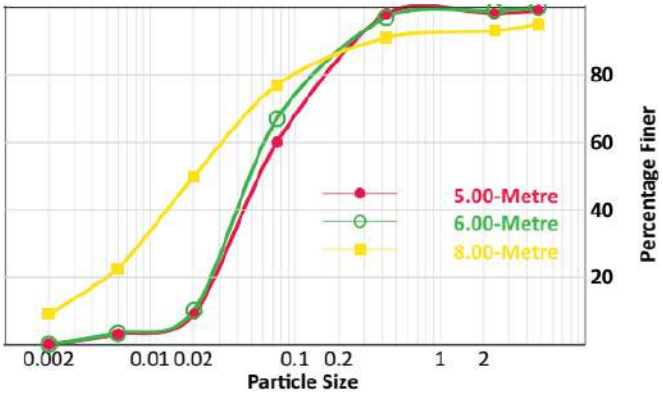
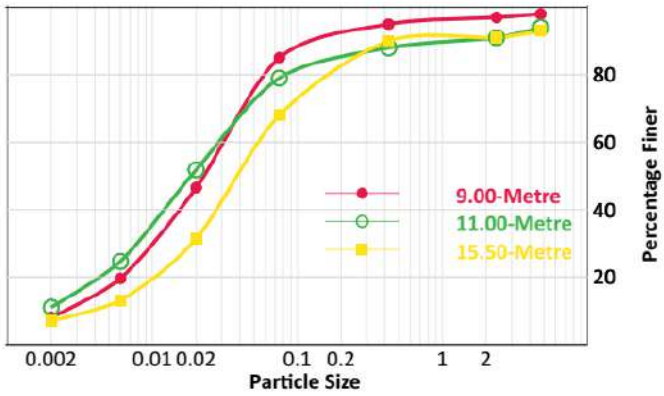
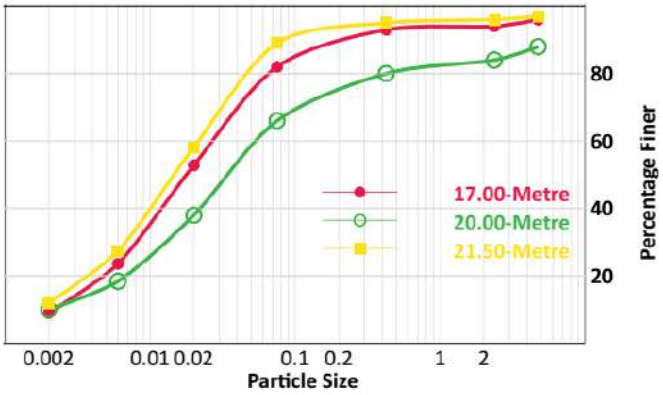


BH- P120A-CH.24066.247



BH- P120A-CH.24066.247



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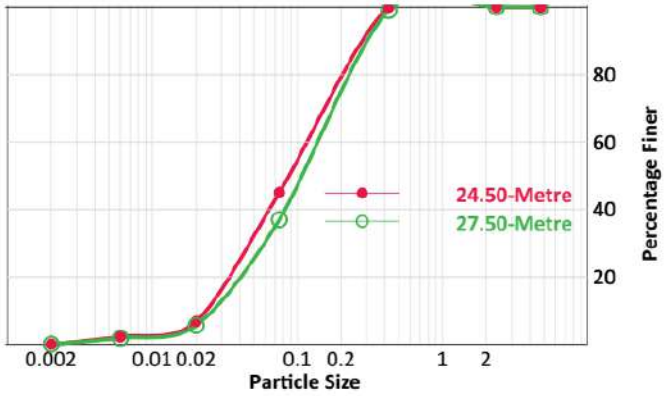
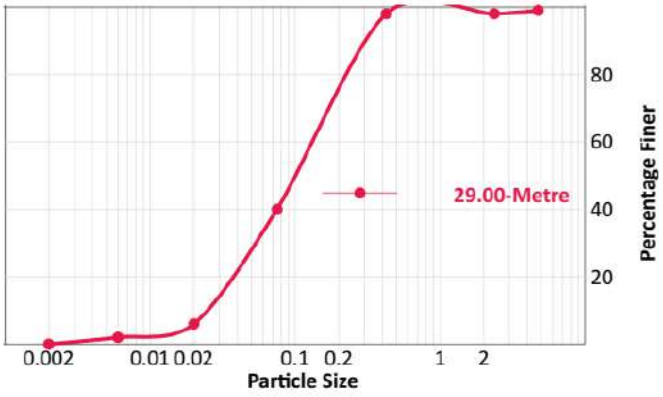
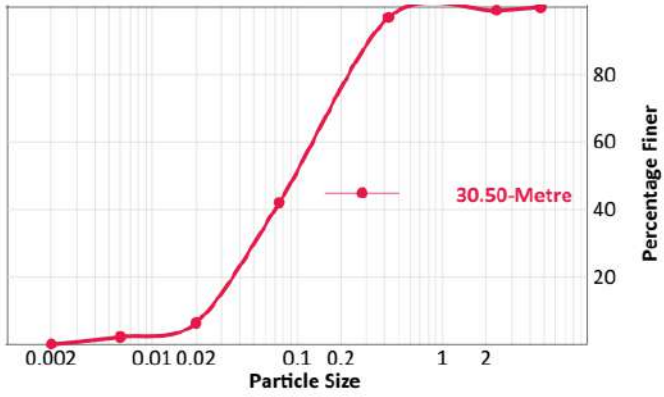


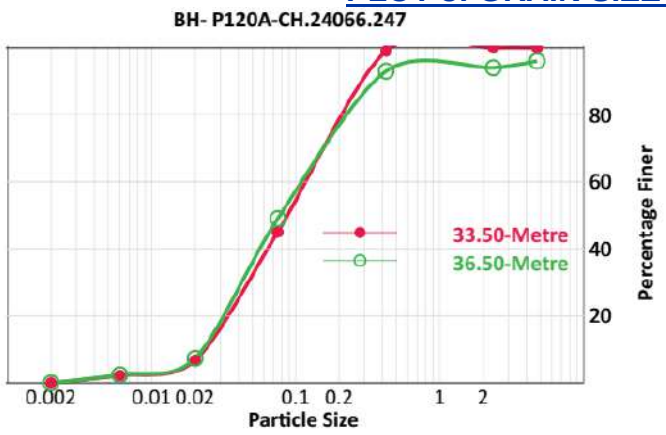
BH- P120A-CH.24066.247

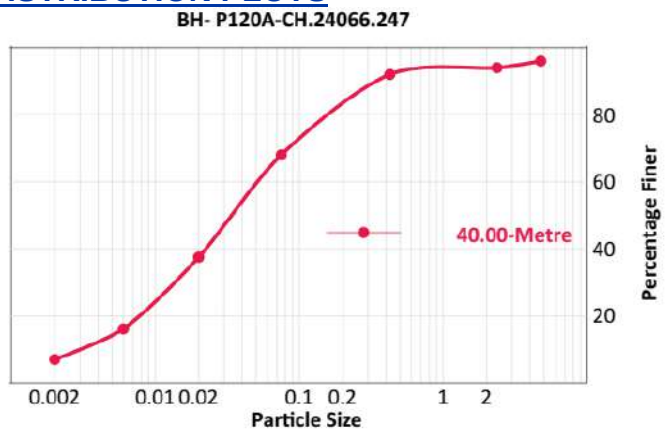


BH- P120A-CH.24066.247



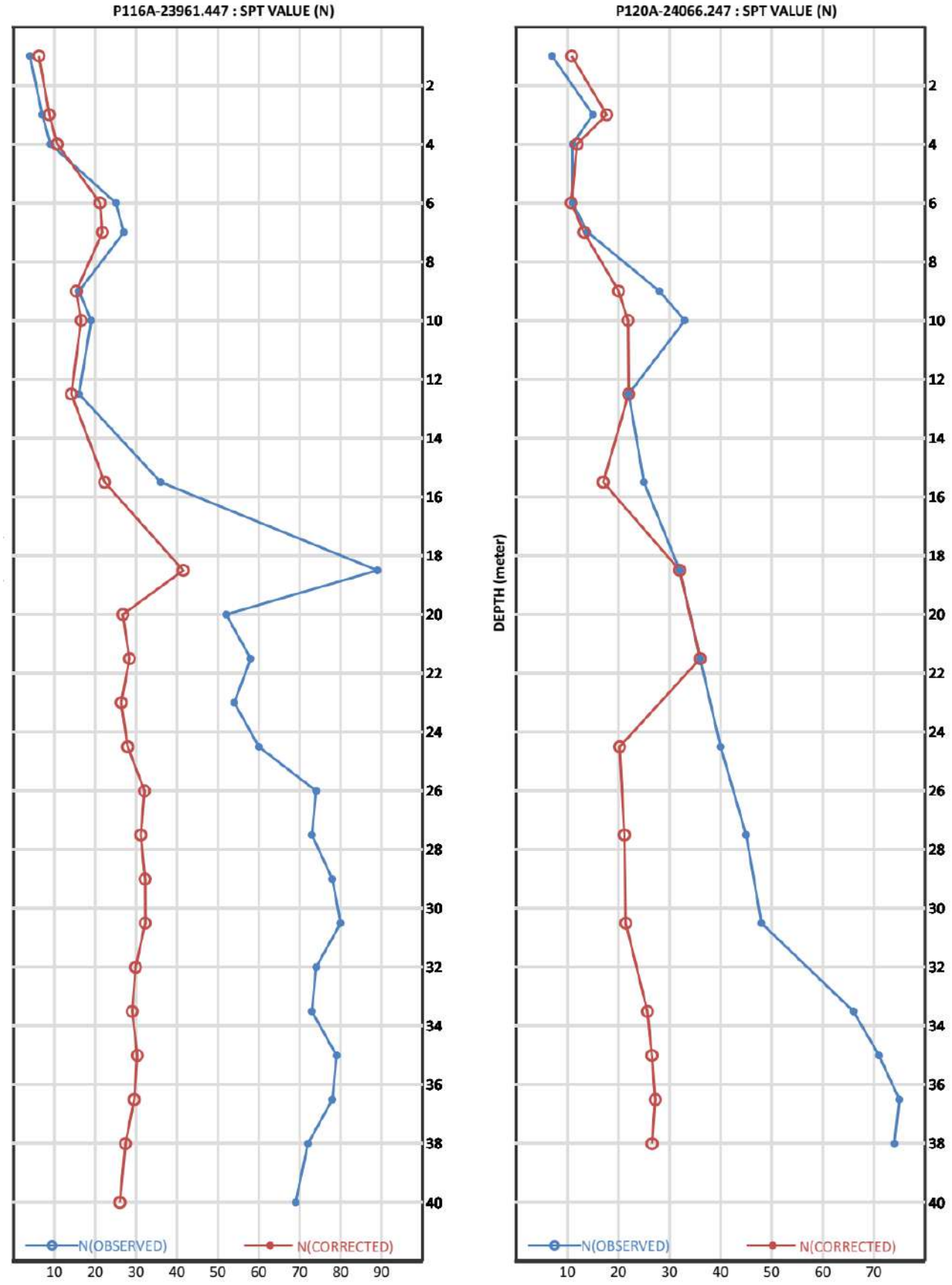
APPENDIX-D
PLOT 3: GRAIN SIZE DISTRIBUTION PLOTS





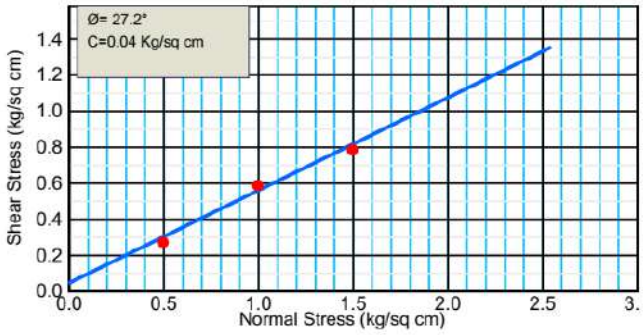
APPENDIX-E

PLOT 1: RECORDED SPT Vs CORRECTED SPT

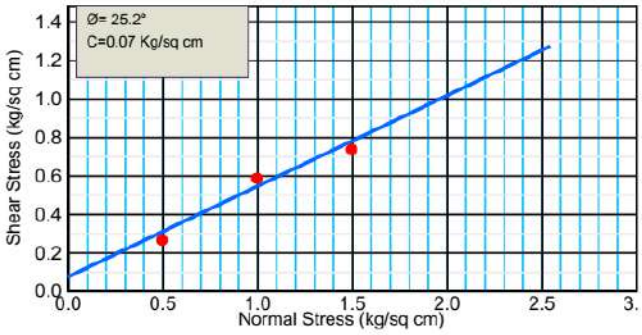


APPENDIX-F
GRAPH 1: DST GRAPH

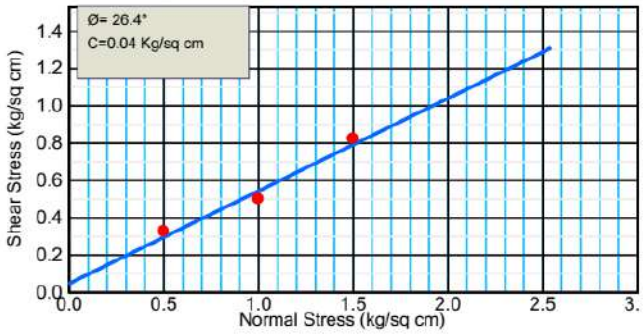
1901-HRIDC-VII-23961.447
BH-P116A, DEPTH=2.00M, DIRECT SHEAR TEST



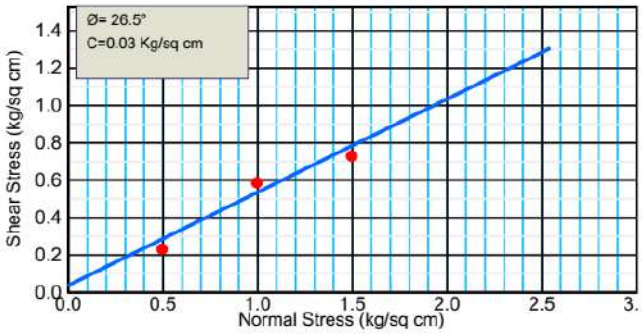
1901-HRIDC-VII-23961.447
BH-P116A, DEPTH=5.00M, DIRECT SHEAR TEST



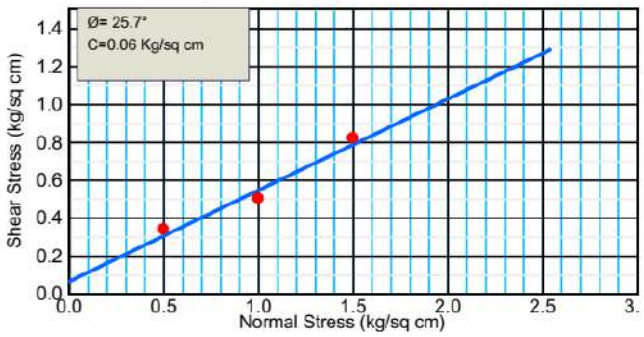
1901-HRIDC-VII-23961.447
BH-P116A, DEPTH=8.00M, DIRECT SHEAR TEST



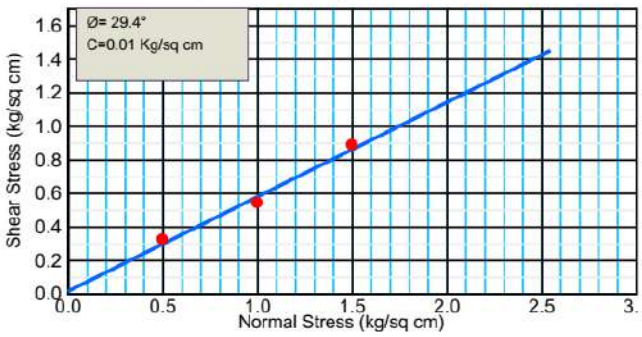
1901-HRIDC-VII-24066.247
BH-P120A, DEPTH=2.00M, DIRECT SHEAR TEST



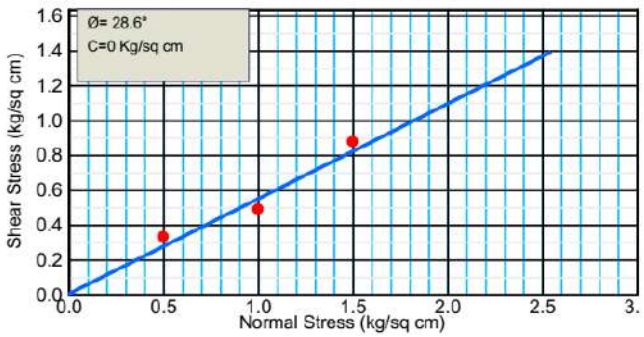
1901-HRIDC-VII-24066.247
BH-P120A, DEPTH=5.00M, DIRECT SHEAR TEST



1901-HRIDC-VII-24066.247
BH-P120A, DEPTH=29.00M, DIRECT SHEAR TEST

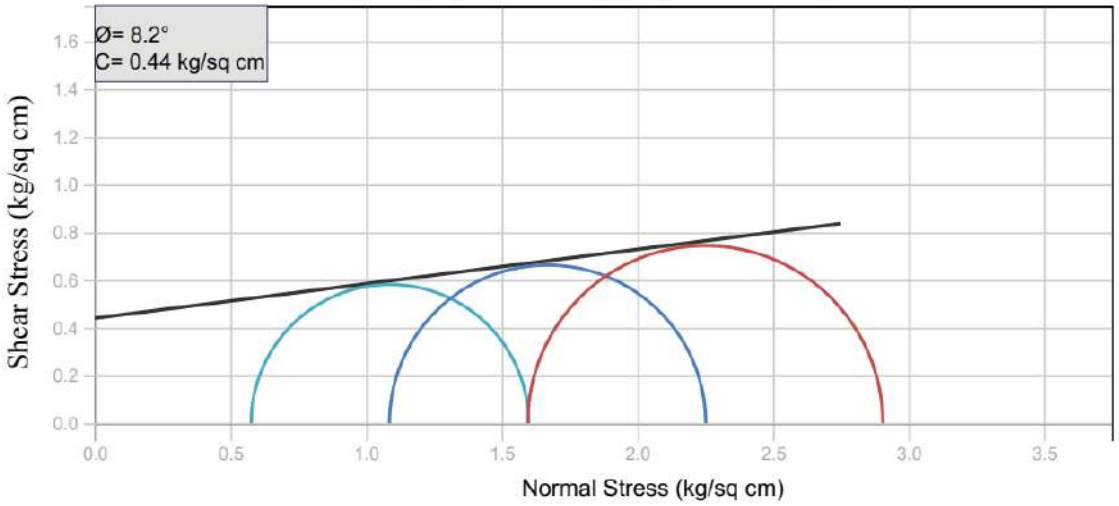


1901-HRIDC-VII-24066.247
BH-P120A, DEPTH=32.00M, DIRECT SHEAR TEST

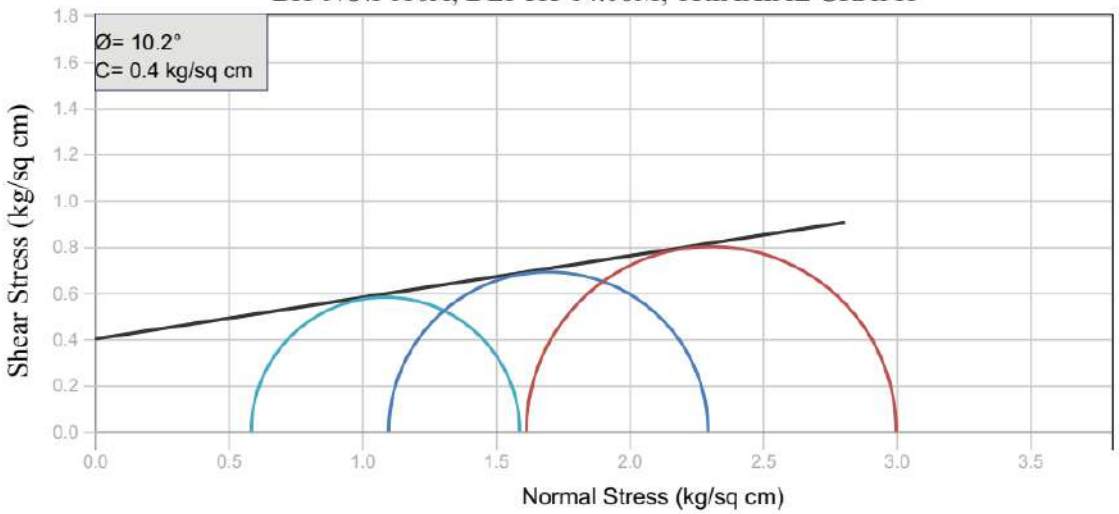


APPENDIX-G
GRAPH 1: UU GRAPH

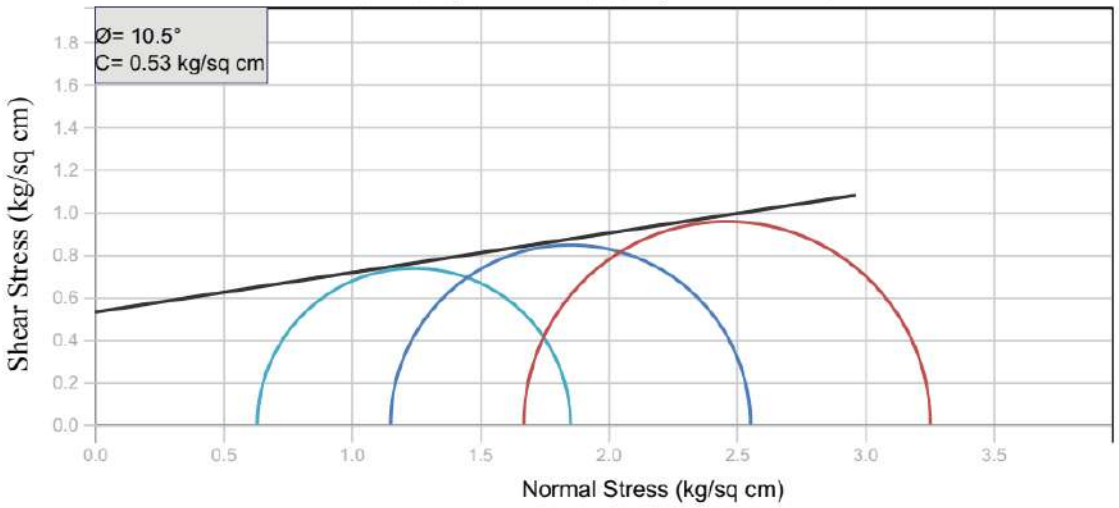
1901-HRIDC-VII-23961.447
BH-NO.P116A, DEPTH-11.00M, TRIAXIAL GRAPH



1901-HRIDC-VII-23961.447
BH-NO.P116A, DEPTH-14.00M, TRIAXIAL GRAPH

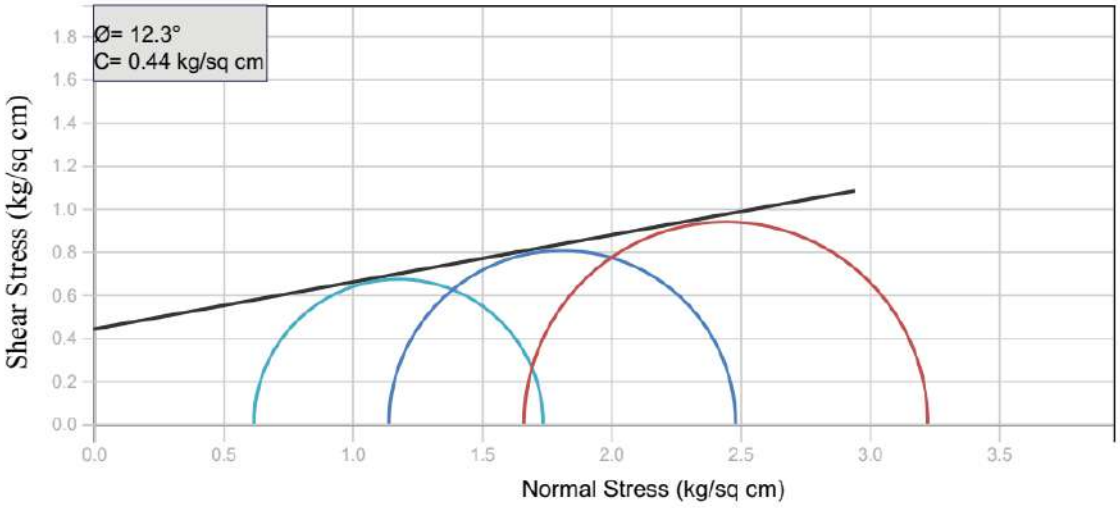


1901-HRIDC-VII-23961.447
BH-NO.P116A, DEPTH-17.00M, TRIAXIAL GRAPH

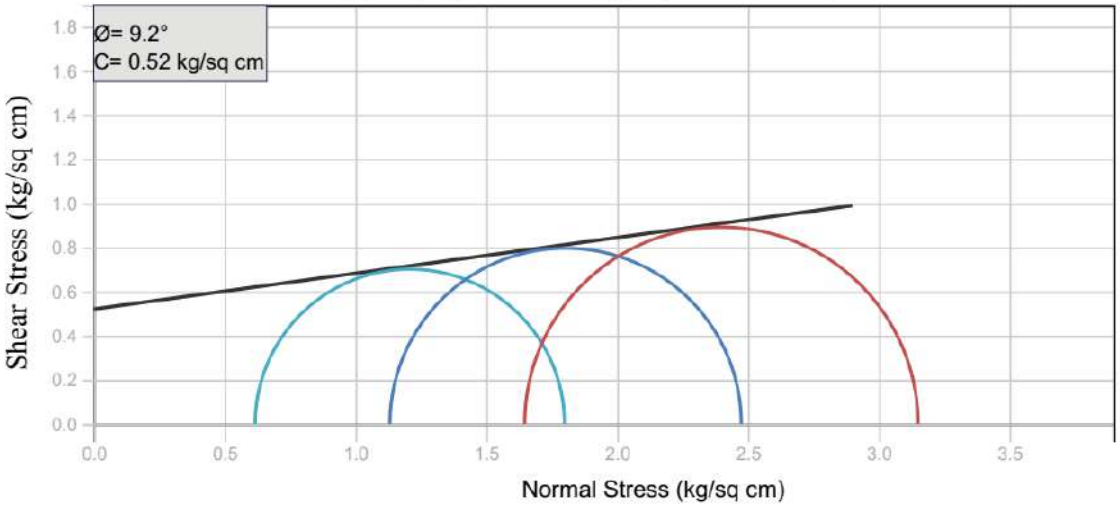


APPENDIX-G
GRAPH 2: UU GRAPH

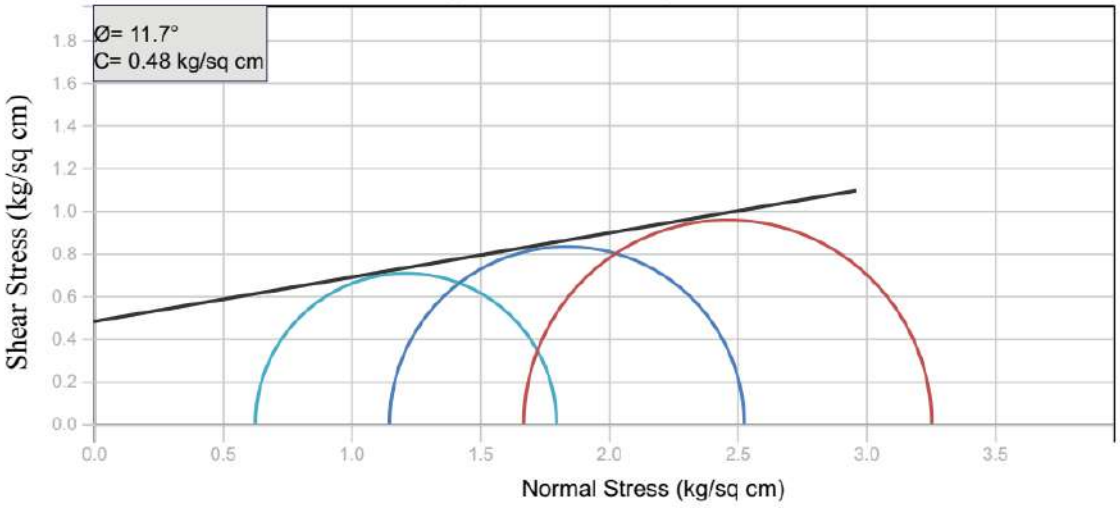
1901-HRIDC-VII-24066.247
BH-NO.P120A, DEPTH-8.00M, TRIAXIAL GRAPH



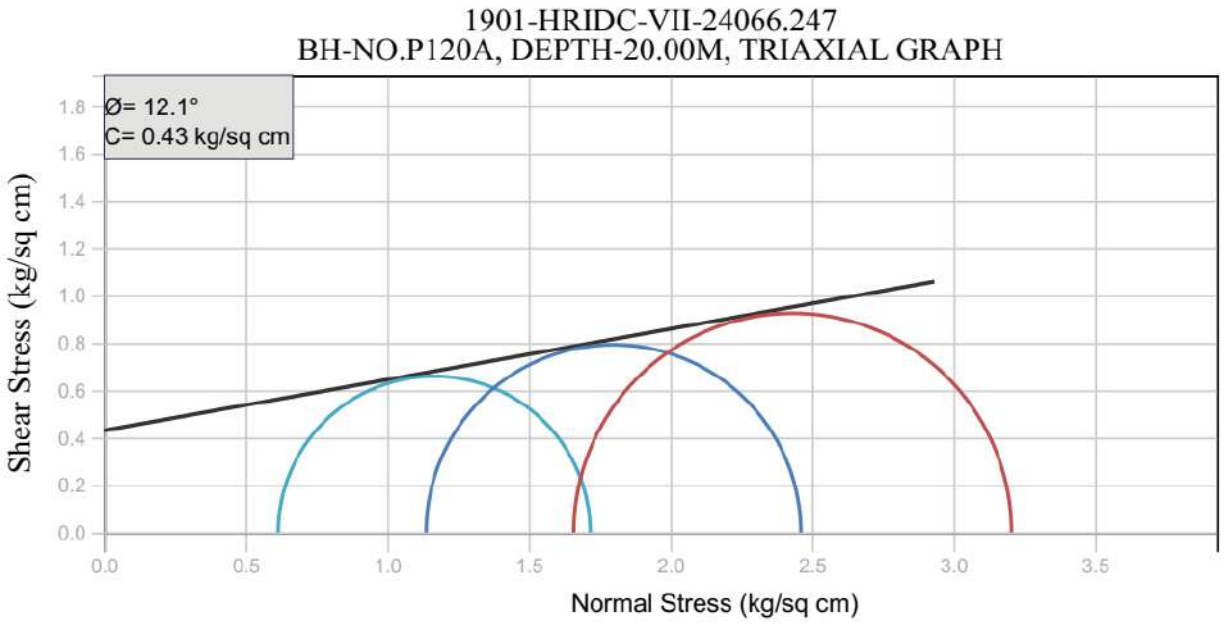
1901-HRIDC-VII-24066.247
BH-NO.P120A, DEPTH-11.00M, TRIAXIAL GRAPH

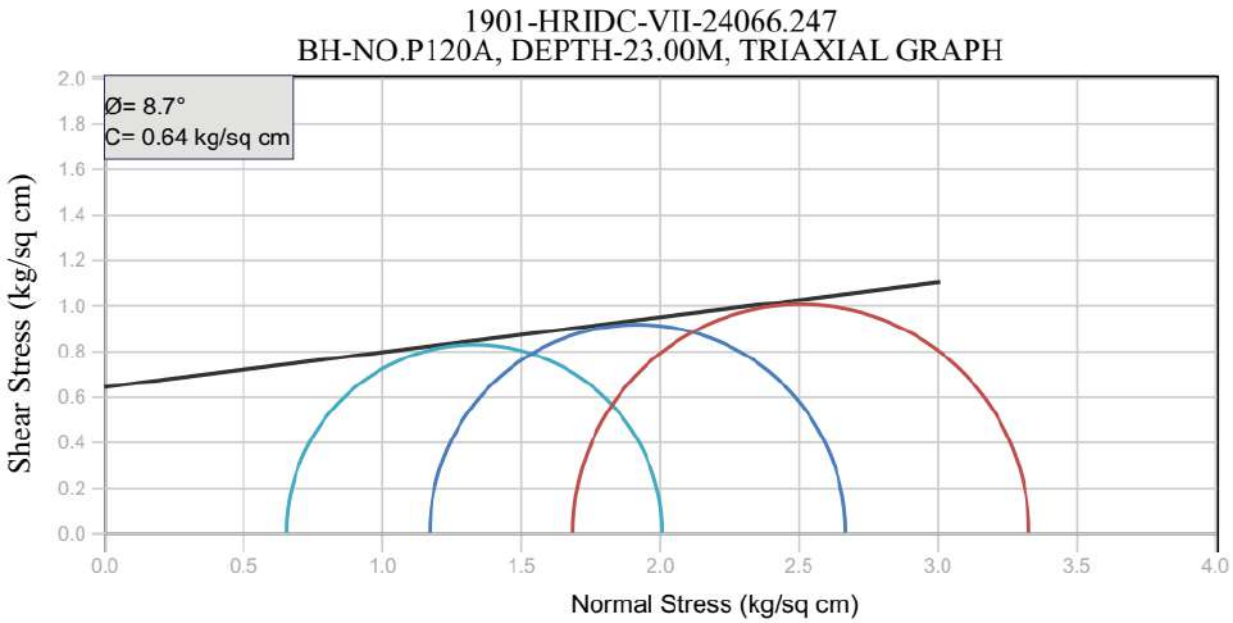


1901-HRIDC-VII-24066.247
BH-NO.P120A, DEPTH-17.00M, TRIAXIAL GRAPH



APPENDIX-G
GRAPH 3: RUU GRAPH





APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Q_b	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
BORE NO: P116A, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.62	9.62	26.46	1.57	27.2	27.2	1.0	21.37	0	4	1.0	6.3	0	3.0	25.2	0	9.62	10.45	11.34	28.9	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.50	19.62	9.62	33.67	3.14	25.2	25.2	1.0	49.80	0	0	1.0	0.0	0	4.0	25.2	7	9.62	10.45	11.34	38.5	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	5.00	4.50	1.00	2.50	19.62	9.62	43.29	3.14	25.2	25.2	1.0	64.02	0	7	1.0	22.0	0	5.0	25.2	7	9.41	10.45	11.34	48.1	0	0.0	29.5	29.5	**0.00**	**9.82**
5.00	6.00	5.50	1.00	3.50	19.41	9.41	52.81	3.14	25.2	25.2	1.0	78.09	0	7	1.0	22.0	0	6.0	26.4	4	9.41	13.15	14.11	57.5	674.8	674.8	41.3	41.3	**269.90**	**13.75**
6.00	7.00	6.50	1.00	4.50	19.41	9.41	62.22	3.14	26.4	26.4	1.0	97.06	97.06	4	1.0	12.6	12.57	7.0	26.4	4	10.45	13.15	14.11	66.9	777.8	887.4	53.0	162.7	**354.96**	**54.22**
7.00	9.00	8.00	2.00	6.50	20.45	10.45	77.37	6.29	26.4	26.4	1.0	241.41	338.48	4	1.0	25.1	37.71	9.0	25.4	0	10.45	10.90	11.80	87.8	800.6	1176.8	76.6	452.8	**470.72**	**150.93**
9.00	10.00	9.50	1.00	7.50	20.45	10.45	93.05	3.14	25.4	25.4	1.0	138.85	477.33	0	1.0	0.0	37.71	10.0	25.4	0	10.45	10.90	11.80	98.3	890.1	1405.2	88.4	603.4	**562.07**	**201.15**
10.00	11.00	10.50	1.00	8.50	20.45	10.45	103.50	3.14	25.4	25.4	1.0	154.45	631.78	0	1.0	0.0	37.71	11.0	8.2	44	10.23	2.15	0.94	108.7	498.2	1167.7	100.2	769.7	**467.10**	**256.56**
11.00	12.50	11.75	1.50	10.00	20.23	10.23	116.39	4.71	8.2	8.2	1.0	79.07	710.85	44	1.0	207.4	245.14	12.5	8.2	44	9.86	2.15	0.94	124.1	524.0	1480.0	117.9	1073.9	**591.99**	**357.95**
12.50	15.50	14.00	3.00	13.00	19.86	9.86	138.86	9.43	8.2	8.2	1.0	188.66	899.51	44	1.0	414.9	660.00	15.5	16.7	24	9.86	4.78	3.58	124.1	649.2	2208.7	153.2	1712.7	**883.48**	**570.91**
15.50	17.00	16.25	1.50	14.50	19.86	9.86	138.86	4.71	16.7	16.7	1.0	196.39	1095.90	24	1.0	113.1	773.14	17.0	10.5	53	10.50	2.62	1.36	124.1	635.5	2504.6	170.9	2039.9	**1001.82**	**679.98**
17.00	18.50	17.75	1.50	16.00	20.50	10.50	138.86	4.71	10.5	10.5	1.0	121.32	1217.22	53	1.0	249.9	1023.00	18.5	30.4	0	10.50	23.27	24.45	124.1	2369.6	4609.9	188.6	2428.8	**1843.95**	**809.60**
18.50	20.00	19.25	1.50	17.50	20.50	10.50	138.86	4.71	30.4	30.4	1.0	391.73	1608.96	0	1.0	0.0	1023.00	20.0	11.0	38	10.50	2.76	1.51	124.1	544.4	3176.3	206.3	2838.2	**1270.53**	**946.07**
20.00	21.50	20.75	1.50	19.00	20.50	10.50	138.86	4.71	11.0	11.0	1.0	127.24	1736.20	38	1.0	179.1	1202.14	21.5	11.0	38	9.26	2.76	1.51	124.1	543.6	3482.0	223.9	3162.3	**1392.79**	**1054.09**
21.50	23.00	22.25	1.50	20.50	19.26	9.26	138.86	4.71	11.0	11.0	1.0	127.24	1863.44	38	1.0	179.1	1381.29	23.0	17.0	32	9.94	4.92	3.75	124.1	720.9	3965.6	241.6	3486.3	**1586.25**	**1162.11**
23.00	24.50	23.75	1.50	22.00	19.94	9.94	138.86	4.71	17.0	17.0	1.0	200.13	2063.57	32	1.0	150.9	1532.14	24.5	31.4	0	8.88	28.31	29.58	124.1	2863.0	6458.7	259.3	3855.0	**2583.49**	**1285.00**
24.50	26.00	25.25	1.50	23.50	18.88	8.88	138.86	4.71	31.4	31.4	1.1	427.54	2491.11	0	1.0	0.0	1532.14	26.0	31.4	0	9.14	28.31	29.58	124.1	2866.0	6889.3	277.0	4300.2	**2755.72**	**1433.41**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Q_b	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
26.00	27.50	26.75	1.50	25.00	19.14	9.14	138.86	4.71	31.4	31.4	1.1	427.54	2918.66	0	1.0	0.0	1532.14	27.5	30.0	0	8.82	21.26	22.40	124.1	2150.0	6600.8	294.6	4745.4	**2640.31**	**1581.81**
27.50	29.00	28.25	1.50	26.50	18.82	8.82	138.86	4.71	30.0	30.0	1.0	377.93	3296.59	0	1.0	0.0	1532.14	29.0	27.4	10	8.56	15.40	16.41	124.1	1627.5	6456.3	312.3	5141.1	**2582.50**	**1713.68**
29.00	30.00	29.50	1.00	27.50	18.56	8.56	138.86	3.14	27.4	27.4	1.0	226.21	3522.80	10	1.0	31.4	1563.57	30.0	27.4	10	8.56	15.40	16.41	124.1	1627.5	6713.9	324.1	5410.5	**2685.56**	**1803.49**
30.00	30.50	30.25	0.50	28.00	18.56	8.56	138.86	1.57	27.4	27.4	1.0	113.10	3635.90	10	1.0	15.7	1579.29	30.5	31.8	0	9.18	30.33	31.63	124.1	3070.3	8285.5	330.0	5545.2	**3314.20**	**1848.40**
30.50	32.00	31.25	1.50	29.50	19.18	9.18	138.86	4.71	31.8	31.8	1.1	442.40	4078.30	0	1.0	0.0	1579.29	32.0	31.8	0	9.12	30.33	31.63	124.1	3069.6	8727.2	347.7	6005.3	**3490.86**	**2001.76**
32.00	32.50	32.25	0.50	30.00	19.12	9.12	138.86	1.57	31.8	31.8	1.1	147.47	4225.77	0	1.0	0.0	1579.29	32.5	31.8	0	9.12	30.33	31.63	124.1	3069.6	8874.6	353.6	6158.6	**3549.85**	**2052.88**
32.50	33.50	33.00	1.00	31.00	19.12	9.12	138.86	3.14	31.8	31.8	1.1	294.93	4520.70	0	1.0	0.0	1579.29	33.5	30.8	0	9.48	25.29	26.50	124.1	2563.9	8663.9	365.4	6465.3	**3465.56**	**2155.11**
33.50	35.00	34.25	1.50	32.50	19.48	9.48	138.86	4.71	30.8	30.8	1.0	405.83	4926.53	0	1.0	0.0	1579.29	35.0	31.6	0	9.16	29.32	30.60	124.1	2968.2	9474.0	383.0	6888.9	**3789.59**	**2296.28**
35.00	36.50	35.75	1.50	34.00	19.16	9.16	138.86	4.71	31.6	31.6	1.1	434.93	5361.46	0	1.0	0.0	1579.29	36.5	31.6	0	9.02	29.32	30.60	124.1	2966.5	9907.2	400.7	7341.5	**3962.89**	**2447.15**
36.50	37.50	37.00	1.00	35.00	19.02	9.02	138.86	3.14	31.6	31.6	1.1	289.95	5651.42	0	1.0	0.0	1579.29	37.5	31.4	0	9.02	28.31	29.58	124.1	2864.6	10095.3	412.5	7643.2	**4038.14**	**2547.73**
37.50	38.00	37.75	0.50	35.50	19.02	9.02	138.86	1.57	31.4	31.4	1.1	142.51	5793.93	0	1.0	0.0	1579.29	38.0	32.0	0	9.11	31.33	32.65	124.1	3171.3	10544.5	418.4	7791.6	**4217.82**	**2597.20**
38.00	40.00	39.00	2.00	37.50	19.11	9.11	138.86	6.29	32.0	32.0	1.1	599.93	6393.86	0	1.0	0.0	1579.29	40.0	30.0	0	10.49	21.26	22.40	124.1	2164.7	10137.8	442.0	8415.1	**4055.13**	**2805.04**
BORE NO: P120A, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.55	9.55	26.26	1.57	26.5	26.5	1.0	20.58	0	3	1.0	4.7	0	3.0	25.7	6	9.55	11.58	12.49	28.7	0	0.0	5.9	5.9	**0.00**	**1.96**
3.00	4.00	3.50	1.00	1.50	19.55	9.55	33.43	3.14	25.7	25.7	1.0	50.56	0	6	1.0	18.9	0	4.0	25.7	6	9.86	11.58	12.49	38.2	0	0.0	17.7	17.7	**0.00**	**5.89**
4.00	6.00	5.00	2.00	3.50	19.86	9.86	48.06	6.29	25.7	25.7	1.0	145.39	0	6	1.0	37.7	0	6.0	25.7	6	9.86	11.58	12.49	57.9	0	0.0	41.3	41.3	**0.00**	**13.75**
6.00	7.00	6.50	1.00	4.50	19.86	9.86	62.85	3.14	25.7	25.7	1.0	95.06	0	6	1.0	18.9	0	7.0	25.7	6	9.86	11.58	12.49	67.8	707.3	707.3	53.0	53.0	**282.93**	**17.68**
7.00	8.00	7.50	1.00	5.50	19.86	9.86	72.71	3.14	25.7	25.7	1.0	109.98	109.98	6	1.0	18.9	18.86	8.0	12.3	44	9.97	3.15	1.88	77.6	510.4	639.2	64.8	193.7	**255.69**	**64.55**

APPENDIX-H

TABLE 1: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Q_b	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
8.00	9.00	8.50	1.00	6.50	19.97	9.97	82.63	3.14	12.3	12.3	1.0	56.62	166.60	44	1.0	138.3	157.14	9.0	9.2	52	9.97	2.33	1.10	87.6	532.1	855.9	76.6	400.3	**342.35**	**133.45**
9.00	10.00	9.50	1.00	7.50	19.97	9.97	92.60	3.14	9.2	9.2	1.0	47.13	213.73	52	1.0	163.4	320.57	10.0	9.2	52	10.56	2.33	1.10	97.6	550.6	1084.9	88.4	622.7	**433.96**	**207.57**
10.00	12.50	11.25	2.50	10.00	20.56	10.56	110.78	7.86	9.2	9.2	1.0	140.98	354.71	52	1.0	408.6	729.14	12.5	9.2	52	10.56	2.33	1.10	124.0	598.8	1682.7	117.9	1201.7	**673.08**	**400.57**
12.50	15.50	14.00	3.00	13.00	20.56	10.56	139.82	9.43	9.2	9.2	1.0	213.52	568.23	52	1.0	490.3	1219.43	15.5	12.0	29	10.35	3.06	1.79	124.0	510.2	2297.9	153.2	1940.9	**919.16**	**646.96**
15.50	17.00	16.25	1.50	14.50	20.35	10.35	139.82	4.71	12.0	12.0	1.0	140.11	708.33	29	1.0	136.7	1356.14	17.0	11.7	48	10.35	2.97	1.71	124.0	635.7	2700.1	170.9	2235.4	**1080.06**	**745.12**
17.00	18.50	17.75	1.50	16.00	20.35	10.35	139.82	4.71	11.7	11.7	1.0	136.50	844.84	48	1.0	226.3	1582.43	18.5	11.7	48	9.85	2.97	1.71	124.0	635.3	3062.6	188.6	2615.8	**1225.04**	**871.95**
18.50	21.50	20.00	3.00	19.00	19.85	9.85	139.82	9.43	11.7	11.7	1.0	273.01	1117.84	48	1.0	452.6	2035.00	21.5	8.7	64	10.75	2.24	1.02	124.0	674.7	3827.5	223.9	3376.8	**1531.01**	**1125.59**
21.50	24.50	23.00	3.00	22.00	20.75	10.75	139.82	9.43	8.7	8.7	1.0	201.73	1319.57	64	1.0	603.4	2638.43	24.5	28.1	0	10.75	16.98	18.02	124.0	1730.3	5688.3	259.3	4217.3	**2275.31**	**1405.76**
24.50	27.50	26.00	3.00	25.00	20.75	10.75	139.82	9.43	28.1	28.1	1.0	703.91	2023.48	0	1.0	0.0	2638.43	27.5	29.5	0	9.10	20.13	21.25	124.0	2037.2	6699.1	294.6	4956.6	**2679.66**	**1652.18**
27.50	30.00	28.75	2.50	27.50	19.10	9.10	139.82	7.86	29.5	29.5	1.0	621.55	2645.03	0	1.0	0.0	2638.43	30.0	29.0	0	9.10	19.01	20.10	124.0	1923.4	7206.9	324.1	5607.6	**2882.76**	**1869.19**
30.00	30.50	30.25	0.50	28.00	19.10	9.10	139.82	1.57	29.0	29.0	1.0	121.79	2766.82	0	1.0	0.0	2638.43	30.5	28.6	0	9.10	18.11	19.17	124.0	1832.4	7237.6	330.0	5735.3	**2895.06**	**1911.75**
30.50	32.50	31.50	2.00	30.00	19.10	9.10	139.82	6.29	28.6	28.6	1.0	479.17	3246.00	0	1.0	0.0	2638.43	32.5	28.6	0	10.93	18.11	19.17	124.0	1846.2	7730.6	353.6	6238.0	**3092.24**	**2079.33**
32.50	33.50	33.00	1.00	31.00	20.93	10.93	139.82	3.14	28.6	28.6	1.0	239.59	3485.58	0	1.0	0.0	2638.43	33.5	30.4	0	10.93	23.27	24.45	124.0	2372.2	8496.2	365.4	6489.4	**3398.49**	**2163.12**
33.50	35.00	34.25	1.50	32.50	20.93	10.93	139.82	4.71	30.4	30.4	1.0	394.46	3880.04	0	1.0	0.0	2638.43	35.0	30.6	0	10.93	24.28	25.48	124.0	2474.8	8993.2	383.0	6901.5	**3597.29**	**2300.50**
35.00	36.50	35.75	1.50	34.00	20.93	10.93	139.82	4.71	30.6	30.6	1.0	401.52	4281.56	0	1.0	0.0	2638.43	36.5	29.8	0	8.84	20.81	21.94	124.0	2103.3	9023.3	400.7	7320.7	**3609.30**	**2440.23**
36.50	37.50	37.00	1.00	35.00	18.84	8.84	139.82	3.14	29.8	29.8	1.0	251.67	4533.22	0	1.0	0.0	2638.43	37.5	29.6	0	8.84	20.36	21.48	124.0	2057.8	9229.4	412.5	7584.2	**3691.78**	**2528.05**
37.50	38.00	37.75	0.50	35.50	18.84	8.84	139.82	1.57	29.6	29.6	1.0	124.82	4658.04	0	1.0	0.0	2638.43	38.0	30.0	0	8.48	21.26	22.40	124.0	2145.6	9442.0	418.4	7714.9	**3776.82**	**2571.62**
38.00	40.00	39.00	2.00	37.50	18.48	8.48	139.82	6.29	30.0	30.0	1.0	507.42	5165.45	0	1.0	0.0	2638.43	40.0	0.0	0	0.00	1.00	0.00	124.0	97.4	7901.3	442.0	8245.8	**3160.52**	**2748.62**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 1.13 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Q_b	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
BORE NO: P116A, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.62	9.62	26.46	1.89	27.2	27.2	1.0	25.64	0	4	1.0	7.5	0	3.0	25.2	0	9.62	10.45	11.34	28.9	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.50	19.62	9.62	33.67	3.77	25.2	25.2	1.0	59.75	0	0	1.0	0.0	0	4.0	25.2	7	9.62	10.45	11.34	38.5	0	0.0	25.5	25.5	**0.00**	**8.49**
4.00	5.00	4.50	1.00	2.50	19.62	9.62	43.29	3.77	25.2	25.2	1.0	76.83	0	7	1.0	26.4	0	5.0	25.2	7	9.41	10.45	11.34	48.1	0	0.0	42.4	42.4	**0.00**	**14.14**
5.00	6.00	5.50	1.00	3.50	19.41	9.41	52.81	3.77	25.2	25.2	1.0	93.71	0	7	1.0	26.4	0	6.0	26.4	4	9.41	13.15	14.11	57.5	986.7	986.7	59.4	59.4	**394.66**	**19.80**
6.00	7.00	6.50	1.00	4.50	19.41	9.41	62.22	3.77	26.4	26.4	1.0	116.48	116.48	4	1.0	15.1	15.09	7.0	26.4	4	10.45	13.15	14.11	66.9	1136.7	1268.2	76.4	207.9	**507.29**	**69.31**
7.00	9.00	8.00	2.00	6.50	20.45	10.45	77.37	7.54	26.4	26.4	1.0	289.70	406.17	4	1.0	30.2	45.26	9.0	25.4	0	10.45	10.90	11.80	87.8	1166.8	1618.3	110.3	561.7	**647.31**	**187.25**
9.00	10.00	9.50	1.00	7.50	20.45	10.45	93.05	3.77	25.4	25.4	1.0	166.63	572.80	0	1.0	0.0	45.26	10.0	25.4	0	10.45	10.90	11.80	98.3	1295.7	1913.8	127.3	745.3	**765.51**	**248.45**
10.00	11.00	10.50	1.00	8.50	20.45	10.45	103.50	3.77	25.4	25.4	1.0	185.34	758.14	0	1.0	0.0	45.26	11.0	8.2	44	10.23	2.15	0.94	108.7	718.6	1522.0	144.3	947.7	**608.79**	**315.88**
11.00	12.50	11.75	1.50	10.00	20.23	10.23	116.39	5.66	8.2	8.2	1.0	94.88	853.02	44	1.0	248.9	294.17	12.5	8.2	44	9.86	2.15	0.94	124.1	755.6	1902.8	169.7	1316.9	**761.11**	**438.97**
12.50	15.50	14.00	3.00	13.00	19.86	9.86	138.86	11.31	8.2	8.2	1.0	226.39	1079.41	44	1.0	497.8	792.00	15.5	16.7	24	9.86	4.78	3.58	153.6	1098.7	2970.1	220.6	2092.0	**1188.04**	**697.35**
15.50	17.00	16.25	1.50	14.50	19.86	9.86	161.04	5.66	16.7	16.7	1.0	273.32	1352.73	24	1.0	135.8	927.77	17.0	10.5	53	10.50	2.62	1.36	168.4	1048.1	3328.6	246.1	2526.6	**1331.46**	**842.20**
17.00	18.50	17.75	1.50	16.00	20.50	10.50	176.31	5.66	10.5	10.5	1.0	184.86	1537.59	53	1.0	299.8	1227.60	18.5	30.4	0	10.50	23.27	24.45	168.4	4609.8	7374.9	271.5	3036.7	**2949.98**	**1012.25**
18.50	20.00	19.25	1.50	17.50	20.50	10.50	176.31	5.66	30.4	30.4	1.0	596.88	2134.47	0	1.0	0.0	1227.60	20.0	11.0	38	10.50	2.76	1.51	168.4	924.4	4286.5	297.0	3659.1	**1714.60**	**1219.69**
20.00	21.50	20.75	1.50	19.00	20.50	10.50	176.31	5.66	11.0	11.0	1.0	193.88	2328.35	38	1.0	215.0	1442.57	21.5	11.0	38	9.26	2.76	1.51	168.4	923.2	4694.1	322.5	4093.4	**1877.63**	**1364.46**
21.50	23.00	22.25	1.50	20.50	19.26	9.26	176.31	5.66	11.0	11.0	1.0	193.88	2522.23	38	1.0	215.0	1657.54	23.0	17.0	32	9.94	4.92	3.75	168.4	1289.5	5469.3	347.9	4527.7	**2187.71**	**1509.23**
23.00	24.50	23.75	1.50	22.00	19.94	9.94	176.31	5.66	17.0	17.0	1.0	304.94	2827.17	32	1.0	181.0	1838.57	24.5	31.4	0	8.88	28.31	29.58	168.4	5573.8	10239.5	373.4	5039.1	**4095.80**	**1679.70**
24.50	26.00	25.25	1.50	23.50	18.88	8.88	176.31	5.66	31.4	31.4	1.1	651.44	3478.61	0	1.0	0.0	1838.57	26.0	31.4	0	9.14	28.31	29.58	168.4	5579.0	10896.2	398.8	5716.0	**4358.46**	**1905.34**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 1.13 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Q_b	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
26.00	27.50	26.75	1.50	25.00	19.14	9.14	176.31	5.66	31.4	31.4	1.1	651.44	4130.05	0	1.0	0.0	1838.57	27.5	30.0	0	8.82	21.26	22.40	168.4	4185.6	10154.2	424.3	6392.9	**4061.69**	**2130.97**
27.50	29.00	28.25	1.50	26.50	18.82	8.82	176.31	5.66	30.0	30.0	1.0	575.86	4705.90	0	1.0	0.0	1838.57	29.0	27.4	10	8.56	15.40	16.41	168.4	3132.9	9677.3	449.7	6994.2	**3870.94**	**2331.41**
29.00	30.00	29.50	1.00	27.50	18.56	8.56	176.31	3.77	27.4	27.4	1.0	344.67	5050.57	10	1.0	37.7	1876.29	30.0	27.4	10	8.56	15.40	16.41	168.4	3132.9	10059.7	466.7	7393.6	**4023.89**	**2464.52**
30.00	30.50	30.25	0.50	28.00	18.56	8.56	176.31	1.89	27.4	27.4	1.0	172.34	5222.91	10	1.0	18.9	1895.14	30.5	31.8	0	9.18	30.33	31.63	168.4	5976.6	13094.6	475.2	7593.3	**5237.85**	**2531.08**
30.50	32.00	31.25	1.50	29.50	19.18	9.18	176.31	5.66	31.8	31.8	1.1	674.08	5896.99	0	1.0	0.0	1895.14	32.0	31.8	0	9.12	30.33	31.63	168.4	5975.3	13767.4	500.7	8292.8	**5506.96**	**2764.26**
32.00	32.50	32.25	0.50	30.00	19.12	9.12	176.31	1.89	31.8	31.8	1.1	224.69	6121.68	0	1.0	0.0	1895.14	32.5	31.8	0	9.12	30.33	31.63	168.4	5975.3	13992.1	509.1	8526.0	**5596.84**	**2841.99**
32.50	33.50	33.00	1.00	31.00	19.12	9.12	176.31	3.77	31.8	31.8	1.1	449.39	6571.07	0	1.0	0.0	1895.14	33.5	30.8	0	9.48	25.29	26.50	168.4	4990.0	13456.2	526.1	8992.3	**5382.49**	**2997.44**
33.50	35.00	34.25	1.50	32.50	19.48	9.48	176.31	5.66	30.8	30.8	1.0	618.36	7189.43	0	1.0	0.0	1895.14	35.0	31.6	0	9.16	29.32	30.60	168.4	5777.8	14862.3	551.6	9636.1	**5944.93**	**3212.05**
35.00	36.50	35.75	1.50	34.00	19.16	9.16	176.31	5.66	31.6	31.6	1.1	662.70	7852.13	0	1.0	0.0	1895.14	36.5	31.6	0	9.02	29.32	30.60	168.4	5774.8	15522.1	577.0	10324.3	**6208.85**	**3441.43**
36.50	37.50	37.00	1.00	35.00	19.02	9.02	176.31	3.77	31.6	31.6	1.1	441.80	8293.93	0	1.0	0.0	1895.14	37.5	31.4	0	9.02	28.31	29.58	168.4	5576.6	15765.6	594.0	10783.1	**6306.26**	**3594.36**
37.50	38.00	37.75	0.50	35.50	19.02	9.02	176.31	1.89	31.4	31.4	1.1	217.15	8511.07	0	1.0	0.0	1895.14	38.0	32.0	0	9.11	31.33	32.65	168.4	6173.4	16579.6	602.5	11008.7	**6631.85**	**3669.57**
38.00	40.00	39.00	2.00	37.50	19.11	9.11	176.31	7.54	32.0	32.0	1.1	914.10	9425.18	0	1.0	0.0	1895.14	40.0	30.0	0	10.49	21.26	22.40	168.4	4211.0	15531.3	636.4	11956.7	**6212.52**	**3985.58**
BORE NO: P120A, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	19.55	9.55	26.26	1.89	26.5	26.5	1.0	24.69	0	3	1.0	5.7	0	3.0	25.7	6	9.55	11.58	12.49	28.7	0	0.0	8.5	8.5	**0.00**	**2.83**
3.00	4.00	3.50	1.00	1.50	19.55	9.55	33.43	3.77	25.7	25.7	1.0	60.67	0	6	1.0	22.6	0	4.0	25.7	6	9.86	11.58	12.49	38.2	0	0.0	25.5	25.5	**0.00**	**8.49**
4.00	6.00	5.00	2.00	3.50	19.86	9.86	48.06	7.54	25.7	25.7	1.0	174.46	0	6	1.0	45.3	0	6.0	25.7	6	9.86	11.58	12.49	57.9	0	0.0	59.4	59.4	**0.00**	**19.80**
6.00	7.00	6.50	1.00	4.50	19.86	9.86	62.85	3.77	25.7	25.7	1.0	114.08	0	6	1.0	22.6	0	7.0	25.7	6	9.86	11.58	12.49	67.8	1032.5	1032.5	76.4	76.4	**412.99**	**25.46**
7.00	8.00	7.50	1.00	5.50	19.86	9.86	72.71	3.77	25.7	25.7	1.0	131.97	131.97	6	1.0	22.6	22.63	8.0	12.3	44	9.97	3.15	1.88	77.6	737.1	891.7	93.3	247.9	**356.67**	**82.65**

APPENDIX-H

TABLE 2: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 1.13 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
8.00	9.00	8.50	1.00	6.50	19.97	9.97	82.63	3.77	12.3	12.3	1.0	67.94	199.92	44	1.0	165.9	188.57	9.0	9.2	52	9.97	2.33	1.10	87.6	767.5	1156.0	110.3	498.8	**462.39**	**166.27**
9.00	10.00	9.50	1.00	7.50	19.97	9.97	92.60	3.77	9.2	9.2	1.0	56.56	256.48	52	1.0	196.1	384.69	10.0	9.2	52	10.56	2.33	1.10	97.6	794.2	1435.3	127.3	768.4	**574.13**	**256.15**
10.00	12.50	11.25	2.50	10.00	20.56	10.56	110.78	9.43	9.2	9.2	1.0	169.17	425.65	52	1.0	490.3	874.97	12.5	9.2	52	10.56	2.33	1.10	124.0	863.6	2164.3	169.7	1470.3	**865.71**	**490.11**
12.50	15.50	14.00	3.00	13.00	20.56	10.56	139.82	11.31	9.2	9.2	1.0	256.22	681.87	52	1.0	588.3	1463.31	15.5	12.0	29	10.35	3.06	1.79	155.7	846.5	2991.6	220.6	2365.8	**1196.66**	**788.60**
15.50	17.00	16.25	1.50	14.50	20.35	10.35	163.42	5.66	12.0	12.0	1.0	196.51	878.38	29	1.0	164.1	1627.37	17.0	11.7	48	10.35	2.97	1.71	171.2	1076.0	3581.7	246.1	2751.8	**1432.69**	**917.28**
17.00	18.50	17.75	1.50	16.00	20.35	10.35	178.95	5.66	11.7	11.7	1.0	209.64	1088.02	48	1.0	271.5	1898.91	18.5	11.7	48	9.85	2.97	1.71	171.2	1075.4	4062.3	271.5	3258.5	**1624.93**	**1086.16**
18.50	21.50	20.00	3.00	19.00	19.85	9.85	178.95	11.31	11.7	11.7	1.0	419.29	1507.31	48	1.0	543.1	2442.00	21.5	8.7	64	10.75	2.24	1.02	171.2	1092.2	5041.5	322.5	4271.8	**2016.61**	**1423.92**
21.50	24.50	23.00	3.00	22.00	20.75	10.75	178.95	11.31	8.7	8.7	1.0	309.82	1817.13	64	1.0	724.1	3166.11	24.5	28.1	0	10.75	16.98	18.02	171.2	3420.4	8403.7	373.4	5356.6	**3361.48**	**1785.54**
24.50	27.50	26.00	3.00	25.00	20.75	10.75	178.95	11.31	28.1	28.1	1.0	1081.07	2898.20	0	1.0	0.0	3166.11	27.5	29.5	0	9.10	20.13	21.25	171.2	4030.8	10095.1	424.3	6488.6	**4038.05**	**2162.87**
27.50	30.00	28.75	2.50	27.50	19.10	9.10	178.95	9.43	29.5	29.5	1.0	954.58	3852.78	0	1.0	0.0	3166.11	30.0	29.0	0	9.10	19.01	20.10	171.2	3805.6	10824.5	466.7	7485.6	**4329.80**	**2495.20**
30.00	30.50	30.25	0.50	28.00	19.10	9.10	178.95	1.89	29.0	29.0	1.0	187.05	4039.83	0	1.0	0.0	3166.11	30.5	28.6	0	9.10	18.11	19.17	171.2	3625.5	10831.4	475.2	7681.1	**4332.56**	**2560.38**
30.50	32.50	31.50	2.00	30.00	19.10	9.10	178.95	7.54	28.6	28.6	1.0	735.92	4775.75	0	1.0	0.0	3166.11	32.5	28.6	0	10.93	18.11	19.17	171.2	3649.3	11591.1	509.1	8451.0	**4636.46**	**2817.00**
32.50	33.50	33.00	1.00	31.00	20.93	10.93	178.95	3.77	28.6	28.6	1.0	367.96	5143.71	0	1.0	0.0	3166.11	33.5	30.4	0	10.93	23.27	24.45	171.2	4689.3	12999.1	526.1	8835.9	**5199.65**	**2945.31**
33.50	35.00	34.25	1.50	32.50	20.93	10.93	178.95	5.66	30.4	30.4	1.0	605.81	5749.52	0	1.0	0.0	3166.11	35.0	30.6	0	10.93	24.28	25.48	171.2	4892.0	13807.7	551.6	9467.2	**5523.07**	**3155.74**
35.00	36.50	35.75	1.50	34.00	20.93	10.93	178.95	5.66	30.6	30.6	1.0	616.65	6366.17	0	1.0	0.0	3166.11	36.5	29.8	0	8.84	20.81	21.94	171.2	4162.0	13694.3	577.0	10109.3	**5477.73**	**3369.77**
36.50	37.50	37.00	1.00	35.00	18.84	8.84	178.95	3.77	29.8	29.8	1.0	386.51	6752.68	0	1.0	0.0	3166.11	37.5	29.6	0	8.84	20.36	21.48	171.2	4072.1	13990.9	594.0	10512.8	**5596.34**	**3504.27**
37.50	38.00	37.75	0.50	35.50	18.84	8.84	178.95	1.89	29.6	29.6	1.0	191.69	6944.38	0	1.0	0.0	3166.11	38.0	30.0	0	8.48	21.26	22.40	171.2	4246.6	14357.1	602.5	10713.0	**5742.83**	**3570.99**
38.00	40.00	39.00	2.00	37.50	18.48	8.48	178.95	7.54	30.0	30.0	1.0	779.29	7723.67	0	1.0	0.0	3166.11	40.0	0.0	0	0.00	1.00	0.00	171.2	193.7	11083.5	636.4	11526.2	**4433.39**	**3842.07**

APPENDIX-H

TABLE 3: COMPUTATION OF LATERAL PILE LOAD CAPACITY (Dia. 1000 mm)

Bore No.	Dia. of pile (m)	Cut-off length (m)	Scour depth (m)	Concrete Grade	Young's Modulus (kN/m^2)	Moment of Inertia (m^4)	Average SPT	Modulus of sub grade (k_1)	Stiffness Factor (T)	Cantilever length	L_1/T	L_f/T	Permissible deflection (m)	Depth of Fixity (m)	Allowable Load capacity of pile(kN)
P116A	1.00	2.50	0.00	35	29580399	0.0491	18	2552	3.56	3.50	0.98	2.08	0.005	7.41	67
P120A	1.00	2.50	0.00	35	29580399	0.0491	19	2696	3.52	4.50	1.28	2.04	0.005	7.17	55

APPENDIX-H

TABLE 4: COMPUTATION OF LATERAL PILE LOAD CAPACITY (Dia. 1200 mm)

Bore No.	Dia. of pile (m)	Cut-off length (m)	Scour depth (m)	Concrete Grade	Young's Modulus (kN/m^2)	Moment of Inertia (m^4)	Average SPT	Modulus of sub grade (k_1)	Stiffness Factor (T)	Cantilever length	L_1/T	L_f/T	Permissible deflection (m)	Depth of Fixity (m)	Allowable Load capacity of pile(kN)
P116A	1.20	2.50	0.00	35	29580399	0.1018	17	2408	4.16	3.50	0.84	2.10	0.005	8.76	98
P120A	1.20	2.50	0.00	35	29580399	0.1018	19	2696	4.07	4.50	1.11	2.06	0.005	8.40	84

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
P116A	0.50	SM	47	4	9.80	5.00	4.80	1.00	0.317	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.534	Liquefiable
	1.00	SM	47	4	19.60	10.00	9.60	0.99	0.316	1.70	6.80	5.00	1.20	13.16	0.14	1.00	0.169	0.536	Liquefiable
	3.00	SM	46	7	58.80	30.00	28.80	0.98	0.311	1.70	11.90	5.00	1.20	19.28	0.21	1.00	0.246	0.792	Liquefiable
	4.00	CL-ML	68	9	78.40	40.00	38.40	0.97	0.309	1.61	14.52	5.00	1.20	22.43	0.25	1.00	-	-	Non-liquefiable
	5.00	ML	70	9	98.00	50.00	48.00	0.96	0.306	1.44	12.99	5.00	1.20	20.59	0.22	1.00	0.266	0.868	Liquefiable
	6.00	ML	70	25	116.40	60.00	56.40	0.95	0.307	1.33	33.29	5.00	1.20	44.95	0.52	1.00	0.620	2.019	Non-liquefiable
	7.00	CL-ML	56	27	135.80	70.00	65.80	0.95	0.305	1.23	33.29	5.00	1.20	44.94	0.52	1.00	-	-	Non-liquefiable
	9.00	SM-SC	48	16	174.60	90.00	84.60	0.93	0.300	1.09	17.40	5.00	1.20	25.87	0.31	1.00	0.370	1.234	Non-liquefiable
	10.00	SM-SC	48	19	205.00	100.00	105.00	0.91	0.276	0.98	18.54	5.00	1.20	27.25	0.35	1.00	0.412	1.492	Non-liquefiable
	11.00	CL-ML	88	19	225.50	110.00	115.50	0.88	0.268	0.93	17.68	5.00	1.20	26.22	0.32	1.00	-	-	Non-liquefiable
	12.50	CL-ML	88	16	252.50	125.00	127.50	0.84	0.260	0.89	14.17	5.00	1.20	22.00	0.24	1.00	-	-	Non-liquefiable
	15.50	ML	63	36	313.10	155.00	158.10	0.76	0.235	0.80	28.63	5.00	1.20	39.36	0.52	0.87	0.542	2.310	Non-liquefiable
	17.00	CL	79	36	338.30	170.00	168.30	0.72	0.226	0.77	27.75	5.00	1.20	38.30	0.52	0.83	-	-	Non-liquefiable
	18.50	SM	45	89	379.25	185.00	194.25	0.68	0.207	0.72	63.86	5.00	1.20	81.63	0.52	0.79	0.492	2.377	Non-liquefiable
	20.00	CL-ML	78	52	410.00	200.00	210.00	0.64	0.195	0.69	35.88	5.00	1.20	48.06	0.52	0.77	-	-	Non-liquefiable
	21.50	CL-ML	78	58	440.75	215.00	225.75	0.60	0.183	0.67	38.60	5.00	1.20	51.32	0.52	0.75	-	-	Non-liquefiable
	23.00	CL-ML	66	54	471.50	230.00	241.50	0.56	0.171	0.64	34.75	5.00	1.20	46.70	0.52	0.74	-	-	Non-liquefiable
	24.50	SM	42	60	502.25	245.00	257.25	0.56	0.171	0.62	37.41	5.00	1.20	49.89	0.52	0.72	0.447	2.619	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	26.00	SM	42	74	533.00	260.00	273.00	0.56	0.171	0.61	44.79	5.00	1.20	58.74	0.52	0.71	0.438	2.566	Non-liquefiable
	27.50	SM	49	73	563.75	275.00	288.75	0.56	0.171	0.59	42.96	5.00	1.20	56.55	0.52	0.69	0.429	2.516	Non-liquefiable
	29.00	ML	51	78	594.50	290.00	304.50	0.56	0.171	0.57	44.70	5.00	1.20	58.64	0.52	0.68	0.421	2.470	Non-liquefiable
	30.50	SM	40	80	625.25	305.00	320.25	0.56	0.171	0.56	44.70	5.00	1.20	58.64	0.52	0.67	0.414	2.427	Non-liquefiable
	32.00	SM	40	74	656.00	320.00	336.00	0.56	0.171	0.55	40.37	5.00	1.20	53.44	0.52	0.66	0.407	2.387	Non-liquefiable
	33.50	SM	45	73	686.75	335.00	351.75	0.56	0.171	0.53	38.92	5.00	1.20	51.71	0.52	0.65	0.401	2.349	Non-liquefiable
	35.00	SM	41	79	717.50	350.00	367.50	0.56	0.171	0.52	41.21	5.00	1.20	54.45	0.52	0.64	0.395	2.314	Non-liquefiable
	36.50	SM	41	78	748.25	365.00	383.25	0.56	0.171	0.51	39.84	5.00	1.20	52.81	0.52	0.63	0.389	2.280	Non-liquefiable
	38.00	SM	34	72	779.00	380.00	399.00	0.56	0.171	0.50	36.05	4.93	1.19	47.76	0.52	0.62	0.383	2.249	Non-liquefiable
	40.00	SM	34	69	820.00	400.00	420.00	0.56	0.171	0.49	33.67	4.93	1.19	44.94	0.52	0.61	0.377	2.209	Non-liquefiable
P120A	0.50	ML	55	7	9.80	5.00	4.80	1.00	0.317	1.70	11.90	5.00	1.20	19.28	0.21	1.00	0.246	0.777	Liquefiable
	1.00	ML	55	7	19.60	10.00	9.60	0.99	0.316	1.70	11.90	5.00	1.20	19.28	0.21	1.00	0.246	0.780	Liquefiable
	2.00	SM	45	7	39.20	20.00	19.20	0.98	0.314	1.70	11.90	5.00	1.20	19.28	0.21	1.00	0.246	0.786	Liquefiable
	3.00	ML	61	15	58.80	30.00	28.80	0.98	0.311	1.70	25.50	5.00	1.20	35.60	0.52	1.00	0.620	1.993	Non-liquefiable
	4.00	ML	61	11	78.40	40.00	38.40	0.97	0.309	1.61	17.75	5.00	1.20	26.30	0.32	1.00	0.382	1.237	Non-liquefiable
	6.00	ML	67	11	117.60	60.00	57.60	0.95	0.304	1.32	14.49	5.00	1.20	22.39	0.25	1.00	0.295	0.972	Liquefiable
	7.00	ML	67	14	139.30	70.00	69.30	0.95	0.297	1.20	16.82	5.00	1.20	25.18	0.30	1.00	0.352	1.188	Non-liquefiable

APPENDIX-H
TABLE 5: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	8.00	CL	77	14	159.20	80.00	79.20	0.94	0.294	1.12	15.73	5.00	1.20	23.88	0.27	1.00	-	-	Non-liquefiable
	9.00	CL	85	28	180.00	90.00	90.00	0.93	0.291	1.05	29.51	5.00	1.20	40.42	0.52	1.00	-	-	Non-liquefiable
	10.00	CL	85	33	200.00	100.00	100.00	0.91	0.283	1.00	33.00	5.00	1.20	44.60	0.52	1.00	-	-	Non-liquefiable
	12.50	CL	79	22	250.00	125.00	125.00	0.84	0.262	0.89	19.68	5.00	1.20	28.61	0.39	1.00	-	-	Non-liquefiable
	15.50	CL-ML	68	25	319.30	155.00	164.30	0.76	0.230	0.78	19.50	5.00	1.20	28.40	0.38	0.86	-	-	Non-liquefiable
	17.00	CL	82	25	350.20	170.00	180.20	0.72	0.218	0.74	18.62	5.00	1.20	27.35	0.35	0.81	-	-	Non-liquefiable
	18.50	CL	82	32	375.55	185.00	190.55	0.68	0.209	0.72	23.18	5.00	1.20	32.82	0.52	0.79	-	-	Non-liquefiable
	21.50	CL	89	36	436.45	215.00	221.45	0.60	0.184	0.67	24.19	5.00	1.20	34.03	0.52	0.75	-	-	Non-liquefiable
	24.50	SM	45	40	487.55	245.00	242.55	0.56	0.176	0.64	25.68	5.00	1.20	35.82	0.52	0.73	0.451	2.571	Non-liquefiable
	27.50	SM	37	45	569.25	275.00	294.25	0.56	0.169	0.58	26.23	5.00	1.20	36.48	0.52	0.68	0.421	2.492	Non-liquefiable
	30.50	SM	42	48	631.35	305.00	326.35	0.56	0.169	0.55	26.57	5.00	1.20	36.88	0.52	0.76	0.470	2.780	Non-liquefiable
	33.50	SM	45	66	639.85	335.00	304.85	0.56	0.183	0.57	37.80	5.00	1.20	50.36	0.52	0.77	0.477	2.604	Non-liquefiable
	35.00	SM	45	71	731.50	350.00	381.50	0.56	0.167	0.51	36.35	5.00	1.20	48.62	0.52	0.73	0.453	2.704	Non-liquefiable
	36.50	SM	49	75	762.85	365.00	397.85	0.56	0.167	0.50	37.60	5.00	1.20	50.12	0.52	0.72	0.448	2.677	Non-liquefiable
	38.00	SM	49	74	794.20	380.00	414.20	0.56	0.167	0.49	36.36	5.00	1.20	48.63	0.52	0.72	0.444	2.652	Non-liquefiable
	40.00	CL-ML	68	100	836.00	400.00	436.00	0.56	0.167	0.48	47.89	5.00	1.20	62.47	0.52	0.71	-	-	Non-liquefiable

APPENDIX-I
SITE PHOTOGRAPHS

UDS at depth 15.50 m

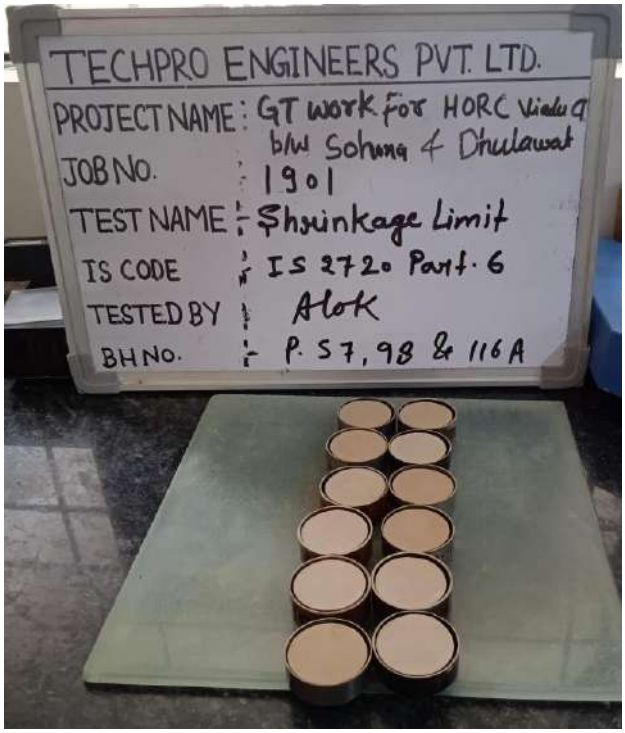
SPT sample at depth 20.00 m

SPT at depth 10.00 m

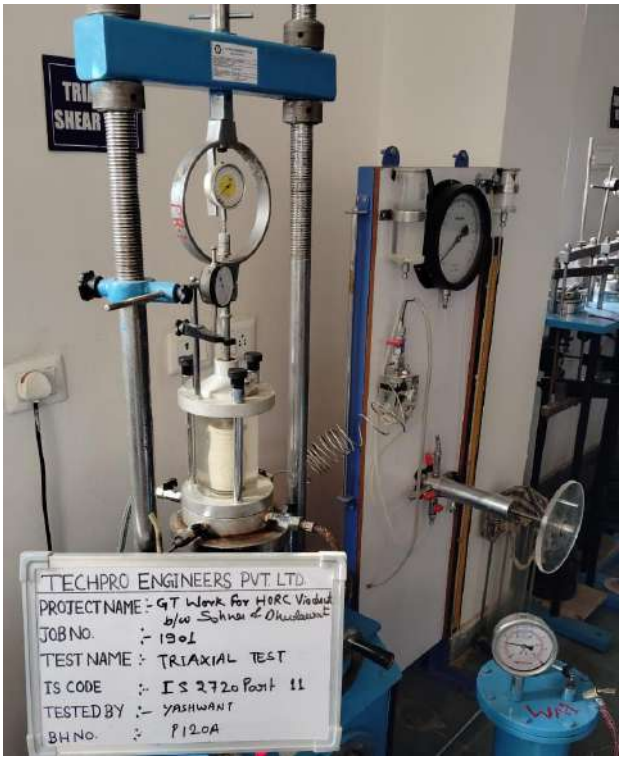
SPT sample at depth 21.50 m

APPENDIX-J
LABORATORY PHOTOGRAPHS

Atterberg's limit test



Shrinkage limit test



Tri-axial test

Direct shear test

APPENDIX-K
CHART 1: FIELD BORELOG CHARTS (P116A)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	(6/7L)-HORC Viaduct b/w Sohana Dhulawat station			Project Code:	1901
Coordinate:	N: 3120097.53	E: 700986.631		Location/ Chainage:	23961.4470
Method of Drilling:	Percussion	Drilling Equipment:	Mannual Powerwinch	Bore No.:	P-116A
Casing Lowered (M):	24.00 Bentonite Used:	NO	Standard Sampler:	Yes	Barrel Type:	N/A
Ground Elevation:	R.L-195.485	Date: From 31/10/23	to 3/11/23	Water Table (M):	1.90

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
31/10/23	0.00	0.50	0.50	D.S	SX	collected										
"	1.00	1.45	0.45	DP	"	1	2	2	4							Non-cohesive soil
"	2.00	2.45	0.45	U	"	Received										— do —
"	3.00	3.45	0.45	DP	"	2	3	4	7							— do —
"	4.00	4.45	0.45	DP	"	3	4	5	9							— do —
"	5.00	5.45	0.45	U	"	Received										Non-cohesive soil with gravel
"	6.00	6.45	0.45	DP	"	5	11	14	25							— do —
"	7.00	7.45	0.45	DP	"	6	12	15	27							— do —
"	8.00	8.45	0.45	U	"	Supplied										cohesive soil
"	9.00	9.45	0.45	DP	"	4	7	9	16							cohesive soil with gravel
"	10.00	10.45	0.45	DP	"	5	9	10	19							— do —
"	11.00	11.45	0.45	U	"	Received										— do —
"	12.50	12.95	0.45	DP	"	5	7	9	16							— do —
"	14.00	14.45	0.45	U	"	Received										— do —
"	15.50	15.95	0.45	DP	"	8	15	21	36							Non-cohesive soil with gravel
"	17.00	17.45	0.45	U	"	Received										Non-cohesive soil
"	18.50	18.95	0.45	DP	"	16	36	53	89							— do —
"	20.00	20.45	0.45	DP	"	13	24	28	52							Cohesive soil with gravel
"	21.50	21.95	0.45	DP	"	15	26	32	58							— do —
"	23.00	23.45	0.45	DP	"	11	23	31	54							Non-cohesive soil
"	24.50	24.95	0.45	DP	"	13	25	35	60							— do —
"	26.00	26.45	0.45	DP	"	24	32	42	74							— do —
2/11/23	27.50	27.95	0.45	DP	"	23	30	43	73							— do —
"	29.00	29.45	0.45	DP	"	26	33	45	78							— do —

Nitesh
Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 2: FIELD BORELOG CHARTS (P116A)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTIN-HORC Viaduct blw Sohana Dhulawat station			Project Code:	1901
Coordinate:	N: 3120897.53	E: 700986.631		Location/ Chainage:	23961.4470
Method of Drilling:	Percussion	Drilling Equipment:	Manual Rotary Winch	Bore No.:	P-116A
Casing Lowered (M):	24.00	Bentonite Used: NO	Standard Sampler:	Yes	Barrel Type:	N/A
Ground Elevation:	R.L-195.485	Date: From 31/10/23 to 3/11/23			Water Table (M):	1.90

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
31/10/23	30.50	30.95	0.45	DP	95	27	37	43	80							Non-cohesive soil
11	33.00	33.45	0.45	DP	11	30	34	40	74							— do —
2/11/23	33.50	33.95	0.45	DP	11	29	31	42	73							— do —
11	35.00	35.45	0.45	DP	11	32	35	44	79							— do —
3/11/23	36.50	36.95	0.45	DP	11	33	36	42	78							— do —
11	38.00	38.45	0.45	DP	11	30	32	40	72							— do —
11	40.00	40.45	0.45	DP	11	28	30	39	69							— do —

Nitesh
Supervisor

Techpro Engineers Pvt. Ltd. Gurgaon

E - in - C

Abbreviation Used :- U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 3: FIELD BORELOG CHARTS (P120A)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTL-HORC Viaduct b/w Sohana Dhulawat station			Project Code:	1901
Coordinate:	N: 3191001.95	E: 700972.032	Location/ Chainage:	24066.247	
Method of Drilling:	Percussion	Drilling Equipment:	Manual Powerwinch	Bore No.:	P120A
Casing Lowered (M):	9.00	Bentonite Used: Yes	Standard Sampler: Yes	Barrel Type:	N/A
Ground Elevation:	R.L-196.008	Date: From 18/11/23 to 21/11/23		Water Table (M):	5.00M

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
18/11/23	0.00	0.50	0.50	DS	SX	collected										Non-cohesive soil
"	1.00	1.45	0.45	DP	"	2	3	4	7							— do —
"	2.00	2.45	0.45	U	"	Received										— do —
"	3.00	3.45	0.45	DP	"	5	7	8	15							Non-cohesive soil with gravel
"	4.00	4.45	0.45	DP	"	3	5	6	11							Non-cohesive soil
"	5.00	5.45	0.45	U	"	Received										— do —
"	6.00	6.45	0.45	DP	"	4	5	6	11							— do —
"	7.00	7.45	0.45	DP	"	4	6	8	14							— do —
"	8.00	8.45	0.45	U	"	Received										— do —
"	9.00	9.45	0.45	DP	"	5	10	18	28							Cohesive soil with gravel
"	10.00	10.45	0.45	DP	"	6	13	20	33							— do —
"	11.00	11.45	0.45	U	"	Received										— do —
19/11/23	12.50	12.95	0.45	DP	"	6	9	13	22							— do —
	14.00	14.45	0.45	U	"	slipped										-do- DS collected
	15.50	15.95	0.45	DP	"	10	12	13	25							Non-cohesive soil with gravel
"	17.00	17.45	0.45	U	"	Received										— do —
"	18.50	18.95	0.45	DP	"	12	14	18	32							— do —
"	20.00	20.45	0.45	U	"	slipped										-do- DS collected
"	21.50	21.95	0.45	DP	"	13	15	21	36							Non-cohesive soil with gravel
"	23.00	23.45	0.45	U	"	slipped										— do —
"	24.50	24.95	0.45	DP	"	14	17	23	40							Non-cohesive soil
"	26.00	26.45	0.45	U	"	slipped										-do- DS collected
"	27.50	27.95	0.45	DP	"	16	20	25	45							Non-cohesive soil
"	29.00	29.45	0.45	U	"	Received										— do —

Supervisor

Techpro Engineers Pvt. Ltd. Kanpur

E - in - C

Abbreviation Used U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-K
CHART 4: FIELD BORELOG CHARTS (P120A)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW-HORC Viaduct b/w Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 3121001.95	E: 700978.032		Location/ Chainage:	24066.247
Method of Drilling:	Percussion	Drilling Equipment:	Mannual Powerwinch	Bore No.:	P120A
Casing Lowered (M):	21.00	Bentonite Used: Yes	Standard Sampler: Yes	Barrel Type:	N/A
Ground Elevation:	R.L-196.008	Date: From 18/11/23 to 21/11/23		Water Table (M):	5.00M

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
20/11/23	30.50	30.95	0.45	DP	SX	17	21	27	48							Non-cohesive soil
"	32.00	32.45	0.45	U	"	slipped										-do- D.B collected
"	33.50	33.95	0.45	DP	"	22	30	36	66							Non-cohesive soil with gravel
"	35.00	35.45	0.45	DP	"	27	33	38	71							— do —
21/11/23	36.50	36.95	0.45	DP	"	29	35	40	75							— do —
"	38.00	38.45	0.45	DP	"	28	32	42	74							— do —
"	40.00	40.45	0.45	DP	"	46	56	–	R							— do —

Nitesh
Supervisor

Techpro Engineers Pvt. Ltd. Kanpur

E - In - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

End of Report

Report No: 1901-HORC-VIII

Report No.: 1901-HORC-VIII

Date: Dec 05th; 2023

GEOTECHNICAL INVESTIGATION REPORT

ULR No.: TC916923000000032P
REVISION-R0

AT THE SITE FOR

HORC VIADUCT BETWEEN SOHANA & DHULAWAT STATIONS OF HARYANA ORBITAL RAIL CORRIDOR (HORC) PROJECT, HARYANA

FROM BOREHOLES P134A TO A2A

CLIENT

HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LTD.

Plot No. 143, 5th floor RailTel tower, Sector-44,
Gurugram, Haryana 122003

GENERAL CONSULTANTS

RITES-SMEC JV

Gurugram, Haryana

GEOTECHNICAL CONSULTANTS

TECHPRO ENGINEERS PVT. LTD.

114, RAM GANGA HOUSING SOCIETY, NARAMAU, G T ROAD, KANPUR-209 217, Phone: 9793209918

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TC-9169

TECHPRO ENGINEERS PVT.LTD.
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Web site: www.techproindia.com

REPORT FORMAT

Report No.	Bore included	Total Number of Bores
1901-HORC-I	A1 to P20	21
1901-HORC-II	P21 to P40	20
1901-HORC-III	P41 to P60	20
1901-HORC-IV	P61 to P80	20
1901-HORC-V	P81 to P100	20
1901-HORC-VI	P101 to P113	13
1901-HORC-VII	P114A to P133A	20
1901-HORC-VIII	P134A to A2A	16
1901-HORC-IX	P114B to P133B	20
1901-HORC-X	P134B to A2B	16

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National Accreditation Board for Testing and Calibration Laboratories

NABL

CERTIFICATE OF ACCREDITATION

TECHPRO ENGINEERS PVT. LTD. (LABORATORY DIVISION)

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"General Requirements for the Competence of Testing & Calibration Laboratories"

for its facilities at

114, RAM GANGA HOUSING SOCIETY, NARAMAU, G.T. ROAD, KANPUR, UTTAR PRADESH, INDIA

in the field of

TESTING

Certificate Number: TC-9169

Issue Date: 23/12/2022 **Valid Until:** 22/12/2024

This certificate remains valid for the Scope of Accreditation as specified in the annexure subject to continued satisfactory compliance to the above standard & the relevant requirements of NABL.
(To see the scope of accreditation of this laboratory, you may also visit NABL website www.nabl-india.org)

Name of Legal Identity : Techpro Engineers Private Limited

Signed for and on behalf of NABL

N. Venkateswaran
Chief Executive Officer

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Dec 05th; 2023

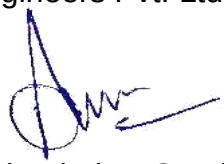
ACKNOWLEDGEMENTS

We are pleased to submit the part-8 of the report of Geotechnical investigation, conducted for the boreholes P134A to P148A and A2A for the design of foundations for HORC Viaduct between Sohana & Dhulawat stations of Haryana Orbital Rail Corridor (HORC) project in the state of Haryana, India.

We hereby, convey our sincere thanks to Mr. Neeraj Bhandari (CPM/South) and Mr. Raju Solanki (DGM/C/South), HRIDCL for trust and support during the investigation. We also acknowledge our thanks to Mr. Uma Maheshwara Rao B, DGM/C/West, HRIDCL for awarding the said work to us. We are also grateful Mr. Ravindra Dutta Upadhyay (Geotech Expert), Mr. PS Gautam & Mr. Jitender Parashar, Site Engineer from the RITES- SMEC JV and Mohd. Ishak (Executive/Civil) from HRIDCL, for their help rendered during and prior to the investigation work.

We are also thankful to our staff members for conducting field and laboratory test, preparing sketches, and typing the report.

for Techpro Engineers Pvt. Ltd.



(Arvind K. Garg)
B.Tech. (Civil), M.Tech.
Principal Consultant &
Managing Director

1. INTRODUCTION:

Haryana Rail Infrastructure Development Corporation Ltd. (HRIDC) and Ministry of Railways, Govt. of India has come together to form a new company namely Haryana Orbital Rail Corporation Limited (HORCL), to design and construction of new BG line from Palwal to Sonipat named Haryana Orbital Rail Corridor (HORC), in the state of Haryana, India. In this connection, a Geotechnical investigation has been planned for the design of foundations of Viaduct between Sohana & Dhulawat stations of Haryana Orbital Rail Corridor (HORC) Project in the state of Haryana. The work of conducting the detailed Geotechnical Investigation has been awarded to us by HRIDC, through work order No. HRIDC/HORC/GTI/211/2023-2024/Vol-0 dated 02-09-2023, which includes investigation in field, laboratory testing of disturbed and undisturbed samples, collected from the field, and submission of the geotechnical **investigation** test report.

A geotechnical investigation was carried out, with the locations, planned by the client. Purpose of the investigation is to determine the nature and properties of soil and rock strata across the bore holes and representing them through log sections showing the levels, nature, and properties of various strata up to a sufficient depth below the founding level, proneness of site to artesian conditions, seismic disturbance and other engineering properties of soil and rock strata.

This part -8 of the report includes the detailed methodology of investigation, collection of samples, field and laboratory test result including their interpretation/ analysis, recommendations on the properties of soils and rock required for design of foundation and suggesting suitable type and depth of foundation with allowable bearing capacity for safe and strong foundations for the Bore Hole numbers P134A to P148A and A2A.

2. SCOPE OF WORK:

For the design of foundation of viaduct, it is required to determine the allowable bearing capacity together with necessary engineering characteristics of underlying soil & rock strata. In general, the geotechnical investigation has been planned as per IS:1892-2021 and further extended to IS: 1904, IS:2911 (part-1/Sec 2) & IRC 78:2014 for planning the laboratory testing and computing the allowable bearing capacity, hence the scope of work is as follows:

2.1. Mobilisation of all tools & plants along with accessories, materials, labours etc. at site of work for drilling and testing work, including setting up boring and shifting to different bore holes point etc.

2.2. Exploratory drilling of 150 mm diameter bore holes through soil deposits and 75 mm in rock within the proposed alignment upto the required depth.

2.3. Collection of disturbed soil samples at an interval of 3.00 meter in all the bore holes.

2.4. Collection of undisturbed soil samples at every 3.00 m interval or at change of stratum from all the boreholes.

2.5. To conduct Standard Penetration Test (SPT) at an interval of 3.00 m or noticeable change of stratum in soil deposits in all bore holes.

2.6. Collection of rock core samples and preserving them in core boxes.

2.7. To collect ground water sample on completion of bore holes.

2.8. To record the ground water table in all the bore holes.

2.9. Transporting all the disturbed, undisturbed soil and rock core samples collected during the field investigation to our NABL accredited Geotech Engineering laboratory at Kanpur.

2.10. To conduct the laboratory tests on all the soil and rock core samples collected during field investigation for determination of their engineering characteristics.

2.11. To compile of field and laboratory test results, working out the allowable bearing capacity and preparing the report including detailed recommendations and necessary precautions.

3. GEOLOGICAL INFORMATION OF THE REGION:

3.1. Geography:

The project location is in the bordering area of Gurugram and Nuh (recent old name-Mewat), districts in the Indian state of Haryana. The stretch of the alignment of the proposed corridor starts from southmost part of Gurugram in the town of Sohna and ends at Dhulawat, which is a village lying at the north of Nuh district.

Haryana is a state located in the northern part of India. Gurugram is among one

of the districts in Haryana which is also the part of National Capital Region (30km south of New Delhi). It lies at an elevation of 217 m above msl. Sohna is a small town located 25km in the south of Gurugram. Sohna is well known for its hot water springs and famous Shiva temple. Sohna is located in between 28°15' N latitude and 77°40' E longitude at the elevation of 212.14m above msl. Mewat district is located at 28 °12′ N latitude, 77 °3′ E longitude, at the south of Gurugram at an elevation of 199 m above msl. The location is bordered by Rewari district on west and Faridabad & Palwal district on the east.

3.2. Geology:

The Gurugram district is having of almost flat topography, however, in the north-eastern part small isolated hillocks of Precambrian rocks are exposed. Small hill ranges which are part of the Aravali and Mangar Bani ranges exists in the district. The major part of district is underlain by Quaternary alluvium consisting of sand, clay and silt. The alluvial plain is formed by the Sahibi river which is a tributary of River Yamuna. Soils of the Gurgaon district is classified as tropical and brown soils, existing in the north western extreme, northern and north eastern parts of the district and water logged and salt affected soils in the southern parts of the district. The soils are medium textured loamy sand is the average texture in Gurgaon and Sohna blocks.

3.3. Rainfall and Climate:

The area has hot semi-arid type of climate characterising extreme dryness of the air except in the monsoon season. Intense hot summer and cold winters. The total annual rainfall in the region is about 596 mm, of which 75 to 80% is because of the south-west monsoon.

3.4. Seismicity:

The site under consideration exists in the district of Gurugram and Mewat which lies in the Seismic Zone IV (high damage risk zone), as per the current seismic zonation map of India (IS 1893-2016): RA 2021 and have a zone factor of 0.24 for design basis earthquake. The region is surrounded by many in-homogeneities in the form of faults and ridges like Sohna Fault, Moradabad Fault, Delhi-Moradabad Fault, Delhi-Haridwar ridge, junction of Aravalli and Alluvium near Delhi. The Sohna fault line lies between the Delhi ridge and Sohna town and falls between the Arjangarh and

Manesar outcrops. All the developed area in Gurugram comes within 200 km of the fault line. The Sohna fault line is located at the junction between the hard rock terrain of the Aravalli hills and the sandy formation of the Yamuna River and is currently inactive from several years and is capable of a disastrous earthquake.

The project location has been marked in Fig.1 Seismic zone map of India.

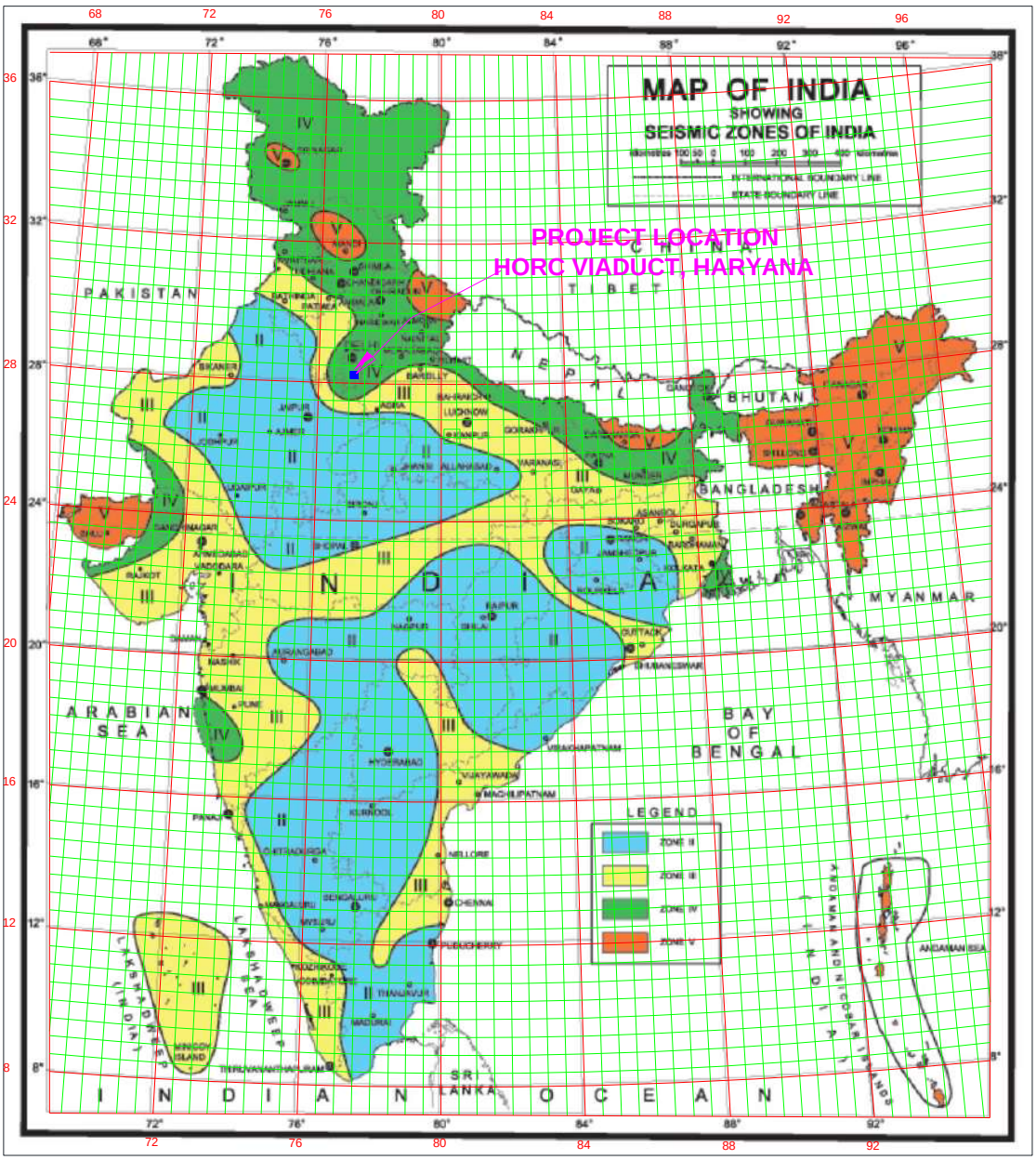


Fig.1: Seismic Zone Map of India

4. FIELD INVESTIGATION:

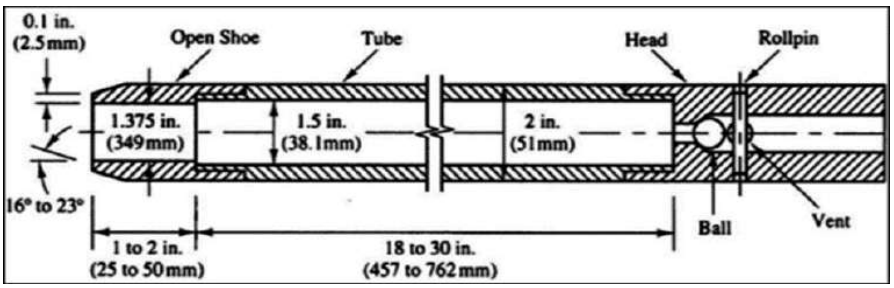
The field investigation work at this site was carried out from Nov 1st; 2023 to Nov 4th; 2023 & Nov 25th; 2023 to Nov 27th; 2023. The following investigation

work was carried out:

4.1. **Sixteen numbers** of boreholes were proposed to be made in this stretch, out of which **two number** of **borehole** (marked as P134A & P146A) of diameter 150 mm in soil and 75 mm in rock were made for conducting Standard Penetration Test and collection of disturbed, undisturbed soil and rock core samples. The borehole was progressed using hydraulic rig and power winch machine under **rotary** and **percussion** methods of drilling. Casing was used to keep the borehole stable and Bentonite was also used as drilling mud to help prevent wall collapse of boreholes at deeper depth. The records of achieved depth of bore holes have been given in Para No. 6, the details of drilled bores along with depth of casing used have been reported in Appendix B. Locations of boreholes have been reported in "TEST LOCATION PLAN" in Appendix A.

4.2. **Standard Penetration Tests** were conducted at 1.00 to 2.00 metre interval upto the depth of 12.00 meter and 3.00 metre interval, beyond 12.00 metre depth, as per the procedure in IS: 2131-1981-(RA: 2021) in all the bore holes. The **standard SPT sampler** (without liner and with no space for liner) and **auto-trip hammer** of standard weight of 63.50 kg have been used to perform the test.

For conducting the test, the bottom of the borehole was properly cleaned, and split spoon sampler was properly seated in position in the borehole. The split spoon sampler resting on the bottom of borehole was allowed to sink under its own weight; then the sampler was allowed to penetrate 15 cm with the blows of the hammer 63.50 kg weight falling free through 75cm, thereafter the split spoon sampler was further driven by another 15 cm. For the 3rd and final drive, the sampler was further allowed to penetrate 15 cm. The number of blows required to get each 15 cm of penetration, was recorded. The first 15 cm of drive is seating drive.



Structure of SPT Sampler

The total blows of penetration for the second and third 15 cm of penetration is

termed the penetration resistance N. The N' values are indicative of the compactness/ relative density of cohesion less soils and consistency of cohesive soils.

In case the blows count of SPT in soil (including the number of blows of seating) exceeds 100, the corresponding penetration was recorded and this particular test at that depth stopped. If the total penetration is more than the seating penetration of 15 cm, then breakup of blow counts for 15 cm seating penetration and for remaining portion of penetration is also given.

SPT 'N' values are correlated with non-cohesive stratum as per BS: 5930 (1999) – for sandy strata and with consistency of cohesive stratum.

Correlation For Clay/Plastic Silt		**Correlation For Sand/Non-Plastic Silt**	
Consistency of clays	**Penetration Value**	**Relative Density of sand**	**Penetration Value**
Very Soft	0 to 2 Blows	Very loose	0 to 4 Blows
Soft	3 to 4 Blows	Loose	5 to 10 Blows
Medium Stiff	5 to 8 Blows	Medium	11 to 30 Blows
Stiff	9 to 16 Blows	Dense	31 to 50 Blows
Very Stiff	17 to 32 Blows	Very Dense	Above 50
Hard	Above 32		

In this method, the sampler acts as a probe and the driving energy is supplied by the fall of the drop weight. The values of 'N' depend on the compactness or relative density of the material. In hard formations, the testing is discontinued if 'N' value is found to be more than 100. It is termed as 'Refusal'. Refusal is also recorded when SPT blow count records 50 or more for any of the single drive of 15 cm.

'N' value depends upon degree of saturation and over burden pressure of the formation. Silty fine sand and fine sand below the water table develop pore water pressure depending on the in-situ void ratio which in turn affects the effective stress. This change in effective stress influences the 'N' value considerably.

Depth of overburden affects the SPT values in none to low cohesive soils and hence need correction. The SPT value after the overburden correction, N' is as follows:

$$N' = 0.77x \log (2000/q) \times N$$

Where, q= Overburden Pressure (kN/m^2) and N = observed SPT value

N' is corrected further for dilatancy in case of saturated fine sands and silts for the values of N' greater than 15.

Modified value after dilatancy correction N" = 15+ (N'-15)/2

Soil samples obtained from split spoon sampler were collected in the polythene bags of suitable size. These samples were property sealed, labelled, and carefully transported to the laboratory for testing. The results have been reported in Table 1 to 2 of Appendix B under the title "SUMMARY OF TEST RESULTS".

4.3. **Disturbed soil samples** were collected at 0.50 metre, then at 1.00 to 2.00 metre interval upto the depth of 12.00 meter and 3.00 metre interval, beyond 12.00 metre depth and at significant change of stratum. Soil from cutting edge of SPT samplers and retained in split spoon, used for Standard Penetration Tests was taken as disturbed samples. These samples were placed without delay in adequately sealed polythene bags. Where the collection of disturbed soil samples could not be collected from SPT samples, Shelby tubes were driven and retained soil samples were obtained. The laboratory tests were conducted on the collected soil samples and reported in Table 1 to 2 of Appendix-B under the title "SUMMARY OF TEST RESULTS".

4.4. **Undisturbed soil samples** were collected in accordance with IS: 2132-1986-(RA: 2021) at an interval of 3.00 metre or at change of stratum, starting from the depth of 1.00 or 2.00 m, by using 100 mm dia. and 450 mm long MS tubes provided with sampler head with ball check arrangement. However, the some of the samples could not be extracted due to the partial penetration or slippage during the evacuation.

Moreover, collection of Undisturbed samples in very hard cohesive soils/ dense granular soils/gravels/ cobbles/ pebbles/ boulders, refusal strata is practically not possible and such collected samples will not truly represent the undisturbed conditions.

Immediately after taking undisturbed sample in the tube, the adopter head was removed along with the disturbed material. The visible ends of the samples shall then be trimmed off any wet disturbed soil. The ends will then be coated alternately with four layers of molten wax. More molten wax will then be added to give a total thickness

of not less than 25 mm. The laboratory test results have been reported in Table 1 to 2 of Appendix-B.

4.5. **Rock Core samples** recovered during the NX size drilling have been measured, numbered, and packed in core boxes. The Core Recovery (CR) and RQD information have been reported in Field bore log charts and Core Measurement Sheet and results have been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix B**.**

4.6. The **ground water table** in the borehole was allowed to stabilize and measured after 8, 16, 24 and 48 hours after completion of the bore hole. It was ensured that last two reading were identical. The records of ground water table have been given in Para No.6.

4.7. **Ground water samples** were collected from borehole as per IS: 6935-1973-(RA:2019) for chemical analysis to determine aggressiveness in relation to attack on concrete / reinforcement including determination of pH value.

5. LABORATORY TESTS:

The following laboratory tests were conducted to determine the engineering characteristics of sub-soils:

5.1. **Field moisture contents** were determined by oven drying method as per IS: 2720 (part II)-1973-(RA: 2020). The results have been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.2. **Bulk density** of soil strata was obtained using Shelby tubes in accordance with IS 2720 (part XXIX)-1975-(RA: 2020). The results have been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.3. **Mechanical sieve analysis** test was performed in accordance with IS: 2720 (Part IV) – 1985-(RA: 2020), for the purpose of identification by grain size analysis, on coarse part of the soil samples and the results have been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.4. **Particle size analysis** test by **Hydrometer method** were performed in accordance with IS: 2720 (Part IV) -1985-(RA: 2020) on the part of soil samples obtained after the sieve analysis. The results have been reported in Table 1 to 2: "SUMMARY OF TEST

RESULTS" of Appendix B.

5.5. **Atterbergs' limits tests** were performed in accordance with IS: 2720 (part V)-1985-(RA: 2020) and results have been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.6. **Specific gravity tests** were performed in accordance with IS 2720 (part III-sec. 1) -1980-(RA: 2021) and the results have been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.7. **Consolidation tests** were performed on cohesive soil samples in accordance with IS: 2720 (part XV)-1965-(RA: 2021). The results have been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.8. **Direct shear tests** were performed as per IS: 2720 (part XIII)-1986-(RA: 2021), on the undisturbed soil samples obtained during the field investigation. The results and the density of samples have been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.9. **Tri-axial Compression Test** under Unconsolidated Un-drained (UU) condition as per IS: 2720 (Part-XI)-1993-(RA: 2021) were performed on the selected undisturbed soil samples, obtained during the field investigation. The results have been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.10. **Unconfined Compressive strength tests** were performed in accordance with IS 2720 (Part-X) -1991-(RA:2020) on selected undisturbed soil samples and the results have been reported in Table 3 of Appendix B.

5.11. **Shrinkage Limit tests** were performed in accordance with IS 2720 (part-VI) -1972-(RA: 2021) and the results have been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.12. **Free Swell Index** were performed in accordance with IS 2720 (part-XL) -1977-(RA: 2021) and the results have been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.13. **Density test** on rock sample were performed in accordance with IS 13030-1991-(RA: 2021) and results have been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.14. **Water absorption and Porosity test on rock** samples were performed in accordance with IS: 1124-1974-(RA:2017) and results have been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.15. **Hardness test** on rock samples were performed in accordance with IS: 13630 (part-XIII) -2019 and results have been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.16. **Unconfined Compressive Strength** tests on rock samples were performed in accordance with IS 9143-1979-(RA:2021) and results have been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.17. **Point load index tests** on rock samples were performed in accordance with IS: 8764-1998-(RA:2019) and results have been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.18. **Cerchar Abrasive Index** test on rock samples were performed in accordance with ASTM-D7625 and results have been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix B.

6. GROUND WATER TABLE:

The water table at this site was encountered during the drilling operation up to the depth of investigation.

Borehole No.	Chainage	Global Co-ordinates (UTM format)		Reduced level (m)	Depth of Borehole (m)	Water table (m)
		Easting	Northing			
P134A	24433.047	700904.347	3121360.768	200.107	40.00	9.20
P146A	24747.447	700789.522	3121563.095	207.274	12.50	9.10

7. DESCRIPTION OF STRATA:

The classification of soil stratum has been done with the help of soil characteristics obtained in laboratory tests as per IS 1498-1970-(RA:2021). The classification of rock masses has been done based on RMR as per IS: 4464-1985, IS: 13365-1. The detailed nature of the strata has been reported in Table 1 to 2: "SUMMARY

OF TEST RESULTS" of Appendix-B and represented through Lithological plots in Appendix-C.

The strata exhibited in the bore hole P134A is predominantly consisting of silty sands, with inorganic silty clays of low plastic category and inorganic silts of non to low plastic category. Borehole P146A is consists of slightly to highly weathered fine grained quartzite rock mass which the top covered with a small thickness of 0.50 m with silty sands, till the depth of investigation.

8. CLASSIFICATION CRITERIA OF ROCK MASSES:

Rock classification in terms of weathering, state of fractures and strength is carried out in the following manner based on IS: 4464-1985, IS: 13365-1. Tabulations given in below explain it briefly.

TERMS	DESCRIPTION	GRADE	GEOLOGIST INTERPRETATION
Fresh	No visible sign of rock material weathering; perhaps slight coloration on major discontinuity surfaces	I	CR > 90 %
Slightly Weathered	Discoloration indicates weathering of rock material and discontinuity surfaces. All the rock material may be discoloured by weathering.	II	CR between 70 % to 90 %
Moderately Weathered	Less than half of the rock material is decomposed or disintegrated to a soil. Fresh or discoloured rock is present either as a continuous framework or as core-stones.	III	CR between 51 % to 70 %
Highly Weathered	More than half of the rock material is decomposed or disintegrated to a soil. Fresh or discoloured rock is present either as a discontinuous framework or as core-stones.	IV	CR between 11 % to 50 %
Completely weathered	All rock material is decomposed and / or disintegrated to soil. The original mass structure is still largely intact.	V	CR between zero to 10 %
Residual Soil	All rock material is converted to soil. The mass structure and material fabric are destroyed. There is a large change in volume, but the soil has not been significantly transported.	VI	CR = Zero % But N > 50

CR indicate Core Recovery

It should be understood that all grades of weathering may not be seen in a given rock mass and that in some cases a particular grade may be present to a very small extent. Distribution of the various weathering grades of rock material in the rock mass may be related

to the porosity of the rock material and the presence of open discontinuities of all types in the rock mass.

8.1 Relation between RQD and In-situ Rock quality:

Relation between RQD and In-situ Rock quality is further measured by frequency of natural joints in rock mass. Rock Quality Designation (RQD) is used to define state of fractures or massiveness of rock. Following table defines the quality of rock mass.

RQD classification	RQD (%)
Excellent	91 to 100
Good	76 to 90
Fair	51-75
Poor	25-50
Very Poor	0-25

8.2 Classification of Rock by Compressive Strength:

Rock type	Unconfined compressive strength (MPa)
Extremely strong	>200
Very Strong	100 to 200
Strong	50 to 100
Moderately Strong	12.5 to 50
Moderately Weak	5 to 12.5
Weak	1.25 to 5
Very weak	<1.25

9. SAFE BEARING CAPACITY COMPUTATIONS:

For the construction of viaducts, deep foundation proposed to be resting on soil and rock mass **(Bored Cast-In-Situ RCC piles** and **bored cast-in-situ rock socketed RCC piles)** have been considered for computation of load bearing capacity of the underlying strata. The computation of load bearing capacity of bored cast-in-situ RCC piles have been done as per IS 2911 (part-1, section-2)-2010-(RA: 2020), with due consideration of effects of liquefaction and rock

socketed RCC piles as per IRC:78-2014

9.1. Pile Load Capacity in soils:

9.1.1. Design Parameters:

Factor of safety in Compression	=	2.50
Factor of safety in Tension	=	3.00
Depth of critical water table	=	0.00 m
Diameter of pile	=	1.00 & 1.20 m
Cut off length	=	2.50 m
Type of pile head consider	=	Fixed

9.1.2. Computation of friction along pile stem:

$Q_{uf} = \sum K_i . P_{di} . \tan\delta_i . A_{si}$

where,

Q_{uf} = Ultimate shaft friction (kN/m^2)

K_i = Coefficient of earth pressure at mid-depth of ith layer

P_{di} = Effective overburden pressure at mid-depth of ith layer (kN/m^2)

A_{si} = Surface area of pile stem in i^{th} layer (m^2)

δ_i = Angle of wall friction between pile and soil of ith layer (= ϕ) (degree)

ϕ_i = Angle of internal friction of soil in i^{th} layer (degree)

$\sum$ = Sum of all layers up to i^{th} layer

9.1.3. Computation of Cohesion along the stem of pile:

$Q_{uc} = \sum \alpha_i . c_i . A_{si}$

Where,

c_i = Cohesion in i^{th} layer

A_{si} = Surface area of pile stem in i^{th} layer (m^2)

α_i = Adhesion factor for i^{th} layer of soil depending of consistency of soils

$\sum$ = Sum of cohesion of all layers considered

9.1.4. Computation of end bearing resistance:

$Q_{ub} = A_p (c.Nc + q.Nq + 0.5.\ \gamma.B.N\gamma)$

Where,

A_p = Area of the pile toe (m^2)

c = cohesion of soils at pile toe (kN/m^2)

γ = Effective Unit weight of soils at pile toe (kN/m^3)

B = Diameter of pile (m)

q = Effective overburden pressure at pile toe (kN/m^2)

N_c = Bearing Capacity Factor (Recommended equal to 9)

$Nq, N\gamma$ = Bearing Capacity Factor

9.1.5. Lateral load capacity of piles in soils:

$Q_u = 12.E.I.\delta/(L_1+L_f)^3$

where,

Q_u = Ultimate lateral load capacity of pile (kN)

δ = Permissible deflection (m) = 5 mm

E = Young Modulus of pile material (kN/m^2)

I = Moment of Inertia of the pile cross section (m^4)

L_1 = Cantilever Length of pile (m)

L_f = Length of fixity (m)

Detailed calculations of pile load carrying capacity in compression & uplift in soil have been reported in **Table-4 to 5** of **Appendix-I.**

Pile lateral Load capacity has been given in **Table-6 to 7** of **Appendix-I**.

9.2. Pile Load Capacity in rock:

Computations of the vertical load capacity of the piles in rock has been work out as per the method given in IRC:78-2014.

9.2.1. As per IRC:78-2014 (Method-1):

If the rock mass encountered at this site exhibits (CR+RQD)/2 > **30%**, Method 1 of IRC: 78-2014 shall be been used for

computing the axial pile load capacity in rock formations.

$$Q_a = R_e/3 + R_{af}/6$$

where,

R_e = K_{sp} x D_f x q_c x A_b

R_{af} = C_{us} x A_s

D = Diameter of the pile (m)

Q_a = Allowable load capacity of pile socketed into rock (kN/m^2)

R_e = Ultimate end bearing capacity (kN/m^2)

R_{af} = Ultimate side socket shear capacity (kN/m^2)

K_{sp} = empirical value ranging from 0.3 to 1.2

L_s = Socket length of pile (m)

D_f = Depth factor =1 + 0.4 L_s/D (≤ 1.2)

q_c = average unconfined compressive strength below base of pile (up to 2D)

A_b = Area of pile base (mm^2)

A_s = Area of socket (mm^2)

C_{us} = Estimated average shear strength of rock along socket length (≤ 3.0 for M35 Concrete).

9.2.2. As per IRC:78-2014 (Method-2):

If the rock mass encountered at the site exhibits (CR+RQD)/2< **30%**, Method 2 of IRC: 78-2014 shall be been used for computing the axial pile load capacity in rock formations.

$$Q_a = R_e/3 + R_{af}/6$$

$$Q_t = R_{af}/6 + \text{Self weight of pile}$$

where,

R_e = C_{ub} x N_c x A_b

R_{af} = C_{us} x A_s

D = Diameter of the pile (m)

Q_a = Allowable load capacity of pile socketed into rock (kN)

Q_t = Allowable load capacity of pile in uplift (kN)

R_e = Ultimate end bearing capacity (kN/m^2)

R_{af} = Ultimate side socket shear capacity (kN/m^2)

C_{ub} = Average shear strength below base of pile tip for depth upto 2D

L_s = Socket length of pile (m)

N_c = Bearing Capacity factor = 9 (as per code)

A_b = Area of pile base (m^2)

A_s = Area of socket (m^2)

C_{us} = Shear strength along socket length (≤ 3.0 for M35 Concrete).

The detailed calculations of pile load carrying capacity in compression and uplift on rock based on method-1 of IRC:78-2014 have been reported in **Table-2 & 3** of **Appendix-I.**

9.3. Computation of RMR values:

A gross estimate of bearing capacity of completely or partially weathered rock masses have been done based on Rock Mass Rating (RMR). The estimation of RMR value of jointed rock masses have been worked out based on IS 13365 (part I). Rock Mass Rating parameters are reproduced from Annexure B of IS 13365 (part I) below for ready reference. The final RMR value of rock is referred from the Table 3 of IS code 12070.

9.3.1. Rating as per UCS

Description	Compressive Strength (MPa)	Rating	Basis
Exceptionally Strong	>250	15	UCS value data of specific borehole from laboratory test is used in RMR
Very Strong	100 to 250	12	
Strong	50 to 100	7	
Average	25 to 50	4	
Weak	10 to 25	2	
Very Weak	2 to 10	1	
Extremely Weak	<2	0	

9.3.2. Rating as per RQD

Description	RQD (%)	Rating	Basis
Excellent	91 to 100	20	RQD values of specific boreholes below given depth from relevant borehole are used in RMR.
Good	76 to 90	17	
Fair	51 to 75	13	
Poor	26 to 50	8	
Very Poor	0 to 25	3	

9.3.3. Rating as per Spacing of discontinuities

Description	Spacing (m)	Rating	Basis
Vey wide	>2	20	Spacing of discontinuities of specific borehole from field observations is used in RMR
Wide	0.6 to 2	15	
Moderate	0.2 to 0.6	10	
Close	0.06 to 0.2	8	
Very close	<0.06	5	

9.3.4. Rating as per Condition of discontinuities

Condition	Rating
Very rough and un-weathered rock wall rock, tight and discontinuous, no separation	30
rough and slightly weathered wall rock surface, separation < 1mm	25
slightly rough and moderately to highly weathered wall rock surface, separation< 1mm	20
Slickensides wall rock surface or 1-5mm thick gauge or1-5 mm wide opening, continuous discontinuity	10
Soft gauge> 5 mm thick or Separation > 5 mm	0

9.3.5. Rating as per Ground Water Conditions

General Description	Rating
Completely dry	15
Damp	10
Wet	7
Dripping	4
Flowing	0

9.3.6. Rating as per adjustment for discontinuity orientations

Strike and dip orientations of discontinuities	Very favourable	Favourable	Fair	Un-favourable	Very Un-favourable
Foundation	0	-2	-7	-15	-35

9.3.7. Net safe bearing pressures based on RMR as per Table 3 of IS:12070-1987-(RA: 2020)

Classification No.	I	II	III	IV	V
Rock Description	Very Good	Good	Fair	Poor	Very Poor
RMR	100-81	80-61	60-41	40-21	20-0
Q_{net} (t/m^2)	600-448	440-288	280-141	135-48	45-30

The results of Rock Mass Rating have been reported in **Table-1** of **Appendix-I.**

10. LIQUEFACTION ANALYSIS:

Liquefaction is the sudden loss of shear strength of the loose fine sands due to earthquake-induced vibration under saturated conditions. Liquefaction generally takes place in loose fine sands (fines < 10 %, D_{60}= 0.20 mm to 1.0 mm and C_u between 2 to 5) with N value less than 15. In case of soil strata having N>15, liquefaction of soil will not take place normally.

The present site falls in **seismic zone – IV.** Considering the history of past earthquakes and available seismic data, an earthquake of **magnitude 7.0** having peak ground acceleration **a_{max}= 0.24 g** is considered in the present analysis.

Preliminary assessment of liquefaction potential of foundation strata is made by simplified approach proposed by IS: 1893 (part-1)-2016-(RA: 2021) from the data obtained in Standard Penetration Test.

In this method, cyclic shear stress likely to be induced in the foundation strata by Design Basis Earthquake is first evaluated. Next threshold cyclic shear stress, which is good enough to cause liquefaction, is determined from SPT data and the empirical relations. Finally, comparison of these two stresses is used in the estimation of liquefaction susceptibility of the foundation strata.

Cyclic Stress Ratio (CSR):

The equivalent average of shear stress likely to be induced in the foundation material due to an earthquake is calculated by using the equations

Cyclic Resistance Ratio (CRR):

It expresses capacity of soil to resist liquefaction. CRR is determined using correlation between corrected blow count $(N_1)_{60}$ and CRR for earthquake of magnitude 7.5. $(N_1)_{60}$ is the SPT blow count corrected to an effective overburden pressure of 100 kPa and to hammer energy efficiency of 60 %.

Following variable have been adopted in calculation of N_{60} (SPT value for 60% efficiency)

Energy correction to SPT values:

C_{60} = 1.00 (energy efficiency factor)

Design Earthquake Base:

Earthquake zone	= IV
Magnitude of earthquake	= 7
Seismic Zone factor	= 0.24

Status of Liquefaction:

The value of CSR and CRR are computed at different depth and then the ratio of CRR to CSR to get the factor of safety towards the susceptibility of the stratum towards liquefaction potential.

If factor of safety:

< 1.00 : Stratum is to be considered as liquefiable

> 1.20 : Non-Liquefiable

The detailed calculations of liquefaction, have been reported in **Table-8** of **Appendix-I.**

11. RECOMMENDATIONS:

Keeping in mind, the field test results, laboratory test results and IS codes of practice the following recommendations are hereby made:

11.1. Bored Cast-In-Situ RCC Piles of diameter 1000 and 1200 mm have been adopted for

SBC computations of foundation for Viaduct.

11.2. **Cut off length** of piles have been considered as 2.50 m for piles in soil and 2.00 m for pile in rock from the existing ground level for the purpose of computation of SBC.

11.3. **Pile length** recommended in the table below, shall be measured **after the cut-off depth.**

11.4. **Allowable load carrying capacity** of pile corresponding to the length and diameter of pile shall be read from the tables below:

11.4.1. For Pile diameter = 1000 mm

Borehole No.	End bearing Strata type	Pile Length (m)	Rock Socket length (m)	Load carrying Capacity (kN)		
				Compression	Uplift	Lateral Concrete M35*
P134A	Soils	25.00	-	2450	1600	235
		27.50	-	2750	1750	
		30.00	-	2500	1950	
		32.50	-	3500	2150	
		35.00	-	2900	2300	
P146A	Rock	3.50	3.50	7650	3800	-

***** *Indicates Grade of Concrete*

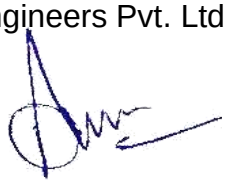
11.4.2. For Pile diameter = 1200 mm

Borehole No.	End bearing Strata type	Pile Length (m)	Rock Socket length (m)	Load carrying Capacity (kN)		
				Compression	Uplift	Lateral Concrete M35*
P134A	Soils	25.00	-	3700	2250	330
		27.50	-	4250	2500	
		30.00	-	3700	2800	
		32.50	-	5400	3100	
		35.00	-	4250	3350	
P146A	Rock	4.20	4.20	11400	5850	-

***** *Indicates Grade of Concrete*

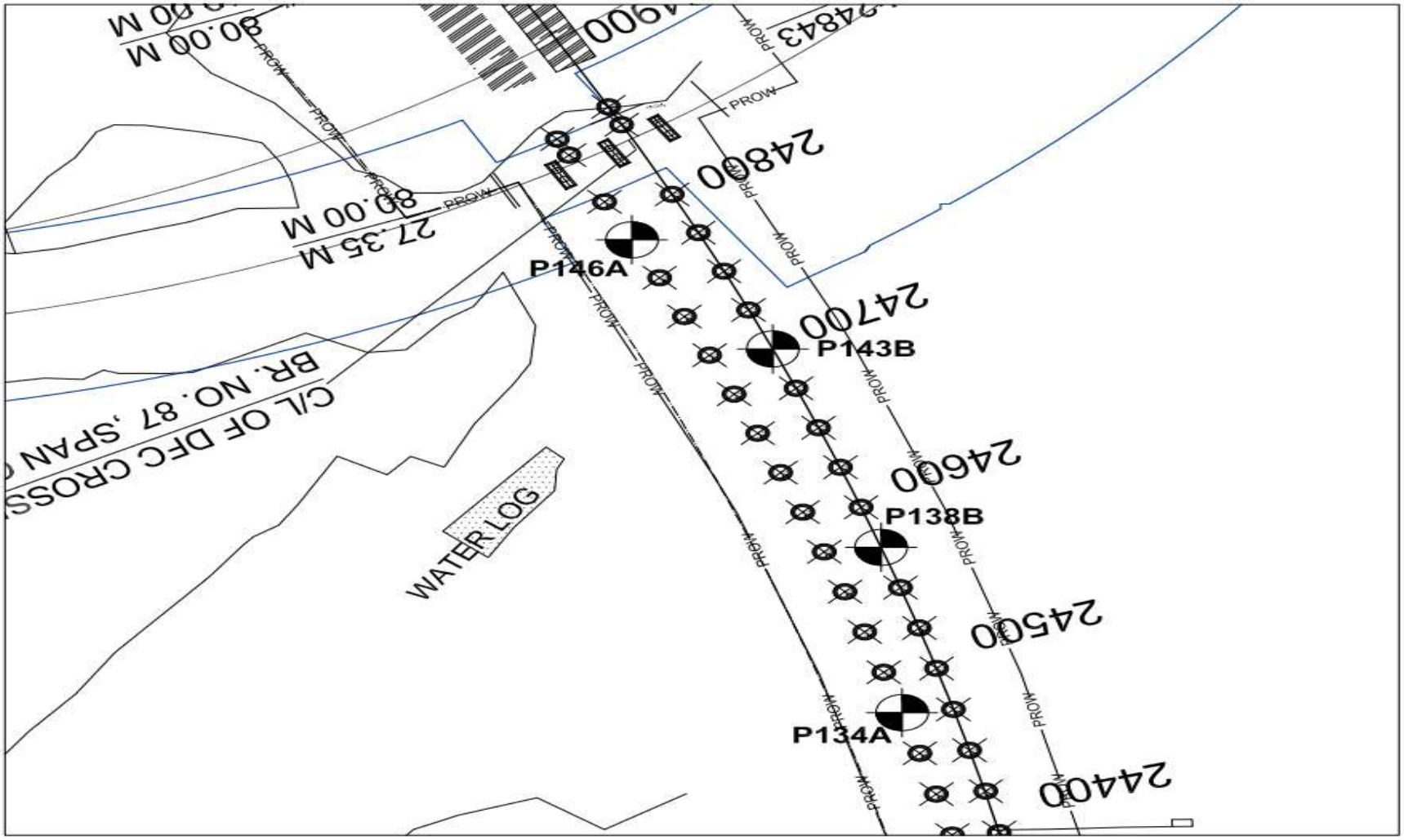
11.5. Liquefaction Potential: Both the bore holes have been analysed for Liquefaction potential as per IS: 1893 (part-1)-2016-(RA: 2021) with Seismic Zone IV, earthquake intensity of 7.0 on Richter scale and critical ground water table at existing ground level. Out of which none of the boreholes show the liquefaction potential.

for Techpro Engineers Pvt. Ltd.



(Arvind K. Garg)
B.Tech.(Civil), M.Tech.
Principal Consultant &
Managing Director

APPENDIX-A
TEST LOCATION PLAN



APPENDIX "B"

TABLE 1: SUMMARY OF TEST RESULTS

Bore No : P134A	Ground Elevation : RL 200.107 m	Method of drilling :Percussion	Depth of Water : 9.20 m
Diameter of Bore Hole : 150 mm	Bore Retained using : Casing	Starting Date : 25/11/2023	SPT Sampler: Standard
Location / Chainage : 24433.047	Casing Lowered : 17.00 m	Ending Date : 27/11/2023	Hammer type: Rope-pulley driven

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Correct N)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	SM	0	0	0	82	18	0	2.26	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-												
	1.00	U	2	-	-	-	-	-	SM	0	0	0	85	15	0	2.97	1.65	1.60	Non Plastic			2.61	DST	0.0	29.9	-	0.631	-	-	-	-												
	2.00	D	3	5	8	10	18	24.71	-	-	-	-	-	-	-	19.64	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	3.00	D	4	4	7	9	16	19.80	SM	0	0	1	72	27	0	13.19	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-												
	4.00	U	5	-	-	-	-	-	-	-	-	-	-	-	-	20.66	1.93	1.60	-	-	-	2.61	DST	2.0	29.1	-	0.631	-	-	-	-	Silty Sands											
	5.00	D	6	8	14	20	34	35.51	SM	0	1	2	71	26	0	13.18	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-												
	6.00	D	7	8	15	20	35	34.23	-	-	-	-	-	-	-	13.49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	7.00	U	8	-	-	-	-	-	SM	0	0	0	72	28	0	18.50	1.82	1.54	Non Plastic			2.63	DST	2.0	30.2	-	0.708	-	-	-	-												
	8.00	D	9	9	16	22	38	33.45	-	-	-	-	-	-	-	21.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	9.00	D	10	8	15	25	40	40.00	CL	4	1	2	12	73	8	19.43	-	-	29.0	20.5	8.5	-	-	-	-	-	-	-	-	-	-												
	10.00	U	11	-	-	-	-	-	CL	3	1	3	14	67	12	20.42	2.01	1.67	31.5	21.5	10.0	2.68	UU	50.0	10.1	0.141	0.605	-	8	19	-												
	11.00	D	12	10	10	17	27	27.00	-	-	-	-	-	-	-	23.40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	12.00	D	13	9	11	18	29	29.00	-	-	-	-	-	-	-	20.67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	13.00	U	15	-	-	-	-	-	CL	8	4	6	11	58	13	18.27	2.05	1.73	29.5	20.0	9.5	2.67	UU	61.0	14.7	-	0.543	-	7	19	-												
	14.50	D	16	7	10	16	26	17.08	ML	0	1	2	24	66	7	22.19	-	-	27.0	22.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	16.00	D	17	-	-	-	-	-	SM	2	1	1	66	30	0	20.02	2.08	1.73	Non Plastic			2.66	RDST	0.0	29.6	-	0.538	-	-	-	-	Silty Sands											
	17.50	D	18	25	30	43	73	32.74	-	-	-	-	-	-	-	20.28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

APPENDIX "B"
TABLE 1: SUMMARY OF TEST RESULTS

Bore No : P134A	**Ground Elevation : RL 200.107 m**	**Method of drilling :Percussion**	**Depth of Water : 9.20 m**
Diameter of Bore Hole : 150 mm	**Bore Retained using : Casing**	**Starting Date : 25/11/2023**	**SPT Sampler: Standard**
Location / Chainage : 24433.047	**Casing Lowered : 17.00 m**	**Ending Date : 27/11/2023**	**Hammer type: Rope-pulley driven**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Correct N)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m²)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm²)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	19.00	D	19	24	28	38	66	29.64	SM	5	2	2	67	24	0	19.41	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	20.50	D	20	13	25	38	63	28.13	-	-	-	-	-	-	-	17.59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	22.00	D	21	16	28	35	63	27.64	-	-	-	-	-	-	-	18.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	23.50	D	22	18	30	40	70	29.35	SM	1	0	1	74	24	0	18.40	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-												
	25.00	D	23	15	25	32	57	24.90	-	-	-	-	-	-	-	16.63	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	26.50	D	24	18	30	39	69	28.08	SM	0	0	1	74	25	0	20.32	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-												
	28.00	D	25	13	28	32	60	25.00	SM	4	1	1	53	41	0	19.21	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-												
	29.50	D	26	14	24	35	59	24.33	SM-SC	5	2	3	41	42	7	19.61	-	-	27.0	21.5	5.5	-	-	-	-	-	-	-	-	-	-	Silty Sands with clay binder											
	31.00	D	27	13	21	41	62	24.81	-	-	-	-	-	-	-	18.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	32.50	D	28	18	40	45	85	85.00	CL	7	1	5	30	48	9	15.95	-	-	29.0	21.5	7.5	2.67	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity											
	34.00	D	29	17	21	41	62	24.09	SM	0	0	0	82	18	0	20.72	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	35.50	D	30	18	25	32	57	22.44	CL-ML	3	1	2	28	60	6	18.88	-	-	26.0	21.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	37.00	D	31	13	21	38	59	22.64	ML	4	1	3	25	61	6	21.13	-	-	27.0	22.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silts of low plasticity											
	38.50	D	32	15	25	38	63	23.34	-	-	-	-	-	-	-	19.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	40.00	D	33	18	23	32	55	21.05	SM	2	1	0	75	22	0	19.33	-	-	Non Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 2: SUMMARY OF TEST RESULTS

Bore No: P146A	Ground Elevation: RL 207.274 m	Method of drilling: Rotary	Depth of Water: 9.10 m
Diameter of Bore Hole: 150 mm	Bore Retained using: Casing	Starting Date: 01/11/2023	
Location / Chainage: 24747.447	Casing Lowered: 3.00	Ending Date: 04/09/2023	

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.00	D	1	-	-	-	-	-	SM	1	1	0	65	33	0	6.45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Silty Sands											
	0.50	C	2	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	Highly weathered and very-poor quality quartzite Rock									35	0	2.59	2.73	0.05	0.59	-	-	0.15	-	-	-
	1.25	C	3	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-										33	0	-	2.53	-	0.94	7.85	-	-	8.00	-	2.70
	2.00	C	4	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-										33	13	-	-	-	-	-	80.25	-	-	-	-
	2.75	C	5	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-										31	13	2.62	-	0.13	-	5.66	-	0.22	-	-	-
	3.50	C	6	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	Moderately weathered and poor quality quartzite Rock									53	45	-	-	-	-	9.69	86.17	-	8.50	-	2.71
	4.25	C	7	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-										56	47	-	2.67	-	0.06	-	-	-	-	-	-
	5.00	C	8	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	Highly weathered and very-poor quality quartzite Rock									48	0	2.64	-	0.02	-	-	-	0.05	-	-	-
	5.75	C	9	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	Slightly weathered and Fair quality quartzite Rock									73	73	-	-	-	-	9.86	115.82	-	-	-	3.30
	6.50	C	10	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	Moderately weathered and very-poor quality quartzite Rock									51	13	-	2.76	-	0.08	-	-	-	8.50	-	-
	7.25	C	11	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-										56	16	2.66	2.65	0.14	0.33	-	-	0.40	-	-	-
	8.00	C	12	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-										53	19	2.56	-	0.14	-	-	74.44	1.53	-	-	3.20
	8.75	C	13	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	Moderately weathered and poor quality quartzite Rock									56	33	-	-	-	-	4.64	46.54	-	8.00	-	-
	9.50	C	14	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	Slightly weathered and poor quality quartzite Rock									73	31	2.45	2.59	0.08	0.11	-	91.28	0.64	-	-	3.70
	10.25	C	15	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	Moderately weathered and very-poor quality quartzite Rock									58	15	2.63	-	0.14	-	-	-	0.12	-	-	-

APPENDIX "B"
TABLE 2: SUMMARY OF TEST RESULTS

Bore No: P146A	**Ground Elevation: RL 207.274 m**	**Method of drilling: Rotary**	**Depth of Water: 9.10 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 01/11/2023**	
Location / Chainage: 24747.447	**Casing Lowered: 3.00**	**Ending Date: 04/09/2023**	

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	11.00	C	16	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	Moderately weathered and very-poor quality quartzite Rock									56	0	-	2.68	-	0.07	-	-	-	-	-	3.60
	12.50	C	17	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	Highly weathered and very- poor quality quartzite Rock									31	0	-	-	-	-	10.56	-	-	8.50	-	-

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX-B
TABLE 3: UCS TEST ON SOIL SAMPLES

BH No.	DEPTH (m)	UCS (kg/cm²)
P134A	10.00	0.54
	13.00	0.76

APPENDIX-C
PLOT 1: LITHOLOGICAL PROFILE-01

PROFILE SHEET IS TO BE AFFIX

APPENDIX-C
PLOT 2: LITHOLOGICAL PLOTS

BH-P134A-24433.047

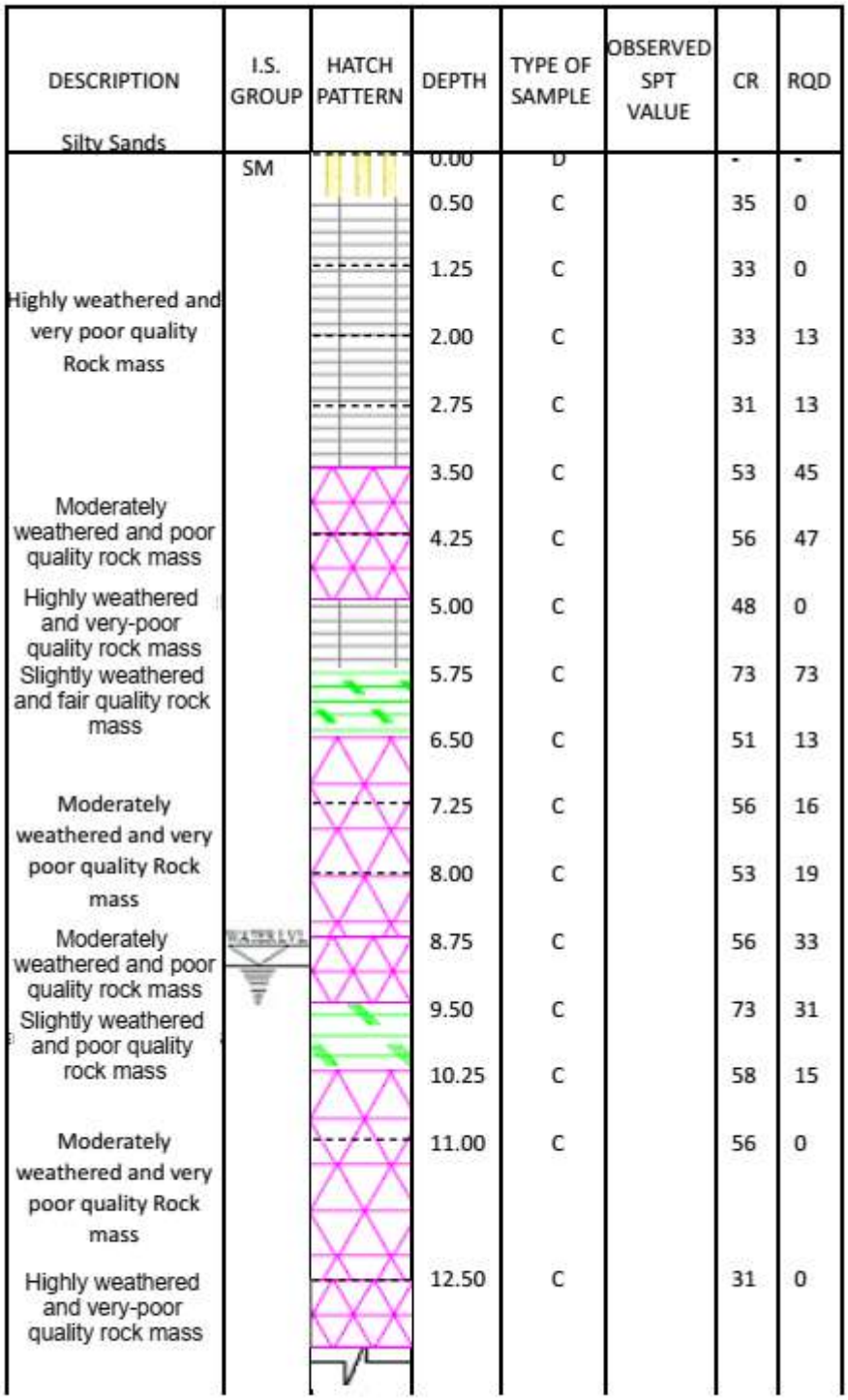
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Silty Sands	SM		0.50	D		-	-
			1.00	U		-	-
			2.00	D	18	-	-
			3.00	D	16	-	-
			4.00	U		-	-
			5.00	D	34	-	-
			6.00	D	35	-	-
			7.00	U		-	-
			8.00	D	38	-	-
			9.00	D	40	-	-
			10.00	U		-	-
Inorganic clays of low plasticity	CL		11.00	D	27	-	-
			12.00	D	29	-	-
			13.00	U		-	-
Inorganic Silts of low plasticity	ML		14.50	D	26	-	-
			16.00	D		-	-
Silty Sands	SM		17.50	D	73	-	-
			19.00	D	66	-	-
			20.00	D	63	-	-

BH-P134A-24433.047

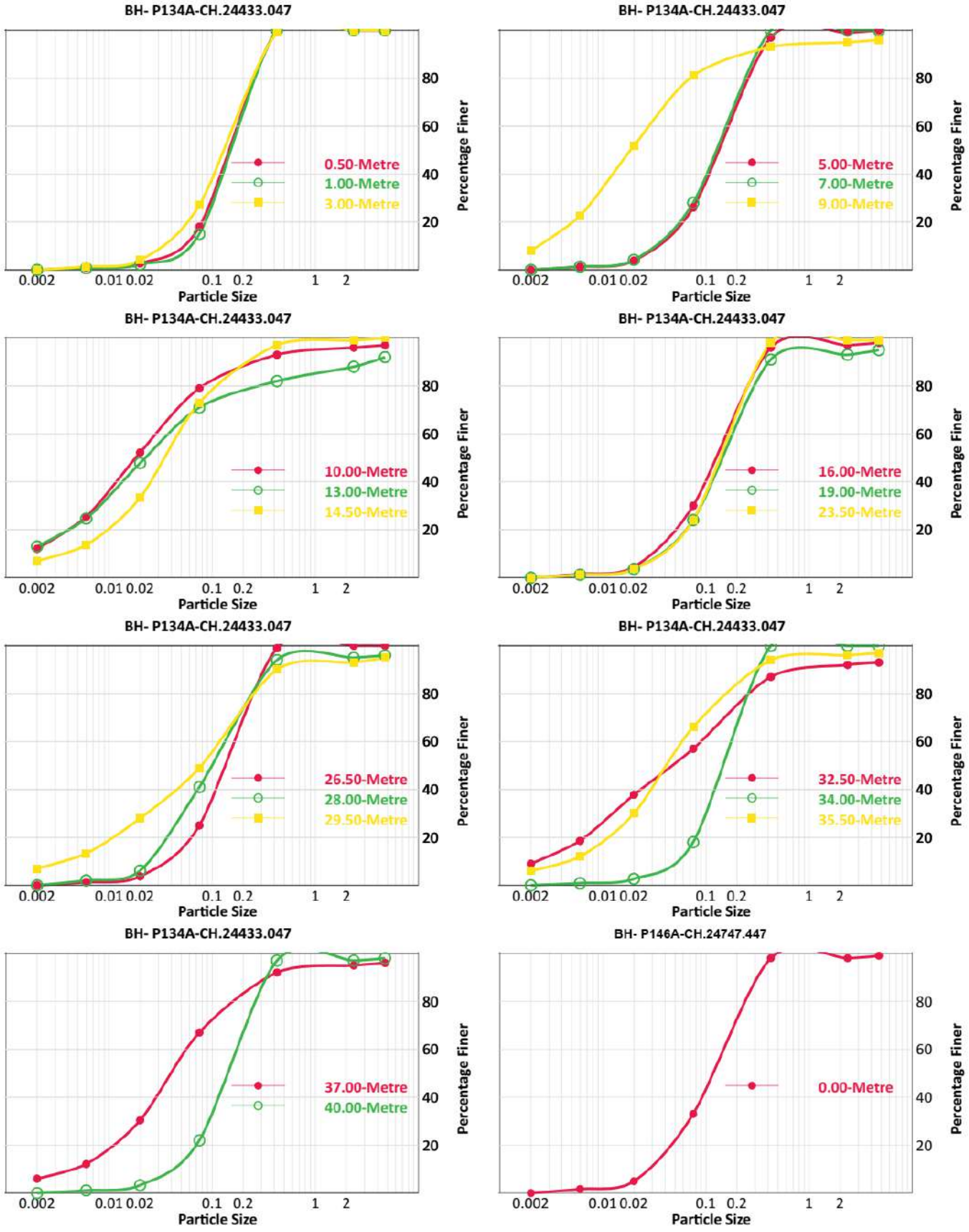
DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			20.50	D	63	-	-
			22.00	D	63	-	-
			23.50	D	70	-	-
Silty Sands	SM		25.00	D	57	-	-
			26.50	D	69	-	-
			28.00	D	60	-	-
			29.50	D	59	-	-
Silty Sands with clay binder	SM-SC		31.00	D	62	-	-
Inorganic clays of low plasticity	CL		32.50	D	85	-	-
Silty Sands	SM		34.00	D	62	-	-
Inorganic Silty Clays of low plasticity	CL-ML		35.50	D	57	-	-
			37.00	D	59	-	-
Inorganic Silts of low plasticity	ML		38.50	D	63	-	-
			40.00	D	55	-	-

APPENDIX-C
PLOT 3: LITHOLOGICAL PLOTS

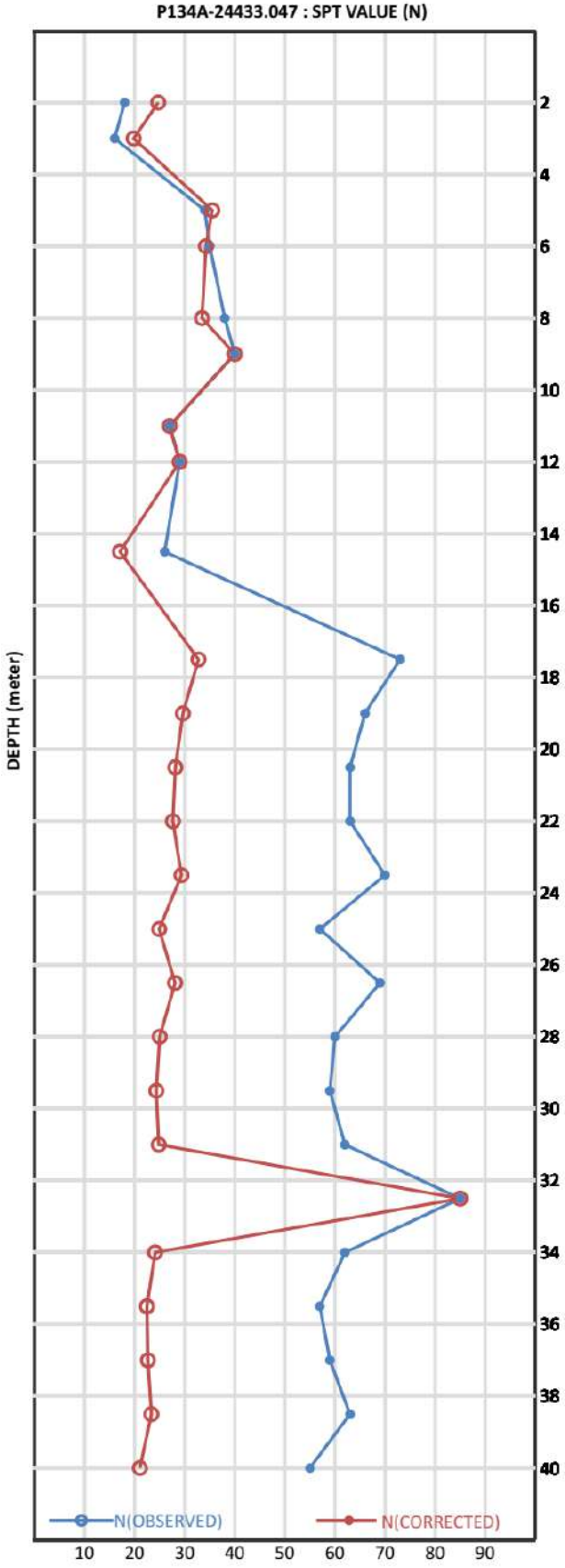
BH-P146A-24747.4470



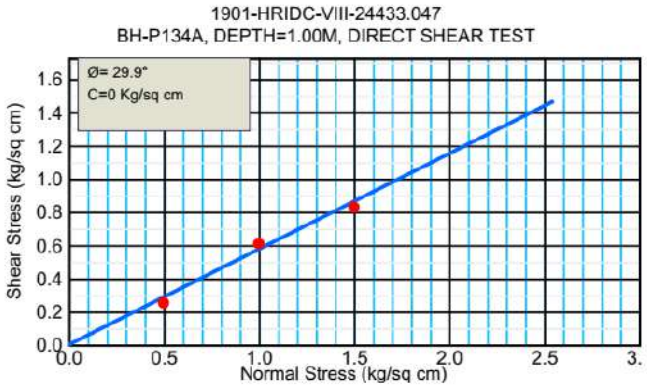
APPENDIX-D
PLOT 1: GRAIN SIZE DISTRIBUTION PLOTS

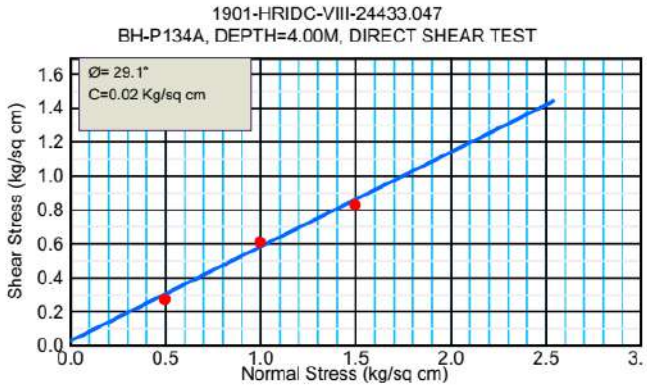


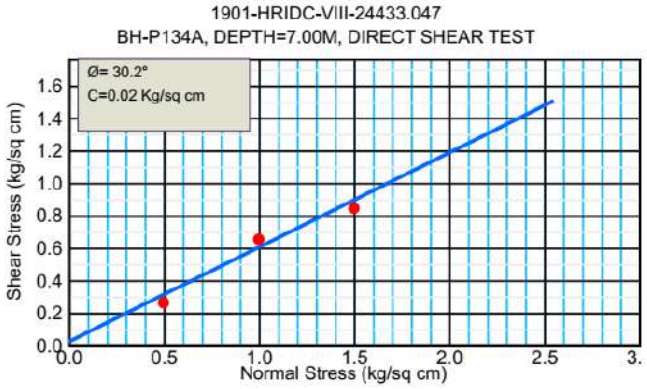
APPENDIX-E
PLOT 1: RECORDED SPT Vs CORRECTED SPT (P134A)

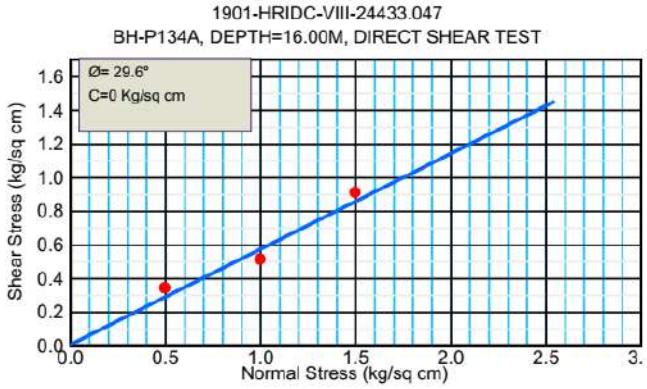


APPENDIX-F
GRAPH 1: DST GRAPH

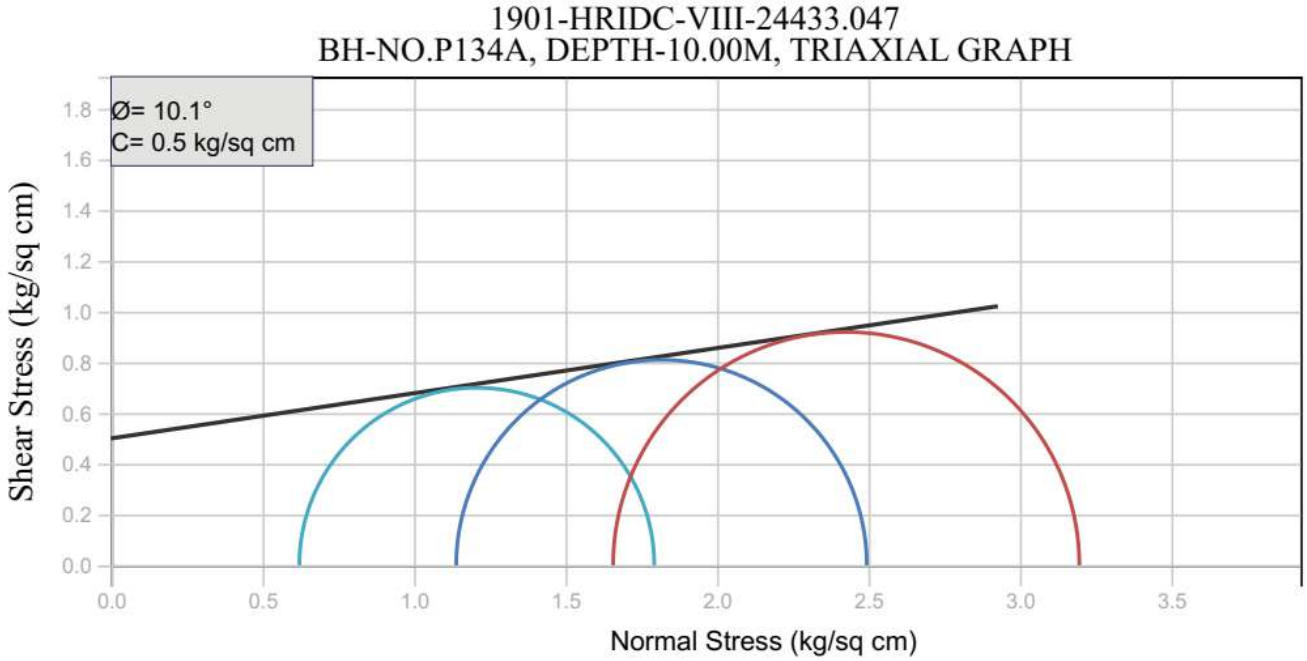


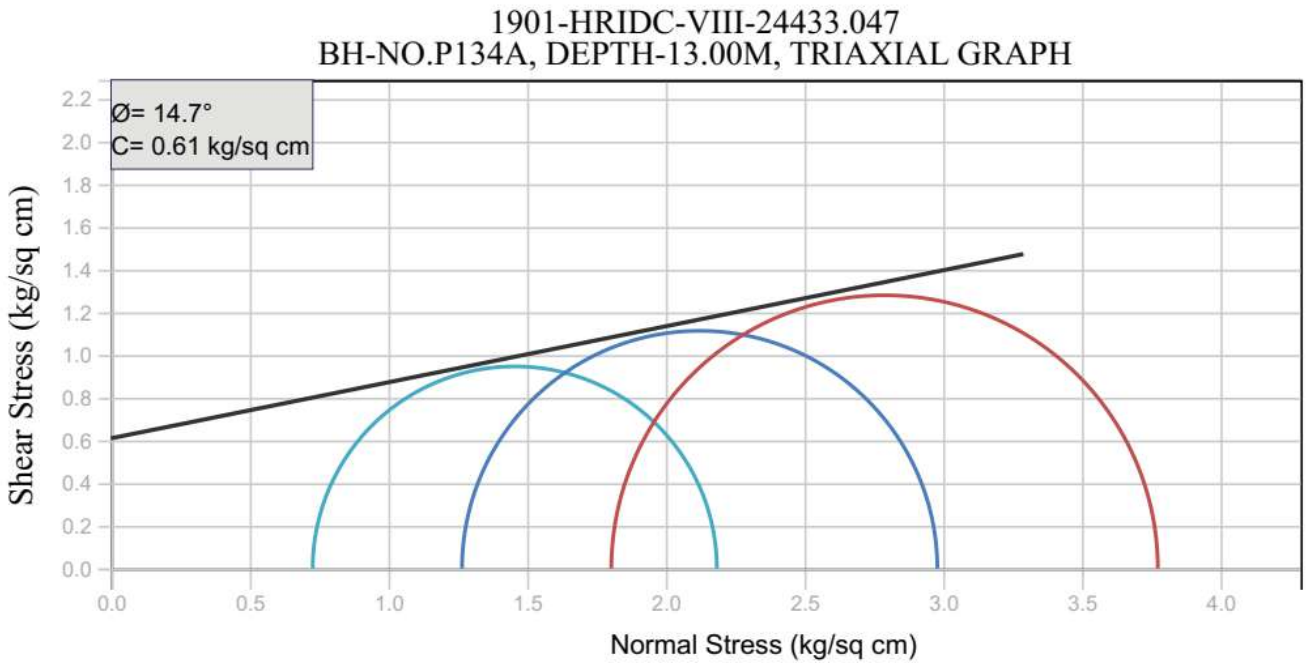




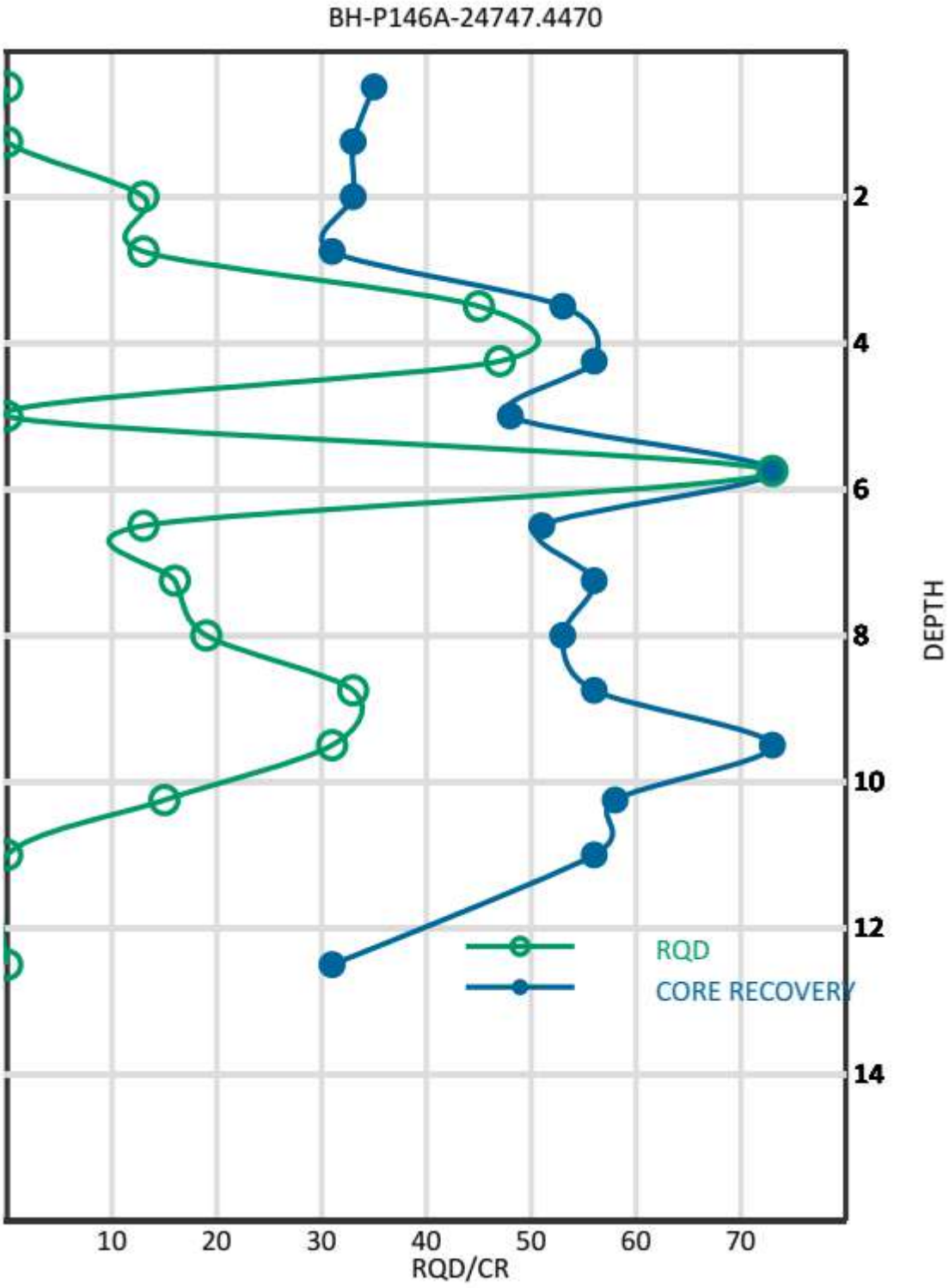


APPENDIX-G
GRAPH 1: UU GRAPH





APPENDIX-H
PLOT 1: CR Vs RQD PLOTS



APPENDIX-I
TABLE 1: RMR COMPUTATIONS

Bore Hole No.	Depth (m)	UCS Rating	RQD Rating	Spacing of Joint Rating	Condition of discontinuity	Ground Water Rating	Strike & Dip Orientation of Joint	RMR Value	Rock Class	Description
BH-P146A	0.50-1.25	7	3	8	20	10	-2	46	III	Fair
BH-P146A	1.25-2.00	7	3	8	20	10	-2	46	III	Fair
BH-P146A	2.00-2.75	7	3	5	20	10	-2	43	III	Fair
BH-P146A	2.75-3.50	7	3	8	20	10	-2	46	III	Fair
BH-P146A	3.50-4.25	7	8	8	20	10	-2	51	III	Fair
BH-P146A	4.25-5.00	7	8	8	20	10	-2	51	III	Fair
BH-P146A	5.00-5.75	7	3	8	20	10	-2	46	III	Fair
BH-P146A	5.75-6.50	12	13	8	20	10	-2	61	II	Good
BH-P146A	6.50-7.25	7	3	8	20	7	-7	38	IV	Poor
BH-P146A	7.25-8.00	7	3	8	20	7	-7	38	IV	Poor
BH-P146A	8.00-8.75	7	3	8	20	0	-7	31	IV	Poor
BH-P146A	8.75-9.50	4	8	8	20	0	-7	33	IV	Poor
BH-P146A	9.50-10.25	7	8	8	20	0	-7	36	IV	Poor
BH-P146A	10.25-11.00	4	3	8	20	0	-7	28	IV	Poor
BH-P146A	11.00-12.50	4	3	8	20	0	-7	28	IV	Poor
BH-P146A	12.50-13.25	4	3	5	20	0	-7	25	IV	Poor

APPENDIX-I

TABLE 2: VERTICAL PILE LOAD CAPACITY IN ROCK (Dia. 1000 mm)

Bore No.	Depth of Overburden Soil (m)	Diameter of pile (mm)	Socket Length Provided (L_s) mm	Design Socket Length (L_s<=6 D) mm	D_f	Overall Length of pile (m)	q_c (Mpa)	K_{sp}	Ab (Area of pile base) (mm^2)	q_{cs} (Mpa)	C_{us} (MPa)	As (Area of socket) (mm^2)	R_e (N)	R_{af} (N)	Allowable Pile end-bearing capacity Q_{ab} (kN)	Allowable Pile shaft friction Q_{af} (kN)	Pile self-weight (kN)	Allowable pile capacity in compression Q_a (kN)	Allowable pile capacity in uplift Q_t (kN)
P146A	0.50	1000	3500	3500	1.2	3.50	110	0.5	785398	83	2.05	10995574	53761626	22539251	17921	3757	69	7684	3825

APPENDIX-I

TABLE 3: VERTICAL PILE LOAD CAPACITY IN ROCK (Dia. 1200 mm)

Bore No.	Depth of Overburden Soil (m)	Diameter of pile (mm)	Socket Length Provided (L_s) mm	Design Socket Length (L_s<=6 D) mm	D_f	Overall Length of pile (m)	q_c (Mpa)	K_{sp}	Ab (Area of pile base) (mm^2)	q_{cs} (Mpa)	C_{us} (MPa)	As (Area of socket) (mm^2)	R_e (N)	R_{af} (N)	Allowable Pile end-bearing capacity Q_{ab} (kN)	Allowable Pile shaft friction Q_{af} (kN)	Pile self-weight (kN)	Allowable pile capacity in compression Q_a (kN)	Allowable pile capacity in uplift Q_t (kN)
P146A	0.50	1200	4200	4200	1.2	4.20	95	0.4	1130973	94	2.18	15833627	46138866	34540360	15380	5757	119	11412	5875

APPENDIX-I

TABLE 4: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
BORE NO: P134A, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	16.48	6.48	17.82	1.57	29.9	29.9	1.0	16.10	16.10	0	1.0	0.0	0.00	3.0	29.1	2	9.31	19.23	20.33	19.4	382.3	398.4	5.9	22.0	**159.34**	**7.33**
3.00	5.00	4.00	2.00	2.50	19.31	9.31	28.75	6.29	29.1	29.1	1.0	100.58	116.69	2	1.0	12.6	12.57	5.0	30.2	2	9.31	22.27	23.43	38.1	765.7	895.0	29.5	158.7	**357.98**	**52.91**
5.00	6.00	5.50	1.00	3.50	19.31	9.31	42.72	3.14	30.2	30.2	1.0	78.92	195.60	2	1.0	6.3	18.86	6.0	30.2	2	8.25	22.27	23.43	47.4	918.8	1133.3	41.3	255.7	**453.31**	**85.24**
6.00	8.00	7.00	2.00	5.50	18.25	8.25	55.62	6.29	30.2	30.2	1.0	205.51	401.12	2	1.0	12.6	31.43	8.0	30.2	2	8.25	22.27	23.43	63.9	1207.5	1640.0	64.8	497.4	**656.02**	**165.79**
8.00	9.00	8.50	1.00	6.50	18.25	8.25	68.00	3.14	30.2	30.2	1.0	125.62	526.73	2	1.0	6.3	37.71	9.0	10.1	50	10.11	2.50	1.25	72.1	500.2	1064.6	76.6	641.1	**425.84**	**213.69**
9.00	11.00	10.00	2.00	8.50	20.11	10.11	82.23	6.29	10.1	10.1	1.0	92.07	618.80	50	1.0	314.3	352.00	11.0	10.1	50	10.11	2.50	1.25	92.3	539.9	1510.7	100.2	1071.0	**604.27**	**356.99**
11.00	12.00	11.50	1.00	9.50	20.11	10.11	97.40	3.14	10.1	10.1	1.0	54.52	673.33	50	1.0	157.1	509.14	12.0	12.3	58	10.46	3.15	1.88	102.5	671.1	1853.5	112.0	1294.4	**741.42**	**431.48**
12.00	14.50	13.25	2.50	12.00	20.46	10.46	115.53	7.86	12.3	12.3	1.0	197.91	871.24	58	1.0	455.7	964.86	14.5	11.5	29	10.46	2.91	1.65	128.6	506.0	2342.1	141.4	1977.5	**936.83**	**659.17**
14.50	16.00	15.25	1.50	13.50	20.46	10.46	115.53	4.71	11.5	11.5	1.0	110.80	982.04	29	1.0	136.7	1101.57	16.0	29.6	0	10.76	20.36	21.48	128.6	2147.9	4231.5	159.1	2242.7	**1692.61**	**747.57**
16.00	17.50	16.75	1.50	15.00	20.76	10.76	115.53	4.71	29.6	29.6	1.0	309.39	1291.43	0	1.0	0.0	1101.57	17.5	30.8	0	10.76	25.29	26.50	128.6	2667.3	5060.3	176.8	2569.8	**2024.14**	**856.59**
17.50	19.00	18.25	1.50	16.50	20.76	10.76	115.53	4.71	30.8	30.8	1.0	337.64	1629.07	0	1.0	0.0	1101.57	19.0	30.1	0	10.76	21.76	22.91	128.6	2295.9	5026.5	194.5	2925.1	**2010.61**	**975.04**
19.00	20.50	19.75	1.50	18.00	20.76	10.76	115.53	4.71	30.1	30.1	1.0	317.28	1946.35	0	1.0	0.0	1101.57	20.5	29.9	0	8.81	21.03	22.17	128.6	2202.1	5250.0	212.1	3260.1	**2100.01**	**1086.69**
20.50	22.00	21.25	1.50	19.50	18.81	8.81	115.53	4.71	29.9	29.9	1.0	313.17	2259.52	0	1.0	0.0	1101.57	22.0	29.8	0	8.99	20.81	21.94	128.6	2180.1	5541.2	229.8	3590.9	**2216.48**	**1196.97**
22.00	23.50	22.75	1.50	21.00	18.99	8.99	115.53	4.71	29.8	29.8	1.0	311.91	2571.43	0	1.0	0.0	1101.57	23.5	30.1	0	8.94	21.76	22.91	128.6	2279.5	5952.5	247.5	3920.5	**2381.00**	**1306.83**
23.50	25.00	24.25	1.50	22.50	18.94	8.94	115.53	4.71	30.1	30.1	1.0	317.28	2888.71	0	1.0	0.0	1101.57	25.0	29.2	0	8.66	19.46	20.56	128.6	2036.0	6026.3	265.2	4255.5	**2410.52**	**1418.49**
25.00	26.50	25.75	1.50	24.00	18.66	8.66	115.53	4.71	29.2	29.2	1.0	304.38	3193.09	0	1.0	0.0	1101.57	26.5	29.9	0	9.25	21.03	22.17	128.6	2205.9	6500.6	282.9	4577.5	**2600.24**	**1525.84**
26.50	27.50	27.00	1.00	25.00	19.25	9.25	115.53	3.14	29.9	29.9	1.0	208.78	3401.87	0	1.0	0.0	1101.57	27.5	27.6	0	9.25	15.85	16.87	128.6	1663.3	6166.8	294.6	4798.1	**2466.71**	**1599.36**

APPENDIX-I

TABLE 4: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
27.50	28.00	27.75	0.50	25.50	19.25	9.25	115.53	1.57	27.6	27.6	1.0	94.91	3496.77	0	1.0	0.0	1101.57	28.0	27.4	0	9.07	15.40	16.41	128.6	1615.0	6213.3	300.5	4898.9	**2485.34**	**1632.96**
28.00	29.50	28.75	1.50	27.00	19.07	9.07	115.53	4.71	27.4	27.4	1.0	282.30	3779.08	0	1.0	0.0	1101.57	29.5	27.4	0	9.14	15.40	16.41	128.6	1615.4	6496.1	318.2	5198.9	**2598.44**	**1732.95**
29.50	30.00	29.75	0.50	27.50	19.14	9.14	115.53	1.57	27.4	27.4	1.0	94.10	3873.18	0	1.0	0.0	1101.57	30.0	28.9	0	9.14	18.78	19.87	128.6	1969.2	6943.9	324.1	5298.9	**2777.56**	**1766.29**
30.00	31.00	30.50	1.00	28.50	19.14	9.14	115.53	3.14	28.9	28.9	1.0	200.43	4073.61	0	1.0	0.0	1101.57	31.0	30.0	0	8.94	21.26	22.40	128.6	2226.8	7402.0	335.9	5511.1	**2960.79**	**1837.02**
31.00	32.50	31.75	1.50	30.00	18.94	8.94	115.53	4.71	30.0	30.0	1.0	314.44	4388.04	0	1.0	0.0	1101.57	32.5	17.3	40	8.55	5.07	3.91	128.6	808.4	6298.1	353.6	5843.2	**2519.22**	**1947.73**
32.50	34.00	33.25	1.50	31.50	18.55	8.55	115.53	4.71	17.3	17.3	1.0	169.63	4557.67	40	1.0	188.6	1290.14	34.0	30.8	0	9.32	25.29	26.50	128.6	2652.4	8500.2	371.3	6219.1	**3400.07**	**2073.02**
34.00	35.00	34.50	1.00	32.50	19.32	9.32	115.53	3.14	30.8	30.8	1.0	225.10	4782.77	0	1.0	0.0	1290.14	35.0	30.8	0	9.32	25.29	26.50	128.6	2652.4	8725.3	383.0	6455.9	**3490.11**	**2151.98**
35.00	35.50	35.25	0.50	33.00	19.32	9.32	115.53	1.57	30.8	30.8	1.0	112.55	4895.32	0	1.0	0.0	1290.14	35.5	17.0	30	9.02	4.92	3.75	128.6	723.0	6908.4	388.9	6574.4	**2763.36**	**2191.46**
35.50	37.00	36.25	1.50	34.50	19.02	9.02	115.53	4.71	17.0	17.0	1.0	166.51	5061.82	30	1.0	141.4	1431.57	37.0	16.5	30	9.38	4.68	3.47	128.6	697.6	7191.0	406.6	6900.0	**2876.40**	**2300.00**
37.00	37.50	37.25	0.50	35.00	19.38	9.38	115.53	1.57	16.5	16.5	1.0	53.77	5115.60	30	1.0	47.1	1478.71	37.5	16.5	30	9.38	4.68	3.47	128.6	697.6	7291.9	412.5	7006.8	**2916.77**	**2335.60**
37.50	38.50	38.00	1.00	36.00	19.38	9.38	115.53	3.14	16.5	16.5	1.0	107.55	5223.15	30	1.0	94.3	1573.00	38.5	14.9	30	9.06	3.91	2.62	128.6	616.7	7412.8	424.3	7220.4	**2965.12**	**2406.81**
38.50	40.00	39.25	1.50	37.50	19.06	9.06	115.53	4.71	14.9	14.9	1.0	144.91	5368.06	30	1.0	141.4	1714.43	40.0	28.5	0	10.49	17.88	18.94	128.6	1884.9	8967.4	442.0	7524.5	**3586.95**	**2508.15**

APPENDIX-I

TABLE 5: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
BORE NO: P134A, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	16.48	6.48	17.82	1.89	29.9	29.9	1.0	19.32	19.32	0	1.0	0.0	0.00	3.0	29.1	2	9.31	19.23	20.33	19.4	571.9	591.2	8.5	27.8	**236.47**	**9.27**
3.00	5.00	4.00	2.00	2.50	19.31	9.31	28.75	7.54	29.1	29.1	1.0	120.70	140.02	2	1.0	15.1	15.09	5.0	30.2	2	9.31	22.27	23.43	38.1	1127.3	1282.4	42.4	197.5	**512.96**	**65.85**
5.00	6.00	5.50	1.00	3.50	19.31	9.31	42.72	3.77	30.2	30.2	1.0	94.70	234.72	2	1.0	7.5	22.63	6.0	30.2	2	8.25	22.27	23.43	47.4	1345.0	1602.3	59.4	316.8	**640.93**	**105.58**
6.00	8.00	7.00	2.00	5.50	18.25	8.25	55.62	7.54	30.2	30.2	1.0	246.62	481.34	2	1.0	15.1	37.71	8.0	30.2	2	8.25	22.27	23.43	63.9	1760.7	2279.7	93.3	612.4	**911.89**	**204.13**
8.00	9.00	8.50	1.00	6.50	18.25	8.25	68.00	3.77	30.2	30.2	1.0	150.74	632.08	2	1.0	7.5	45.26	9.0	10.1	50	10.11	2.50	1.25	72.1	721.7	1399.0	110.3	787.7	**559.60**	**262.55**
9.00	11.00	10.00	2.00	8.50	20.11	10.11	82.23	7.54	10.1	10.1	1.0	110.48	742.56	50	1.0	377.1	422.40	11.0	10.1	50	10.11	2.50	1.25	92.3	778.8	1943.8	144.3	1309.2	**777.52**	**436.41**
11.00	12.00	11.50	1.00	9.50	20.11	10.11	97.40	3.77	10.1	10.1	1.0	65.43	807.99	50	1.0	188.6	610.97	12.0	12.3	58	10.46	3.15	1.88	102.5	968.6	2387.5	161.2	1580.2	**955.01**	**526.73**
12.00	14.50	13.25	2.50	12.00	20.46	10.46	115.53	9.43	12.3	12.3	1.0	237.49	1045.49	58	1.0	546.9	1157.83	14.5	11.5	29	10.46	2.91	1.65	128.6	730.6	2933.9	203.7	2407.0	**1173.55**	**802.32**
14.50	16.00	15.25	1.50	13.50	20.46	10.46	136.45	5.66	11.5	11.5	1.0	157.04	1202.53	29	1.0	164.1	1321.89	16.0	29.6	0	10.76	20.36	21.48	144.3	3480.5	6004.9	229.1	2753.5	**2401.98**	**917.84**
16.00	17.50	16.75	1.50	15.00	20.76	10.76	152.36	5.66	29.6	29.6	1.0	489.64	1692.17	0	1.0	0.0	1321.89	17.5	30.8	0	10.76	25.29	26.50	160.4	4784.0	7798.0	254.6	3268.6	**3119.22**	**1089.54**
17.50	19.00	18.25	1.50	16.50	20.76	10.76	152.36	5.66	30.8	30.8	1.0	534.36	2226.53	0	1.0	0.0	1321.89	19.0	30.1	0	10.76	21.76	22.91	160.4	4117.7	7666.1	280.0	3828.4	**3066.46**	**1276.15**
19.00	20.50	19.75	1.50	18.00	20.76	10.76	152.36	5.66	30.1	30.1	1.0	502.14	2728.67	0	1.0	0.0	1321.89	20.5	29.9	0	8.81	21.03	22.17	160.4	3950.6	8001.2	305.5	4356.0	**3200.48**	**1452.01**
20.50	22.00	21.25	1.50	19.50	18.81	8.81	152.36	5.66	29.9	29.9	1.0	495.63	3224.29	0	1.0	0.0	1321.89	22.0	29.8	0	8.99	20.81	21.94	160.4	3911.1	8457.2	330.9	4877.1	**3382.90**	**1625.71**
22.00	23.50	22.75	1.50	21.00	18.99	8.99	152.36	5.66	29.8	29.8	1.0	493.63	3717.92	0	1.0	0.0	1321.89	23.5	30.1	0	8.94	21.76	22.91	160.4	4089.4	9129.2	356.4	5396.2	**3651.69**	**1798.74**
23.50	25.00	24.25	1.50	22.50	18.94	8.94	152.36	5.66	30.1	30.1	1.0	502.14	4220.06	0	1.0	0.0	1321.89	25.0	29.2	0	8.66	19.46	20.56	160.4	3652.8	9194.7	381.9	5923.8	**3677.89**	**1974.60**
25.00	26.50	25.75	1.50	24.00	18.66	8.66	152.36	5.66	29.2	29.2	1.0	481.71	4701.77	0	1.0	0.0	1321.89	26.5	29.9	0	9.25	21.03	22.17	160.4	3957.3	9980.9	407.3	6431.0	**3992.37**	**2143.66**
26.50	27.50	27.00	1.00	25.00	19.25	9.25	152.36	3.77	29.9	29.9	1.0	330.42	5032.19	0	1.0	0.0	1321.89	27.5	27.6	0	9.25	15.85	16.87	160.4	2983.8	9337.9	424.3	6778.4	**3735.17**	**2259.45**

APPENDIX-I

TABLE 5: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
27.50	28.00	27.75	0.50	25.50	19.25	9.25	152.36	1.89	27.6	27.6	1.0	150.20	5182.39	0	1.0	0.0	1321.89	28.0	27.4	0	9.07	15.40	16.41	160.4	2897.2	9401.5	432.8	6937.0	**3760.59**	**2312.35**
28.00	29.50	28.75	1.50	27.00	19.07	9.07	152.36	5.66	27.4	27.4	1.0	446.78	5629.17	0	1.0	0.0	1321.89	29.5	27.4	0	9.14	15.40	16.41	160.4	2898.0	9849.0	458.2	7409.3	**3939.61**	**2469.76**
29.50	30.00	29.75	0.50	27.50	19.14	9.14	152.36	1.89	27.4	27.4	1.0	148.93	5778.09	0	1.0	0.0	1321.89	30.0	28.9	0	9.14	18.78	19.87	160.4	3532.6	10632.5	466.7	7566.7	**4253.01**	**2522.23**
30.00	31.00	30.50	1.00	28.50	19.14	9.14	152.36	3.77	28.9	28.9	1.0	317.20	6095.30	0	1.0	0.0	1321.89	31.0	30.0	0	8.94	21.26	22.40	160.4	3994.9	11412.1	483.7	7900.9	**4564.82**	**2633.62**
31.00	32.50	31.75	1.50	30.00	18.94	8.94	152.36	5.66	30.0	30.0	1.0	497.63	6592.93	0	1.0	0.0	1321.89	32.5	17.3	40	8.55	5.07	3.91	160.4	1350.6	9265.4	509.1	8424.0	**3706.16**	**2807.99**
32.50	34.00	33.25	1.50	31.50	18.55	8.55	152.36	5.66	17.3	17.3	1.0	268.46	6861.39	40	1.0	226.3	1548.17	34.0	30.8	0	9.32	25.29	26.50	160.4	4758.1	13167.6	534.6	8944.2	**5267.06**	**2981.39**
34.00	35.00	34.50	1.00	32.50	19.32	9.32	152.36	3.77	30.8	30.8	1.0	356.24	7217.63	0	1.0	0.0	1548.17	35.0	30.8	0	9.32	25.29	26.50	160.4	4758.1	13523.9	551.6	9317.4	**5409.56**	**3105.79**
35.00	35.50	35.25	0.50	33.00	19.32	9.32	152.36	1.89	30.8	30.8	1.0	178.12	7395.75	0	1.0	0.0	1548.17	35.5	17.0	30	9.02	4.92	3.75	160.4	1222.2	10166.1	560.1	9504.0	**4066.45**	**3167.99**
35.50	37.00	36.25	1.50	34.50	19.02	9.02	152.36	5.66	17.0	17.0	1.0	263.52	7659.27	30	1.0	169.7	1717.89	37.0	16.5	30	9.38	4.68	3.47	160.4	1176.7	10553.9	585.5	9962.7	**4221.55**	**3320.89**
37.00	37.50	37.25	0.50	35.00	19.38	9.38	152.36	1.89	16.5	16.5	1.0	85.10	7744.37	30	1.0	56.6	1774.46	37.5	16.5	30	9.38	4.68	3.47	160.4	1176.7	10695.5	594.0	10112.8	**4278.22**	**3370.94**
37.50	38.50	38.00	1.00	36.00	19.38	9.38	152.36	3.77	16.5	16.5	1.0	170.21	7914.58	30	1.0	113.1	1887.60	38.5	14.9	30	9.06	3.91	2.62	160.4	1031.5	10833.7	611.0	10413.1	**4333.48**	**3471.05**
38.50	40.00	39.25	1.50	37.50	19.06	9.06	152.36	5.66	14.9	14.9	1.0	229.34	8143.92	30	1.0	169.7	2057.31	40.0	28.5	0	10.49	17.88	18.94	160.4	3380.7	13581.9	636.4	10837.7	**5432.77**	**3612.55**

APPENDIX-I

TABLE 6: COMPUTATION OF LATERAL PILE LOAD CAPACITY (Dia. 1000 mm)

Bore No.	Dia. of pile (m)	Cut-off length (m)	Scour depth (m)	Concrete Grade	Young's Modulus (kN/m^2)	Moment of Inertia (m^4)	Average SPT	Modulus of sub grade (k_1)	Stiffness Factor (T)	Cantilever length	L_1/T	L_f/T	Permissible deflection (m)	Length of Fixity (m)	Allowable Load capacity of pile(kN)
P134A	1.00	2.50	0.00	35	29580399	0.0491	30	4280	3.21	0.00	0.00	2.23	0.005	7.15	238

APPENDIX-I

TABLE 7: COMPUTATION OF LATERAL PILE LOAD CAPACITY (Dia. 1200 mm)

Bore No.	Dia. of pile (m)	Cut-off length (m)	Scour depth (m)	Concrete Grade	Young's Modulus (kN/m^2)	Moment of Inertia (m^4)	Average SPT	Modulus of sub grade (k_1)	Stiffness Factor (T)	Cantilever length	L_1/T	L_f/T	Permissible deflection (m)	Length of fixity (m)	Allowable Load capacity of pile(kN)
P134A	1.20	2.50	0.00	35	29580399	0.1018	32	4568	3.66	0.00	0.00	2.23	0.005	8.17	332

APPENDIX-I

TABLE 8: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
P134A	0.50	SM	18	18	8.25	5.00	3.25	1.00	0.394	1.70	30.60	3.23	1.07	35.86	0.52	1.00	0.620	1.572	Non-liquefiable
	2.00	SM	15	18	33.00	20.00	13.00	0.98	0.390	1.70	30.60	2.50	1.05	34.57	0.52	1.00	0.620	1.591	Non-liquefiable
	3.00	SM	27	16	49.50	30.00	19.50	0.98	0.387	1.70	27.20	4.48	1.13	35.22	0.52	1.00	0.620	1.603	Non-liquefiable
	5.00	SM	26	34	82.50	50.00	32.50	0.96	0.381	1.70	57.80	4.39	1.12	69.27	0.52	1.00	0.620	1.629	Non-liquefiable
	6.00	SM	26	35	115.80	60.00	55.80	0.95	0.309	1.34	46.85	4.39	1.12	56.99	0.52	1.00	0.620	2.008	Non-liquefiable
	8.00	SM	28	38	154.40	80.00	74.40	0.94	0.304	1.16	44.06	4.56	1.14	54.70	0.52	1.00	0.620	2.041	Non-liquefiable
	9.00	CL	81	40	163.80	90.00	73.80	0.93	0.322	1.16	46.56	5.00	1.20	60.87	0.52	1.00	-	-	Non-liquefiable
	11.00	CL	79	27	200.20	110.00	90.20	0.88	0.305	1.05	28.43	5.00	1.20	39.11	0.52	1.00	-	-	Non-liquefiable
	12.00	CL	79	29	241.20	120.00	121.20	0.85	0.265	0.91	26.34	5.00	1.20	36.61	0.52	1.00	-	-	Non-liquefiable
	14.50	ML	73	26	291.45	145.00	146.45	0.79	0.244	0.83	21.48	5.00	1.20	30.78	0.52	1.00	0.620	2.539	Non-liquefiable
	16.00	SM	30	26	328.00	160.00	168.00	0.75	0.227	0.77	20.06	4.71	1.15	27.86	0.36	0.83	0.360	1.583	Non-liquefiable
	17.50	SM	30	73	364.00	175.00	189.00	0.71	0.212	0.73	53.10	4.71	1.15	66.00	0.52	0.79	0.492	2.315	Non-liquefiable
	19.00	SM	24	66	395.20	190.00	205.20	0.67	0.200	0.70	46.07	4.18	1.11	55.21	0.52	0.77	0.477	2.382	Non-liquefiable
	20.50	SM	24	63	426.40	205.00	221.40	0.63	0.188	0.67	42.34	4.18	1.11	51.07	0.52	0.75	0.464	2.465	Non-liquefiable
	22.00	SM	24	63	457.60	220.00	237.60	0.59	0.176	0.65	40.87	4.18	1.11	49.45	0.52	0.73	0.452	2.566	Non-liquefiable
	23.50	SM	24	70	488.80	235.00	253.80	0.56	0.168	0.63	43.94	4.18	1.11	52.85	0.52	0.71	0.441	2.624	Non-liquefiable
	25.00	SM	24	57	520.00	250.00	270.00	0.56	0.168	0.61	34.69	4.18	1.11	42.60	0.52	0.70	0.432	2.566	Non-liquefiable
	26.50	SM	25	69	551.20	265.00	286.20	0.56	0.168	0.59	40.79	4.29	1.12	49.77	0.52	0.68	0.423	2.512	Non-liquefiable

APPENDIX-I

TABLE 8: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	28.00	SM	41	60	582.40	280.00	302.40	0.56	0.168	0.58	34.50	5.00	1.20	46.40	0.52	0.67	0.414	2.462	Non-liquefiable
	29.50	SM-SC	49	59	613.60	295.00	318.60	0.56	0.168	0.56	33.05	5.00	1.20	44.67	0.52	0.66	0.406	2.415	Non-liquefiable
	31.00	SM-SC	49	62	644.80	310.00	334.80	0.56	0.168	0.55	33.88	5.00	1.20	45.66	0.52	0.64	0.399	2.372	Non-liquefiable
	32.50	CL	57	85	676.00	325.00	351.00	0.56	0.168	0.53	45.37	5.00	1.20	59.44	0.52	0.63	-	-	Non-liquefiable
	34.00	SM	18	62	707.20	340.00	367.20	0.56	0.168	0.52	32.35	3.23	1.07	37.74	0.52	0.62	0.386	2.293	Non-liquefiable
	35.50	CL-ML	66	57	738.40	355.00	383.40	0.56	0.168	0.51	29.11	5.00	1.20	39.93	0.52	0.61	-	-	Non-liquefiable
	37.00	ML	67	59	769.60	370.00	399.60	0.56	0.168	0.50	29.51	5.00	1.20	40.42	0.52	0.60	0.374	2.224	Non-liquefiable
	38.50	ML	67	63	800.80	385.00	415.80	0.56	0.168	0.49	30.90	5.00	1.20	42.07	0.52	0.59	0.369	2.192	Non-liquefiable
	40.00	SM	22	55	832.00	400.00	432.00	0.56	0.168	0.48	26.46	3.93	1.09	32.85	0.52	0.59	0.364	2.161	Non-liquefiable

APPENDIX-J
SITE PHOTOGRAPHS

SPT at depth 11.00 m

SPT at depth 38.50 m

Coring at depth 1.25 m

Coring at depth 9.50 m

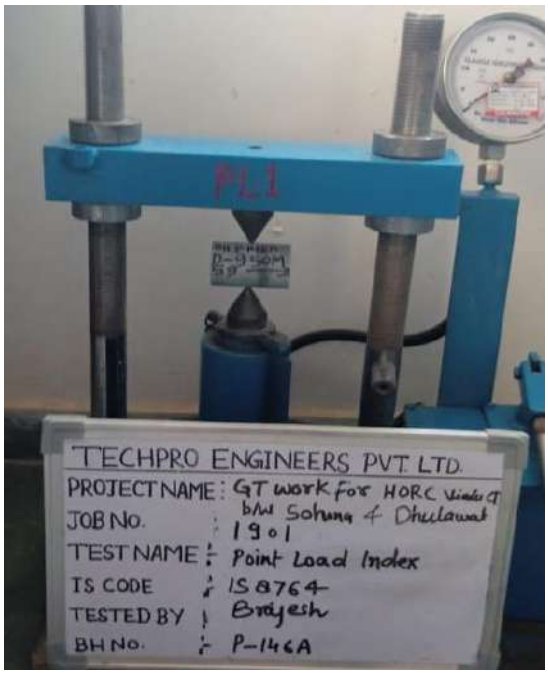
APPENDIX-J
SITE PHOTOGRAPHS

Core box samples

APPENDIX-K
LABORATORY PHOTOGRAPHS

Dry density test of rock

UCS test of rock



Point load index test

Cerchar abrasive index test

APPENDIX-K
LABORATORY PHOTOGRAPHS

Atterbergs' Limit test

Tri-axial shear test

UCS of soil

APPENDIX-L
CHART 1: FIELD BORELOG CHART (P134A)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW for HORC Viaduct B/W Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 3121360.768	E: 700904.347		Location/ Chainage:	24433.0470
Method of Drilling:	Percussion	Drilling Equipment	Auto trip Powerwinch	Bore No.:	P.134A
Casing Lowered (M):	17.00	Bentonite Used: Yes	Standard Sampler : Yes	Barrel Type :	NA
Ground Elevation:	R.L-200.107	Date: From 25/11/23 to 27/11/23		Water Table (M):	9.20

Day	Depth/RUN (m) From	Depth/RUN (m) To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	SPT Record 15-30cm	SPT Record 30-45cm	SPT Record N Value	Run Time Start	Run Time End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
25/11/23	0.0	0.50	0.50	DS	Sx	Collected										Non Cohesive Soil
"	1.00	1.45	0.45	U	"	Received										do
"	2.00	2.45	0.45	DP	"	5	8	10	18							do
"	3.00	3.45	0.45	DP	"	4	7	9	16							do
"	4.00	4.45	0.45	U	"	Received										do
"	5.00	5.45	0.45	DP	"	8	14	20	34							Non Cohesive Soil
"	6.00	6.45	0.45	DP	"	8	15	20	35							do
"	7.00	7.45	0.45	U	"	Received										do
"	8.00	8.45	0.45	DP	"	9	16	22	38							do
"	9.00	9.45	0.45	DP	"	8	15	25	40							Cohesive Soil with
"	10.00	10.45	0.45	U	"	Received										do gravel
"	11.00	11.45	0.45	DP	"	10	10	17	27							do
"	12.00	12.45	0.45	DP	"	9	11	18	29							do
"	13.00	13.45	0.45	U	"	Received										do
"	14.50	14.95	0.45	DP	"	7	10	16	26							do
"	16.00	16.45	0.45	U	"	Slipped										Non Cohesive Soil
"	17.50	17.95	0.45	DP	"	25	30	43	73							do
"	19.00	19.45	0.45	DP	"	24	28	38	66							do
26/11/23	20.50	20.95	0.45	DP	"	13	25	38	63							do
"	22.00	22.45	0.45	DP	"	16	28	35	63							do
"	23.50	23.95	0.45	DP	"	18	30	40	70							do
"	25.00	25.45	0.45	DP	"	15	25	32	57							do
"	26.50	26.95	0.45	DP	"	18	30	39	69							do
"	28.00	28.45	0.45	DP	"	13	28	32	60							do

Supervisor

S.E. Civil
E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-L
CHART 2: FIELD BORELOG CHART (P134A)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GAD for HORC Viaduct Bet Sohana Dhulawat Station			Project Code:	1901
Coordinate:	N: 3121360.768	E: 700904.347		Location/ Chainage:	94433.0470
Method of Drilling:	Percussion	Drilling Equipment	Auto trip Powerwinch	Bore No.:	P.134A
Casing Lowered (M):	17.00	Bentonite Used: Yes	Standard Sampler : Yes	Barrel Type :	NA
Ground Elevation:	R.L-200.107	Date: From 25/11/23 to 27/11/23		Water Table (M):	9.20

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
26/11/23	29.50	29.95	0.45	DP	8x	14	24	35	59							Non Cohesive Soil
11	31.00	31.45	0.45	DP	11	13	21	41	62							do
11	32.50	32.95	0.45	DP	11	18	40	45	85							do
11	34.00	34.45	0.45	DP	11	17	21	41	62							do
11	35.50	35.95	0.45	DP	11	18	25	32	57							do
11	37.00	37.45	0.45	DP	11	13	21	38	59							do
27/11/23	38.50	38.95	0.45	DP	11	15	25	38	63							do
11	40.00	40.45	0.45	DP	11	18	23	32	55							Non Cohesive Soil

Supervisor

E - in - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-L
CHART 3: FIELD BORELOG CHART (P146A)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	GTW HORC Viaduct b/w Sohana & Dhulawat Station			Project Code:	1901
Coordinate:	N: 3121563.095	E: 700789.522		Location/ Chainage:	24747.4470
Method of Drilling:	Rotary	Drilling Equipment:	Hydraulic	Bore No.:	P-146A
Casing Lowered (M):	3.00	Bentonite Used:	Not	Standard Sampler:	Yes	Barrel Type:	Double
Ground Elevation:	R.L-207.274	Date: From 01/11/23 to 04/11/23		Water Table (M):	9.10

Day / Date	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
1/11/23	0.00	0.50	0.50	DS	Sx	Collected.				–	–	–	–	–	-	Non-Cohesive Soil.
"	0.50	1.25	0.75	C	Nx	–	–	–	–	9:00	10:05	35	NiL	25	Light Brown	Light brown Fractured Quartzite Rock
"	1.25	2.00	0.75	C	"	–	–	–	–	10:20	11:30	33	NiL	20	"	—do—
"	2.00	2.75	0.75	C	"	–	–	–	–	11:50	12:35	33	13	15	"	—do—
"	2.75	3.50	0.75	C	"	–	–	–	–	12:55	1:40	31	13	25	"	—do—
"	3.50	4.25	0.75	C	"	–	–	–	–	2:10	2:55	53	45	25	"	—do—
"	4.25	5.00	0.75	C	"	–	–	–	–	3:30	4:30	56	47	35	"	—do—
"	5.00	5.75	0.75	C	"	–	–	–	–	4:50	5:45	48	NiL	45	"	—do—
"	5.75	6.50	0.75	C	"	–	–	–	–	6:00	7:00	73	73	45	"	Light brown Fractured Quartzite Rock
"	6.50	7.25	0.75	C	"	–	–	–	–	7:30	8:35	51	13	55	"	—do—
02/11/23	7.25	8.00	0.75	C	"	–	–	–	–	8:00	9:35	56	16	65	"	—do—
"	8.00	8.75	0.75	C	"	–	–	–	–	10:00	11:45	53	19	60	"	—do—
"	8.75	9.50	0.75	C	"	–	–	–	–	12:20	1:45	56	33	60	"	—do—
"	9.50	10.25	0.75	C	"	–	–	–	–	2:20	3:40	73	31	55	"	—do—
03/11/23	10.25	11.00	0.75	C	"	–	–	–	–	10:00	11:25	58	15	65	"	Light brown Fractured Quartzite Rock
"	11.00	12.50	0.75	C	"	–	–	–	–	11:50	1:15	56	NiL	70	"	—do—
"	12.50	13.25	0.75	C	"	–	–	–	–	2:00	3:30	31	NiL	70	"	—do—
"																

Supervisor

Techpro Engineers Pvt. Ltd.

S.E. Civil

E-in-C 04/11

SRE/Civil

Abbreviation Used: U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-M
CHART 1: CORE MEASUREMENT SHEET (P146A)

TECHPRO ENGINEERS PVT. LTD.

CORE MEASUREMENT SHEET

Doc. No.:	GT/005
Date of Issue:	01.04.2018
Rev. No.:	R00
Rev. Date:	NIL

Project Name: G.T Work for HORC Viaduct b/w Sohna & Dhulawat Station
Location: —
Date: 01/11/23 to 04/11/23
Str./ Chainage: 24747.4470
Project code: 1901
BH-No.: P-146A

Run (M) From	Run (M) To	Total Length (cm)	Core No. From	Core No. To	Core Number/ Length of core pieces (cm)
0.50	1.25	26	1	4	1/7, 2/8, 3/6, 4/5
1.25	2.00	25	5	8	5/11, 6/6, 7/8
2.00	2.75	25	9	14	9/4, 10/3, 11/2, 12/3, 13/3, 14/10
2.75	3.50	23	15	17	15/6, 16/10, 17/7
3.50	4.25	40	18	20	18/12, 19/22, 20/6
4.25	5.00	42	21	23	21/11, 22/24, 23/7
5.00	5.75	36	24	29	24/7, 25/9, 26/3, 27/3, 28/5, 29/9
5.75	6.50	55	30	32	30/14, 31/24, 32/17
6.50	7.25	38	33	39	33/5, 34/5, 35/5, 36/4, 37/5, 38/4, 39/10
7.25	8.00	42	40	47	40/5, 41/2, 42/4, 43/6, 44/2, 45/12, 46/6, 47/5
8.00	8.75	40	48	55	48/2, 49/3, 50/4, 51/3, 52/14, 53/3, 54/5, 55/6
8.75	9.50	42	56	59	56/12, 57/9, 58/8, 59/13
9.50	10.25	55	60	66	60/11, 61/8, 62/8, 63/7, 64/5, 65/4, 66/12
10.25	11.00	44	67	74	67/9, 68/11, 69/6, 70/5, 71/2, 72/3, 73/2, 74/6
11.00	12.50	42	75	83	75/9, 76/5, 77/5, 78/7, 79/4, 80/3, 81/2, 82/4, 83/3
12.50	13.25	23	84	88	84/3, 85/4, 86/3, 87/5, 88/8

Techpro Engineers Pvt. Ltd. • Kanpur •

Supervisor:

E-in-C: 6/11/23 SE(Civil)

End of Report

Report No: 1901-HORC-X

Report No.: 1901-HORC-X

Date: Oct 16th; 2023

GEOTECHNICAL INVESTIGATION REPORT

ULR No.: TC916923000000032P
REVISION-R1

AT THE SITE FOR

HORC VIADUCT BETWEEN SOHANA & DHULAWAT STATIONS OF HARYANA ORBITAL RAIL CORRIDOR (HORC) PROJECT, HARYANA

FROM BOREHOLES P134B TO A2B

CLIENT

HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LTD.

Plot No. 143, 5th floor RailTel tower, Sector-44,
Gurugram, Haryana 122003

GENERAL CONSULTANTS

RITES-SMEC JV

Gurugram, Haryana

GEOTECHNICAL CONSULTANTS

TECHPRO ENGINEERS PVT. LTD.

114, RAM GANGA HOUSING SOCIETY, NARAMAU, G T ROAD, KANPUR-209 217, Phone: 9793209918

e-mail: info@techproindia.com

TC-9169

REVISION NOTES

REVISION NO.	DATE	DESCRIPTION
R1	11.12.23	• Test results, SBC computations and recommendations added for borehole P138B. • Field bore log charts added in Appendix-L and Core Measurement sheet added in Appendix-M.

TECHPRO ENGINEERS PVT.LTD.
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Web site: www.techproindia.com

REPORT FORMAT

Report No.	Bore included	Total Number of Bores
1901-HORC-I	A1 to P20	21
1901-HORC-II	P21 to P40	20
1901-HORC-III	P41 to P60	20
1901-HORC-IV	P61 to P80	20
1901-HORC-V	P81 to P100	20
1901-HORC-VI	P101 to P113	13
1901-HORC-VII	P114A to P133A	20
1901-HORC-VIII	P134A to A2A	16
1901-HORC-IX	P114B to P133B	20
1901-HORC-X	P134B to A2B	16

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National Accreditation Board for Testing and Calibration Laboratories

NABL

CERTIFICATE OF ACCREDITATION

TECHPRO ENGINEERS PVT. LTD. (LABORATORY DIVISION)

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ISO/IEC 17025:2017

"General Requirements for the Competence of Testing & Calibration Laboratories"

for its facilities at

114, RAM GANGA HOUSING SOCIETY, NARAMAU, G.T. ROAD, KANPUR, UTTAR PRADESH, INDIA

in the field of

TESTING

Certificate Number: TC-9169

Issue Date: 23/12/2022 **Valid Until:** 22/12/2024

This certificate remains valid for the Scope of Accreditation as specified in the annexure subject to continued satisfactory compliance to the above standard & the relevant requirements of NABL.
(To see the scope of accreditation of this laboratory, you may also visit NABL website www.nabl-india.org)

Name of Legal Identity : Techpro Engineers Private Limited

Signed for and on behalf of NABL

N. Venkateswaran
Chief Executive Officer

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Oct 16th; 2023

ACKNOWLEDGEMENTS

We are pleased to submit the part-10 of the report of Geotechnical investigation, conducted for the boreholes P134B to P148B and A2B for the design of foundations for HORC Viaduct between Sohana & Dhulawat stations of Haryana Orbital Rail Corridor (HORC) project in the state of Haryana, India.

We hereby, convey our sincere thanks to Mr. Neeraj Bhandari (CPM/South) and Mr. Raju Solanki (DGM/C/South), HRIDCL for trust and support during the investigation. We also acknowledge our thanks to Mr. Uma Maheshwara Rao B, DGM/C/West, HRIDCL for awarding the said work to us. We are also grateful Mr. Ravindra Dutta Upadhyay (Geotech Expert), Mr. PS Gautam & Mr. Jitender Parashar, Site Engineer from the RITES- SMEC JV and Mohd. Ishak (Executive/Civil) from HRIDCL, for their help rendered during and prior to the investigation work.

We are also thankful to our staff members for conducting field and laboratory test, preparing sketches, and typing the report.

for Techpro Engineers Pvt. Ltd.

(Arvind K. Garg)
B.Tech. (Civil), M.Tech.
Principal Consultant &
Managing Director

1. INTRODUCTION:

Haryana Rail Infrastructure Development Corporation Ltd. (HRIDC) and Ministry of Railways, Govt. of India has come together to form a new company namely Haryana Orbital Rail Corporation Limited (HORCL), to design and construction of new BG line from Palwal to Sonipat named Haryana Orbital Rail Corridor (HORC), in the state of Haryana, India. In this connection, a Geotechnical investigation has been planned for the design of foundations of Viaduct between Sohana & Dhulawat stations of Haryana Orbital Rail Corridor (HORC) Project in the state of Haryana. The work of conducting the detailed Geotechnical Investigation has been awarded to us by HRIDC, through work order No. HRIDC/HORC/GTI/211/2023-2024/Vol-0 dated 02-09-2023, which includes investigation in field, laboratory testing of disturbed and undisturbed samples, collected from the field, and submission of the geotechnical **investigation** test report.

A geotechnical investigation was carried out, with the locations, planned by the client. Purpose of the investigation is to determine the nature and properties of soil and rock strata across the bore holes and representing them through log sections showing the levels, nature, and properties of various strata up to a sufficient depth below the founding level, proneness of site to artesian conditions, seismic disturbance and other engineering properties of soil and rock strata.

This part -10 of the report includes the detailed methodology of investigation, collection of samples, field and laboratory test result including their interpretation/ analysis, recommendations on the properties of soils and rock required for design of foundation and suggesting suitable type and depth of foundation with allowable bearing capacity for safe and strong foundations for the Bore Hole numbers P134B to P148B and A2B.

2. SCOPE OF WORK:

For the design of foundation of viaduct, it is required to determine the allowable bearing capacity together with necessary engineering characteristics of underlying soil & rock strata. In general, the geotechnical investigation has been planned as per IS:1892-2021 and further extended to IS: 1904, IS:2911 (part-1/Sec 2) & IRC 78:2014 for planning the laboratory testing and computing the allowable bearing capacity, hence the scope of work is as follows:

2.1. Mobilisation of all tools & plants along with accessories, materials, labours etc. at site of work for drilling and testing work, including setting up boring and shifting to different bore holes point etc.

2.2. Exploratory drilling of 150 mm diameter bore holes through soil deposits and 75 mm in rock within the proposed alignment upto the required depth.

2.3. Collection of disturbed soil samples at an interval of 3.00 meter in all the bore holes.

2.4. Collection of undisturbed soil samples at every 3.00 m interval or at change of stratum from all the boreholes.

2.5. To conduct Standard Penetration Test (SPT) at an interval of 3.00 m or noticeable change of stratum in soil deposits in all bore holes.

2.6. Collection of rock core samples and preserving them in core boxes.

2.7. To collect ground water sample on completion of bore holes.

2.8. To record the ground water table in all the bore holes.

2.9. Transporting all the disturbed, undisturbed soil and rock core samples collected during the field investigation to our NABL accredited Geotech Engineering laboratory at Kanpur.

2.10. To conduct the laboratory tests on all the soil and rock core samples collected during field investigation for determination of their engineering characteristics.

2.11. To compile of field and laboratory test results, working out the allowable bearing capacity and preparing the report including detailed recommendations and necessary precautions.

3. GEOLOGICAL INFORMATION OF THE REGION:

3.1. Geography:

The project location is in the bordering area of Gurugram and Nuh (recent old name-Mewat), districts in the Indian state of Haryana. The stretch of the alignment of the proposed corridor starts from southmost part of Gurugram in the town of Sohna and ends at Dhulawat, which is a village lying at the north of Nuh district.

Haryana is a state located in the northern part of India. Gurugram is among one

of the districts in Haryana which is also the part of National Capital Region (30km south of New Delhi). It lies at an elevation of 217 m above msl. Sohna is a small town located 25km in the south of Gurugram. Sohna is well known for its hot water springs and famous Shiva temple. Sohna is located in between 28°15' N latitude and 77°40' E longitude at the elevation of 212.14m above msl. Mewat district is located at 28 °12′ N latitude, 77 °3′ E longitude, at the south of Gurugram at an elevation of 199 m above msl. The location is bordered by Rewari district on west and Faridabad & Palwal district on the east.

3.2. Geology:

The Gurugram district is having of almost flat topography, however, in the north-eastern part small isolated hillocks of Precambrian rocks are exposed. Small hill ranges which are part of the Aravali and Mangar Bani ranges exists in the district. The major part of district is underlain by Quaternary alluvium consisting of sand, clay and silt. The alluvial plain is formed by the Sahibi river which is a tributary of River Yamuna. Soils of the Gurgaon district is classified as tropical and brown soils, existing in the north western extreme, northern and north eastern parts of the district and water logged and salt affected soils in the southern parts of the district. The soils are medium textured loamy sand is the average texture in Gurgaon and Sohna blocks.

3.3. Rainfall and Climate:

The area has hot semi-arid type of climate characterising extreme dryness of the air except in the monsoon season. Intense hot summer and cold winters. The total annual rainfall in the region is about 596 mm, of which 75 to 80% is because of the south-west monsoon.

3.4. Seismicity:

The site under consideration exists in the district of Gurugram and Mewat which lies in the Seismic Zone IV (high damage risk zone), as per the current seismic zonation map of India (IS 1893-2016): RA 2021 and have a zone factor of 0.24 for design basis earthquake. The region is surrounded by many in-homogeneities in the form of faults and ridges like Sohna Fault, Moradabad Fault, Delhi-Moradabad Fault, Delhi-Haridwar ridge, junction of Aravalli and Alluvium near Delhi. The Sohna fault line lies between the Delhi ridge and Sohna town and falls between the Arjangarh and

Manesar outcrops. All the developed area in Gurugram comes within 200 km of the fault line. The Sohna fault line is located at the junction between the hard rock terrain of the Aravalli hills and the sandy formation of the Yamuna River and is currently inactive from several years and is capable of a disastrous earthquake.

The project location has been marked in Fig.1 Seismic zone map of India.

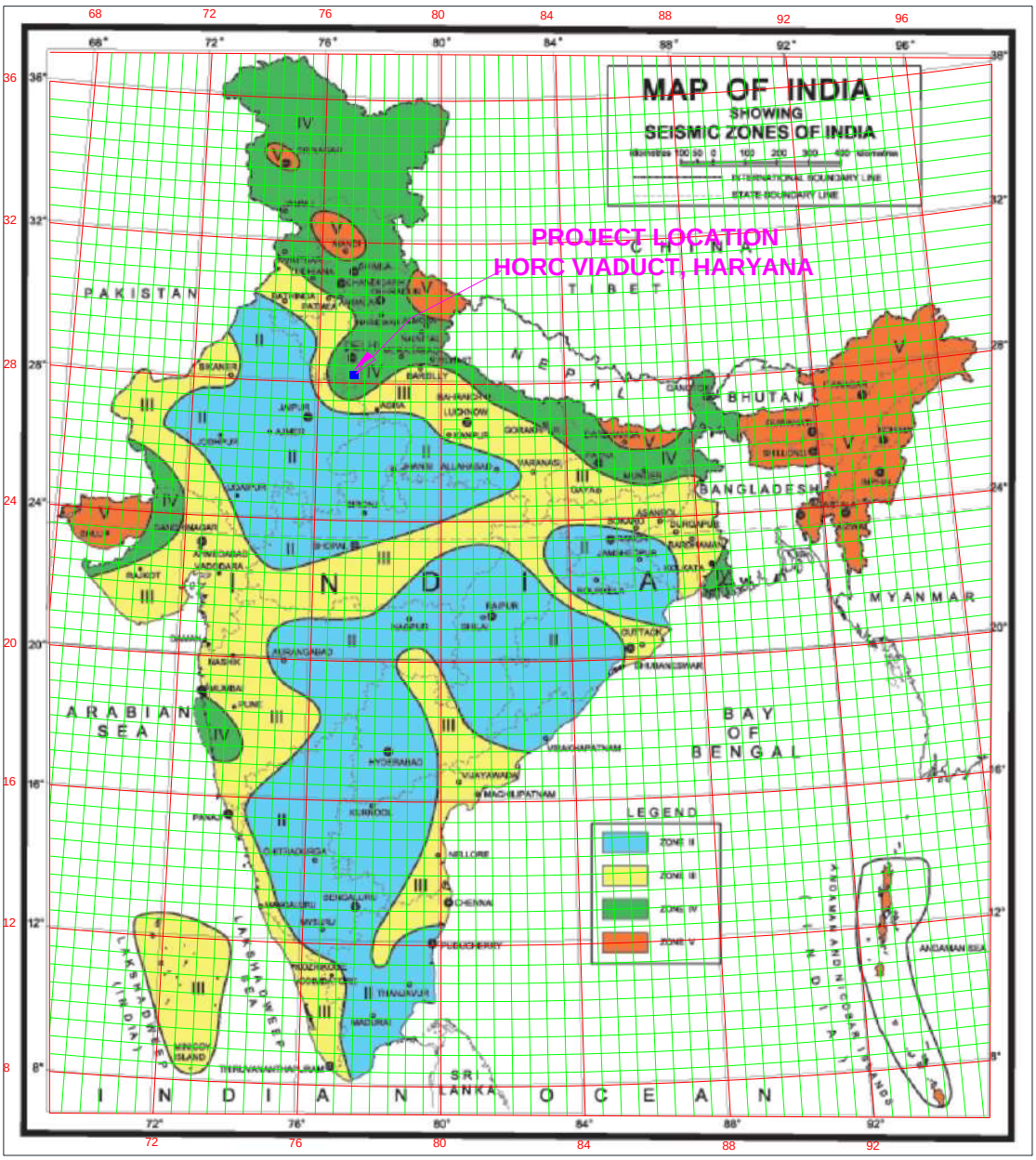


Fig.1: Seismic Zone Map of India

4. FIELD INVESTIGATION:

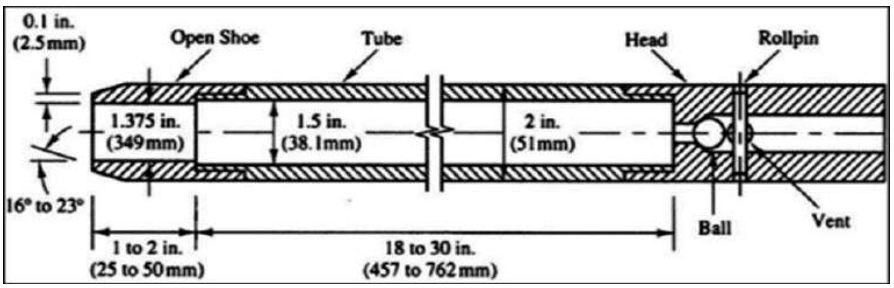
The field investigation work at this site was carried out from Sep 19th; 2023 to Sep 23rd; 2023 & Nov 26th; 2023 to Nov 28th; 2023. The following investigation

work was carried out:

4.1. **Sixteen** number of **boreholes** were proposed to be made at this stretch, out of which **two number** of boreholes (marked as P138B & P143B) of diameter 150 mm in soil and 75 mm in rock were made for conducting Standard Penetration Test and collection of disturbed, undisturbed soil and rock core samples. The boreholes were progressed using hydraulic rig and power winch machine under **rotary** and **percussion** methods of drilling. Casing was used to keep the borehole stable and Bentonite was also used as drilling mud to help prevent wall collapse of boreholes at deeper depth. The records of achieved depth of bore holes have been given in Para No. 6, the details of drilled bores along with depth of casing used have been reported in Appendix B. Locations of boreholes have been reported in "TEST LOCATION PLAN" in Appendix A.

4.2. **Standard Penetration Tests** were conducted at 1.00 to 2.00 metre interval upto the depth of 12.00 meter and 3.00 metre interval, beyond 12.00 metre depth, as per the procedure in IS: 2131-1981-(RA: 2021) in all the bore holes. The **standard SPT sampler** (without liner and with no space for liner) and **rope-pulley driven hammer** of standard weight of 63.50 kg have been used to perform the test.

For conducting the test, the bottom of the borehole was properly cleaned, and split spoon sampler was properly seated in position in the borehole. The split spoon sampler resting on the bottom of borehole was allowed to sink under its own weight; then the sampler was allowed to penetrate 15 cm with the blows of the hammer 63.50 kg weight falling free through 75cm, thereafter the split spoon sampler was further driven by another 15 cm. For the 3rd and final drive, the sampler was further allowed to penetrate 15 cm. The number of blows required to get each 15 cm of penetration, was recorded. The first 15 cm of drive is seating drive.



Structure of SPT Sampler

The total blows of penetration for the second and third 15 cm of penetration is

termed the penetration resistance N. The N' values are indicative of the compactness/ relative density of cohesion less soils and consistency of cohesive soils.

In case the blows count of SPT in soil (including the number of blows of seating) exceeds 100, the corresponding penetration was recorded and this particular test at that depth stopped. If the total penetration is more than the seating penetration of 15 cm, then breakup of blow counts for 15 cm seating penetration and for remaining portion of penetration is also given.

SPT 'N' values are correlated with non-cohesive stratum as per BS: 5930 (1999) – for sandy strata and with consistency of cohesive stratum.

Correlation For Clay/Plastic Silt		**Correlation For Sand/Non-Plastic Silt**	
Consistency of clays	**Penetration Value**	**Relative Density of sand**	**Penetration Value**
Very Soft	0 to 2 Blows	Very loose	0 to 4 Blows
Soft	3 to 4 Blows	Loose	5 to 10 Blows
Medium Stiff	5 to 8 Blows	Medium	11 to 30 Blows
Stiff	9 to 16 Blows	Dense	31 to 50 Blows
Very Stiff	17 to 32 Blows	Very Dense	Above 50
Hard	Above 32		

In this method, the sampler acts as a probe and the driving energy is supplied by the fall of the drop weight. The values of 'N' depend on the compactness or relative density of the material. In hard formations, the testing is discontinued if 'N' value is found to be more than 100. It is termed as 'Refusal'. Refusal is also recorded when SPT blow count records 50 or more for any of the single drive of 15 cm.

'N' value depends upon degree of saturation and over burden pressure of the formation. Silty fine sand and fine sand below the water table develop pore water pressure depending on the in-situ void ratio which in turn affects the effective stress. This change in effective stress influences the 'N' value considerably.

Depth of overburden affects the SPT values in none to low cohesive soils and hence need correction. The SPT value after the overburden correction, N' is as follows:

$$N' = 0.77x \log (2000/q) \times N$$

Where, q= Overburden Pressure (kN/m^2) and N = observed SPT value

N' is corrected further for dilatancy in case of saturated fine sands and silts for the values of N' greater than 15.

Modified value after dilatancy correction N" = 15+ (N'-15)/2

Soil samples obtained from split spoon sampler were collected in the polythene bags of suitable size. These samples were property sealed, labelled, and carefully transported to the laboratory for testing. The results have been reported in Table 1 to 2 of Appendix B under the title "SUMMARY OF TEST RESULTS".

4.3. **Disturbed soil samples** were collected at 0.50 metre, then at 1.00 to 2.00 metre interval upto the depth of 12.00 meter and 3.00 metre interval, beyond 12.00 metre depth and at significant change of stratum. Soil from cutting edge of SPT samplers and retained in split spoon, used for Standard Penetration Tests was taken as disturbed samples. These samples were placed without delay in adequately sealed polythene bags. Where the collection of disturbed soil samples could not be collected from SPT samples, Shelby tubes were driven and retained soil samples were obtained. The laboratory tests were conducted on the collected soil samples and reported in Table 1 to 2 of Appendix-B under the title "SUMMARY OF TEST RESULTS".

4.4. **Undisturbed soil samples** were collected in accordance with IS: 2132-1986-(RA: 2021) at an interval of 3.00 metre or at change of stratum, starting from the depth of 1.00 or 2.00 m, by using 100 mm dia. and 450 mm long MS tubes provided with sampler head with ball check arrangement. However, the some of the samples could not be extracted due to the partial penetration or slippage during the evacuation.

Moreover, collection of Undisturbed samples in very hard cohesive soils/ dense granular soils/gravels/ cobbles/ pebbles/ boulders, refusal strata is practically not possible and such collected samples will not truly represent the undisturbed conditions.

Immediately after taking undisturbed sample in the tube, the adopter head was removed along with the disturbed material. The visible ends of the samples shall then be trimmed off any wet disturbed soil. The ends will then be coated alternately with four layers of molten wax. More molten wax will then be added to give a total thickness

of not less than 25 mm. The laboratory test results have been reported in Table 1 to 2 of Appendix-B.

4.5. **Rock Core samples** recovered during the NX size drilling have been measured, numbered, and packed in core boxes. The Core Recovery (CR) and RQD information have been reported in Field bore log charts and Core Measurement Sheet and results have been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix B**.**

4.6. The **ground water table** in the borehole was allowed to stabilize and measured after 8, 16, 24 and 48 hours after completion of the bore hole. It was ensured that last two reading were identical. The records of ground water table have been given in Para No.6.

4.7. **Ground water samples** were collected from borehole as per IS: 6935-1973-(RA:2019) for chemical analysis to determine aggressiveness in relation to attack on concrete / reinforcement including determination of pH value.

5. LABORATORY TESTS:

The following laboratory tests were conducted to determine the engineering characteristics of sub-soils:

5.1. **Field moisture contents** were determined by oven drying method as per IS: 2720 (part II)-1973-(RA: 2020). The results have been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.2. **Bulk density** of soil strata was obtained using Shelby tubes in accordance with IS 2720 (part XXIX)-1975-(RA: 2020). The results have been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.3. **Mechanical sieve analysis** test was performed in accordance with IS: 2720 (Part IV) – 1985-(RA: 2020), for the purpose of identification by grain size analysis, on coarse part of the soil samples and the results have been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.4. **Particle size analysis** test by **Hydrometer method** were performed in accordance with IS: 2720 (Part IV) -1985-(RA: 2020) on the part of soil samples obtained after the sieve analysis. The results have been reported in Table 1 to 2: "SUMMARY OF TEST

RESULTS" of Appendix B.

5.5. **Atterbergs' limits tests** were performed in accordance with IS: 2720 (part V)-1985-(RA: 2020) and results have been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.6. **Specific gravity tests** were performed in accordance with IS 2720 (part III-sec. 1) -1980-(RA: 2021) and the results have been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.7. **Consolidation tests** were performed on cohesive soil samples in accordance with IS: 2720 (part XV)-1965-(RA: 2021). The results have been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.8. **Direct shear tests** were performed as per IS: 2720 (part XIII)-1986-(RA: 2021), on the undisturbed soil samples obtained during the field investigation. The results and the density of samples have been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.9. **Tri-axial Compression Test** under Unconsolidated Un-drained (UU) condition as per IS: 2720 (Part-XI)-1993-(RA: 2021) were performed on the selected undisturbed soil samples, obtained during the field investigation. The results have been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.10. **Unconfined Compressive strength tests** were performed in accordance with IS 2720 (Part-X) -1991-(RA:2020) on selected undisturbed soil samples and the results have been reported in Table 5 of Appendix B.

5.11. **Shrinkage Limit tests** were performed in accordance with IS 2720 (part-VI) -1972-(RA: 2021) and the results have been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.12. **Free Swell Index** were performed in accordance with IS 2720 (part-XL) -1977-(RA: 2021) and the results have been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.13. **Density test** on rock sample were performed in accordance with IS 13030-1991-(RA: 2021) and results have been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.14. **Water absorption and Porosity test on rock** samples were performed in accordance with IS: 1124-1974-(RA:2017) and results have been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.15. **Hardness test** on rock samples were performed in accordance with IS: 13630 (part-XIII) -2019 and results have been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.16. **Unconfined Compressive Strength** tests on rock samples were performed in accordance with IS 9143-1979-(RA:2021) and results have been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.17. **Point load index tests** on rock samples were performed in accordance with IS: 8764-1998-(RA:2019) and results have been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.18. **Cerchar Abrasive Index** test on rock samples were performed in accordance with ASTM-D7625 and results have been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix B.

5.19. **Chemical analysis on soil samples** was performed in accordance with IS: 2720 (Part-XXVI)-1987-(RA: 2021) for Ph value, IS: 2720 (Part-XXVII)-1977-(RA: 2020) for Sulphate & BS:1377-3-2018 for chlorides and results have been reported in Table 3 "CHEMICAL TEST ON SOIL SAMPLES" of Appendix B.

5.20. **Chemical analysis on Ground Water sample** was performed in accordance with IS: 3025 (Part-XI)-2022 for Ph value, IS: 3025 (Part-XXIV: Sec-1)-2022 for Sulphate & IS: 3025-(Part-XXXII)-1988-(RA: 2019) for chlorides and results have been reported in Table 4 "CHEMICAL TEST ON GROUND WATER SAMPLES" of Appendix B.

6. GROUND WATER TABLE:

The water table at this site was encountered during the drilling operation up to the depth of investigation.

Borehole No.	Chainage	Global Co-ordinates (UTM format)		Reduced level (m)	Depth of Borehole (m)	Water table (m)
		Easting	Northing			
P138B	24530.463	700895.449	3121462.977	209.246	40.00	18.00
P143B	24661.464	700849.414	3121585.595	205.068	40.00	14.40

7. DESCRIPTION OF STRATA:

The classification of soil stratum has been done with the help of soil characteristics obtained in laboratory tests as per IS 1498-1970-(RA:2021). The classification of rock masses has been done based on RMR as per IS: 4464-1985, IS: 13365-1. The detailed nature of the strata has been reported in Table 1 to 2: "SUMMARY OF TEST RESULTS" of Appendix-B and represented through Lithological plots in Appendix-C.

The strata exhibited in the bore hole, P138B is predominantly consisting of silty sands with inorganic silty clays of low plasticity. Borehole P143B consists of Silty sands upto the depth of 17.00 m. Inorganic silty clays of low plasticity were also encountered in between the depth of 10.00 to 11.30 metres. Rock mass encountered at the depth of 11.30 metres to 12.80 metres, and then after 17.05 metres to the depth of investigation. The rock mass is in various stage of weathering, i.e., highly to completely weathered and classified as **Quartzite**. The entire rock mass is of medium to fine grained, non-foliated, **Abrasion Index** and rock hardness falling in the range of **high to very high**.

8. CLASSIFICATION CRITERIA OF ROCK MASSES:

Rock classification in terms of weathering, state of fractures and strength is carried out in the following manner based on IS: 4464-1985, IS: 13365-1. Tabulations given in below explain it briefly.

TERMS	DESCRIPTION	GRADE	GEOLOGIST INTERPRETATION
Fresh	No visible sign of rock material weathering; perhaps slight coloration on major discontinuity surfaces	I	CR > 90 %

TERMS	DESCRIPTION	GRADE	GEOLOGIST INTERPRETATION
Slightly Weathered	Discoloration indicates weathering of rock material and discontinuity surfaces. All the rock material may be discoloured by weathering.	II	CR between 70 % to 90 %
Moderately Weathered	Less than half of the rock material is decomposed or disintegrated to a soil. Fresh or discoloured rock is present either as a continuous framework or as core-stones.	III	CR between 51 % to 70 %
Highly Weathered	More than half of the rock material is decomposed or disintegrated to a soil. Fresh or discoloured rock is present either as a discontinuous framework or as core-stones.	IV	CR between 11 % to 50 %
Completely weathered	All rock material is decomposed and / or disintegrated to soil. The original mass structure is still largely intact.	V	CR between zero to 10 %
Residual Soil	All rock material is converted to soil. The mass structure and material fabric are destroyed. There is a large change in volume, but the soil has not been significantly transported.	VI	CR = Zero % But N > 50

CR indicate Core Recovery

It should be understood that all grades of weathering may not be seen in a given rock mass and that in some cases a particular grade may be present to a very small extent. Distribution of the various weathering grades of rock material in the rock mass may be related to the porosity of the rock material and the presence of open discontinuities of all types in the rock mass.

8.1 Relation between RQD and In-situ Rock quality:

Relation between RQD and In-situ Rock quality is further measured by frequency of natural joints in rock mass. Rock Quality Designation (RQD) is used to define state of fractures or massiveness of rock. Following table defines the quality of rock mass.

RQD classification	RQD (%)
Excellent	91 to 100
Good	76 to 90
Fair	51-75
Poor	25-50

RQD classification	RQD (%)
Very Poor	0-25

8.2 Classification of Rock by Compressive Strength:

Rock type	Unconfined compressive strength (MPa)
Extremely strong	>200
Very Strong	100 to 200
Strong	50 to 100
Moderately Strong	12.5 to 50
Moderately Weak	5 to 12.5
Weak	1.25 to 5
Very weak	<1.25

9. SAFE BEARING CAPACITY COMPUTATIONS:

For the construction of viaducts, deep foundation proposed to be resting on soil and rock mass **(Bored Cast-In-Situ RCC piles** and **bored cast-in-situ rock socketed RCC piles)** have been considered for computation of load bearing capacity of the underlying strata. The computation of load bearing capacity of bored cast-in-situ RCC piles have been done as per IS 2911 (part-1, section-2)-2010-(RA: 2020) and rock socketed RCC piles as per IRC:78-2014, with due consideration of effects of liquefaction.

9.1. Pile Load Capacity in soils:

9.1.1. Design Parameters:

Factor of safety in Compression	=	2.50
Factor of safety in Tension	=	3.00
Depth of critical water table	=	0.00 m
Diameter of pile	=	1.00 & 1.20 m
Cut off length	=	2.50 m
Type of pile head consider	=	Fixed

9.1.2. Computation of friction along pile stem:

$Q_{uf} = \sum K_i . P_{di} . \tan\delta_i . A_{si}$

where,

Q_{uf} = Ultimate shaft friction (kN/m^2)

K_i = Coefficient of earth pressure at mid-depth of ith layer

P_{di} = Effective overburden pressure at mid-depth of ith layer (kN/m^2)

A_{si} = Surface area of pile stem in i^{th} layer (m^2)

δ_i = Angle of wall friction between pile and soil of ith layer (= ϕ) (degree)

ϕ_i = Angle of internal friction of soil in i^{th} layer (degree)

$\sum$ = Sum of all layers up to i^{th} layer

9.1.3. Computation of Cohesion along the stem of pile:

$Q_{uc} = \sum \alpha_i . c_i . A_{si}$

where,

c_i = Cohesion in i^{th} layer

A_{si} = Surface area of pile stem in i^{th} layer (m^2)

α_i = Adhesion factor for i^{th} layer of soil depending of consistency of soils

$\sum$ = Sum of cohesion of all layers considered

9.1.4. Computation of end bearing resistance:

$Q_{ub} = A_p (c.Nc + q.Nq + 0.5.\ \gamma.B.N\gamma)$

where,

A_p = Area of the pile toe (m^2)

c = cohesion of soils at pile toe (kN/m^2)

γ = Effective Unit weight of soils at pile toe (kN/m^3)

B = Diameter of pile (m)

q = Effective overburden pressure at pile toe (kN/m^2)

N_c = Bearing Capacity Factor (Recommended equal to 9)

Nq, $N\gamma$ = Bearing Capacity Factor

9.1.5. Lateral load capacity of piles in soils:

$Q_u = 12.E.I.\delta/(L_1+L_f)^3$

where,

Q_u = Ultimate lateral load capacity of pile (kN)

δ = Permissible deflection (m) = 5 mm

E = Young Modulus of pile material (kN/m^2)

I = Moment of Inertia of the pile cross section (m^4)

L_1 = Cantilever Length of pile (m)

L_f = Length of fixity (m)

Detailed calculations of pile load carrying capacity in compression & uplift in soil have been reported in **Table-3 to 4** of **Appendix-I.**

Pile lateral Load capacity has been given in **Table-5 to 6** of **Appendix-I**.

9.2. Pile Load Capacity in rock:

Computations of the vertical load capacity of the piles in rock has been work out as per the method given in IRC:78-2014.

9.2.1. As per IRC:78-2014:

Since the rock mass encountered at this site exhibits (CR+RQD)/2< **30%**, Method 2 of IRC: 78-2014 has been used for computing the axial pile load capacity in rock formations.

$Q_a = R_e/3 + R_{af}/6$

$Q_t = R_{af}/6$ + Self weight of pile

where,

$R_e = C_{ub} \times N_c \times A_b$

$R_{af} = C_{us} \times A_s$

D = Diameter of the pile (m)

Q_a = Allowable load capacity of pile socketed into rock (kN)

Q_t = Allowable load capacity of pile in uplift (kN)

R_e = Ultimate end bearing capacity (kN/m^2)

R_{af} = Ultimate side socket shear capacity (kN/m^2)

C_{ub} = Average shear strength below base of pile tip for depth upto 2D

L_s = Socket length of pile (m)

N_c = Bearing Capacity factor = 9 (as per code)

A_b = Area of pile base (m^2)

A_s = Area of socket (m^2)

C_{us} = Shear strength along socket length (≤ 3.0 for M35 Concrete).

The detailed calculations of pile load carrying capacity in compression and uplift on rock based on method-2 of IRC: 78-2014 have been reported in **Table-2** of **Appendix-I.**

9.3. Computation of RMR values:

A gross estimate of bearing capacity of completely or partially weathered rock masses have been done based on Rock Mass Rating (RMR). The estimation of RMR value of jointed rock masses have been worked out based on IS 13365 (part I). Rock Mass Rating parameters are reproduced from Annexure B of IS 13365 (part I) below for ready reference. The final RMR value of rock is referred from the Table 3 of IS code 12070.

9.3.1. Rating as per UCS

Description	Compressive Strength (MPa)	Rating	Basis
Exceptionally Strong	>250	15	UCS value data of specific borehole from laboratory test is used in RMR
Very Strong	100 to 250	12	
Strong	50 to 100	7	
Average	25 to 50	4	
Weak	10 to 25	2	
Very Weak	2 to 10	1	
Extremely Weak	<2	0	

9.3.2. Rating as per RQD

Description	RQD (%)	Rating	Basis
Excellent	91 to 100	20	RQD values of specific boreholes below given depth from relevant borehole are used in RMR.
Good	76 to 90	17	
Fair	51 to 75	13	
Poor	26 to 50	8	
Very Poor	0 to 25	3	

9.3.3. Rating as per Spacing of discontinuities

Description	Spacing (m)	Rating	Basis
Vey wide	>2	20	Spacing of discontinuities of specific borehole from field observations is used in RMR
Wide	0.6 to 2	15	
Moderate	0.2 to 0.6	10	
Close	0.06 to 0.2	8	
Very close	<0.06	5	

9.3.4. Rating as per Condition of discontinuities

Condition	Rating
Very rough and un-weathered rock wall rock, tight and discontinuous, no separation	30
rough and slightly weathered wall rock surface, separation < 1mm	25
slightly rough and moderately to highly weathered wall rock surface, separation< 1mm	20
Slickensides wall rock surface or 1-5mm thick gauge or1-5 mm wide opening, continuous discontinuity	10
Soft gauge> 5 mm thick or Separation > 5 mm	0

9.3.5. Rating as per Ground Water Conditions

General Description	Rating
Completely dry	15
Damp	10
Wet	7

General Description	Rating
Dripping	4
Flowing	0

9.3.6. Rating as per adjustment for discontinuity orientations

Strike and dip orientations of discontinuities	Very favourable	Favourable	Fair	Un-favourable	Very Un-favourable
Foundation	0	-2	-7	-15	-35

9.3.7. Net safe bearing pressures based on RMR as per Table 3 of IS:12070-1987-(RA: 2020)

Classification No.	I	II	III	IV	V
Rock Description	Very Good	Good	Fair	Poor	Very Poor
RMR	100-81	80-61	60-41	40-21	20-0
Q_{net} (t/m^2)	600-448	440-288	280-141	135-48	45-30

The results of Rock Mass Rating have been reported in **Table-1** of **Appendix-I.**

10. LIQUEFACTION ANALYSIS:

Liquefaction is the sudden loss of shear strength of the loose fine sands due to earthquake-induced vibration under saturated conditions. Liquefaction generally takes place in loose fine sands (fines < 10 %, D_{60}= 0.20 mm to 1.0 mm and C_u between 2 to 5) with N value less than 15. In case of soil strata having N>15, liquefaction of soil will not take place normally.

The present site falls in **seismic zone – IV.** Considering the history of past earthquakes and available seismic data, an earthquake of **magnitude 7.0** having peak ground acceleration **a_{max}= 0.24 g** is considered in the present analysis.

Preliminary assessment of liquefaction potential of foundation strata is made by simplified approach proposed by IS: 1893 (part-1)-2016-(RA: 2021) from the data obtained in Standard Penetration Test.

In this method, cyclic shear stress likely to be induced in the foundation strata by Design Basis Earthquake is first evaluated. Next threshold cyclic shear stress, which is good enough to cause liquefaction, is determined from SPT data and the empirical relations. Finally, comparison of these two stresses is used in the estimation of liquefaction susceptibility of the foundation strata.

Cyclic Stress Ratio (CSR):

The equivalent average of shear stress likely to be induced in the foundation material due to an earthquake is calculated by using the equations

Cyclic Resistance Ratio (CRR):

It expresses capacity of soil to resist liquefaction. CRR is determined using correlation between corrected blow count $(N_1)_{60}$ and CRR for earthquake of magnitude 7.5. $(N_1)_{60}$ is the SPT blow count corrected to an effective overburden pressure of 100 kPa and to hammer energy efficiency of 60 %.

Following variable have been adopted in calculation of N_{60} (SPT value for 60% efficiency)

Energy correction to SPT values:

C_{60} = 1.00 (energy efficiency factor)

Design Earthquake Base:

Earthquake zone	= IV
Magnitude of earthquake	= 7
Seismic Zone factor	= 0.24

Status of Liquefaction:

The value of CSR and CRR are computed at different depth and then the ratio of CRR to CSR to get the factor of safety towards the susceptibility of the stratum towards liquefaction potential.

If factor of safety:

< 1.00 : Stratum is to be considered as liquefiable

> 1.20 : Non-Liquefiable

The detailed calculations of liquefaction, have been reported in **Table-7** of **Appendix-I.**

11. RECOMMENDATIONS:

Keeping in mind, the field test results, laboratory test results and IS codes of practice the following recommendations are hereby made:

11.1. **Bored Cast-In-Situ RCC Piles** of diameter 1000 and 1200 mm have been adopted for SBC computations of foundation for Viaduct.

11.2. **Cut off length** of piles have been considered as 2.50 m from the existing ground level for the purpose of computation of SBC.

11.3. **Pile length** recommended in the table below, shall be measured **after the cut-off depth.**

11.4. **Allowable load carrying capacity** of pile corresponding to the length and diameter of pile shall be read from the tables below:

11.4.1. For Pile diameter = 1000 mm

Borehole No.	End bearing Strata type	Pile Length (m)	Rock Socket length (m)	Load carrying Capacity (kN)		
				Compression	Uplift	Lateral Concrete M35*
P138B	Soil	25.00	-	2850	1500	165
		27.50		2150	1700	
		30.00		3300	1900	
		32.50		3450	2100	
		35.00		3600	2300	
P143B	Rock	18.00	3.50	4580	3250	315

***** *Indicates Grade of Concrete*

11.4.2. For Pile diameter = 1200 mm

Borehole No.	End bearing Strata type	Pile Length (m)	Rock Socket length (m)	Load carrying Capacity (kN)		
				Compression	Uplift	Lateral Concrete M35*
P138B	Soil	25.00	-	4400	2000	235
		27.50		2900	2250	
		30.00		4950	2550	

Borehole No.	End bearing Strata type	Pile Length (m)	Rock Socket length (m)	Load carrying Capacity (kN)		
				Compression	Uplift	Lateral Concrete M35*
		32.50		5250	2850	
		35.00		5350	3150	
P143B	Rock	18.70	4.20	6600	4750	435

***** *Indicates Grade of Concrete*

11.5. Liquefaction Potential: Both the bore holes have been analysed for Liquefaction potential as per IS: 1893 (part-1)-2016-(RA: 2021) with Seismic Zone IV, earthquake intensity of 7.0 on Richter scale and critical ground water table at existing ground level. The details of liquefaction potential in various boreholes corresponding to depths has been mentioned in the table below:

Bore No.	Liquefiable depth zone (meter)
P138B	Top 3.00
P143B	None

11.6. Type of cement to be used: Since, the effect of harmful chemical at the site are found within the permissible limits. So, Ordinary Portland Cement or Portland Pozzolana Cement may be used for all civil constructions.

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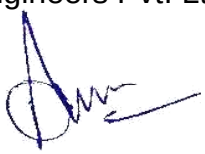

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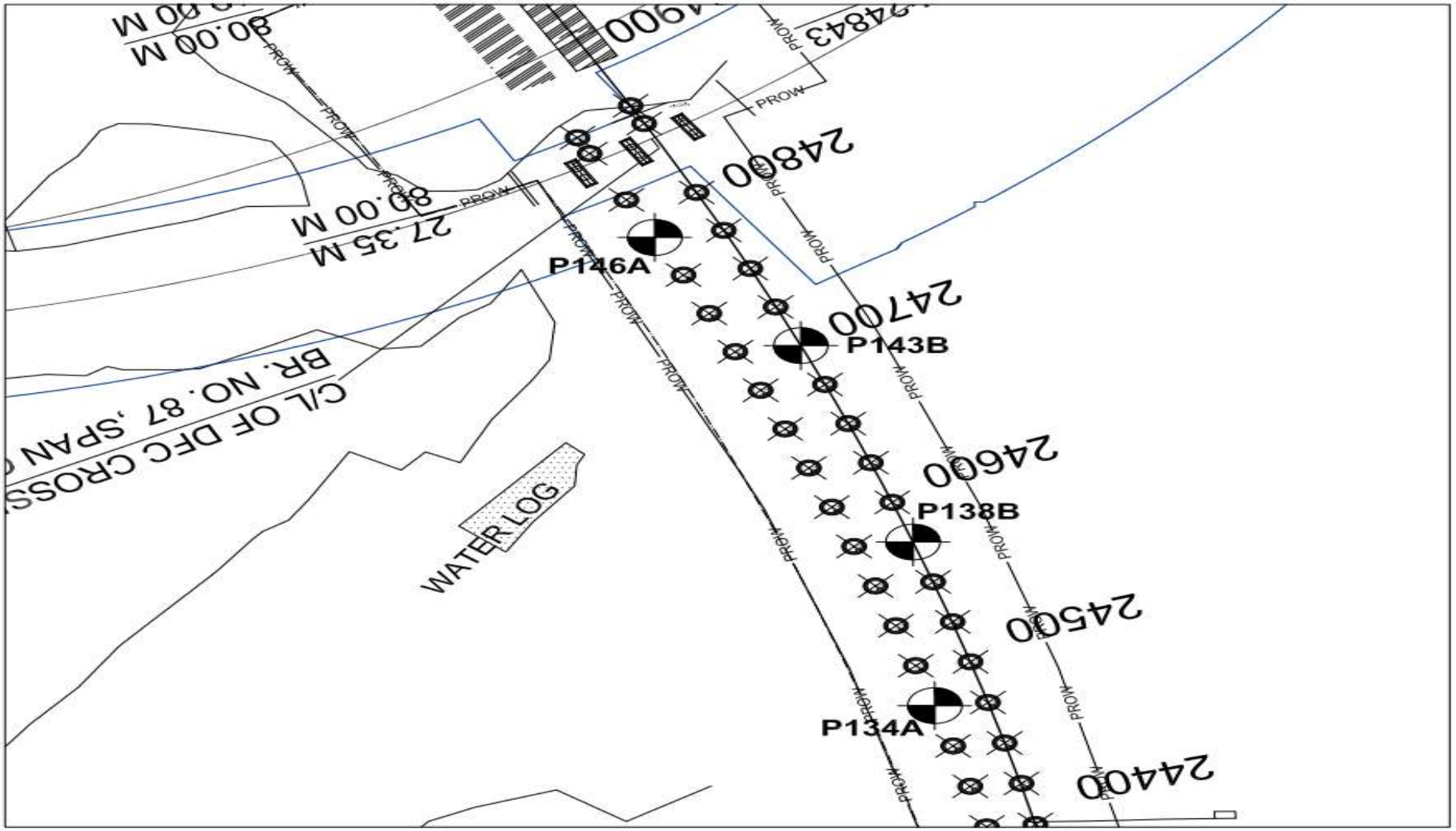
Managing Director

APPENDIX-A
TEST LOCATION PLAN



APPENDIX "B"
TABLE 1: SUMMARY OF TEST RESULTS

Bore No: P138B	**Ground Elevation: RL 209.246 m**	**Method of drilling: Percussion**	**Depth of Water: 18.00 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 26/11/2023**	**SPT Sampler: Standard**
Location / Chainage: 24530.463	**Casing Lowered: 21.00 m**	**Ending Date: 28/11/2023**	**Hammer type: Rope & pulley**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity (GPa)	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	SM	0	0	0	82	18	0	5.33	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	1.00	U	2	-	-	-	-	-	SM	0	1	0	81	18	0	4.61	1.69	1.62	Non-Plastic			2.61	DST	1.0	29.2	-	0.611	-	-	-	-												
	2.00	D	3	1	1	2	3	4.09	-	-	-	-	-	-	-	6.14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	3.00	D	4	1	2	12	14	17.19	-	-	-	-	-	-	-	7.41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	4.00	D	5	-	-	-	-	-	SM	0	0	0	87	13	0	12.15	1.84	1.64	Non-Plastic			-	RDST	0.0	29.6	-	-	-	-	-	-												
	5.00	D	6	4	7	10	17	17.78	SM	0	0	1	85	14	0	7.69	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	6.00	D	7	8	11	17	28	27.50	-	-	-	-	-	-	-	7.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	7.00	U	8	-	-	-	-	-	SM	0	0	0	83	17	0	13.23	1.95	1.72	Non-Plastic			2.60	DST	0.0	28.3	-	0.512	-	-	-	-	Silty Sands											
	8.00	D	9	9	13	20	33	28.96	-	-	-	-	-	-	-	22.24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	9.00	D	10	8	12	19	31	25.90	-	-	-	-	-	-	-	22.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	10.00	U	11	-	-	-	-	-	SM	0	0	0	78	22	0	16.70	1.82	1.56	Non-Plastic			2.62	DST	5.0	28.4	-	0.679	-	-	-	-												
	11.00	D	12	12	25	30	55	42.27	SM	1	0	0	66	33	0	20.63	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	12.00	D	13	15	29	34	63	46.59	-	-	-	-	-	-	-	9.14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	13.00	D	14	18	31	35	66	47.07	SM	0	1	2	60	37	0	12.32	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	14.50	D	15	17	23	28	51	34.41	-	-	-	-	-	-	-	20.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

APPENDIX "B"
TABLE 1: SUMMARY OF TEST RESULTS

Bore No: P138B	**Ground Elevation: RL 209.246 m**	**Method of drilling: Percussion**	**Depth of Water: 18.00 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 26/11/2023**	**SPT Sampler: Standard**
Location / Chainage: 24530.463	**Casing Lowered: 21.00 m**	**Ending Date: 28/11/2023**	**Hammer type: Rope & pulley**

FIELD TEST RESULT										LABORATORY TEST RESULT																																
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity (GPa)	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL										
	16.00	D	16	15	21	27	48	48.00	CL	3	3	2	13	69	10	15.49	-	-	30.0	20.5	9.5	-	-	-	-	-	-	-	-														
	17.50	D	17	13	24	25	49	49.00	-	-	-	-	-	-	-	16.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-														
	19.00	U	18	-	-	-	-	-	CL	2	1	3	11	72	11	20.17	2.07	1.72	31.5	21.5	10.0	2.68	UU	52.0	11.8	-	0.558	-	9	20	-	Inorganic clays of low plasticity												
	20.50	D	19	16	27	31	58	58.00	-	-	-	-	-	-	-	16.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-														
	22.00	D	20	17	29	36	65	25.62	SM	0	0	1	62	37	0	19.40	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-														
	23.50	D	21	15	31	38	69	26.32	-	-	-	-	-	-	-	20.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Silty Sands												
	25.00	D	22	19	33	40	73	26.99	SM	0	1	2	57	40	0	19.43	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-														
	26.50	D	23	21	44	57	R	-	-	-	-	-	-	-	-	18.86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-														
	28.00	D	24	24	50	61	R	-	CL-ML	3	1	4	20	64	8	19.19	-	-	28.0	21.5	6.5	2.67	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity												
	29.50	D	25	21	47	52	99	99.00	CL	3	2	2	16	68	9	20.26	-	-	29.0	21.5	7.5	-	-	-	-	-	-	-	-	-	-	Inorganic clays of low plasticity												
	31.00	D	26	23	46	54	R	-	SM	0	0	1	58	41	0	21.20	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-														
	32.50	D	27	20	41	50	91	29.39	-	-	-	-	-	-	-	21.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-														
	34.00	D	28	22	43	51	94	29.66	SM	0	1	1	56	42	0	20.29	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands												
	35.50	D	29	19	40	48	88	27.83	SM	0	0	1	54	45	0	20.48	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-														
	37.00	D	30	19	41	49	90	27.89	-	-	-	-	-	-	-	19.41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-														

APPENDIX "B"

TABLE 1: SUMMARY OF TEST RESULTS

Bore No: P138B	**Ground Elevation: RL 209.246 m**	**Method of drilling: Percussion**	**Depth of Water: 18.00 m**
Diameter of Bore Hole: 150 mm	**Bore Retained using: Casing**	**Starting Date: 26/11/2023**	**SPT Sampler: Standard**
Location / Chainage: 24530.463	**Casing Lowered: 21.00 m**	**Ending Date: 28/11/2023**	**Hammer type: Rope & pulley**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity (GPa)	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	38.50	D	31	24	44	50	94	28.39	SM	0	1	3	56	40	0	19.24	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	40.00	D	32	26	47	52	99	29.08	-	-	-	-	-	-	-	19.68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX "B"
TABLE 2: SUMMARY OF TEST RESULTS

Bore No: P143B	**Ground Elevation: RL 205.068 m**	**Method of drilling: Rotary**	**Depth of Water-table: 14.40 m**
Diameter of Bore Hole: 150/75 mm	**Bore Retained using: Casing**	**Starting Date: 19/09/2023**	**SPT Sampler: Standard**
Location / Chainage: 24661.464	**Casing Lowered: 12.00 m**	**Ending Date: 23/09/2023**	**Hammer type: Rope & pulley**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity (GPa)	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	0.50	D	1	-	-	-	-	-	SM	0	1	1	68	30	0	5.52	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											
	1.00	D	2	6	7	8	15	22.94	-	-	-	-	-	-	-	21.97	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	2.00	U	3	-	-	-	-	-	SM	0	0	0	87	13	0	23.01	2.07	1.68	Non-Plastic			2.63	DST	2.0	28.4	-	0.565	-	-	-	-												
	3.00	D	4	6	8	14	22	25.56	-	-	-	-	-	-	-	22.63	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	4.00	D	5	13	24	29	53	56.47	-	-	-	-	-	-	-	23.26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	5.00	D	6	18	32	38	70	69.56	SM	0	0	0	84	16	0	23.60	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-												
	6.00	D	7	11	30	33	63	59.10	-	-	-	-	-	-	-	16.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	7.00	D	8	16	38	40	78	69.26	-	-	-	-	-	-	-	22.30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	8.00	D	9	24	69	-	R	-	-	-	-	-	-	-	-	21.78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	9.00	D	10	17	31	43	74	59.80	-	-	-	-	-	-	-	18.89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	10.00	D	11	19	40	45	85	65.84	CL-ML	0	1	1	30	63	5	17.71	-	-	23.0	18.0	5.0	-	-	-	-	-	-	-	-	-	-	Inorganic Silty Clays of low plasticity											
	11.00	D	12	54	100	-	R	-	-	-	-	-	-	-	-	17.98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	11.30	C	13	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	Moderately weathered and poor-quality quartzite rock									57	47	2.58	2.69	0.02	0.30	10.82	124.98	0.31	9.00	-	3.90
	12.05	C	14	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	Highly weathered and very-poor quality quartzite rock									19	0	-	-	-	-	-	-	-	-	-	-
	12.80	D	15	8	9	20	29	20.16	SM	0	1	1	62	36	0	20.06	-	-	Non-Plastic			-	-	-	-	-	-	-	-	-	-	Silty Sands											

APPENDIX "B"
TABLE 2: SUMMARY OF TEST RESULTS

Bore No: P143B	Ground Elevation: RL 205.068 m	Method of drilling: Rotary	Depth of Water-table: 14.40 m
Diameter of Bore Hole: 150/75 mm	Bore Retained using: Casing	Starting Date: 19/09/2023	SPT Sampler: Standard
Location / Chainage: 24661.464	Casing Lowered: 12.00 m	Ending Date: 23/09/2023	Hammer type: Rope & pulley

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity (GPa)	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	14.00	D	16	10	12	25	37	24.62	-	-	-	-	-	-	-	21.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	15.50	D	17	36	50	52	R	-	-	-	-	-	-	-	-	20.62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	17.00	D	18	60	-	-	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
	17.05	C	19	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	Highly weathered and very-poor quality quartzite rock									17	0	-	2.62	-	0.48	-	-	-	-	-	-
	17.75	C	20	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	Moderately weathered and very-poor quality quartzite rock									53	19	-	-	-	-	14.19	79.18	-	-	-	3.20
	18.50	C	21	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-										61	16	2.69	2.70	0.02	0.10	9.87	-	0.18	9.00	-	3.70
	19.25	C	22	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	Highly weathered and very-poor quality quartzite rock									36	13	-	-	-	-	3.78	-	-	-	-	-
	20.00	C	23	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-										36	24	-	-	-	-	6.60	97.30	-	8.50	-	-
	20.75	C	24	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-										41	0	2.70	-	0.03	-	-	-	0.37	8.50	-	4.00
	21.50	C	25	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-										35	0	2.69	2.74	0.10	0.19	-	-	0.86	-	-	-
	22.25	C	26	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	Completely Weathered Rock Mass									0	0	-	-	-	-	-	-	-	-	-	-
	23.00	D	27	100	-	-	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	23.05	C	28	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-									0	0	-	-	-	-	-	-	-	-	-	-
	23.75	D	29	101	-	-	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	23.81	C	30	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-									0	0	-	-	-	-	-	-	-	-	-	-

APPENDIX "B"
TABLE 2: SUMMARY OF TEST RESULTS

Bore No: P143B	**Ground Elevation: RL 205.068 m**	**Method of drilling: Rotary**	**Depth of Water-table: 14.40 m**
Diameter of Bore Hole: 150/75 mm	**Bore Retained using: Casing**	**Starting Date: 19/09/2023**	**SPT Sampler: Standard**
Location / Chainage: 24661.464	**Casing Lowered: 12.00 m**	**Ending Date: 23/09/2023**	**Hammer type: Rope & pulley**

FIELD TEST RESULT										LABORATORY TEST RESULT																																	
				SPT Test Result						Grain Size Analysis						Index Property							Shear Strength Parameters			Consolidation Characteristic			Shrinkage			Test on Rock Specimen											
RL in Meter	Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT	N (Corrected)	Soil Classification	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt (%)	Clay (%)	Moisture Content (%)	Bulk Density (gm/cc)	Dry Density (gm/cc)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Specific Gravity	Type of Test	Cohesion (kN/m^2)	Angle of Friction	Compression Index	Initial Void Ratio	Pre-consolidation Pressure (Kg/cm^2)	Free Swell Index	Shrinkage Limit	Swell Pressure	Core Recovery %	R.Q.D %	Density (gm /cc)	Specific gravity	Moisture content (%)	Water absorption (%)	Point load Index	U.C.S (MPa)	Porosity	Hardness	Modulus of Elasticity (GPa)	Cerchar Abrasive Index
																							Classification of ROCK									Classification of SOIL											
	24.50	D	31	100	-	-	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
	24.54	C	32	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-									0	0	-	-	-	-	-	-	-	-	-	-
	25.25	D	33	102	-	-	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											

Notations: UU= Unconsolidated Undrained Tri-axial compression Test on Undisturbed Sample, DST=Direct Shear Test on Undisturbed samples, CU: Consolidated Undrained tri-axial compression test with measurement of pore water pressure, R=Refusal strata (SPT Value>=100), RUU, RCU & RDST indicates relevant test on remoulded samples, "-" indicates test not performed due to identical sample or irrelevant for the sample or not required, C= Rock Core sample, D= Disturbed sample, U= Undisturbed sample.

APPENDIX-B
TABLE 3: CHEMICAL TEST ON SOIL SAMPLES

BH No.	DEPTH (m)	SULPHATE CONTENT AS SO_3 (%)	CHLORIDE CONTENT (%)	pH VALUE
P143B	2.00	0.069	0.069	8.43

APPENDIX-B
TABLE 4: CHEMICAL TEST ON GROUND WATER SAMPLES

BH No.	SULPHATE CONTENT AS SO_3 (mg/l)	CHLORIDE CONTENT (mg/l)	pH VALUE
P143B	98.760	307.905	7.20

APPENDIX-B
TABLE 5: UCS TEST ON SOIL SAMPLES

BH No.	DEPTH (m)	UCS (kg/cm^2)
P138B	19.00	0.62

APPENDIX-C
PLOT 1: LITHOLOGICAL PROFILE-01

PROFILE SHEET IS TO BE AFFIX

APPENDIX-C
PLOT 2: LITHOLOGICAL PLOTS

BH-P138B-24530.463

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			0.50	D		-	-
			1.00	U		-	-
			2.00	D	3	-	-
			3.00	D	14	-	-
			4.00	D		-	-
			5.00	D	17	-	-
			6.00	D	28	-	-
			7.00	U		-	-
Silty Sands	SM		8.00	D	33	-	-
			9.00	D	31	-	-
			10.00	U		-	-
			11.00	D	55	-	-
			12.00	D	63	-	-
			13.00	D	66	-	-
			14.50	D	51	-	-
			16.00	D	48	-	-
Inorganic clays of low plasticity	CL	WATER LVL	17.50	D	49	-	-
			19.00	U		-	-
			20.00	D	58	-	-

BH-P138B-24530.463

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
Inorganic clays of low plasticity	CL		20.50	D	58	-	-
			22.00	D	65	-	-
			23.50	D	69	-	-
Silty Sands	SM		25.00	D	73	-	-
			26.50	D	101	-	-
Inorganic Silty Clays of low plasticity	CL-ML		28.00	D	111	-	-
			29.50	D	99	-	-
Inorganic clays of low plasticity	CL		31.00	D	100	-	-
			32.50	D	91	-	-
			34.00	D	94	-	-
Silty Sands	SM		35.50	D	88	-	-
			37.00	D	90	-	-
			38.50	D	94	-	-
			40.00	D	99	-	-

APPENDIX-C
PLOT 3: LITHOLOGICAL PLOTS

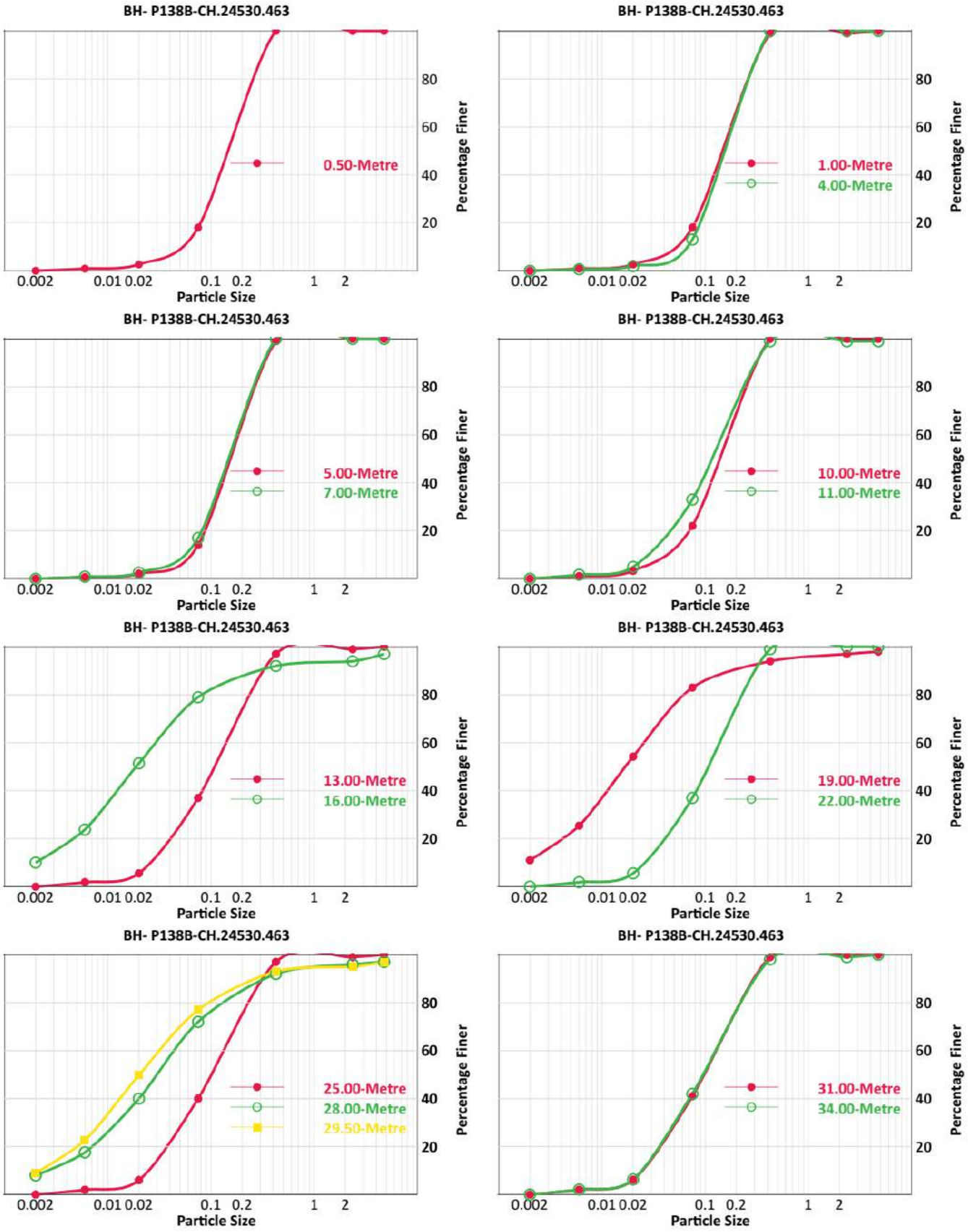
BH-P143B-24661.464

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			0.50	D		-	-
			1.00	D	15	-	-
			2.00	U		-	-
			3.00	D	22	-	-
			4.00	D	53	-	-
Silty Sands	SM		5.00	D	70	-	-
			6.00	D	63	-	-
			7.00	D	78	-	-
			8.00	D	R	-	-
			9.00	D	74	-	-
Inorganic Silty Clays of low plasticity	CL-ML		10.00	D	85	-	-
Moderately weathered and very poor quality Rock			11.00	D	R	-	-
			11.30	C		57	47
Highly weathered and very poor quality Rock mass			12.05	C		19	0
			12.80	D	29	-	-
		WATER LVL	14.00	D	37	-	-
Silty Sands	SM						
			15.50	D	R	-	-
Highly weathered and very poor quality Rock mass			17.00	D	R	17	0
			17.75	C		53	19
Moderately weathered and very poor quality Rock			18.50	C		61	16
Highly weathered and very poor quality Rock mass			19.25	C		36	13
			20.00	C		36	24

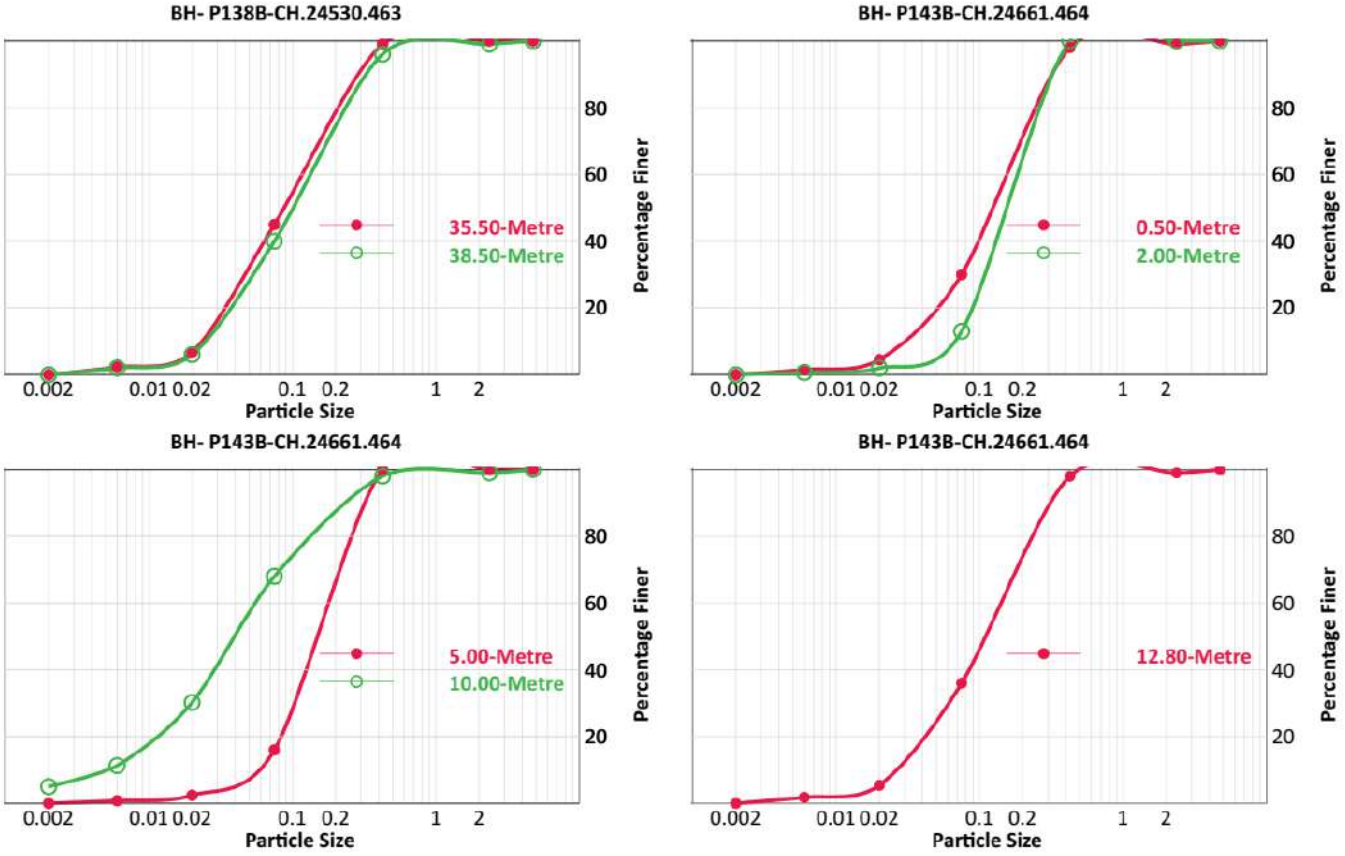
BH-P143B-24661.464

DESCRIPTION	I.S. GROUP	HATCH PATTERN	DEPTH	TYPE OF SAMPLE	OBSERVED SPT VALUE	CR	RQD
			20.00	C		36	24
Highly weathered and very poor quality Rock mass			20.75	C		41	0
			21.50	C		35	0
			22.25	C		0	0
Compeletly Weathered Rock Mass			23.00	D	R	0	0
			23.75	D	R	0	0
			24.50	D	R	0	0
			25.25	D	R	-	-

APPENDIX-D
PLOT 1: GRAIN SIZE DISTRIBUTION PLOTS

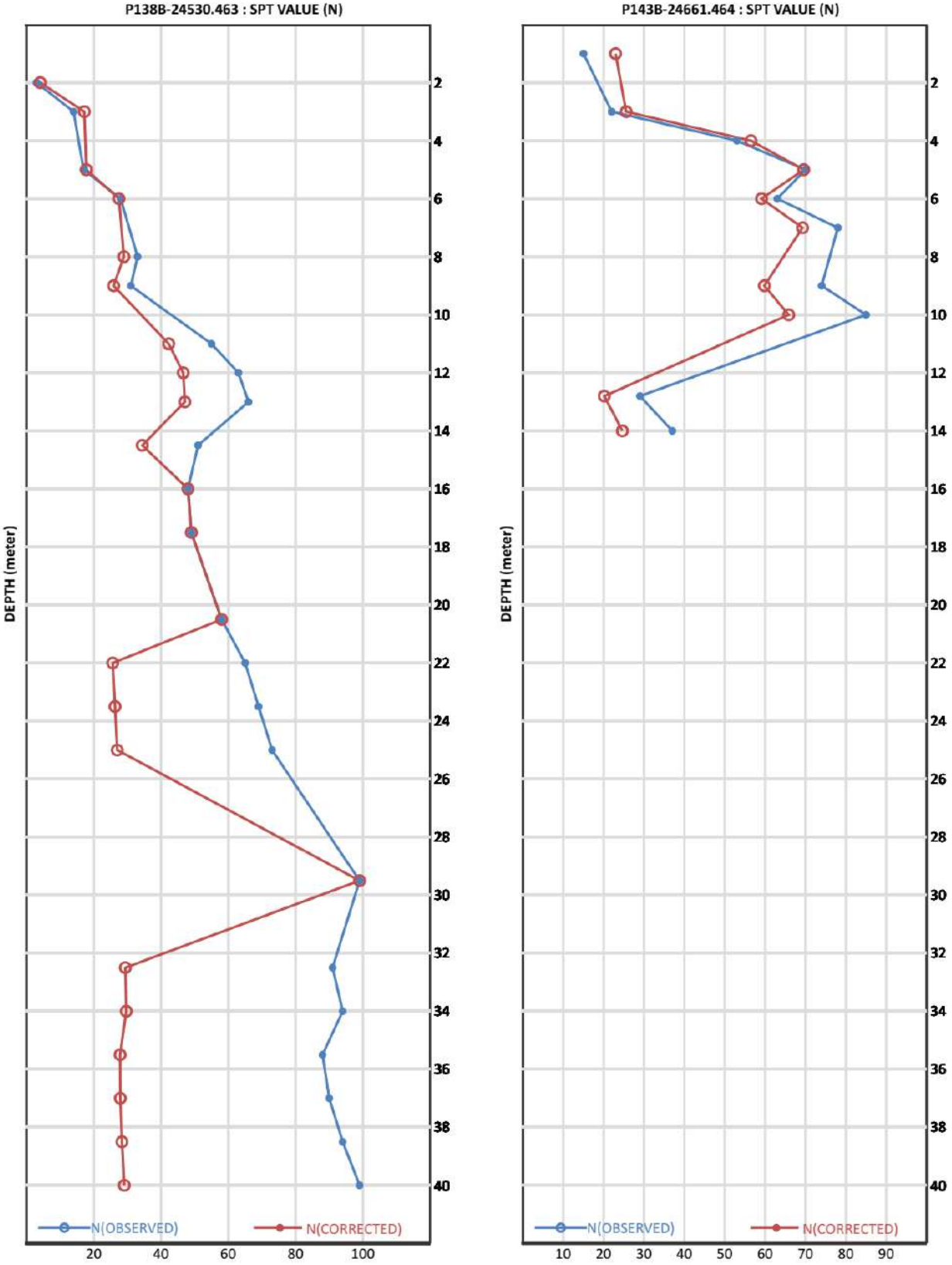


APPENDIX-D
PLOT 2: GRAIN SIZE DISTRIBUTION PLOTS

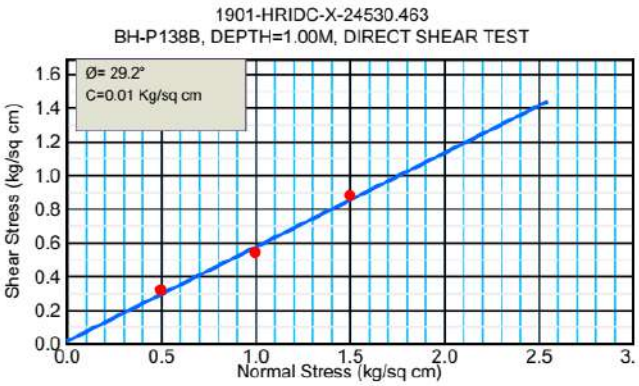


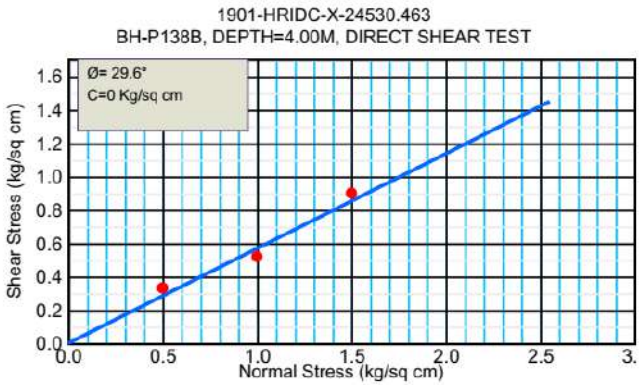
APPENDIX-E

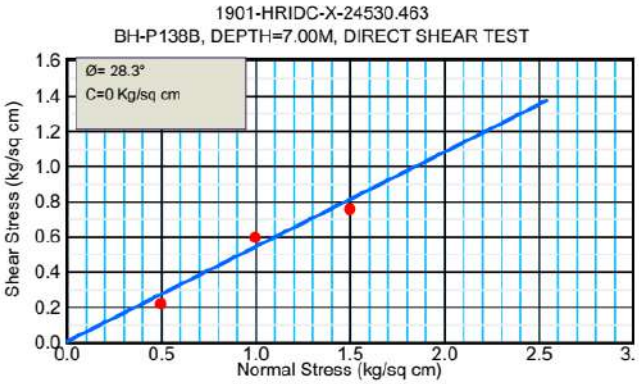
PLOT 1: RECORDED SPT Vs CORRECTED SPT (P138B & P143B)

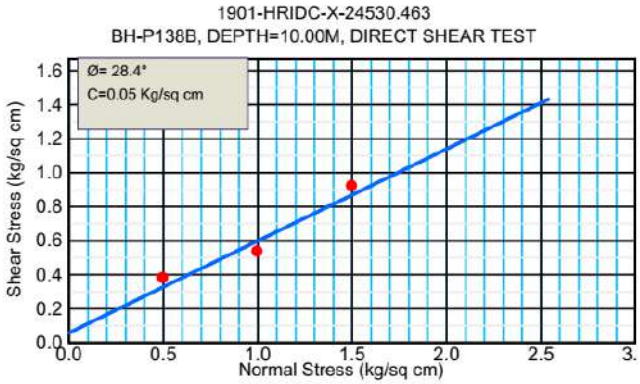


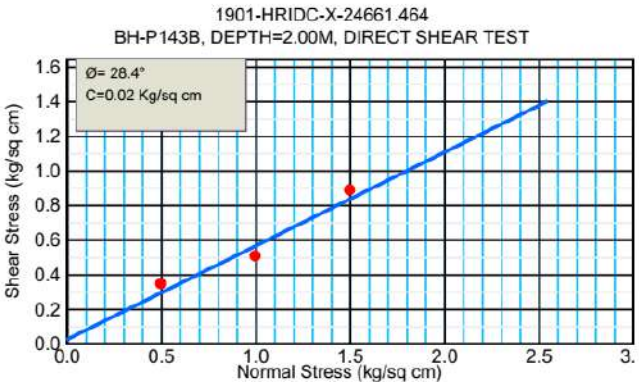
APPENDIX-F
GRAPH 1: DST GRAPH



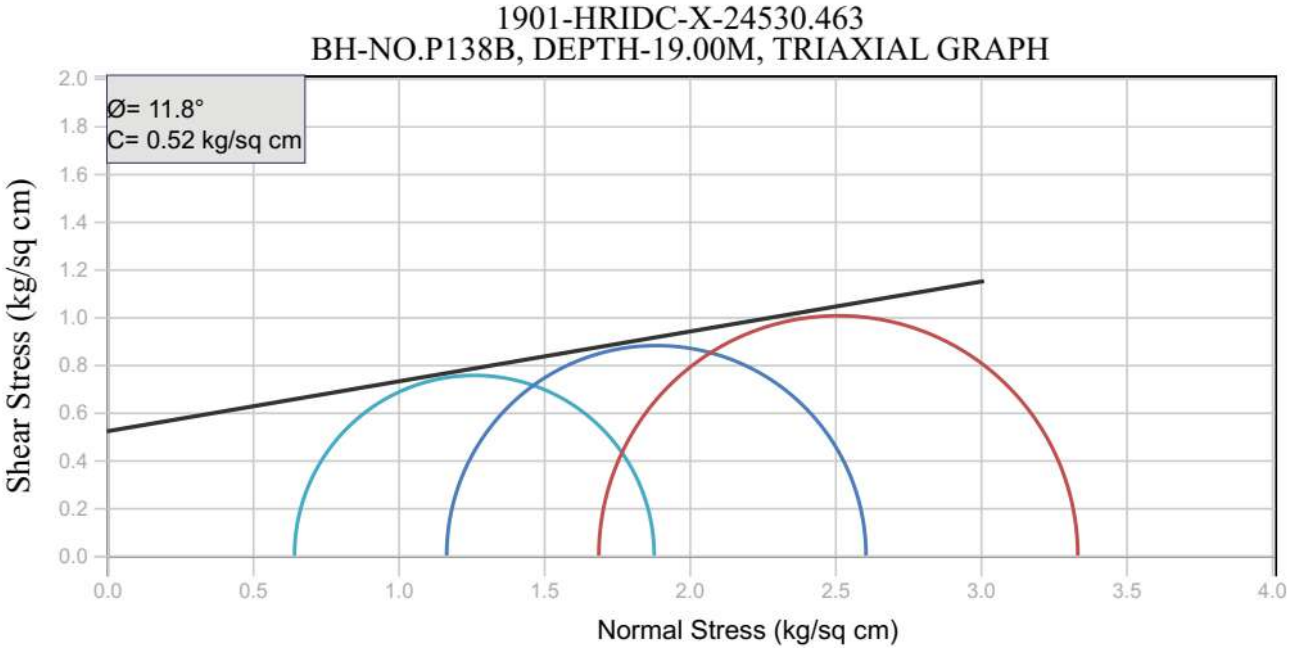




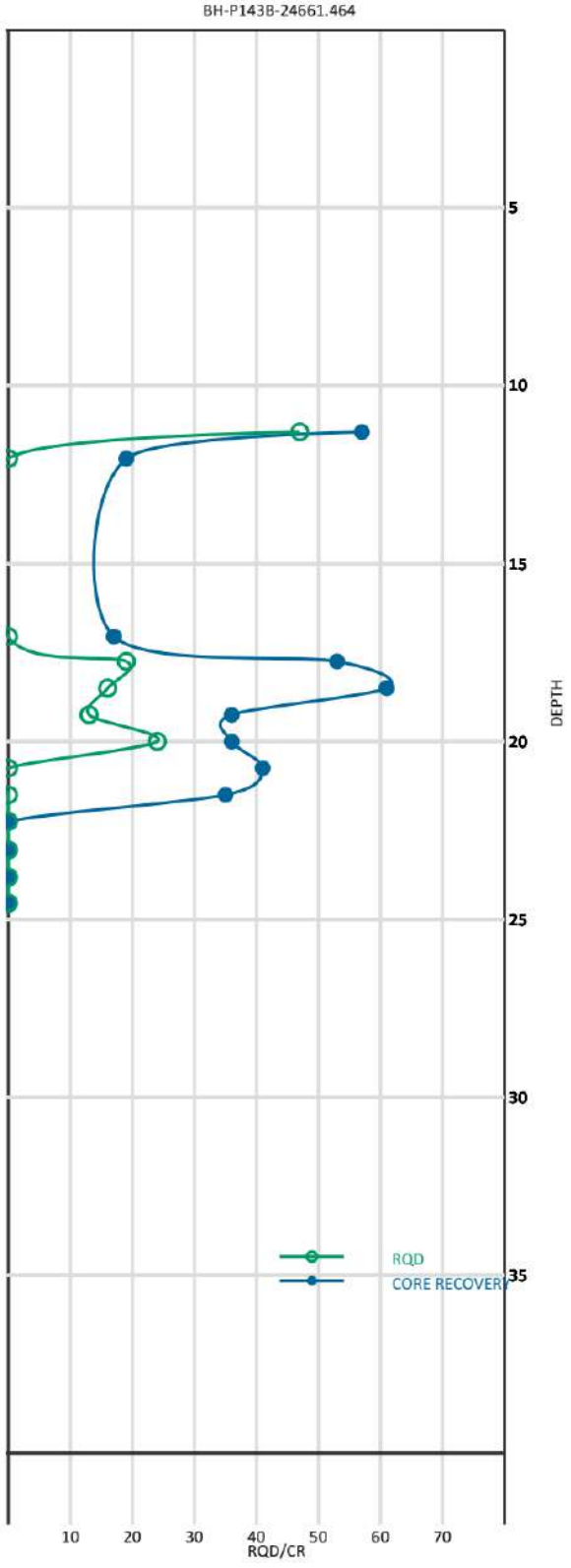




APPENDIX-G
GRAPH 1: UU GRAPH



APPENDIX-H
PLOT 1: CR Vs RQD PLOTS



APPENDIX-I
TABLE 1: RMR COMPUTATIONS

Bore Hole No.	Depth (m)	UCS Rating	RQD Rating	Spacing of Joint Rating	Condition of discontinuity	Ground Water Rating	Strike & Dip Orientation of Joint	RMR Value	Rock Class	Description
BH-P143B	11.30-12.05	12	8	10	20	7	-2	55	III	Fair
BH-P143B	12.05-12.80	12	3	8	20	7	-2	48	III	Fair
BH-P143B	17.05-17.75	7	3	5	20	0	-2	33	IV	Poor
BH-P143B	17.75-18.50	7	3	8	20	0	-2	36	IV	Poor
BH-P143B	18.50-19.25	7	3	8	20	0	-2	36	IV	Poor
BH-P143B	19.25-20.00	7	3	8	20	0	-2	36	IV	Poor
BH-P143B	20.00-20.75	7	3	8	20	0	-2	36	IV	Poor
BH-P143B	20.75-21.50	7	3	8	20	0	-2	36	IV	Poor
BH-P143B	21.50-22.25	7	3	8	20	0	-2	36	IV	Poor

APPENDIX-I

TABLE 2: VERTICAL PILE LOAD CAPACITY IN ROCK (IRC:78-2014/Method-2)

Bore No.	Dia of pile shaft (m)	Depth of overburden soil over rock bed (m)	Extrapolated SPT Value below rock socket	Extrapolated SPT Value along rock socket	Cut off length (m)	Socket length of pile (m)	Overall length of pile below cut-off length (m)	Shear strength of rock below pile tip (kN/m^2)	Average shear strength of rock in the socketed length of pile (kN/m^2)	Pile capacity in end bearing in rock (kN)	Pile load capacity due to shaft friction in rock (kN)	Self-weight of pile (kN)	Pile load capacity in compression (kN)	Pile load capacity in uplift (kN)
	B	**D**	**N_b**	**N_a**	**l**	**L_c**	**l**	**C_{ub}**	**C_{us}**	**Q_b**	**Q_f**	**W_s**	**Q_a**	**Q_t**
P143B	1.00	17.00	100	175	2.50	3.5	18.00	700	1600	1649	2932	353	4581	3286
P143B	1.20	17.00	100	175	2.50	4.2	18.70	700	1600	2375	4222	529	6597	4751

APPENDIX-I

TABLE 3: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m | Factor of Safety in Compression: 2.5 | Area of Pile: 0.79 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
BORE NO: P138B, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	16.95	6.95	19.11	1.57	29.6	29.6	1.0	17.06	0	0	1.0	0.0	0	3.0	29.2	0	8.39	19.46	20.56	20.9	386.5	386.5	5.9	5.9	**154.61**	**1.96**
3.00	5.00	4.00	2.00	2.50	18.39	8.39	29.24	6.29	29.2	29.2	1.0	102.72	102.72	0	1.0	0.0	0.00	5.0	29.6	0	8.39	20.36	21.48	37.6	672.7	775.4	29.5	132.2	**310.18**	**44.06**
5.00	6.00	5.50	1.00	3.50	18.39	8.39	41.83	3.14	29.6	29.6	1.0	74.67	177.39	0	1.0	0.0	0.00	6.0	28.3	0	9.48	17.43	18.48	46.0	699.1	876.5	41.3	218.6	**350.61**	**72.88**
6.00	8.00	7.00	2.00	5.50	19.48	9.48	55.50	6.29	28.3	28.3	1.0	187.84	365.23	0	1.0	0.0	0.00	8.0	28.3	0	9.48	17.43	18.48	65.0	958.8	1324.0	64.8	430.1	**529.61**	**143.35**
8.00	9.00	8.50	1.00	6.50	19.48	9.48	69.72	3.14	28.3	28.3	1.0	117.98	483.22	0	1.0	0.0	0.00	9.0	28.4	5	8.21	17.66	18.71	74.5	1128.7	1611.9	76.6	559.8	**644.76**	**186.61**
9.00	11.00	10.00	2.00	8.50	18.21	8.21	82.67	6.29	28.4	28.4	1.0	280.97	764.19	5	1.0	31.4	31.43	11.0	28.4	5	8.21	17.66	18.71	90.9	1356.5	2152.1	100.2	895.8	**860.84**	**298.60**
11.00	12.00	11.50	1.00	9.50	18.21	8.21	94.99	3.14	28.4	28.4	1.0	161.41	925.60	5	1.0	15.7	47.14	12.0	27.9	0	8.21	16.53	17.56	99.1	1343.7	2316.4	112.0	1084.7	**926.56**	**361.57**
12.00	13.00	12.50	1.00	10.50	18.21	8.21	103.20	3.14	27.9	27.9	1.0	171.72	1097.32	0	1.0	0.0	47.14	13.0	28.0	0	8.21	16.76	17.79	107.3	1470.0	2614.5	123.8	1268.2	**1045.79**	**422.74**
13.00	14.50	13.75	1.50	12.00	18.21	8.21	113.46	4.71	28.0	28.0	1.0	284.40	1381.72	0	1.0	0.0	47.14	14.5	28.0	0	10.67	16.76	17.79	119.6	1649.3	3078.2	141.4	1570.3	**1231.28**	**523.43**
14.50	16.00	15.25	1.50	13.50	20.67	10.67	113.46	4.71	28.0	28.0	1.0	284.40	1666.11	0	1.0	0.0	47.14	16.0	11.8	52	10.67	3.00	1.73	119.6	656.9	2370.1	159.1	1872.4	**948.05**	**624.12**
16.00	17.50	16.75	1.50	15.00	20.67	10.67	113.46	4.71	11.8	11.8	1.0	111.74	1777.85	52	1.0	245.1	292.29	17.5	11.8	52	10.67	3.00	1.73	119.6	656.9	2727.0	176.8	2246.9	**1090.80**	**748.97**
17.50	20.50	19.00	3.00	18.00	20.67	10.67	113.46	9.43	11.8	11.8	1.0	223.48	2001.33	52	1.0	490.3	782.57	20.5	11.8	52	10.67	3.00	1.73	119.6	656.9	3440.8	212.1	2996.0	**1376.31**	**998.68**
20.50	22.00	21.25	1.50	19.50	20.67	10.67	113.46	4.71	11.8	11.8	1.0	111.74	2113.07	52	1.0	245.1	1027.71	22.0	27.6	0	10.67	15.85	16.87	119.6	1560.8	4701.6	229.8	3370.6	**1880.64**	**1123.54**
22.00	23.50	22.75	1.50	21.00	20.67	10.67	113.46	4.71	27.6	27.6	1.0	279.62	2392.70	0	1.0	0.0	1027.71	23.5	27.8	0	9.23	16.31	17.33	119.6	1595.3	5015.7	247.5	3667.9	**2006.27**	**1222.64**
23.50	25.00	24.25	1.50	22.50	19.23	9.23	113.46	4.71	27.8	27.8	1.0	282.01	2674.70	0	1.0	0.0	1027.71	25.0	28.1	0	9.11	16.98	18.02	119.6	1660.4	5362.8	265.2	3967.6	**2145.14**	**1322.53**
25.00	26.50	25.75	1.50	24.00	19.11	9.11	113.46	4.71	28.1	28.1	1.0	285.59	2960.30	0	1.0	0.0	1027.71	26.5	31.8	0	9.02	30.33	31.63	119.6	2962.3	6950.3	282.9	4270.9	**2780.12**	**1423.62**
26.50	27.50	27.00	1.00	25.00	19.02	9.02	113.46	3.14	31.8	31.8	1.1	240.99	3201.28	0	1.0	0.0	1027.71	27.5	31.8	0	9.02	30.33	31.63	119.6	2962.3	7191.3	294.6	4523.6	**2876.52**	**1507.88**

APPENDIX-I

TABLE 3: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1000 mm)

Dia. Of Pile: 1.00 m
Critical water table: 0.00 m
Factor of Safety in Compression: 2.5
Factor of Safety in Tension: 3.0
Area of Pile: 0.79 m^2

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
27.50	28.00	27.75	0.50	25.50	19.02	9.02	113.46	1.57	31.8	31.8	1.1	120.49	3321.78	0	1.0	0.0	1027.71	28.0	14.0	42	9.02	3.65	2.36	119.6	648.4	4997.9	300.5	4650.0	**1999.16**	**1550.01**
28.00	29.50	28.75	1.50	27.00	19.02	9.02	113.46	4.71	14.0	14.0	1.0	133.36	3455.14	42	1.0	198.0	1225.71	29.5	11.5	45	9.24	2.91	1.65	119.6	597.8	5278.6	318.2	4999.1	**2111.45**	**1666.36**
29.50	30.00	29.75	0.50	27.50	19.24	9.24	113.46	1.57	11.5	11.5	1.0	36.27	3491.41	45	1.0	70.7	1296.43	30.0	11.5	45	9.24	2.91	1.65	119.6	597.8	5385.6	324.1	5111.9	**2154.25**	**1703.98**
30.00	31.00	30.50	1.00	28.50	19.24	9.24	113.46	3.14	11.5	11.5	1.0	72.55	3563.96	45	1.0	141.4	1437.86	31.0	31.6	0	9.02	29.32	30.60	119.6	2864.0	7865.8	335.9	5337.7	**3146.31**	**1779.24**
31.00	32.50	31.75	1.50	30.00	19.02	9.02	113.46	4.71	31.6	31.6	1.1	355.38	3919.34	0	1.0	0.0	1437.86	32.5	31.6	0	9.40	29.32	30.60	119.6	2868.5	8225.7	353.6	5710.8	**3290.29**	**1903.59**
32.50	34.00	33.25	1.50	31.50	19.40	9.40	113.46	4.71	31.6	31.6	1.1	355.38	4274.72	0	1.0	0.0	1437.86	34.0	31.4	0	9.25	28.31	29.58	119.6	2768.3	8480.9	371.3	6083.8	**3392.36**	**2027.94**
34.00	35.00	34.50	1.00	32.50	19.25	9.25	113.46	3.14	31.4	31.4	1.1	232.89	4507.61	0	1.0	0.0	1437.86	35.0	31.4	0	9.25	28.31	29.58	119.6	2768.3	8713.8	383.0	6328.5	**3485.52**	**2109.50**
35.00	35.50	35.25	0.50	33.00	19.25	9.25	113.46	1.57	31.4	31.4	1.1	116.45	4624.06	0	1.0	0.0	1437.86	35.5	30.8	0	9.28	25.29	26.50	119.6	2473.4	8535.3	388.9	6450.8	**3414.13**	**2150.28**
35.50	37.00	36.25	1.50	34.50	19.28	9.28	113.46	4.71	30.8	30.8	1.0	331.60	4955.66	0	1.0	0.0	1437.86	37.0	30.8	0	9.11	25.29	26.50	119.6	2471.6	8865.1	406.6	6800.1	**3546.06**	**2266.71**
37.00	37.50	37.25	0.50	35.00	19.11	9.11	113.46	1.57	30.8	30.8	1.0	110.53	5066.19	0	1.0	0.0	1437.86	37.5	30.8	0	9.11	25.29	26.50	119.6	2471.6	8975.7	412.5	6916.5	**3590.27**	**2305.52**
37.50	38.50	38.00	1.00	36.00	19.11	9.11	113.46	3.14	30.8	30.8	1.0	221.07	5287.26	0	1.0	0.0	1437.86	38.5	31.8	0	9.08	30.33	31.63	119.6	2963.0	9688.2	424.3	7149.4	**3875.26**	**2383.13**
38.50	40.00	39.25	1.50	37.50	19.08	9.08	113.46	4.71	31.8	31.8	1.1	361.48	5648.74	0	1.0	0.0	1437.86	40.0	31.8	0	10.49	30.33	31.63	119.6	2980.6	10067.2	442.0	7528.6	**4026.86**	**2509.52**

APPENDIX-I

TABLE 4: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)										Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)												
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
BORE NO: P138B, CUT OFF LENGTH: 2.50 m, Nc= 9																														
2.50	3.00	2.75	0.50	0.50	16.95	6.95	19.11	1.89	29.6	29.6	1.0	20.47	0	0	1.0	0.0	0	3.0	29.2	0	8.39	19.46	20.56	20.9	576.1	576.1	8.5	8.5	**230.44**	**2.83**
3.00	5.00	4.00	2.00	2.50	18.39	8.39	29.24	7.54	29.2	29.2	1.0	123.26	123.26	0	1.0	0.0	0.00	5.0	29.6	0	8.39	20.36	21.48	37.6	989.1	1112.4	42.4	165.7	**444.95**	**55.23**
5.00	6.00	5.50	1.00	3.50	18.39	8.39	41.83	3.77	29.6	29.6	1.0	89.61	212.87	0	1.0	0.0	0.00	6.0	28.3	0	9.48	17.43	18.48	46.0	1026.6	1239.4	59.4	272.3	**495.78**	**90.76**
6.00	8.00	7.00	2.00	5.50	19.48	9.48	55.50	7.54	28.3	28.3	1.0	225.41	438.28	0	1.0	0.0	0.00	8.0	28.3	0	9.48	17.43	18.48	65.0	1400.5	1838.8	93.3	531.6	**735.51**	**177.21**
8.00	9.00	8.50	1.00	6.50	19.48	9.48	69.72	3.77	28.3	28.3	1.0	141.58	579.86	0	1.0	0.0	0.00	9.0	28.4	5	8.21	17.66	18.71	74.5	1642.7	2222.6	110.3	690.2	**889.03**	**230.06**
9.00	11.00	10.00	2.00	8.50	18.21	8.21	82.67	7.54	28.4	28.4	1.0	337.16	917.02	5	1.0	37.7	37.71	11.0	28.4	5	8.21	17.66	18.71	90.9	1970.7	2925.5	144.3	1099.0	**1170.19**	**366.33**
11.00	12.00	11.50	1.00	9.50	18.21	8.21	94.99	3.77	28.4	28.4	1.0	193.69	1110.72	5	1.0	18.9	56.57	12.0	27.9	0	8.21	16.53	17.56	99.1	1951.2	3118.5	161.2	1328.5	**1247.38**	**442.84**
12.00	13.00	12.50	1.00	10.50	18.21	8.21	103.20	3.77	27.9	27.9	1.0	206.07	1316.78	0	1.0	0.0	56.57	13.0	28.0	0	8.21	16.76	17.79	107.3	2133.3	3506.7	178.2	1551.6	**1402.68**	**517.18**
13.00	14.50	13.75	1.50	12.00	18.21	8.21	113.46	5.66	28.0	28.0	1.0	341.28	1658.06	0	1.0	0.0	56.57	14.5	28.0	0	10.67	16.76	17.79	119.6	2396.5	4111.2	203.7	1918.3	**1644.46**	**639.43**
14.50	16.00	15.25	1.50	13.50	20.67	10.67	127.62	5.66	28.0	28.0	1.0	383.87	2041.93	0	1.0	0.0	56.57	16.0	11.8	52	10.67	3.00	1.73	135.6	1002.3	3100.8	229.1	2327.6	**1240.31**	**775.87**
16.00	17.50	16.75	1.50	15.00	20.67	10.67	143.62	5.66	11.8	11.8	1.0	169.74	2211.67	52	1.0	294.2	350.74	17.5	11.8	52	10.67	3.00	1.73	151.6	1056.6	3619.0	254.6	2817.0	**1447.60**	**938.99**
17.50	20.50	19.00	3.00	18.00	20.67	10.67	143.62	11.31	11.8	11.8	1.0	339.48	2551.14	52	1.0	588.3	939.09	20.5	11.8	52	10.67	3.00	1.73	151.6	1056.6	4546.8	305.5	3795.7	**1818.73**	**1265.24**
20.50	22.00	21.25	1.50	19.50	20.67	10.67	143.62	5.66	11.8	11.8	1.0	169.74	2720.88	52	1.0	294.2	1233.26	22.0	27.6	0	10.67	15.85	16.87	151.6	2842.2	6796.3	330.9	4285.1	**2718.52**	**1428.36**
22.00	23.50	22.75	1.50	21.00	20.67	10.67	143.62	5.66	27.6	27.6	1.0	424.76	3145.64	0	1.0	0.0	1233.26	23.5	27.8	0	9.23	16.31	17.33	151.6	2905.8	7284.7	356.4	4735.3	**2913.89**	**1578.43**
23.50	25.00	24.25	1.50	22.50	19.23	9.23	143.62	5.66	27.8	27.8	1.0	428.38	3574.02	0	1.0	0.0	1233.26	25.0	28.1	0	9.11	16.98	18.02	151.6	3024.6	7831.9	381.9	5189.1	**3132.74**	**1729.71**
25.00	26.50	25.75	1.50	24.00	19.11	9.11	143.62	5.66	28.1	28.1	1.0	433.83	4007.85	0	1.0	0.0	1233.26	26.5	31.8	0	9.02	30.33	31.63	151.6	5396.3	10637.4	407.3	5648.4	**4254.97**	**1882.81**
26.50	27.50	27.00	1.00	25.00	19.02	9.02	143.62	3.77	31.8	31.8	1.1	366.07	4373.92	0	1.0	0.0	1233.26	27.5	31.8	0	9.02	30.33	31.63	151.6	5396.3	11003.5	424.3	6031.5	**4401.40**	**2010.49**

APPENDIX-I

TABLE 4: COMPUTATION OF VERTICAL PILE LOAD CAPACITY (Dia.=1200 mm)

Dia. Of Pile: 1.20 m | Factor of Safety in Compression: 2.5 | Area of Pile: 1.13 m^2

Critical water table: 0.00 m | Factor of Safety in Tension: 3.0

Layers (m)									Ultimate Shaft Friction Quf = ΣKi.Pdi.tan δ.Asi					Ultimate Shaft Cohesion Quc= Σα.c.Asi				Ultimate Bearing Resistance = Ap *(c.Nc +q.Nq+0.5. γ.B. Nγ)											
From	To	Mean depth (m)	Layer Thickness (m)	Length of Pile (m)	Bulk Unit Weight (kN/m^3)	Eff. Unit Weight (kN/m^3)	Effective Overburden at mid depth	Area of Pile Stem Asi (m^2)	ϕ	δ	Ki	Qi	∑Qi	c	α	α.c.Asi	∑Qi	Depth of Pile toe (m)	ϕ ' at pile toe	c at pile toe(kN/m2)	Eff. Unit Weight at pile toe (kN/m^3)	Nq	Nγ	q	Qb	Total Ultimate Load Capacity in Compression (kN)	Self-Weight of Pile (kN)	Total Ultimate load Capacity in Tension (kN)	Safe Load Capacity in Compression (kN)	Safe Load Capacity in Tension (kN)
27.50	28.00	27.75	0.50	25.50	19.02	9.02	143.62	1.89	31.8	31.8	1.1	183.04	4556.96	0	1.0	0.0	1233.26	28.0	14.0	42	9.02	3.65	2.36	151.6	1068.3	6858.5	432.8	6223.0	**2743.42**	**2074.33**
28.00	29.50	28.75	1.50	27.00	19.02	9.02	143.62	5.66	14.0	14.0	1.0	202.58	4759.54	42	1.0	237.6	1470.86	29.5	11.5	45	9.24	2.91	1.65	151.6	968.0	7198.4	458.2	6688.6	**2879.34**	**2229.54**
29.50	30.00	29.75	0.50	27.50	19.24	9.24	143.62	1.89	11.5	11.5	1.0	55.10	4814.64	45	1.0	84.9	1555.71	30.0	11.5	45	9.24	2.91	1.65	151.6	968.0	7338.3	466.7	6837.1	**2935.33**	**2279.02**
30.00	31.00	30.50	1.00	28.50	19.24	9.24	143.62	3.77	11.5	11.5	1.0	110.20	4924.84	45	1.0	169.7	1725.43	31.0	31.6	0	9.02	29.32	30.60	151.6	5217.2	11867.5	483.7	7134.0	**4746.99**	**2377.98**
31.00	32.50	31.75	1.50	30.00	19.02	9.02	143.62	5.66	31.6	31.6	1.1	539.84	5464.68	0	1.0	0.0	1725.43	32.5	31.6	0	9.40	29.32	30.60	151.6	5225.1	12415.2	509.1	7699.2	**4966.08**	**2566.42**
32.50	34.00	33.25	1.50	31.50	19.40	9.40	143.62	5.66	31.6	31.6	1.1	539.84	6004.51	0	1.0	0.0	1725.43	34.0	31.4	0	9.25	28.31	29.58	151.6	5042.7	12772.7	534.6	8264.5	**5109.06**	**2754.85**
34.00	35.00	34.50	1.00	32.50	19.25	9.25	143.62	3.77	31.4	31.4	1.1	353.78	6358.29	0	1.0	0.0	1725.43	35.0	31.4	0	9.25	28.31	29.58	151.6	5042.7	13126.4	551.6	8635.3	**5250.57**	**2878.43**
35.00	35.50	35.25	0.50	33.00	19.25	9.25	143.62	1.89	31.4	31.4	1.1	176.89	6535.18	0	1.0	0.0	1725.43	35.5	30.8	0	9.28	25.29	26.50	151.6	4505.4	12766.0	560.1	8820.7	**5106.41**	**2940.22**
35.50	37.00	36.25	1.50	34.50	19.28	9.28	143.62	5.66	30.8	30.8	1.0	503.72	7038.89	0	1.0	0.0	1725.43	37.0	30.8	0	9.11	25.29	26.50	151.6	4502.4	13266.7	585.5	9349.8	**5306.68**	**3116.61**
37.00	37.50	37.25	0.50	35.00	19.11	9.11	143.62	1.89	30.8	30.8	1.0	167.91	7206.80	0	1.0	0.0	1725.43	37.5	30.8	0	9.11	25.29	26.50	151.6	4502.4	13434.6	594.0	9526.2	**5373.84**	**3175.41**
37.50	38.50	38.00	1.00	36.00	19.11	9.11	143.62	3.77	30.8	30.8	1.0	335.81	7542.61	0	1.0	0.0	1725.43	38.5	31.8	0	9.08	30.33	31.63	151.6	5397.6	14665.7	611.0	9879.0	**5866.26**	**3293.00**
38.50	40.00	39.25	1.50	37.50	19.08	9.08	143.62	5.66	31.8	31.8	1.1	549.11	8091.72	0	1.0	0.0	1725.43	40.0	31.8	0	10.49	30.33	31.63	151.6	5427.9	15245.0	636.4	10453.6	**6098.01**	**3484.52**

APPENDIX-I

TABLE 5: COMPUTATION OF LATERAL PILE LOAD CAPACITY (Dia. 1000 mm)

Bore No.	Dia. of pile (m)	Cut-off length (m)	Scour depth (m)	Concrete Grade	Young's Modulus (kN/m^2)	Moment of Inertia (m^4)	Average SPT	Modulus of sub grade (k_1)	Stiffness Factor (T)	Cantilever length	L_1/T	L_f/T	Permissible deflection (m)	Length of Fixity (m)	Allowable Load capacity of pile(kN)
P138B	1.00	2.50	0.00	35	29580399	0.0491	22	3128	3.41	0.50	0.15	2.21	0.005	7.54	168
P143B	1.00	2.50	0.00	35	29580399	0.0491	52	6831	2.92	0.00	0.00	2.23	0.005	6.51	315

APPENDIX-I

TABLE 6: COMPUTATION OF LATERAL PILE LOAD CAPACITY (Dia. 1200 mm)

Bore No.	Dia. of pile (m)	Cut-off length (m)	Scour depth (m)	Concrete Grade	Young's Modulus (kN/m^2)	Moment of Inertia (m^4)	Average SPT	Modulus of sub grade (k_1)	Stiffness Factor (T)	Cantilever length	L_1/T	L_f/T	Permissible deflection (m)	Length of fixity (m)	Allowable Load capacity of pile(kN)
P138B	1.20	2.50	0.00	35	29580399	0.1018	23	3272	3.92	0.50	0.13	2.21	0.005	8.66	235
P143B	1.20	2.50	0.00	35	29580399	0.1018	56	7262	3.34	0.00	0.00	2.23	0.005	7.44	438

APPENDIX-I

TABLE 7: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
P138B	0.50	SM	18	3	8.45	5.00	3.45	1.00	0.381	1.70	5.10	3.23	1.07	8.67	0.10	1.00	0.121	0.318	Liquefiable
	2.00	SM	18	3	33.80	20.00	13.80	0.98	0.376	1.70	5.10	3.23	1.07	8.67	0.10	1.00	0.121	0.322	Liquefiable
	3.00	SM	18	14	50.70	30.00	20.70	0.98	0.373	1.70	23.80	3.23	1.07	28.61	0.39	1.00	0.469	1.256	Non-liquefiable
	5.00	SM	14	17	84.50	50.00	34.50	0.96	0.367	1.70	28.90	2.20	1.04	32.33	0.52	1.00	0.620	1.688	Non-liquefiable
	6.00	SM	14	28	110.40	60.00	50.40	0.95	0.326	1.41	39.44	2.20	1.04	43.32	0.52	1.00	0.620	1.902	Non-liquefiable
	8.00	SM	17	33	147.20	80.00	67.20	0.94	0.321	1.22	40.26	3.01	1.06	45.69	0.52	1.00	0.620	1.933	Non-liquefiable
	9.00	SM	17	31	175.50	90.00	85.50	0.93	0.298	1.08	33.53	3.01	1.06	38.55	0.52	1.00	0.620	2.080	Non-liquefiable
	11.00	SM	33	55	214.50	110.00	104.50	0.88	0.282	0.98	53.80	4.88	1.18	68.35	0.52	1.00	0.620	2.200	Non-liquefiable
	12.00	SM	33	63	218.40	120.00	98.40	0.85	0.296	1.01	63.51	4.88	1.18	79.80	0.52	1.00	0.620	2.099	Non-liquefiable
	13.00	SM	37	66	236.60	130.00	106.60	0.83	0.286	0.97	63.92	5.00	1.20	81.71	0.52	1.00	0.620	2.166	Non-liquefiable
	14.50	SM	37	51	263.90	145.00	118.90	0.79	0.272	0.92	46.77	5.00	1.20	61.13	0.52	1.00	0.620	2.277	Non-liquefiable
	16.00	CL	79	48	291.20	160.00	131.20	0.75	0.259	0.87	41.91	5.00	1.20	55.29	0.52	0.95	-	-	Non-liquefiable
	17.50	CL	79	49	318.50	175.00	143.50	0.71	0.245	0.83	40.90	5.00	1.20	54.09	0.52	0.93	-	-	Non-liquefiable
	20.50	CL	83	58	373.10	205.00	168.10	0.63	0.217	0.77	44.73	5.00	1.20	58.68	0.52	0.84	-	-	Non-liquefiable
	22.00	SM	37	65	455.40	220.00	235.40	0.59	0.177	0.65	42.37	5.00	1.20	55.84	0.52	0.75	0.464	2.619	Non-liquefiable
	23.50	SM	37	69	486.45	235.00	251.45	0.56	0.169	0.63	43.51	5.00	1.20	57.22	0.52	0.73	0.453	2.683	Non-liquefiable
	25.00	SM	40	73	517.50	250.00	267.50	0.56	0.169	0.61	44.63	5.00	1.20	58.56	0.52	0.72	0.444	2.627	Non-liquefiable
	26.50	SM	40	101	548.55	265.00	283.55	0.56	0.169	0.59	59.98	5.00	1.20	76.98	0.52	0.70	0.435	2.575	Non-liquefiable

APPENDIX-I

TABLE 7: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	28.00	CL-ML	72	111	579.60	280.00	299.60	0.56	0.169	0.58	64.13	5.00	1.20	81.95	0.52	0.69	-	-	Non-liquefiable
	29.50	CL	77	99	610.65	295.00	315.65	0.56	0.169	0.56	55.72	5.00	1.20	71.87	0.52	0.68	-	-	Non-liquefiable
	31.00	SM	41	100	641.70	310.00	331.70	0.56	0.169	0.55	54.91	5.00	1.20	70.89	0.52	0.67	0.413	2.442	Non-liquefiable
	32.50	SM	41	91	672.75	325.00	347.75	0.56	0.169	0.54	48.80	5.00	1.20	63.56	0.52	0.65	0.406	2.403	Non-liquefiable
	34.00	SM	42	94	703.80	340.00	363.80	0.56	0.169	0.52	49.28	5.00	1.20	64.14	0.52	0.64	0.400	2.366	Non-liquefiable
	35.50	SM	45	88	734.85	355.00	379.85	0.56	0.169	0.51	45.15	5.00	1.20	59.18	0.52	0.64	0.394	2.332	Non-liquefiable
	37.00	SM	45	90	765.90	370.00	395.90	0.56	0.169	0.50	45.23	5.00	1.20	59.28	0.52	0.63	0.388	2.299	Non-liquefiable
	38.50	SM	40	94	796.95	385.00	411.95	0.56	0.169	0.49	46.31	5.00	1.20	60.58	0.52	0.62	0.383	2.268	Non-liquefiable
	40.00	SM	40	99	828.00	400.00	428.00	0.56	0.169	0.48	47.85	5.00	1.20	62.42	0.52	0.61	0.378	2.239	Non-liquefiable
P143B	0.50	SM	30	15.00	10.35	5.00	5.35	1.00	0.301	1.70	25.50	4.71	1.15	34.14	0.52	1.00	0.620	2.063	Non-liquefiable
	1.00	SM	30	15.00	20.70	10.00	10.70	0.99	0.299	1.70	25.50	4.71	1.15	34.14	0.52	1.00	0.620	2.071	Non-liquefiable
	3.00	SM	13	22.00	62.10	30.00	32.10	0.98	0.295	1.70	37.40	1.89	1.04	40.67	0.52	1.00	0.620	2.103	Non-liquefiable
	4.00	SM	13	53.00	82.80	40.00	42.80	0.97	0.293	1.53	81.01	1.89	1.04	85.89	0.52	1.00	0.620	2.120	Non-liquefiable
	5.00	SM	16	70.00	103.50	50.00	53.50	0.96	0.290	1.37	95.70	2.77	1.05	103.64	0.52	1.00	0.620	2.137	Non-liquefiable
	6.00	SM	16	63.00	124.20	60.00	64.20	0.95	0.288	1.25	78.63	2.77	1.05	85.64	0.52	1.00	0.620	2.154	Non-liquefiable
	7.00	SM	16	78.00	144.90	70.00	74.90	0.95	0.286	1.16	90.13	2.77	1.05	97.76	0.52	1.00	0.620	2.171	Non-liquefiable
	8.00	SM	16	100.00	165.60	80.00	85.60	0.94	0.283	1.08	108.08	2.77	1.05	116.69	0.52	1.00	0.620	2.189	Non-liquefiable

APPENDIX-I

TABLE 7: LIQUEFACTION ANALYSIS

Magnitude of earthquake (Mw)=7 **Earthquake Zone= IV** **amax/g=0.24** **K(alpha)= 1.00** **MSF= 1.193** **Critical Water Table (m)=0.00 m**

BH No.	Depth (m)	Soil Type	Fines Content (FC), %	Corrected N Value N60	Total Overburden Stress (S_{v0}) kN/m^2	Pore Water Pressure (μ) kN/m^2	Effective Overburden Stress (S_{v0}'), kN/m^2	Stress Reduction Factor (r_d)	Cyclic Stress Ratio (CSR)	Overburden Correction factor (C_N)	Corrected SPT for Overburden $(N_1)_{60}$	Coefficient (α)	Coefficient (β)	Corrected SPT for fines content $(N_1)_{60CS}$	Cyclic Resistance Ratio ($CRR_{7.5}$)	K_σ	Cyclic Resistance Ratio (CRR)	Factor of Safety against Liquefaction (FS)	Status of Liquefaction
	9.00	SM	16	74.00	186.30	90.00	96.30	0.93	0.281	1.02	75.41	2.77	1.05	82.25	0.52	1.00	0.620	2.207	Non-liquefiable
	10.00	CL-ML	68	85.00	207.00	100.00	107.00	0.91	0.274	0.97	82.17	5.00	1.20	103.61	0.52	1.00	-	-	Non-liquefiable
	11.00	CL-ML	68	85.00	227.70	110.00	117.70	0.88	0.266	0.92	78.35	5.00	1.20	99.02	0.52	1.00	-	-	Non-liquefiable
	12.80	SM	36	29.00	264.96	128.00	136.96	0.83	0.251	0.85	24.78	5.00	1.20	34.74	0.52	1.00	0.620	2.469	Non-liquefiable
	14.00	SM	36	37.00	289.80	140.00	149.80	0.80	0.241	0.82	30.23	5.00	1.20	41.28	0.52	1.00	0.620	2.568	Non-liquefiable
	15.50	SM	36	100.00	320.85	155.00	165.85	0.76	0.229	0.78	77.65	5.00	1.20	98.18	0.52	0.87	0.540	2.352	Non-liquefiable
	17.00	SM	36	100.00	351.90	170.00	181.90	0.72	0.217	0.74	74.15	5.00	1.20	93.97	0.52	0.84	0.521	2.397	Non-liquefiable

APPENDIX-J
SITE PHOTOGRAPHS

SPT at depth 6.00 m

UDS at depth 7.00 m

SPT sample at depth 22.00 m

APPENDIX-J
SITE PHOTOGRAPHS

SPT sample at depth 4.00 m

SPT sample at depth 10.00 m

Coring at depth 17.75 m

Coring at depth 20.00 m

APPENDIX-K
LABORATORY PHOTOGRAPHS

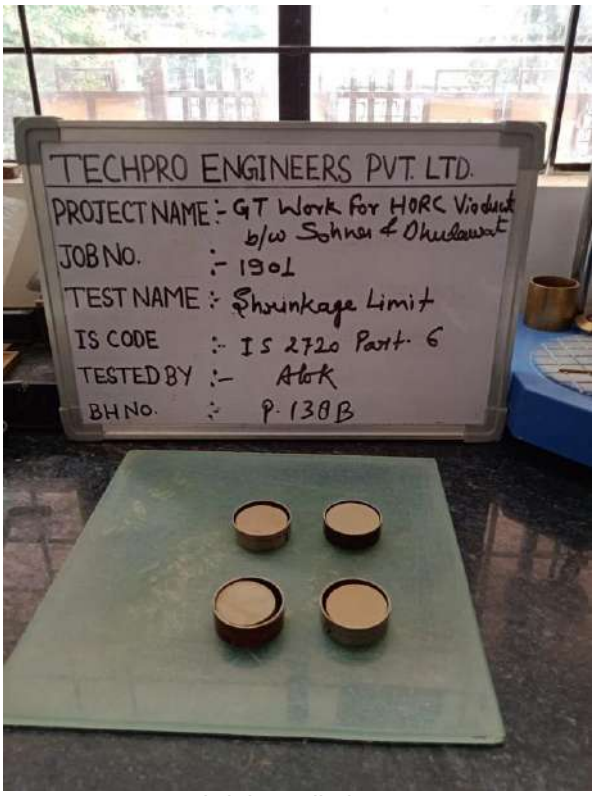
Dry density test of rock

UCS test of rock

Cerchar abrasion test

APPENDIX-K
LABORATORY PHOTOGRAPHS

Atterbergs' limit test



Shrinkage limit test

Tri-axial shear test

Direct shear test

APPENDIX-L
CHART 1: FIELD BORELOG CHARTS (P138B)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name: Const. for HORC Viaduct B/w Sohana & Dhulawat station				Project Code:	1901
Coordinate:	N: 312162.977	E: 700895.449		Location/ Chainage:	29530.463
Method of Drilling:	Percussion	Drilling Equipment:	Manual/ Power winch	Bore No.:	P-138B
Casing Lowered (M):	21.00	Bentonite Used:	YES	Standard Sampler:	YES
Barrel Type:	N/A				
Ground Elevation:	RL-209.246	Date: From 26/11/2023 to 28/11/2023		Water Table (M):	18.00

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
27/11/23	00	0.50	0.50	D	SX	Collected				—	—	—	—	—	—	Non cohesive soil
"	1.00	1.45	0.45	U	—	Received				—	—	—	—	—	—	— do —
"	2.00	2.45	0.45	DP	—	1	1	2	3	—	—	—	—	—	—	— do —
"	3.00	3.45	0.45	DP	—	1	2	12	14	—	—	—	—	—	—	— do —
"	4.00	4.45	0.45	U	—	Slipped				—	—	—	—	—	—	— do —
"	5.00	5.45	0.45	DP	—	4	7	10	17	—	—	—	—	—	—	— do —
"	6.00	6.45	0.45	DP	—	8	11	17	28	—	—	—	—	—	—	— do —
"	7.00	7.45	0.45	U	—	Received				—	—	—	—	—	—	Non cohesive soil
"	8.00	8.45	0.45	DP	—	9	13	20	33	—	—	—	—	—	—	— do —
"	9.00	9.45	0.45	DP	—	8	12	19	31	—	—	—	—	—	—	— do —
"	10.00	10.45	0.45	U	—	Received				—	—	—	—	—	—	— do —
"	11.00	11.45	0.45	DP	—	12	25	30	55	—	—	—	—	—	—	— do —
"	12.00	12.45	0.45	DP	—	15	29	34	63	—	—	—	—	—	—	— do —
"	13.00	13.45	0.45	DP	—	18	31	35	66	—	—	—	—	—	—	— do —
"	14.50	14.95	0.45	DP	—	17	23	28	51	—	—	—	—	—	—	— do —
"	16.00	16.45	0.45	DP	—	15	21	27	48	—	—	—	—	—	—	Non cohesive soil with gravel
"	17.50	17.95	0.45	DP	—	13	24	25	49	—	—	—	—	—	—	cohesive soil with gravel
"	19.00	19.45	0.45	U	—	Received				—	—	—	—	—	—	— do —
"	20.50	20.95	0.45	DP	—	16	27	31	58	—	—	—	—	—	—	— do —
28/11/23	22.00	22.45	0.45	DP	—	17	29	36	65	—	—	—	—	—	—	— do —
"	23.50	23.95	0.45	DP	—	15	31	38	69	—	—	—	—	—	—	Non cohesive soil
"	25.00	25.45	0.45	DP	—	19	33	40	73	—	—	—	—	—	—	— do —
"	26.50	26.95	0.45	DP	—	21	44	57	101	—	—	—	—	—	—	cohesive soil
"	28.00	28.45	0.45	DP	—	24	50	61	111	—	—	—	—	—	—	— do —

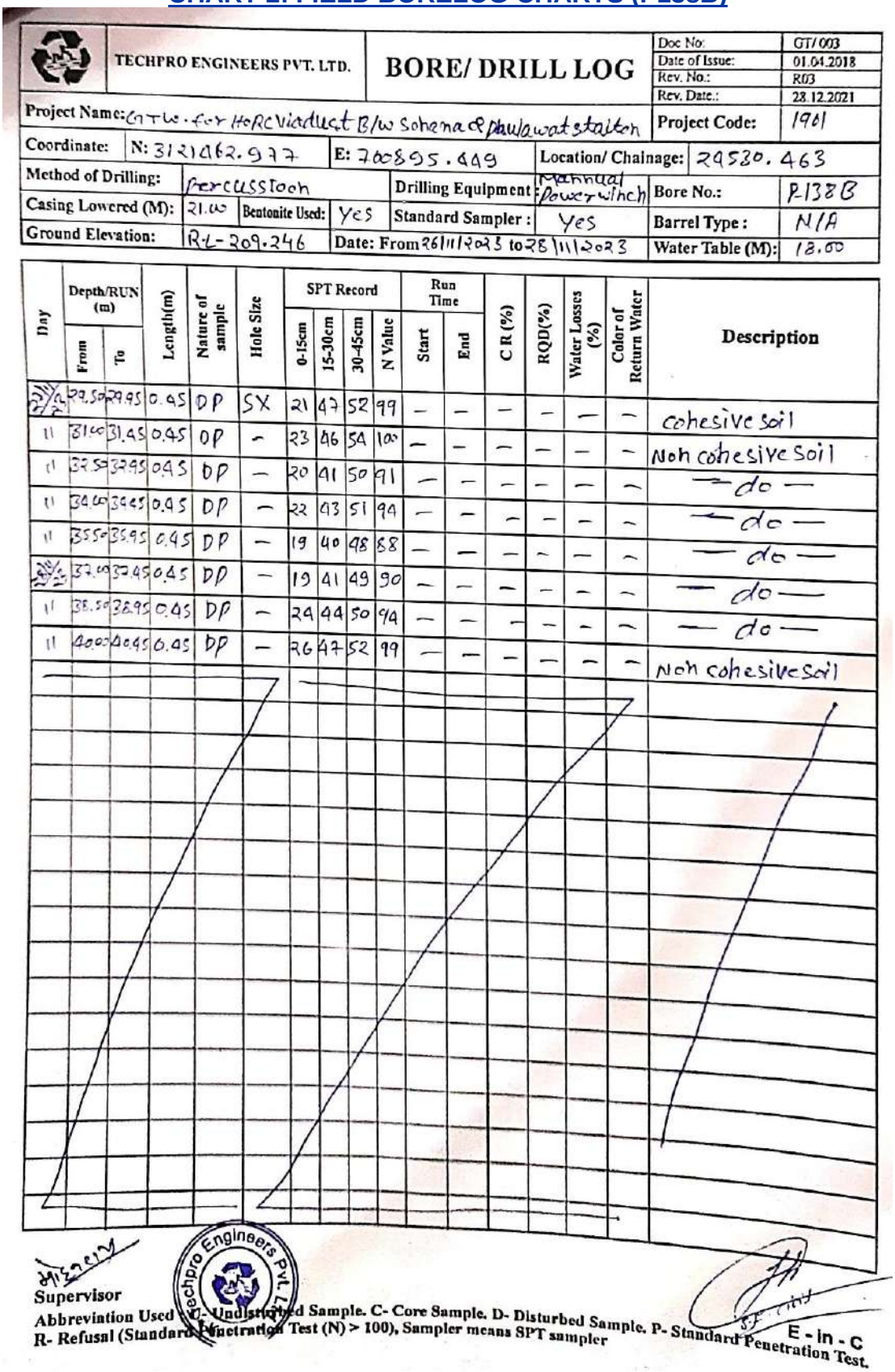
Supervisor

Techpro Engineers Pvt. Ltd.

E - In - C

Abbrevintion Used: U- Undisturbed Sample, C- Core Sample, D- Disturbed Sample, P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-L
CHART 2: FIELD BORELOG CHARTS (P138B)



TECHPRO ENGINEERS PVT. LTD.

BORE/ DRILL LOG

Doc No:	GT/003
Date of Issue:	01.04.2018
Rev. No.:	R03
Rev. Date.:	28.12.2021

Project Name: G+T W. for HORC Viaduct B/w Sohana & Dhulawat station — Project Code: 1901

Coordinate: N: 3121462.977 — E: 700895.449 — Location/ Chainage: 29580.463

Method of Drilling: percussion — Drilling Equipment: Manual Power winch — Bore No.: P-138B

Casing Lowered (M): 21.00 — Bentonite Used: Yes — Standard Sampler: Yes — Barrel Type: N/A

Ground Elevation: R.L- 209.246 — Date: From 26/11/2023 to 28/11/2023 — Water Table (M): 18.00

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
27/28	29.50	29.95	0.45	DP	SX	21	47	52	99	—	—	—	—	—	—	cohesive soil
11	31.00	31.45	0.45	DP	—	23	46	54	100	—	—	—	—	—	—	Non cohesive Soil
11	32.50	32.95	0.45	DP	—	20	41	50	91	—	—	—	—	—	—	— do —
11	34.00	34.45	0.45	DP	—	22	43	51	94	—	—	—	—	—	—	— do —
11	35.50	35.95	0.45	DP	—	19	40	48	88	—	—	—	—	—	—	— do —
27/28	37.00	37.45	0.45	DP	—	19	41	49	90	—	—	—	—	—	—	— do —
11	38.50	38.95	0.45	DP	—	24	44	50	94	—	—	—	—	—	—	— do —
11	40.00	40.45	0.45	DP	—	26	47	52	99	—	—	—	—	—	—	Non cohesive Soil

Supervisor

Abbrevation Used :- U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

E - in - C

APPENDIX-L
CHART 3: FIELD BORELOG CHARTS (P143B)

TECHPRO ENGINEERS PVT. LTD. — BORE/ DRILL LOG

Doc No:	GIT/003		
Date of Issue:	01.04.2018		
Rev No:	003		
Rev Date:	28.12.2021		

Project Name: GT-EOR HORC Viaduct Between Sohana-Dhulawat Stretch — Project Code: 1901

Coordinate: N: 312585.595 E: 700849.414 — Location/ Chainage: 21661.764

Method of Drilling: Rotary — Drilling Equipment: Hydraulic — Bore No.: P143B

Casing Lowered (M): 12.00 M — Bentonite Used: Not — Standard Sampler: Yes — Barrel Type: Double

Ground Elevation: RL-305.068 — Date: From 19/09/23 to 23/09/23 — Water Table (M): 14.40 M

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
19/9/23	0.00	0.50	0.50	DS	SX	Collected				-	-	-	-	-	-	Non cohesive soil
"	1.00	1.45	0.45	DP	"	6	7	8	15	-	-	-	-	-	-	do
"	2.00	2.45	0.45	U	"	Received				-	-	-	-	-	-	do
"	3.00	3.45	0.45	DP	"	6	8	14	22	-	-	-	-	-	-	do
"	4.00	4.45	0.45	DP	"	13	24	29	53	-	-	-	-	-	-	do
"	5.00	5.45	0.45	DP	"	18	32	38	70	-	-	-	-	-	-	do
20/9/23	6.00	6.45	0.45	DP	"	11	30	33	63	-	-	-	-	-	-	do
"	7.00	7.45	0.45	DP	"	16	38	40	78	-	-	-	-	-	-	do
"	8.00	8.29	0.29	DP	"	24	69	-	R	-	-	-	-	-	-	Non cohesive soil with Gravel
"	9.00	9.45	0.45	DP	"	17	31	43	74	-	-	-	-	-	-	do
"	10.00	10.45	0.45	DP	NX	19	40	45	85	-	-	-	-	-	-	do
"	11.00	11.30	0.30	DP	"	54	100	-	R	-	-	-	-	-	-	do
21/9/23	11.30	12.05	0.75	C	"	-	-	-	-	9.00	10.00	57	47	50	Light Brown	Light Brown Calcrete Rock Fractured
"	12.05	12.80	0.75	C	"	-	-	-	-	10.15	11.00	19	NIL	50	Light Brown	do
"	12.80	13.25	0.45	DP	"	8	9	20	29	-	-	-	-	-	-	Non cohesive soil
"	14.00	14.45	0.45	DP	"	10	12	25	37	-	-	-	-	-	-	do
"	15.45	15.95	0.45	DP	"	36	50	52	R	-	-	-	-	-	-	do
"	17.00	17.05	0.05	DP	"	60	-	-	R	-	-	-	-	-	-	Crumbled Rock Bore.
"	17.00	17.75	0.75	C	"	-	-	-	-	11.10	12.00	17	NIL	60	Light Brown	Light Brown Fractured Quartzite Rock
"	17.75	18.50	0.75	C	"	-	-	-	-	12.15	1.00	53	19	80	"	do
"	18.50	19.25	0.75	C	"	-	-	-	-	1.30	2.30	61	16	80	"	do
"	19.25	20.00	0.75	C	"	-	-	-	-	2.40	3.40	36	13	100	"	do
"	20.00	20.75	0.75	C	"	-	-	-	-	4.00	5.30	36	24	100	"	do
22/9/23	20.75	21.50	0.75	C	"	-	-	-	-	8.50	10.00	41	Nil	100	"	do

Supervisor 23/09/23

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test.
R- Refusal (Standard Penetration Test (N Value) > 100), Sampler means SPT sampler

APPENDIX-L
CHART 4: FIELD BORELOG CHARTS (P143B)

TECHPRO ENGINEERS PVT. LTD.	BORE/ DRILL LOG	Doc No:	GT/ 003
		Date of Issue:	01.04.2018
		Rev. No.:	R03
		Rev. Date.:	28.12.2021

Project Name:	G T Work for HORC Viaduct between Sohana-Dhulawat Section			Project Code:	1901
Coordinate:	N: 3121585.595	E: 700849.414		Location/ Chainage:	24661.464
Method of Drilling:	Rotary		Drilling Equipment:	Hydraulic	Bore No.:	P-143B
Casing Lowered (M):	12.00	Bentonite Used: Not	Standard Sampler:	Yes	Barrel Type:	Double
Ground Elevation:	RL - 305.068	Date: From 19/09/23	to 23/09/2023		Water Table (M):	14.70m

Day	Depth/RUN (m) From	To	Length(m)	Nature of sample	Hole Size	SPT Record 0-15cm	15-30cm	30-45cm	N Value	Run Time Start	End	C R (%)	RQD(%)	Water Losses (%)	Color of Return Water	Description
22/9/23	21.50	22.25	0.75	C	NX	–	–	–	–	10:30	11:30	35	NIL	100		Light brown Fractured Quartzite Rock.
23/9/23	22.25	23.00	0.75	C	"	–	–	–	–	8:50	9:50	NIL	NIL	100		Gray Highly weathered severely Rock into sand.
"	23.00	23.05	0.05	DP	"	100	–	–	R	–	–	–	–	–	–	
"	23.00	23.75	0.75	C	"	–	–	–	–	10:15	11:00	NIL	NIL	100		— do —
"	23.75	23.81	0.06	DP	"	101	–	–	R	–	–	–	–	–	–	
"	23.75	24.50	0.75	C	"	–	–	–	–	11:10	12:00	NIL	NIL	100		— do —
"	24.50	24.54	0.04	DP	"	100	–	–	R	–	–	–	–	–	–	
"	24.50	25.25	0.75	C	"	–	–	–	–	12:15	1:00	NIL	NIL	100		— do —
"	25.25	25.31	0.06	DP	"	102	–	–	R	–	–	–	–	–	–	
																Termination Parameter
																S.F. - 0.01
																verified by P.S. 0.01

Supervisor

Techpro Engineers Pvt. Ltd. Sohana

E - In - C

Abbreviation Used : U- Undisturbed Sample. C- Core Sample. D- Disturbed Sample. P- Standard Penetration Test. R- Refusal (Standard Penetration Test (N) > 100), Sampler means SPT sampler

APPENDIX-M
CHART 1: CORE MEASUREMENT SHEET (P143B)

TECHPRO ENGINEERS PVT. LTD.

CORE MEASUREMENT SHEET

Doc. No.:	GT 005
Date of Issue:	01.04.2018
Rev. No.:	R00
Rev. Date:	NIL

Project Name: GT Ext HORC Viaduct Between Sohana Dhulawat station — Project code: 1901

Location: — Date: 21/9/23 23/9/23 — Str./ Chainage: 24661.464 — BH-No. P143B

Run (M) From	Run (M) To	Total Length (cm)	Core No. From	Core No. To	Core Number/ Length of core pieces (cm)													
11.30	12.05	43	1	2	Y35	2/8												
12.05	12.80	14	3	5	3/4	4/2	5/8											
17.00	17.75	13	6	8	6/3	7/5	8/5											
17.75	18.50	40	9	13	9/6	10/7	11/14	12/10	13/3									
18.50	19.25	46	14	19	14/7	15/9	16/12	17/4	18/5	19/9								
19.25	20.00	17	20	23	20/7	21/6	22/4	23/10										
20.00	20.75	27	24	25	24/9	25/18												
20.75	21.50	31	26	31	26/9	27/3	28/9	29/4	30/4	31/9								
21.50	22.25	26	32	36	32/5	33/3	34/8	35/6	36/4									

Supervisor: — E-in-C:

End of Report