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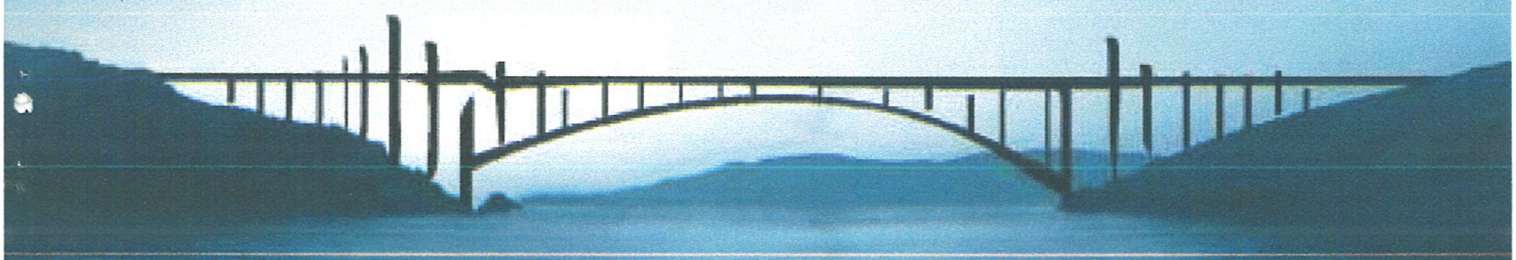
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SOIL INVESTIGATION REPORT

CLIENT

M/S. URBAN TREE REHA SPACES LLP

NUNGAMBAKKAM, CHENNAI



PROJECT LOCATION

VANAGARAM, CHENNAI

REPORT NO.: SI/CHN/22/1671/01

AUGUST 2022

GEO FOUNDATIONS & STRUCTURES PVT LTD

GEO TECHNICAL DIVISION CHENNAI

Email: soil@geo.net.in

NAME OF PROJECT

SOIL INVESTIGATION FOR THE PROPOSED (G+5 FLOORS) STRUCTURE AT VANAGARAM, CHENNAI

CLIENT

M/s. URBAN TREE REHA SPACES LLP,
NEW No. 18, OLD No. 08, RUTLAND GATE,
5TH STREET, NUNGAMBAKKAM,
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GEOTECHNICAL CONSULTANT

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PROJECT No.: 1671					
Rev.No.	**Date**	**Description**	**Created by**	**Verified by**	**Approved by**
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SOIL INVESTIGATION REPORT

1.0 INTRODUCTION

1.1 The work of "Soil Investigation for the Proposed (G+5 Floors) Structure at Survey No. 218/1B2A, 213/2A1A1B1, Vanagaram, Chennai." was entrusted to **M/s. Geo Foundations and Structures (P) Ltd., Adyar, Chennai – 600 020**, by **M/s. Urban Tree Reha Spaces LLP, Nungambakkam, Chennai – 600 006**

1.2 The soil investigation works were carried out during **August 2022.** This report summarizes the results of the soil investigation, and presents recommendations for suitable type of foundations for the proposed (G+5 Floors) structure.

2.0 OBJECTIVE OF INVESTIGATION

2.1 The objective of soil investigation is to determine the nature and characteristics of sub-soil below the ground level for the proposed (G+5 Floors) structure. The study includes identification of suitable type of foundations and assessment of safe bearing capacities for the proposed (G+5 Floors) structure.

3.0 SCOPE OF WORK

The scope of work at this site comprises of the following:

3.1 Mobilization of Calyx drilling machine with all necessary equipments and personnel.

3.2 Boring of **2** bore holes of 150 mm diameter with Calyx drilling equipments through sand, silt, clay & weathered rock.

3.3 Conducting Standard Penetration Tests in the bore holes and collecting the disturbed but representative soil samples, including packing and transportation to laboratory.

3.4 To conduct the following laboratory tests on soil samples:

(a) Grain size analysis

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(b) Index properties:

(i) Liquid limit

(ii) Plastic limit

(iii) Shrinkage limit

(c) Moisture content

(d) Dry and bulk density

(e) Specific Gravity

(f) Free Swell Index

(g) Triaxial / Direct Shear Test

(h) Unconfined Compressive Strength

(i) Chemical Analysis of Ground Water

3.5 Preparation and submission of detailed report of field and laboratory results with recommendations for suitable type of foundations.

4.0 FIELD INVESTIGATIONS-GEO-TECHNICAL STUDIES

4.1 Boring rig, with all requisite equipments and accessories, were mobilized at the worksite. A team of technical personnel with skilled laborers were also deputed.

4.2 **Two** bore holes of 150 mm diameter were bored to a maximum depth up to **26.5 m** below the existing ground level. The bore holes were made as per relevant Indian Standard IS: 1892: 2021.

4.3 Representative soil samples were collected at every change of strata or at about 1 m depth interval, up to 5 m, from the existing ground level in BH 1, 1.5 m depth interval, up to 17 m in BH 1, 2 m depth interval, up to 22 m in BH 1, followed by 1 m depth interval, up to termination depth in BH 1 and 1 m depth interval, up to 5 m, from the existing ground level in BH 2, 1.5 m depth interval, up to 15.5 m in BH 2, 2 m depth interval, up to 24.5 m in BH 2, followed by 1 m depth interval, up to termination depth in BH 2. The samples so collected were sealed and numbered

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with full particulars for identification and sent to the laboratory for conducting the required tests.

4.4 Standard Penetration tests were conducted in the bore holes at 1 m depth interval, up to 5 m, from the existing ground level in BH 1, 1.5 m depth interval, up to 17 m in BH 1, 2 m depth interval, up to 22 m in BH 1, followed by 1 m depth interval, up to termination depth in BH 1 and 1 m depth interval, up to 5 m, from the existing ground level in BH 2, 1.5 m depth interval, up to 15.5 m in BH 2, 2 m depth interval, up to 24.5 m in BH 2, followed by 1 m depth interval, up to termination depth in BH 2, as per the relevant Indian Standard, IS: 2131-1981(Reaffirmed 2021). In this test, a standard split spoon sampler is driven into the ground at the required depth by means of standard hammer of 63.5 kgs weight, falling from a height of 75 cm. Number of blows for the first 15 cm is not taken into consideration because of possible disturbances or presence of settled, suspended matters at the bottom of the bore- holes. The total number of blows for the next 30 cm depth of penetration is considered as SPT 'N' value as shown in Figure nos. 01 & 02 **(Appendix I).**

5.0 LABORATORY INVESTIGATION

The following laboratory tests were conducted on the selected soil samples collected from the bore holes:

(a) Grain size analysis

(b) Index properties:

(i) Liquid limit

(ii) Plastic limit

(c) Natural Moisture content

(d) Dry and bulk density

(e) Specific Gravity

(f) Free Swell Index

(g) Triaxial Test

(h) Direct Shear Test

(i) Chemical Analysis of Ground Water

All the above laboratory tests were carried out as per relevant Indian Standards.

All the soil samples were identified and classified as per relevant Indian Standard, IS: 1498-1970(Reaffirmed 2021).The results are shown in Table Nos.1 to 3 **(Appendix II & III).**

6.0 SOIL PROFILE

In borehole BH 1, Stiff sandy clay of low plasticity occurs from ground level up to 2 m, followed by medium stiff of sandy clay of low plasticity up to 3 m, soft clay of medium plasticity up to 4 m, medium stiff clay of high plasticity up to 5 m, loose sandy silt up to 6.5 m, medium dense clayey sand up to 8 m, medium stiff clay of high plasticity up to 9.5 m, stiff clay of high plasticity up to 11 m, soft clay of high plasticity up to 12.5 m, medium dense silty sand up to 14 m, dense silty sand up to 15.5 m, medium stiff sandy clay of medium plasticity up to 17 m, very stiff sandy clay of high plasticity up to 19 m, followed by hard clay of high plasticity up to **25 m,** at which depth the bore hole was terminated.

In borehole BH 2, Soft sandy clay of low plasticity occurs from ground level up to 2 m, followed by soft clay of high plasticity up to 3 m, soft sandy clay of medium plasticity up to 4 m, stiff sandy clay of medium plasticity up to 5 m, medium dense silty sand up to 6.5 m, medium dense clayey sand up to 8 m, stiff sandy clay of low plasticity up to 9.5 m, very stiff clay of medium plasticity up to 11 m, stiff clay of high plasticity up to 12.5 m, medium dense silty sand up to 14 m, medium dense sand up to 17.5 m, medium stiff sandy clay of medium plasticity up to 19.5 m, stiff sandy clay of medium plasticity up to 21.5 m, followed by hard sandy clay of high plasticity up to **26.5 m,** at which depth the bore hole was terminated.

7.0 GROUND WATER TABLE

Ground water levels were met at a depth of **3 m** from the existing ground level at the time of investigation in the boreholes BH 1 & BH 2, during continuous boring from **02.08.2022** to **07.08.2022.**

8.0 RECOMMENDATIONS FOR SUITABLE TYPE OF FOUNDATIONS:

Bore holes were made for soil investigation to assess the nature and strength of the subsoil strata for sustainability of the loads. This report gives the details of the soil strata, suitable type of foundations and safe bearing capacity. Based on the subsoil conditions described in Sl. No. 6, the following recommendations are made for suitable type of foundations for the proposed (G+5 Floors) structure.

8.1 Pile Foundations

- Bored cast in situ concrete pile foundations are recommended
- The recommended safe load carrying capacity of bored cast in situ concrete piles are considered as per IS 2911 (Part 1/Sec2): 2010 (Reaffirmed 2020)
- The pile bore may be terminated at a depth of minimum three times diameter of the pile in to hard strata (where four consecutive SPT 'N' values of more than 100 are obtained in each test at depth intervals of one pile diameter).
- To satisfy the above criterion, the pile length may be of the order of **25 m** from the existing ground level.
- In terms of concrete used for the piles, to provide the required factor of safety of **2.5** for stress in the pile concrete, we recommend minimum M 30 Grade Concrete.
- According to the structural strength of concrete determined for different pile diameters, assuming 5 grades less to allow for underwater concreting, consider M 25 grade concrete instead of M 30 grade concrete.

- The recommended safe load carrying capacity of bored cast in situ concrete piles as per IS 2911 (Part 1/Sec2): 2010 (Reaffirmed 2020) for different pile diameters are presented in **Table A.**

Table A

Approximate Length of Pile from G.L (m)	Diameter (mm)	Recommended Safe Vertical Load Capacity (T)
25	500	100
	600	140
	750	200

8.1.1 R.C.C. BORED CAST IN SITU PILES

Safe capacity of RCC Bored cast-in-situ pile can be computed by using the formula given in IS: 2911 (Part-1/Sec-2):2010 (Reaffirmed 2020)

Ultimate bearing capacity Qu of piles in Cohesionless soil:

$$Q_U = A_P(0.5.D.\gamma.N\gamma + P_D.N_q) + \sum_{i=1}^{i=n} K.P_{Di}.\tan\delta.A_{si}$$

Where, A_p = Cross sectional area of pile toe in cm^2

D= Stem dia. in cm

γ= Effective unit weight of soil at pile toe in kg /cm^3

P_D = Effective overburden pressure in kg / cm^2

$N\gamma$ and Nq = Bearing capacity factors depending upon the angle of internal friction Ø at toe

$\sum_{i=1}^{i=n}$ = Summation of N layers in which pile is installed

K = Coefficient of earth pressure

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P_{Di} = Effective overburden pressure in kg /cm² for the i^{th} layer where i varies from 1 to n.

δ= Angle of wall friction between pile and soil in degrees (may be taken equal to Ø)

A_{si} =Surface area of pile stem in cm² in the i^{th} layer where i varies from 1 to n.

For cohesive soil:-

Safe capacity of pile = $1/f \{A_P . Nc . Cp + \alpha . C . A_S\}$

Where,

A_P- c/s area of pile toe in cm²

Nc- bearing capacity factor

Cp- average cohesion at pile tip in kg/cm²

α - Reduction factor

C – average cohesion throughout the length of pile in kg/cm²

A_S- Surface area of pile shaft in cm²

f - factor of safety.

9.0 CHEMICAL COMPOSITION OF GROUND WATER

The results of chemical analysis on the ground water sample collected from the borehole, presented in **Appendix – III** show that:

- Since the pH value is more than 6, the ground water, in terms of pH value, is suitable for mixing concrete as per Clause 5.4.2 of Indian Standard: 456-2000, (Reaffirmed 2021), plain and reinforced concrete – code of practice (Fourth Revision).
- The chloride content is more than the permissible upper limit of 500 mg/l. for use of ground water for mixing in concrete for RCC, as per IS: 456-2000, (Reaffirmed 2021).

Therefore, in terms of chloride content in the ground water, the ground water is not suitable for mixing concrete for RCC, but it can be used for PCC.

- The sulphate content (expressed as SO_3) is less than the permissible upper limit of 400 mg/l for use of ground water for mixing in concrete, as per IS: 456-2000 (Reaffirmed 2021). Therefore, in terms of sulphate content, the ground water is suitable for mixing concrete for RCC. The sulphate content (expressed as SO_3) is less than 300 mg/l which comes under Class 1 of "Requirements for concrete exposed to sulphate attack", as per IS:456-2000 (Reaffirmed 2021), Table 4. For this Class, the requirements are: Ordinary Portland cement or Portland slag cement or Portland pozzolana cement can be used with a minimum cement content of 280 kg/ m^3 of concrete and with a maximum free water: cement ratio of 0.55"

Hence, the ground water is not suitable for mixing concrete for Construction purpose.

10.0 The results given in this report are based on the results of the soil investigation carried out. In actual execution, if any variation is found, the consultants may also be referred to.

APPROVED BY,

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APPENDIX- I

BORE LOGS



Project : Soil Investigation for the Proposed (G+5 Floors) Structure at Vanagaram, Chennai.

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Bore Hole No	: BH 1
Location	: Vanagaram
Type of Boring	: Calyx
Ground Water Level	: 3.0 m from G.L on 05.08.2022
UTM Co-ordinate	: 407644 E, 1442221 N
Termination Depth	: 25.00 m

Drilling Hole Record-BH 1

Fig No. 01

Reduced Level	:	99.6
Start Date	:	02.08.2022
End Date	:	04.08.2022

SOIL DESCRIPTION	COLOUR	STRUCTURE	DEPTH BELOW GROUND LEVEL (m)	REDUCED LEVEL (m)	LEGEND	TEST NO	SAMPLE TYPE	DEPTH BELOW GROUND LEVEL (m)	TEST DEPTH	PENETRATION VALUES 15cm	30cm	45cm	SPT 'N' Blows/300mm	SPT 'N' PROFILE 20 40 60 80 100	C.R (%)	R.Q.D(%)	REMARKS
Sandy **CLAY** (CL)	Brown	Stiff, Layered				SPT-1	SS	1.00	1.00-1.45	4	4	5	9				
			2.00	97.60		UDS-1	OT	1.50	1.50-1.95	-	-	-	-				
Greyish, Medium Stiff , Sandy **CLAY** (CL)						SPT-2	SS	2.00	2.00-2.45	2	2	3	5				
			3.00	96.60		SPT-3	SS	3.00	3.00-3.45	2	2	2	4				G.W.L
Greyish, Soft , **CLAY** (CI)			4.00	95.60		SPT-4	SS	4.00	4.00-4.45	2	3	3	6				
Greyish, Medium Stiff, **CLAY** (CH)			5.00	94.60		SPT-5	SS	5.00	5.00-5.45	6	3	2	5				
Sandy **SILT** (ML)	Grey	Loose, Granular	6.50	93.10		SPT-6	SS	6.50	6.50-6.95	3	9	5	14				
Clayey **SAND** (SC)	Grey	Medium Dense, Granular	8.00	91.60		SPT-7	SS	8.00	8.00-8.45	2	3	4	7				
CLAY (CH)	Grey	Medium Stiff, Layered	9.50	90.10		SPT-8	SS	9.50	9.50-9.95	3	4	5	9				
		Stiff, Layered	11.00	88.60		SPT-9	SS	11.00	11.00-11.45	4	2	1	3				
Greyish, Soft, **CLAY** (CH)																	

G.W.L: 3.0 m from G.L on 05.08.2022	No of SPT: 18 Nos.	No of UDS : 1 No.	No of CR : Nil	**Remarks**
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Note: SPT-Standard Peneration Test
SS-Split Spoon Sample
OT- Open Tube

UDS-Un Disturbed Sample
CS-Core Sample

CR-Core Recovery
RQD-Rock Quality Designation

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Project : Soil Investigation for the Proposed (G+5 Floors) Structure at Vanagaram, Chennai.

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Bore Hole No	: BH 1
Location	: Vanagaram
Type of Boring	: Calyx
Ground Water Level	: 3.0 m from G.L on 05.08.2022
UTM Co-ordinate	: 407644 E, 1442221 N
Termination Depth	: 25.00 m

Drilling Hole Record-BH 1

Fig No. 01

Reduced Level	:	99.6
Start Date	:	02.08.2022
End Date	:	04.08.2022

SOIL DESCRIPTION	COLOUR	STRUCTURE	DEPTH BELOW GROUND LEVEL (m)	REDUCED LEVEL (m)	LEGEND	TEST NO	SAMPLE TYPE	DEPTH BELOW GROUND LEVEL (m)	TEST DEPTH	PENETRATION VALUES 15cm	30cm	45cm	SPT 'N' Blows/300mm	SPT 'N' PROFILE	C.R (%)	R.Q.D(%)	REMARKS
CLAY (CH)	Grey	Soft, Layered	12.50	87.10		SPT-10	SS	12.50	12.50-12.95	14	21	14	35				
Silty **SAND** (SM)	Grey	Dense, Granular	14.00	85.60		SPT-11	SS	14.00	14.00-14.45	18	24	28	52				
		Very Dense, Granular	15.50	84.10		SPT-12	SS	15.50	15.50-15.95	2	2	3	5				
Sandy **CLAY** (CI)	Grey	Medium Stiff, Layered	17.00	82.60		SPT-13	SS	17.00	17.00-17.45	11	14	14	28				
Sandy **CLAY** (CH)	Grey	Very Stiff, Layered	19.00	80.60		SPT-14	SS	19.00	19.00-19.45	9	15	28	43				
		Hard, Layered				SPT-15	SS	22.00	22.00-22.45	16	20	30	50				
						SPT-16	SS	23.00	23.00-23.40	20	35	>50	>100				50/10 cm Peneration

SPT 'N' PROFILE: 20, 40, 60, 80, 100

G.W.L: 3.0 m from G.L on 05.08.2022	No of SPT: 18 Nos.	No of UDS : 1 No.	No of CR : Nil	Remarks
---	---	---	---	---

Note: SPT-Standard Peneration Test
SS-Split Spoon Sample
OT- Open Tube

UDS-Un Disturbed Sample
CS-Core Sample

CR-Core Recovery
RQD-Rock Quality Designation

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Project : Soil Investigation for the Proposed (G+5 Floors) Structure at Vanagaram, Chennai.

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Bore Hole No	: BH 1
Location	: Vanagaram
Type of Boring	: Calyx
Ground Water Level	: 3.0 m from G.L on 05.08.2022
UTM Co-ordinate	: 407644 E, 1442221 N
Termination Depth	: 25.00 m

Drilling Hole Record-BH 1

Fig No. 01

Reduced Level	:	99.6
Start Date	:	02.08.2022
End Date	:	04.08.2022

SOIL DESCRIPTION	COLOUR	STRUCTURE	DEPTH BELOW GROUND LEVEL (m)	REDUCED LEVEL (m)	LEGEND	TEST NO	SAMPLE TYPE	DEPTH BELOW GROUND LEVEL (m)	TEST DEPTH	PENETRATION VALUES 15cm	30cm	45cm	SPT'N" Blows/300mm	SPT 'N' PROFILE	C.R (%)	R.Q.D(%)	REMARKS
Sandy **CLAY** (CH)	Grey	Hard, Layered				SPT-17	SS	24.00	24.00-24.21	35	>50	-	>100				50/6 cm Peneration
			25.00	76.60		SPT-18	SS	25.00	25.00-25.05	>50	-	-	>100				50/5 cm Peneration
Greyish, Hard, Sandy **CLAY** (CL)																	

SPT 'N' PROFILE scale: 20, 40, 60, 80, 100

G.W.L: 3.0 m from G.L on 05.08.2022	No of SPT: 18 Nos.	No of UDS : 1 No.	No of CR : Nil	**Remarks**

Note: SPT-Standard Peneration Test
SS-Split Spoon Sample
OT- Open Tube

UDS-Un Disturbed Sample
CS-Core Sample

CR-Core Recovery
RQD-Rock Quality Designation

Project : Soil Investigation for the Proposed (G+5 Floors) Structure at Vanagaram, Chennai.

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Bore Hole No	: BH 2
Location	: Vanagaram
Type of Boring	: Calyx
Ground Water Level	: 3.0 m from G.L on 08.08.2022
UTM Co-ordinate	: 407611 E, 1442223 N
Termination Depth	: 26.50 m

Drilling Hole Record BH 2

Fig No. 02

Reduced Level	:	99.6
Start Date	:	05.08.2022
End Date	:	07.08.2022

SOIL DESCRIPTION	COLOUR	STRUCTURE	DEPTH BELOW GROUND LEVEL (m)	REDUCED LEVEL (m)	LEGEND	TEST NO	SAMPLE TYPE	DEPTH BELOW GROUND LEVEL (m)	TEST DEPTH	PENETRATION VALUES 15cm	30cm	45cm	SPT'N" Blows/300mm	SPT 'N' PROFILE	C.R (%)	R.Q.D(%)	REMARKS
Sandy **CLAY** (CL)	Grey	Very Soft, Layerec				SPT-1	SS	1.00	1.00-1.45	1	1	1	2				
			2.00	97.60		SPT-2	SS	2.00	2.00-2.45	1	2	2	4				
Greyish, Soft , **CLAY** (CH)						UDS-1	OT	2.50	2.50-2.95	-	-	-	-				G.W.L
			3.00	96.60		SPT-3	SS	3.00	3.00-3.45	2	2	2	4				
Greyish, Soft, Sandy **CLAY** (CI)			4.00	95.60		SPT-4	SS	4.00	4.00-4.45	2	4	6	10				
Sandy **CLAY** (CI)	Grey	Stiff, Layered	5.00	94.60		SPT-5	SS	5.00	5.00-5.45	3	6	5	11				
Silty **SAND** (SM)	Grey	Medium Dense, Granular	6.50	93.10		UDS-2	OT	5.50	5.50-5.95	-	-	-	-				
						SPT-6	SS	6.50	6.50-6.95	2	4	7	11				
Clayey **SAND** (SC)	Grey	Medium Dense, Granular	8.00	91.60		SPT-7	SS	8.00	8.00-8.45	3	6	9	15				
Sandy **CLAY** (CL)	Grey	Stiff, Layered	9.50	90.10		SPT-8	SS	9.50	9.50-9.95	4	15	10	25				
CLAY (CI)	Grey	Very Stiff, Layered	11.00	88.60		SPT-9	SS	11.00	11.00-11.45	2	3	6	9				
Greyish, Stiff , **CLAY** (CH)																	

SPT 'N' PROFILE scale: 20, 40, 60, 80, 100

G.W.L: 3.0 from GL on 08.08.2022	No of SPT: 19 Nos.	No of UDS : 2 Nos.	No of CR : Nil	**Remarks**
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Note: SPT-Standard Peneration Test
SS-Split Spoon Sample
OT- Open Tube

UDS-Un Disturbed Sample
CS-Core Sample

CR-Core Recovery
RQD-Rock Quality Designation

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Project : Soil Investigation for the Proposed (G+5 Floors) Structure at Vanagaram, Chennai.

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Bore Hole No	: BH 2
Location	: Vanagaram
Type of Boring	: Calyx
Ground Water Level	: 3.0 m from G.L on 08.08.2022
UTM Co-ordinate	: 407611 E, 1442223 N
Termination Depth	: 26.50 m

Drilling Hole Record-BH 2

Fig No. 02

Reduced Level	:	99.6
Start Date	:	05.08.2022
End Date	:	07.08.2022

SOIL DESCRIPTION	COLOUR	STRUCTURE	DEPTH BELOW GROUND LEVEL (m)	REDUCED LEVEL (m)	LEGEND	TEST NO	SAMPLE TYPE	DEPTH BELOW GROUND LEVEL (m)	TEST DEPTH	PENETRATION VALUES 15cm	30cm	45cm	SPT'N" Blows/300mm	SPT 'N' PROFILE	C.R (%)	R.Q.D(%)	REMARKS
CLAY (CH)	Grey	Stiff, Layered	12.80	87.10													
Silty SAND (SM)	Grey	Medium Dense, Granular	14.00	85.60		SPT-10	SS	12.50	12.50-12.95	3	3	8	11				
SAND (SP)	Grey	Medium Dense, Granular	17.50	82.10		SPT-11	SS	14.00	14.00-14.45	3	6	10	16				
						SPT-12	SS	15.50	15.50-15.95	5	9	11	20				
Sandy CLAY (CI)	Grey	Medium Stiff, Layered	19.50	80.10		SPT-13	SS	17.50	17.50-17.95	3	3	5	8				
		Stiff, Layered	21.50	78.10		SPT-14	SS	19.50	19.50-19.95	2	4	6	10				
Sandy CLAY (CH)	Grey	Hard, Layered				SPT-15	SS	21.50	21.50-21.95	9	15	19	34				

SPT 'N' PROFILE: 20 | 40 | 60 | 80 | 100

G.W.L: 3.0 from GL on 08.08.2022	No of SPT: 19 Nos.	No of UDS : 2 Nos.	No of CR : Nil	Remarks
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Note: SPT-Standard Peneration Test
SS-Split Spoon Sample
OT- Open Tube

UDS-Un Disturbed Sample
CS-Core Sample

CR-Core Recovery
RQD-Rock Quality Designation

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Project : Soil Investigation for the Proposed (G+5 Floors) Structure at Vanagaram, Chennai.

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Bore Hole No	: BH 2
Location	: Vanagaram
Type of Boring	: Calyx
Ground Water Level	: 3.0 m from G.L on 08.08.2022
UTM Co-ordinate	: 407611 E, 1442223 N
Termination Depth	: 26.50 m

Drilling Hole Record-BH 2

Fig No. 02

Reduced Level	:	99.6
Start Date	:	05.08.2022
End Date	:	07.08.2022

SOIL DESCRIPTION	COLOUR	STRUCTURE	DEPTH BELOW GROUND LEVEL (m)	REDUCED LEVEL (m)	LEGEND	TEST NO	SAMPLE TYPE	DEPTH BELOW GROUND LEVEL (m)	TEST DEPTH	PENETRATION VALUES 15cm	30cm	45cm	SPT"N" Blows/300mm	SPT 'N' PROFILE 20 40 60 80 100	C.R (%)	R.Q.D(%)	REMARKS
Sandy **CLAY** (CH)	Grey	Hard, Layered	26.50	73.10		SPT-16	SS	23.50	23.50-23.95	22	23	24	67				
						SPT-17	SS	24.50	24.50-24.91	27	35	>50	>100				50/11 cm Peneration
						SPT-18	SS	25.50	25.50-25.86	32	43	>50	>100				50/6 cm Peneration
						SPT-19	SS	26.50	26.50-26.73	38	>50	-	>100				50/8 cm Peneration

G.W.L: 3.0 from GL on 08.08.2022	NO OF SPT: 19 Nos.	NO OF UDS : 2 Nos.	NO OF CR : Nil	Remarks
---	---	---	---	---

Note: SPT-Standard Peneration Test
SS-Split Spoon Sample
OT- Open Tube

UDS-Un Disturbed Sample
CS-Core Sample

CR-Core Recovery
RQD-Rock Quality Designation

APPENDIX – II

LABORATORY TEST RESULTS

GEO FOUNDATIONS & STRUCTURES PVT LTD

LABORATORY TEST RESULTS

Project : Soil Investigation for the Proposed (G+5 Floors) Structure at Vanagaram, Chennai.

Boring Start : 02.08.2022	Table No. 1
Boring End : 04.08.02022	Bore-Hole No. 1
Location	G.W.T: 3 m
Vanagaram	Termination Depth: 25 m

Site Recorded N Value	Corrected N Value	DEPTH (m)	SAMPLE	SOIL DESCRIPTION	IS. CLASSIFICATION	GRAIN SIZE ANALYSIS			ATTERBERG LIMITS				DRY DENSITY, gm/cc	WET DENSITY, gm/cc	WATER CONTENT, %	SPECIFIC GRAVITY	FREE SWELL INDEX, %	SHEAR PARAMETERS		
						GRAVEL, %	SAND, %	SILT & CLAY %	LIQUID LIMIT,%	PLASTIC LIMIT,%	PLASTICITY INDEX	SHRINKAGE LIMIT, %						TEST METHOD	C in Kg/cm²	Φ in degrees
9	9	1.00	SPT-1	Sandy **CLAY**	CL	0	46	54	30	15	15				19	2.52	20			
-	-	1.50	UDS-1										1.68	2.01				TA	0.32	
5	5	2.00	SPT-2		CL	0	41	59	29	16	13				20	2.57				
4	4	3.00	SPT-3	**CLAY**	CI	0	2	98	48	24	24				37		45			
6	6	4.00	SPT-4		CH	0	1	99	60	29	31				40		45			
5	6	5.00	SPT-5	Sandy **SILT**	ML	0	43	57	25	Non-Plastic					21					
14	15	6.50	SPT-6	Clayey **SAND**	SC	1	63	36							24					
7	7	8.00	SPT-7	**CLAY**	CH	0	3	97	57	28	29				41		50			
9	9	9.50	SPT-8		CH				56	27	29				37		50			
3	3	11.00	SPT-9																	
35	25	12.50	SPT-10	Silty **SAND**	SM	0	85	15							20					
52	34	14.00	SPT-11		SM	0	90	10							16					
5	5	15.50	SPT-12	Sandy **CLAY**	CI	3	47	50	46	20	26				37					
28	28	17.00	SPT-13		CH	0	25	75	76	31	45				35					
43	43	19.00	SPT-14		CH	0	35	65	60	26	34				29					
50	50	22.00	SPT-15		CH	0	26	74	79	37	42				36					
>100	>100	23.00-23.40	SPT-16		CH	0	23	77	66	31	35				26					
>100	>100	24.00-24.21	SPT-17		CH	0	20	80	73	36	37				31					
>100	>100	25.00-25.05	SPT-18		CL	0	19	81	31	22	9				29					

NOTE: Type of Sample
SPT- Standard Penetration Test
UDS- Un Disturbed Sample

Test Method:
UCS- UnConfined Compressive Strength
DS - Direct Shear
TA - Tri Axial test

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LABORATORY TEST RESULTS

Project : Soil Investigation for the Proposed (G+5 Floors) Structure at Vanagaram, Chennai.

Boring Start : 05.08.2022 | **Table No. 2**

Boring End : 07.08.2022 | **Bore-Hole No. 2**

Location | **G.W.T: 3 m**

Vanagaram | **Termination Depth: 26.5 m**

Site Recorded N Value	Corrected N Value	DEPTH (m)	SAMPLE	SOIL DESCRIPTION	IS. CLASSIFICATION	GRAIN SIZE ANALYSIS			ATTERBERG LIMITS				DRY DENSITY, gm/cc	WET DENSITY, gm/cc	WATER CONTENT, %	SPECIFIC GRAVITY	FREE SWELL INDEX, %	SHEAR PARAMETERS		
						GRAVEL, %	SAND, %	SILT & CLAY %	LIQUID LIMIT,%	PLASTIC LIMIT,%	PLASTICITY INDEX	SHRINKAGE LIMIT, %						TEST METHOD	C in Kg/cm²	Φ in degrees
2	2	1.00	SPT-1	Sandy **CLAY**	CL	0	31	69	29	17	12				19		40			
4	4	2.00	SPT-2	**CLAY**	CH	0	6	94	57	27	30				37		58			
-	-	2.50	UDS-1										1.47	2.08				TA	0.25	
4	4	3.00	SPT-3	Sandy **CLAY**	CI	1	14	85	48	23	25				47		50			
10	10	4.00	SPT-4		CI	0	20	80	48	25	23				48					
11	12	5.00	SPT-5	Silty **SAND**	SM	0	71	29	22	Non Plastic					19					
-	-	5.50	UDS-2										1.61	2.02		2.67		DS		29
11	12	6.50	SPT-6	Clayey **SAND**	SC	0	62	38	21	16	5				26	2.69				
15	15	8.00	SPT-7	Sandy **CLAY**	CL	0	36	64	33	17	16				33					
25	25	9.50	SPT-8	**CLAY**	CI	0	9	91	44	28	16				33					
9	9	11.00	SPT-9		CH				54	25	29				37					
11	11	12.50	SPT-10	Silty **SAND**	SM	0	89	11							16					
16	16	14.00	SPT-11	**SAND**	SP	0	93	7							15					
20	18	15.50	SPT-12		SP	0	94	6							15					
8	8	17.50	SPT-13	Sandy **CLAY**	CI	0	15	85	46	21	25				31					
10	10	19.50	SPT-14		CI	0	46	54	43	22	21				45					
34	34	21.50	SPT-15		CH	4	27	69	90	30	60				35					
62	62	23.50	SPT-16		CH	4	29	67	90	31	59				24					
>100	>100	24.50-24.91	SPT-17		CH	0	22	78	71	30	41				34					
>100	>100	25.50-25.86	SPT-18		CH	1	25	74	81	34	47				27					
>100	>100	26.50-26.73	SPT-19		CH	3	40	57	85	34	51				33					

NOTE: Type of Sample
SPT- Standard Penetration Test
UDS- Un Disturbed Sample

Test Method:
UCS- UnConfined Compressive Strength
DS - Direct Shear
TA - Tri Axial Test

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APPENDIX-III

CHEMICAL ANALYSIS OF GROUND WATER

GEO FOUNDATIONS & STRUCTURES PVT.LTD.

CHEMICAL ANALYSIS OF GROUND WATER

Project. No.	**: 1671**
Name of Project	**: Soil Investigation for the Proposed (G+5 Floors) Structure at Vanagaram, Chennai.**
Ref. No.	**: SI/CHN/22/1671/01**

Table No. 3

Sl. No.	Tests	BH 1	Limits for using the ground water for mixing concrete
1	**Sulphate as SO_3 mg/l**	Nil	400 mg/l
2	**Chloride as Cl mg/l**	540	I.2000 mg/l for Plain concrete II. 500 mg/l for reinforced concrete
3	**pH @ 25° C**	7	6.0 Min

APPENDIX-IV

BOREHOLES LOCATION DRAWING

GEO FOUNDATIONS & STRUCTURES PVT. LTD. CHENNAI-600 020.

GEO FOUNDATIONS & STRUCTURES PVT. LTD.
No.89, 1st Main Road, Gandhi Nagar, Adyar, Chennai – 600 020.



Project Number : 1671

Project Name : Soil Investigation for the Proposed (G+5 Floors) Structure at Vanagaram, Chennai.



COORDINATES:

Borehole No.	UTM Co-ordinates
BH 1	407644 E, 1442221 N
BH 2	407611 E, 1442223 N

Note: The boreholes distance & Coordinates are approximate. The image is captured from Google Earth.



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Certified EC, Patta, legal opinions, property verification, due diligence, litigation solutions, and legal heir certificates.

Property Development & Approvals

Building plan approvals, construction, layout and sub-division approvals, zone conversion, and occupancy certification.

NRI & Investment Services

Escrow Services, Rentals, Litigation Solutions, Property Valuation and Property Management

Compliance & Special Services

Demolition, Vaasthu checks, regularization of unauthorized buildings, and office space solutions.



empowering your real estate decisions with smart tools

Property Valuation & Cost Estimation

Guideline Value, Apartment Composite Value, Stamp Duty & Registration Fees Calculator, Building Value Calculator, Capital Gains Calculator, Area Unit Converter, Length Unit Converter

Ownership, Compliance & Legal Verification

Encumbrance Certificate (EC) Search, Find Your SRO, Temple Property Check, WAQF Property Check, View Patta/Chitta, View FMB, Patta Analyzer, EC Analyzer

Zoning & Land Use Analysis

Land Use Zone Finder, CRZ Zone Check, Aquifer Zone Check, CBA Check, EWS Check, Road Width Check, Proposed Road Widening Check, FSI Calculator

Property Documentation & Workflow Tools

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