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SOIL EXPLORATION REPORT

For

Ref: GEO-CH-096-2022 ***Date : 10.08.2022 to 11.08.2022***

PROJECT NAME:

SOIL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING WITH STILT + 5 FLOORS @ PLOT NO:7 & 10, RAJAJI SALAI, SENTHIL NAGAR, THIRUMULAIVOYAL, CHENNAI-600062.

GEODESIGN INDIA PRIVATE LIMITED

(An ISO 9001 : 2008 Certified Company)

Soil Investigations, SPT Test, DTH, Diamond core drilling, & Grouting works

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1. INTRODUCTION

1.1. PURPOSE AND SCOPE

Geo-technical site investigation work for "SOIL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING WITH STILT + 5 FLOORS @ PLOT NO:7 & 10, RAJAJI SALAI, SENTHIL NAGAR, THIRUMULAIVOYAL, CHENNAI-600062." The primary purpose of our investigation is to obtain data to develop foundation design recommendations for the above work. At, first instance, Three boreholes was bored at site. Client's representatives selected the locations of borings. To accomplish these purposes, the following tasks were performed:

1. Detailed soil borings were done up to stratum to explore the sub surface stratigraphy and obtain soil samples for testing. Field and laboratory tests were conducted to evaluate the index and engineering properties of the soils
2. Engineering analysis were performed to develop foundation design information for proposed structure

1.2. THE SITE:

"SOIL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING WITH STILT + 5 FLOORS @ PLOT NO:7 & 10, RAJAJI SALAI, SENTHIL NAGAR, THIRUMULAIVOYAL, CHENNAI-600062."

2. FIELD INVESTIGATIONS

2.1. ROTARY BORING

Rotary drilling technique was adapted using Calyx machine in this field. In this method, boring is effected by the cutting action of a rotating bit that is kept in firm contact with the bottom of the hole. The bit is attached to the lower end of a hollow drill rod that is rotated by a suitable chuck. Drilling mud (usually Bentonite) is continuously forced down the hollow drill rods. The mud returning upwards though the annular space between the drill rods and the side of the hold bring the cutting to the surface.

2.2. STANDARD PENETRATION TEST

It is now most commonly used in site test. The test measures the penetration resistance of the split spoon sampler, when it is driven into the soil, at the bottom of a borehole in a standard manner. The N-value, which is the number of blow required to achieve 300mm penetration of the soil, indicates the relative density of sand or gravel, the consistency of other soil such as silts or clays and the strength of weak rocks. The test is described in IS 2131 - 1981. The split spoon sampler is attached to stiff drill rod and lowered to the bottom of the bore hold. A standard blow consists of dropping a mass of 63.5kg free fall through 750 mm on to an donut hammer at the top of the rods and ensuing that this amount of dynamic energy is transferred to the sampler as much as possible.

The number of blows required to achieve each 150mm penetration is recorded for a fall penetration of 450mm. The initial 150mm penetration is referred to as seating drive and the blows required for this penetration are not considered as this zone is in disturbed soil. The next 300mm of penetration is referred to as the test drive and the number of blows required to achieve this fully is termed the penetration resistance or N-value.

2.3. SAMPLING

Soil samples were collected through Split spoon and rock core sample were collected through single tube core barrel.

3. LABORATARY TESTS

The operations to be performed in the laboratory depend upon the type of the nature of data required for the problem at hand. In case of cohesionless material, like sand, the laboratory tests are usually minimum and the design parameters are worked out from field test data such as form SPT- N value, Core resistance and plate load test data.

In the case of cohesive soils, the programme of laboratory testing can vary from carrying out simple tests such as unconfined tests to comprehensive study of soil behaviour using triaxial shear tests and consolidation tests.

Following laboratory tests are conducted.

For Cohesion & cohesionless soil

a) Specific gravity

b) Sieve analysis

c) Atterberg's limits

d) Natural moisture content

4. FOUNDATION ANALYSIS

4.1 Soil Profile

The profile of the area as observed in the bore hole is given in the chart. The water level is observed far below. The soil layer up to 15.00m depth SILTY FINE SAND was obtained.

4.2 Safe Bearing Capacity

The bearing capacity of granular soil depends upon the unit weight and angle of internal friction of the soil. These two properties of granular soils are determined by standard penetration tests.

The allowable bearing pressure based on tolerable settlement has been established empirically by Terzaghi and Peck, 1948 and may be expressed by the equation.

Safe bearing capacity (SBC) $= 3.5\ (N-3)\ \{(B+0.3)/2B\}^2 \times R_W \times F_D + P$

Where

N = Corrected N value N1

B = Width of Foundation = constant 1

RW = Water Correction = constant 0.5

FD = Depth of Factor = constant 1

P = Over Burden Pressure

5 . RECOMMENDATION

- The site of "SOIL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING WITH STILT + 5 FLOORS @ PLOT NO:7 & 10, RAJAJI SALAI, SENTHIL NAGAR, THIRUMULAIVOYAL, CHENNAI-600062." The borehole investigation was conduct and SBC was determined.
- The site up to 15.00m SLITY FINE SAND is obtained.
- The **ISOLATED FOOTING** is recommended for this site.
- **Rest the Foundation at 3.00m from the Existing Ground Level.**
- The **SBC at 3.00m is 15.00 Ton/m^2** is determined in BORE HOLE NO-3 @ Foundation Level. **(OR)**
- **PILE FOUNDATION** is recommended for this site.

Er.K.P.VETRISELVAN.M.E.(GEOTECH),MIGS,MISTE.,
GEOTECHNICAL ENGINEER

6. REFERENCES

1. **IS: 1892-1979** – Indian Standard Code of Practice for Determination of Bearing Capacity Of Shallow Foundation

2. **IS: 1892-1979** - Indian Standard Code of Practice for Subsurface Investigation for Foundations

3. **IS: 2131-1981** - Indian Standard Method for Standard Penetration Test for Soils

4. **IS: 8009 (Part 1) - 1976** - Indian Standard Code of Practice for Calculation of Settlements of Foundations

5. **IS: 2720 (Part-2) - 1973** - Indian Standard Methods of Test for Soils, Determination of Water Content

6. **IS: 2720 (Part-4) - 1985** - Indian Standard Methods of Test for Soils, Grain Size Analysis

7. **IS: 2720 (Part-5) – 1985** - Indian Standard Method of Test for Soils, Determination of Liquid and Plastic Limit

8. **IS: 2720 (Part-3/Sec-1)1980** - Indian Standard Methods of Test for Soils, Determination of Specific Gravity.

1

Bore Log

Ref: GEO/ CH /096/2022

Name of Project: "SOIL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING WITH STILT + 5 FLOORS @ PLOT NO:7 & 10, RAJAJI SALAI, SENTHIL NAGAR, THIRUMULAIVOYAL, CHENNAI-600062."

Soil Investigation done by: GEODESIGN INDIA PRIVATE LIMITED Soil Exploration Consultant, Chennai-94.

Type of Drilling: Rotary – Mud Circulation

G.W.T- 8.20m

Bore hole No: 1
Location/R.L: 1

Date of commencement : 10.08.2022
Date of completion : 10.08.2022

Depth below G.L.(R.L)	Soil Profile	Description of Soil	Thickness of layer (m)	Standard penetration test data: Depth at which test is conducted	N – Value- Depth of penetration: 15cm	30cm	45cm	For 30cm	Relative density / Consistency	Graphical representation of penetration resistance: 0 20 40 60 80 100
				1.50	3	4	5	9	Loose	
				3.00	5	8	10	18	Medium	
		Clayey Sand	**8.80**	4.50	4	6	6	12	Medium	
				6.00	5	6	9	15	Medium	
				7.50	6	8	11	19	Medium	
8.80m										
				9.00	6	7	11	18	Medium	
		Silty Fine Sand	**1.20**							
10.00m				10.00	8	14	17	31	Medium	

Contd….2

2

Bore Log

Ref: GEO/ CH /096/2022

Name of Project: "SOIL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING WITH STILT + 5 FLOORS @ PLOT NO:7 & 10, RAJAJI SALAI, SENTHIL NAGAR, THIRUMULAIVOYAL, CHENNAI-600062."

Soil Investigation done by: GEODESIGN INDIA PRIVATE LIMITED, Soil Exploration Consultant, Chennai-94.

Type of Drilling: Rotary – Mud Circulation

G.W.T- 8.20m

Bore hole No: 2
Location/R.L: 2

Date of commencement : 10.08.2022
Date of completion : 10.08.2022

Depth below G.L.(R.L)	Soil Profile	Description of Soil	Thickness of layer (m)	Standard penetration test data: Depth at which test is conducted	N – Value- Depth of penetration: 15cm	30cm	45cm	For 30cm	Relative density / Consistency	Graphical representation of penetration resistance (0 20 40 60 80 100)
				1.50	2	4	5	9	Loose	
				3.00	6	10	11	21	Medium	
		Clayey Sand	9.50	4.50	3	4	5	9	Loose	
				6.00	4	5	6	11	Medium	
				7.50	4	6	6	12	Medium	
9.50m				9.00	5	7	9	16	Medium	
		Silty Fine Sand	0.50							
10.00m				10.00	7	12	13	25	Medium	

Contd….3

3

Bore Log

Ref: GEO/ CH /096/2022

"SOIL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING WITH STILT + 5 FLOORS @ PLOT NO:7 & 10, RAJAJI SALAI, SENTHIL NAGAR, THIRUMULAIVOYAL, CHENNAI-600062."

Soil Investigation done by: GEODESIGN INDIA PRIVATE LIMITED Soil Exploration Consultant, Chennai-94.

Type of Drilling: Rotary – Mud Circulation

G.W.T- 8.20m

Bore hole No: 3
Location/R.L: 3

Date of commencement : 10.08.2022
Date of completion : 11.08.2022

Depth below G.L.(R.L)	Soil Profile	Description of Soil	Thickness of layer (m)	Standard penetration test data: Depth at which test is conducted	N – Value- Depth of penetration: 15cm	30cm	45cm	For 30cm	Relative density / Consistency	Graphical representation of penetration resistance
				1.50	2	3	5	8	Loose	
				3.00	4	7	10	17	Medium	
				4.50	4	5	6	11	Medium	
		Clayey Sand	**9.70**	6.00	6	6	8	14	Medium	
				7.50	6	5	8	13	Medium	
				9.00	7	8	9	17	Medium	
9.70m										
				10.50	9	13	14	27	Medium	
		Silty Fine Sand	**5.30**	12.00	11	15	18	33	Medium	
				13.50	17	19	21	40	Dense	
15.00m				15.00	20	26	31	57	V.Dense	

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SOIL TEST RESULTS

Name of Project: "SOIL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING WITH STILT + 5 FLOORS @ PLOT NO:7 & 10, RAJAJI SALAI, SENTHIL NAGAR, THIRUMULAIVOYAL, CHENNAI-600062."

Geodesign India Limited Soil Exploration Consultant, Chennai-94.					BORE NUMBER - 1			LOCATION : 1				GROUND WATER LEVEL: 8.20m		COMMENCEMENT OF LAB TESTING 12.08.2022				COMPLETION OF LAB TESTING 22.08.2022			
SOIL PROFILE AND DEPTH IN METRES	DEPTH OF SAMPLING (m)	IS SOIL CLASSIFICATION	NATURAL WET DENSITY kN/m³	NATURAL MOISTURE CONTENT %	INDEX TEST			SIEVE ANALYSIS % PASSING IS SIEVE ANALYSIS				SPECIFIC GRAVITY	SHEAR TEST		STANDARD PENETRATION TEST				CONSOLIDATION TEST			
					LIQUID LIMIT %	PLASTIC LIMIT %	PLASTICITY INDEX	% of GRAVEL	% of SAND	% of SILT	% of CLAY		COHESION C Ton / m²	ANGLE OF INTERNAL FRICTION °	DEPTH OF TESTING M	OBSERVED N VALUE	CORRECTED N VALUE	SAFE BEARING CAPACITY T/m²	COMPRESSION INDEX C_c	PRE-CONSOLIDATION PRESSURE kg/cm²	INITIAL VOIDS RATIO	CO-EFFECT OF CONSOLIDATION C_v IN cm²/sec
															1.50	9	15	10.13				
															3.00	18	21	15.68				
															4.50	12	15	12.52				
		SC	15.74	15.63	-	-	-	-	35	27	38	2.67	-	-	6.00	15	16	14.49	-	-	-	-
															7.50	19	18	16.89				
															9.00	18	17	17.13				
															10.00	31	24	23.12				
	8.80																					
		SS	15.62	15.44	-	-	-	-	62	28	10	2.63	-	25					-	-	-	-
	10.00																					

SC-CLAYEY SAND, SS-SILTY FINE SAND.

Contd…..2

2

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SOIL TEST RESULTS

Name of Project: "SOIL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING WITH STILT + 5 FLOORS @ PLOT NO:7 & 10, RAJAJI SALAI, SENTHIL NAGAR, THIRUMULAIVOYAL, CHENNAI-600062."

Geodesign India Limited Soil Exploration Consultant, Chennai-94.					BORE NUMBER - 2			LOCATION : 2				GROUND WATER LEVEL: 8.20m		COMMENCEMENT OF LAB TESTING 12.08.2022				COMPLETION OF LAB TESTING 22.08.2022			
SOIL PROFILE AND DEPTH IN METRES	DEPTH OF SAMPLING (m)	IS SOIL CLASSIFICATION	NATURAL WET DENSITY kN/m³	NATURAL MOISTURE CONTENT %	INDEX TEST			SIEVE ANALYSIS % PASSING IS SIEVE ANALYSIS				SPECIFIC GRAVITY	SHEAR TEST		STANDARD PENETRATION TEST				CONSOLIDATION TEST			
					LIQUID LIMIT %	PLASTIC LIMIT %	PLASTICITY INDEX	% of GRAVEL	% of SAND	% of SILT	% of CLAY		COHESION C Ton / m²	ANGLE OF INTERNAL FRICTION °	DEPTH OF TESTING M	OBSERVED N VALUE	CORRECTED N VALUE	SAFE BEARING CAPACITY T/m²	COMPRESSION INDEX C_C	PRE-CONSOLIDATION PRESSURE kg/cm²	INITIAL VOIDS RATIO	CO-EFFECT OF CONSOLIDATION C_v IN cm²/sec
															1.50	9	15	10.13				
															3.00	21	23	17.39				
															4.50	9	13	11.01				
		SC	15.77	15.65	-	-	-	-	36	26	38	2.67	-	-	6.00	11	14	12.63	-	-	-	-
															7.50	12	14	13.83				
															9.00	16	16	16.29				
															10.00	25	21	20.71				
	9.50																					
		SS	15.63	15.43	-	-	-	-	64	27	9	2.62	-	26					-	-	-	-
	10.00																					

SC-CLAYEY SAND, SS-SILTY FINE SAND.

Contd…..3

3

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SOIL TEST RESULTS

Name of Project: "SOIL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING WITH STILT + 5 FLOORS @ PLOT NO:7 & 10, RAJAJI SALAI, SENTHIL NAGAR, THIRUMULAIVOYAL, CHENNAI-600062."

Geodesign India Limited Soil Exploration Consultant, Chennai-94.					BORE NUMBER - 3			LOCATION : 3						GROUND WATER LEVEL: 8.20m		COMMENCEMENT OF LAB TESTING 12.08.2022				COMPLETION OF LAB TESTING 22.08.2022			
SOIL PROFILE AND DEPTH IN METRES	DEPTH OF SAMPLING (m)	IS SOIL CLASSIFICATION	NATURAL WET DENSITY kN/m³	NATURAL MOISTURE CONTENT %	INDEX TEST			SIEVE ANALYSIS % PASSING IS SIEVE ANALYSIS				SPECIFIC GRAVITY	SHEAR TEST		STANDARD PENETRATION TEST				CONSOLIDATION TEST			
					LIQUID LIMIT %	PLASTIC LIMIT %	PLASTICITY INDEX	% of GRAVEL	% of SAND	% of SILT	% of CLAY		COHESION C Ton / m²	ANGLE OF INTERNAL FRICTION °	DEPTH OF TESTING M	OBSERVED N VALUE	CORRECTED N VALUE	SAFE BEARING CAPACITY T/m²	COMPRESSION INDEX C_c	PRE-CONSOLIDATION PRESSURE kg/cm²	INITIAL VOIDS RATIO	CO-EFFECT OF CONSOLIDATION C_v IN cm²/sec
															1.50	8	14	9.49				
															3.00	17	20	15.11				
															4.50	11	15	12.02				
															6.00	14	16	14.02				
		SC	15.75	15.61	-	-	-	-	35	26	39	2.67	-	-	7.50	13	15	14.27	-	-	-	-
															9.00	17	17	16.71				
															10.50	27	22	21.51				
															12.00	33	24	24.46				
	9.70														13.50	40	27	27.72				
															15.00	57	50	45.23				
		SS	15.60	15.42	-	-	-	-	63	26	11	2.63	-	26					-	-	-	-
	15.00																					

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