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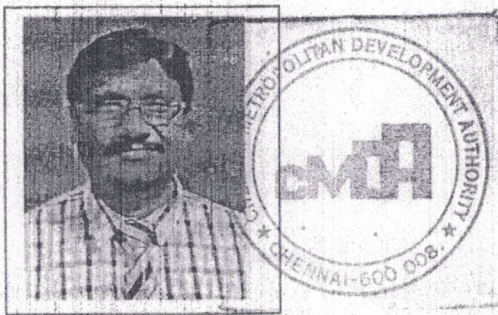
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Egmore, Chennai-600 008.

PROFESSIONAL REGISTRATION CERTIFICATE

This is to certify that the **Thiru. R. VENKATA KRISHNAIAH** has enrolled as **Registered Geo-Technical Engineer (RGTE)** with Chennai Metropolitan Development Authority (CMDA) who has the qualification of **M.E.,(Civil) (Geo-Technical Engg.)** and experience in the relevant field for **10 years.**

He has been given the Registration No.**GTE/2019/07/032** Renewed on **05.07.2024**. He shall be required to comply with the duties and responsibilities prescribed by the Government of Tamil Nadu in Part-V, "Registration of Professionals", Tamil Nadu Combined Development and Building Rules, 2019 approved vide G.O.(Ms) No.18 MAWS (MA1) Dept. dated 04.02.2019.

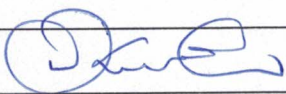
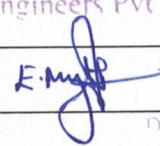
This Registration is valid upto **04.07.2029**.



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Superintendent

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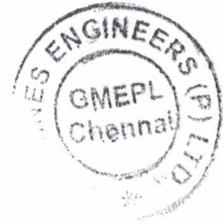
CONSULTANTS		GEO MINES ENGINEERS PVT. LTD. GEOTECHNICAL ENGINEERING DIVISION, No. 96, 3 rd FLOOR, VELLALAR STREET, MOGAPPAIR WEST, CHENNAI-37 Ph. No. 98413 16631, 9840157478 Email: geomines@gmail.com , gmepl77@gmail.com Website: www.geominesengineers.com	
CLIENT		SREENIVAS CONSTRUCTIONS, CHENNAI	
PROJECT		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING (STILT+05) AT NARAYANASWAMY NAICKER 4 TH STREET, SHOLINGANALLUR	
TITLE		GEOTECHNICAL INVESTIGATION REPORT	
			
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		For Geo Mines Engineers Pvt Ltd	
		 Director	
0	26-07-2023	GMEPL/SREENIVAS CONSTRUCTIONS/235/2023-24	
REV.	DATE	REPORT NUMBER	 PREP. BY

DISCLAIMER

We've been asked to look into the ground and identify and quantify everything that mother nature has put there and predict how those materials will react to construction and long-term performance of a facility - and we may fall short of this lofty goal. We have made reasonable and prudent conclusions but a cloud of uncertainty inherently looms over the project as per the pre and post facilities laid and their elemental behaviour on the mother soil. Also, the variable nature of soil strata and its varying characteristics may make the recommended foundation system disqualify and hence it's recommended that special care shall be taken by the owner during and after the construction is complete and during the run period of the building.



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CHAPTER-1

INTRODUCTION

1.0 Preamble

Sreenivas Constructions, Chennai proposed to construct a **Residential Building (Stilt+05) at Narayanaswamy Naicker 4th Street, Sholinganallur.**

For the purpose of designing the foundations, the responsibility of carrying out suitable soil investigation was entrusted to **M/s. Geo Mines ENGINEERS Pvt. Ltd., Chennai.**

This report contains the field and laboratory test results along with Design computations and recommendations for suitable foundation systems.

1.1 Scope of Work

- ❖ Sinking Two Standard Soil investigation bore holes of 150mm diameter up to a depth below existing ground level where $SPT > 100$ or as directed by the engineer-in-charge.
- ❖ Conducting Standard Penetration Test (SPT) at regular depth intervals.
- ❖ Collection of Split Spoon Samples or Disturbed Soil Samples
- ❖ Collection of water samples from each bore hole.
- ❖ Conducting relevant laboratory test results.

1.2 Structure of the Report

- ❖ Contents
- ❖ Introduction
- ❖ Investigation Methodology & Test Results
- ❖ Figures & Tables
- ❖ Sub-Surface Stratification
- ❖ Foundation Systems
- ❖ Recommendations
- ❖ Annexure (Design Computations)


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CHAPTER-2

INVESTIGATION METHODOLOGY & TEST RESULTS

2.0 Field Testing:

2.1 Preamble:

Two standard soil investigation boreholes were put. The equipment used and the methodology adopted to carry out the fieldwork is described below.

2.2 Equipment Used and Method of Drilling:

2.2.1 Equipment Used

The equipment used for performing the drilling operations is a Calyx Rotary Drill Rig with direct mud circulation technique. The drill mud used was made out of Sodium Bentonite.

2.2.2 Methodology of drilling

In the soil strata, the drilling operations have been carried out using special drill bits and cutters coupled with direct mud circulation.

2.3 In-Situ Strength Tests:

2.3.1 Standard Penetration Test:

Standard penetration tests were conducted at the borehole location, in accordance with IS: 2131. The tests were conducted at every change of strata up to the depth of termination of the borehole as directed by the engineer-in-charge.

2.4 Collection of Samples:

2.4.1 Disturbed Soil Samples

The SPT-samples collected were used as disturbed soil samples. These samples were used for visual and physical identification and for conducting laboratory classification tests as per I.S.1498-1970.


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2.4.2 Ground Water

For conducting suitable chemical tests, the ground water sample was collected from the respective borehole.

2.5 Summary of Field Work

The locations of the boreholes are shown in site plan given in Fig. 2.0. The soil profiles obtained at each location is shown in Figs. 2.1 & 2.2.

2.6 Laboratory Testing:

2.6.1 Coarse Grained Samples:

2.6.1.1 Grain size Analysis Tests:

On the coarse-grained soil samples, grain size distribution tests were conducted as per I.S.2720 (Part 4)-1985, to know the gradation characteristics and to classify them. These results are presented in Tables 2.1 & 2.2.

2.6.2 Fine Grained Samples:

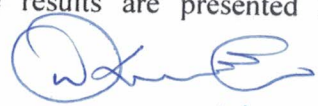
2.6.2.1 Index Property – Free Swell Tests:

Atterberg Limits were carried out on fine grained soil samples to evaluate the limits of different consistency states. Generally Liquid limits, Plastic limits and Shrinkage Limits tests were conducted as per I.S.2720 (Part-5)-1985 and I.S.2720 (Part 6)-1972. As no such type of soil strata encountered at the investigation locations, no such tests could be conducted.

2.6.3 Chemical Analysis Tests:

2.6.3.1 Water Samples:

On representative water samples, chemical analysis tests were conducted to estimate pH, Chlorides and Sulphates. These results are presented in Table-2.3.


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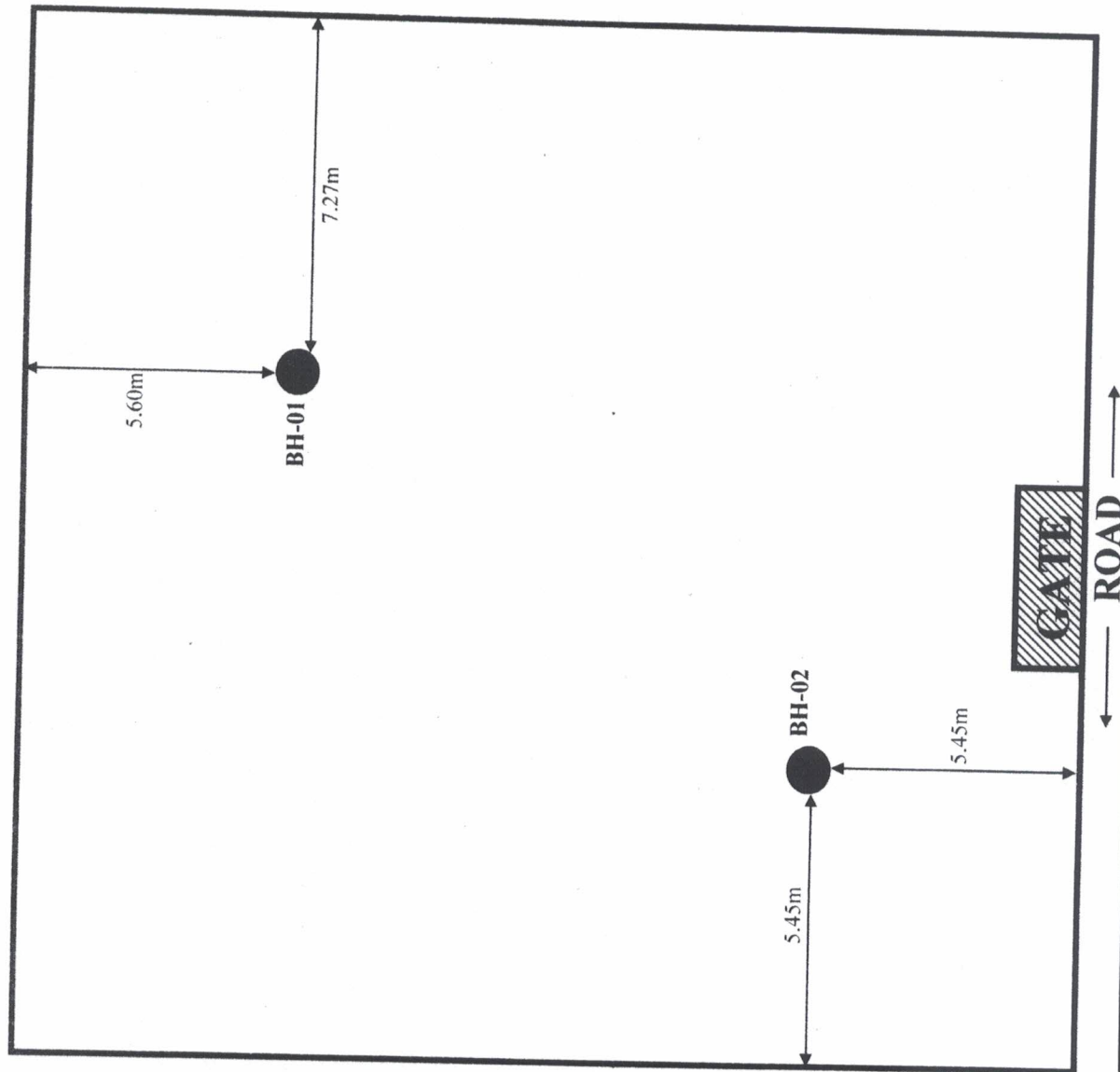


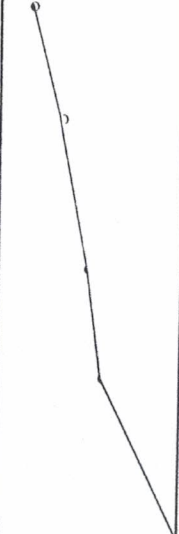
Fig. 2.0: Site Plan Representing the locations of Field Investigation Points


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Project : Proposed Construction of Residential Building (Stilt+05) at Narayanaswamy Naicker 4th Street, Sholinganallur.

Location: BH-01

Started On : 22/07/2023; Ended On : 22/07/2023 G.W.T: 1.00m below existing ground level

G.W.T. 1.00m below existing ground level																					
R.L of Layer (m)	G.W.T. (m)	Soil Profile	Engineering Description of Soil	SPT - Details			Graphical Representation of SPT Data										Relative Density/Consistency	Type of Sample			
				Depth of SPT below E.G.L (m)	0-15 cm	15-30 cm	30-45 cm	N-Value													
G.W.T	↓		Reddish Medium Dense Silty Fine Sand	1.50	3	6	11	17											M.Dense	SS	
2.00			Reddish Dense Silty Fine Sand	3.00	8	14	19	33											Dense	SS	
3.80			Greyish to Whitish Dense Silty Fine to Medium Coarse Sand	4.50	23	21	26	47											Dense	SS	
5.50			Greyish to Whitish Very Dense Silty Fine to Medium Coarse Sand	6.00	19	24	31	55											V.Dense	SS	
7.50			Weathered Rock	8.00	SPT Hammer Rebounded														V.Dense	SS	
8.20																					

Bore Hole Terminated at a depth of 8.20m below the existing ground level

Fig. 2.1 Soil Profile at BH-01 Location


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Project : Proposed Construction of Residential Building (Stilt+05) at Narayanaswamy Naicker 4th Street, Sholinganallur.

Location: BH-02

Started On : 22/07/2023; Ended On : 22/07/2023 G.W.T: 1.00m below existing ground level

G.W.T. from below existing ground level																							
R.L of Layer (m)	G.W.T. (m)	Soil Profile	Engineering Description of Soil	SPT - Details			SPT - Details										Relative Density/Consistency	Type of Sample					
				Depth of SPT below E.G.L (m)	0-15 cm	15-30 cm	30-45 cm	N-Value	SPT - Details														
									0	1	2	3	4	5	6	7			8	9			
G.W.T	↓																						
			Reddish Medium Dense Silty Fine Sand	1.50	4	6	12	18													M.Dense	SS	
				3.00	5	12	15	27													M.Dense	SS	
3.80																							
			Greyish to Whitish Dense Silty Fine to Medium Coarse Sand	4.50	17	15	23	38													Dense	SS	
5.50																							
			Greyish to Whitish Very Dense Silty Fine to Medium Coarse Sand	6.00	15	21	32	53													V.Dense	SS	
7.20																							
			Weathered Rock	7.50	SPT Hammer Rebounded																V.Dense	SS	
8.50				8.50	SPT Hammer Rebounded																V.Dense	SS	

Bore Hole Terminated at a depth of 8.50m below the existing ground level

Fig. 2.2 Soil Profile at BH-02 Location

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Table 2.1: Laboratory Test Results on the Soil Samples Collected from BH-01

Depth of Sample below E.G.L. (m)	SPT of Sample	Type of Sample	Engineering Description of Soil	NMC(%)	Natural Density (g/cc)	Clay					Relative Density/ Consistency	Sieve Analysis						IS-Classification
						LL (%)	PL (%)	PI	I _c	FS		Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)	
0.00 to 2.00	17	SS	Silty Fine Sand	-	1.6	-	-	-	-	-	M.Dense	0	0	7	73	20	0	SM
2.00 to 3.80	33	SS	Silty Fine Sand	-	1.9	-	-	-	-	-	Dense	0	0	4	81	15	0	SM
3.80 to 5.50	47	SS	Silty Fine to Medium Coarse Sand	-	1.9	-	-	-	-	-	Dense	0	21	16	43	20	0	SM
5.50 to 7.50	55	SS	Silty Fine to Medium Coarse Sand	-	2.0	-	-	-	-	-	V.Dense	0	23	21	34	22	0	SM
7.50 to 8.20	>100	SS	Weathered Rock	-	2.0	-	-	-	-	-	V.Dense	38	18	13	24	7	0	SDR


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Table 2.2: Laboratory Test Results on the Soil Samples Collected from BH-02

Depth of Sample below E.G.L. (m)	SPT of Sample	Type of Sample	Engineering Description of Soil	NMC(%)	Natural Density (g/cc)	Clay					Relative Density/ Consistency	Sieve Analysis						IS-Classification
						LL (%)	PL (%)	PI	I _p	FS		Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)	
0.00 to 3.80	22	SS	Silty Fine Sand	-	1.7	-	-	-	-	-	M.Dense	0	0	8	69	23	0	SM
3.80 to 5.50	38	SS	Silty Fine to Medium Coarse Sand	-	1.9	-	-	-	-	-	Dense	0	24	19	38	19	0	SM
5.50 to 7.20	53	SS	Silty Fine to Medium Coarse Sand	-	2.0	-	-	-	-	-	V.Dense	0	24	22	41	13	0	SM
7.20 to 8.50	>100	SS	Weathered Rock	-	2.0	-	-	-	-	-	V.Dense	39	21	15	20	5	0	SDR


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Table 2.3: Chemical Analysis Results conducted on Water Samples collected from BH-01 & BH-02				
Location	Depth of Sample below E.G.L. (m)	pH	Chlorides (ppm)	Sulphates (ppm)
BH-01	3.00	6.76	991.38	126.38
BH-02	3.00	6.78	982.41	121.46



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CHAPTER-3

SUB-SURFACE STRATIFICATION

3.0 Preamble

The sub surface stratification at borehole locations, with respect to foundation/geotechnical engineering application are derived based on the visual identification, laboratory classification tests and field in-situ strength tests. Further, the strength parameters are estimated based on the in-situ strength test results as per the following correlation.

- * For Coarse Grained Samples, Ref. Fig.1, IS: 6403 to estimate Angle of Shearing Resistance.
- * For Fine Grained Samples, Ref. Terzaghi & Peck, 1948, to estimate Unconfined Compressive Strength.

3.1 Sub Surface Stratification:

3.1.1 Soil Profile at BH-01 Location

(At BH-01 Location, as presented in Site plan)

- * **Layer-1 (from E.G.L to 2.00m depth)**

Type of Strata	Silty Fine Sand
Colour	Reddish
Thickness of Layer	2.00m
SPT of the layer	17
Relative Density	Medium Dense
Angle of Shearing Resistance, ϕ	32.10^0
- * **Layer-2 (from 2.00m to 3.80m depth)**

Type of Strata	Silty Fine Sand
Colour	Reddish
Thickness of Layer	1.80m
SPT of the layer	33
Relative Density	Dense
Angle of Shearing Resistance, ϕ	36.825^0
- * **Layer-3 (from 3.80m to 5.50m depth)**

Type of Strata	Silty Fine to Medium Coarse Sand
Colour	Greyish to Whitish
Thickness of Layer	1.70m
SPT of the layer	47
Relative Density	Dense
Angle of Shearing Resistance, ϕ	40.325^0
- * **Layer-4 (from 5.50m to 7.50m depth)**


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Type of Strata	Silty Fine to Medium
Colour	Coarse Sand
Thickness of Layer	Greyish to Whitish
SPT of the layer	2.00m
Relative Density	55
Angle of Shearing Resistance, ϕ	Very Dense
	41.75°
* Layer-5 (from 7.50m to 8.20m depth)	
Type of Strata	Weathered Rock
Colour	-
Thickness of Layer	0.70m
SPT of the layer	>100
Relative Density	Very Dense
Angle of Shearing Resistance, ϕ	42.50°

Ground Water

Ground water table was encountered at a depth of 1.00m below the existing ground level during the third week of July 2023.

3.1.2 Soil Profile at BH-02 Location

(At BH-02 Location, as presented in Site plan)

* Layer-1 (from E.G.L to 3.80m depth)	
Type of Strata	Silty Fine Sand
Colour	Reddish
Thickness of Layer	3.80m
SPT of the layer	22
Relative Density	Medium Dense
Angle of Shearing Resistance, ϕ	33.60°
* Layer-2 (from 3.80m to 5.50m depth)	
Type of Strata	Silty Fine to Medium
Colour	Coarse Sand
Thickness of Layer	Greyish to Whitish
SPT of the layer	1.70m
Relative Density	38
Angle of Shearing Resistance, ϕ	Dense
	38.20°
* Layer-3 (from 5.50m to 7.20m depth)	
Type of Strata	Silty Fine to Medium
Colour	Coarse Sand
Thickness of Layer	Greyish to Whitish
SPT of the layer	1.70m
Relative Density	53
Angle of Shearing Resistance, ϕ	Very Dense
	41.45°
* Layer-4 (from 7.20m to 8.50m depth)	
Type of Strata	Weathered Rock
Colour	-
Thickness of Layer	1.30m
SPT of the layer	>100


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Relative Density
Angle of Shearing Resistance, ϕ

Very Dense
42.50°

Ground Water

Ground water table was encountered at a depth of 1.00m below the existing ground level during the third week of July 2023.



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CHAPTER-4

FOUNDATION SYSTEM

4.0 Preamble

The foundation system design is an interface between super structure and the sub soil bearing strata characteristics. A sound foundation system should be safe against bearing strata shear response under the super structure load intensity. Similarly, the stability of the foundation system is governed by the bearing strata deformation response under the super structure load intensity. In addition, as a combined system of super structure and foundation, the overall stability is also governed by the super structure arrangement.

Considering the above aspects of foundation design, the suitable type of foundation system with respect to the sub soil conditions encountered at the borehole locations is presented in the subsequent sections.

4.1 Bearing Strata Characteristics

From field investigations, it can be observed that the sub-soil strata encountered at shallow depths are uniformly stratified but possess varying shear strength characteristics, BH-01 being relatively weak from deformation considerations and hence shall be considered as design borehole to determine the bearing strata and foundation design parameters.

Considering BH-01 as design borehole, it can further be envisaged that the coarse-grained soil strata encountered at shallow depths from present existing ground level will hold good to act as bearing strata for proposed impending column loads in the range of 700kN to 800kN respectively.

If coarse-grained soil strata encountered at shallow depths are considered as bearing strata, the safe bearing capacity of open foundation system will be a function of least dimension of footing and effective surcharge over the bearing strata.

Further, the refusal soil strata (SPT>60) encountered below a maximum depth of 7.50m from existing ground level can also be considered as good end bearing strata for proposed impending loads from structure.

Considering the above, suitable foundation systems are presented below.


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4.2. Foundation System

4.2.1 Open Foundation System (Refer BH-01)

Considering the bearing strata characteristics of sub-soil strata encountered at shallow depths at critical borehole BH-01, open foundation system of isolated column footing type located at a design depth of 2.20m below present existing ground level can be adopted.

The safe bearing capacity of such type of open foundation system is presented below which can be adopted for foundation design purposes

Type of Open Foundation System	Depth of <u>Isolated Column Footing below</u> Present Existing Ground Level (m)	Thickness of Fill at Site (m)	Depth of Isolated Column Footing below <u>Natural Ground Level</u> (m)	Safe Bearing Capacity (MT/m ²)	Elastic Settlements (mm)
<u>Isolated Column Footing</u>	2.20	0.00	2.20	20	40

The computations for above are annexed to this report.

4.2.2 Deep Foundation System-8.00m Long Bored Cast-in-Situ Friction cum End Bearing Piles

In case the safe beating capacity as presented in Clause 4.2.1 is lower than the impending foundation stresses, deep foundation system consisting of 8.00m long bored cast-in-situ Friction cum End Bearing Piles can also be adopted.

Piles shall be drilled through DMC (direct mud circulation) technique.

For four different diameters, the safe load carrying capacities of 8.00m long bored cast-in-situ Friction cum End Bearing Piles are computed and presented below which can be adopted for foundation design purposes.



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S. No	Type of Installation of Pile	Length of Pile below Existing Ground Level (m)	Type of Bearing Strata	Diameter of Pile (mm)	Safe Load Carrying Capacity (MT)	Safe Pull Out Capacity (MT)
1	Bored Cast-in-Situ	8.00	Weathered Rock	400	45	15
2				450	55	16
3				500	65	18
4				550	75	19

The computations of safe load carrying capacity for 400mm diameter and 8.00m long bored cast-in-situ Friction cum End Bearing pile are annexed to this report.



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CHAPTER-5

CONCLUSIONS & RECOMMENDATIONS

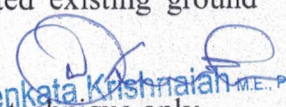
1. Foundation systems presented in Clause 4.2.1 & 4.2.2, Chapter-IV can be adopted for foundation design purposes.

Open Foundation System

2. Care shall be taken so that the ultimate bearing strata are none other than coarse-grained "**Silty Fine Sand**" type.
3. Excavated coarse-grained soil strata can be used for back-filling purposes.
4. Safe bearing capacity presented above is computed considering any rise in the ground water table at or above the level of footing.
5. It is recommended to connect the grade beams so that the structure can act as a single unit against any differential settlements in between the individual footings.
6. Special provisions to contain any lateral collapse of soil from the walls excavated foundation pits are required.
7. In case, the ground water table is encountered within the recommended depths of foundation system, the same shall be bailed out continuously to keep the sub-grade well consolidated.

Deep Foundation System

8. Deep foundation system presented in Clause 4.2.2, Chapter-IV can also be adopted for foundation design purposes.
9. **Care shall be taken so that the ultimate bearing strata are none other than "Weathered Rock" strata.**
10. Suitable pile load tests (as per I.S: 2911, part-IV) shall be performed to confirm the presented **theoretical** safe load carrying capacities and shall be used as **allowable/design** load carrying capacities of pile under considerations.
11. Pile cap can be located over 0.30m thick well compacted existing ground surface.
12. Piles shall be installed using DMC (direct mud circulation) technique only.


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DESIGN OF OPEN FOUNDATION SYSTEM (Ref. BH-01)

1 COMPUTATION OF BEARING CAPACITY AS PER IS:6403

1.1 Geometrical Data :

Type of Foundation System: Isolated Footing
R.L of the top of Borehole (m): 0.00 m
Depth of Foundation below existing ground level (D_f): 2.20 m
Observed Thickness of fill at site: 0.00 m
Effective Depth of Foundation below natural ground level (D_f): 2.20 m
Design Width of Foundation (B): 1.00 m
Thickness of Foundation (T) : 0.25 m

1.2 Soil Data :

Type of Bearing Strata : Silty Fine Sand
Design SPT-value of the Bearing Strata : 17
(considered based upon the density of the strata)
Type of Shear Failure: General
Angle of Shearing Resistance - Limited to a Maximum of: 32.10 Deg.

1.3 Design Parameters:

Bulk Density of Soil above the foundation depth (γ_{bulk}) 16.00 kN/m³
Effective Overburden pressure at foundation level (q) 13.20 kPa
Water Table Correction Factor (w') 0.50

Bearing Capacity Factors:

$N_c = N/A$
 $N_q = 24.66$
 $N_\gamma = 33.16$

Shape Factors:

$S_c = N/A$
 $S_q = 1.63$
 $S_\gamma = 0.60$

Depth Factors :

$D_c = N/A$
 $D_q = 1.00$



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$$D_\gamma = 1.00$$

Inclination Factor:

$$I_c = N/A$$

$$I_q = 1.00$$

$$I_\gamma = 1.00$$

1.4 Ultimate Bearing Capacity (Q_u) :

$$Q_u = C_u * N_c * S_c * D_c * I_c + q * (N_q - 1) * S_q * D_q * I_q + 0.5 * B * \gamma * N_\gamma * S_\gamma * D_\gamma * I_\gamma * w'$$

$$Q_u = 609.26 \text{ kPa}$$

1.5 Safe Bearing Capacity (Q_{safe}) :

$$\text{Factor of Safety (F.S.)} : 2.50$$

$$Q_{safe} : 243.70 \text{ kPa}$$

$$\text{Recommended Safe Bearing Capacity} : 200.00 \text{ kPa}$$

1.6 Settlements

Since, the bearing strata are coarse-grained type, the settlements under the allowable safe bearing pressure 200kPa will be of immediate elastic nature. The elastic settlements corresponding to a safe bearing pressure of 200kPa and average SPT of 17 considering extent of pressure bulb below bottom level of footing are computed to be in the order of 40mm which is within the permissible limits of 50mm for Isolated Footings as per I.S.:1904.


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DESIGN OF PILE FOUNDATION (Refer: BH-02)

Refer, IS:2911(Part I/Sec 2)-1979, Reaffirmed 1997

1.0 Type of Installation of Pile

Bored Cast in Situ

1.1 Geometrical Data

Assumed Diameter of pile(D):	400.0 mm
Assumed R.L of E.G.L:	0.000 m
Length of pile below E.G.L.(l) :	8.000 m
R.L. of Bot. of Pile	-8.00 m

1.2 Design of Pile for Vertical Compression

1.2.1 Computation of Skin Resistance:

1.2.1.1

Layer-I

Type of Strata: Silty Fine Sand

Average SPT of the strata,N: 22

Bulk Density of the strata, γ : 16 kN/m³

Angle of Shearing Resistance, ϕ : 33.6 Deg.

R.L of top of Strata: 0.00 m

R.L of bottom of Strata: -3.80 m

Average Thickness of Strata, I_c : 3.80 m

Effective overburden pressure over the top of strata, σ_{top} : 0.00 kN/m²

Effective overburden pressure over the bottom of strata, σ_{bottom} : 22.80 kN/m²

Effective overburden pressure at the middle of the strata, σ_{middle} : 11.40 kN/m²

Coeff. Of Earth Pressure, k: 1.50

Skin Resistance of the pile, q_s : 54.25 kN

$$(q_s: \sigma * k * \tan \phi * \pi() * d * I_c)$$

1.2.1.2

Layer-II

Type of Strata: Silty Fine to Medium Coa

Average SPT of the strata,N: 38

Bulk Density of the strata, γ : 19 kN/m³

Angle of Shearing Resistance, ϕ : 38.2 Deg.

R.L of top of Strata: -3.80 m

R.L of bottom of Strata: -5.50 m

Average Thickness of Strata, I_c : 1.70 m

Effective overburden pressure over the top of strata, σ_{top} : 22.80 kN/m²

Effective overburden pressure over the bottom of strata, σ_{bottom} : 38.10 kN/m²

Effective overburden pressure at the middle of the strata, σ_{middle} : 30.45 kN/m²

Coeff. Of Earth Pressure, k: 2.00

Skin Resistance of the pile, q_s : 102.38 kN

$$(q_s: \sigma * k * \tan \phi * \pi() * d * I_c)$$

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1.2.1.3

Layer-III

Type of Strata:	Silty Fine to Medium Coe
Average SPT of the strata,N:	53
Bulk Density of the strata, γ :	20 kN/m ³
Angle of Shearing Resistance, ϕ :	41.45 Deg.
R.L of top of Strata:	-5.50 m
R.L of bottom of Strata:	-7.20 m
Average Thickness of Strata, I_c :	1.70 m
Effective overburden pressure over the top of strata, σ_{top} :	38.10 kN/m ²
Effective overburden pressure over the bottom of strata, σ_{bottom} :	55.10 kN/m ²
Effective overburden pressure at the middle of the strata, σ_{middle} :	46.60 kN/m ²
Coeff. Of Earth Pressure, k:	2.50
Skin Resistance of the pile, q_s :	219.80 kN
$(q_s: \sigma * k * \tan \phi * \pi() * d * I_c)$	
Ultimate Skin Resistance,q_s:	376.43 kN

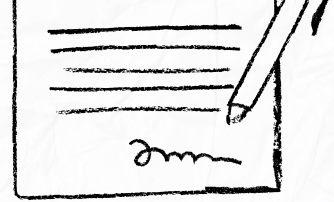
1.2.2 Computation of End Bearing Resistance:

Type of Bearing Strata	Weathered Rock
Cross-Sectional Area of pile, A_p :	0.126 m ²
R.L of bottom of pile:	-8.00
Minimum SPT-value of the Bearing Strata	60
Angle of Shear Resistance, ϕ :	42.50 Deg.
Effective Overburden Pressure, q:	28.00 kPa
Bearing Capacity Factor(N_q)	220.00
Ultimate End Bearing Resistance (Q_p)	774.1 kN
$(Q_p = A_p * q * N_q)$	

1.3.0

Ultimate Load Carrying Capacity ($Q_u = Q_s + Q_p$)	1150.5 kN
Safe Load Carrying Capacity ($Q_{safe} = Q_u / 2.5$)	460.2 kN
However, limit Q_{safe} to the structural capacity of pile:	450.0 kN


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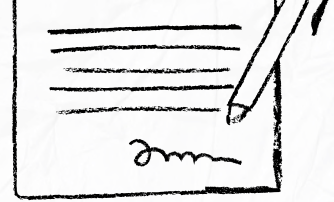
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