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GEO BUILD ENGINEERING INDIA PVT LTD

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GEOTECHNICAL INVESTIGATION REPORT

PROJECT: **GEOTECHNICAL INVESTIGATION REPORT FOR THE PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING (S+5) AT OLD DOOR NO.26, NEW DOOR NO.18, ABHIRAMAPURAM 1st STREET, CHENNAI-600 018.**

CLIENT: ***M/s. Swathi Builders,***

GBE/23-24/007	22.05.2023	Submission for Design of Foundation		
REV	DATE	Description	GT ENG.	P.G.T ENG.

TELANGANA BRANCH OFFICE:
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INTRODUCTION

This report presents the results of the geotechnical investigations carried out by Geo Build Engineering India Private Limited - Geotechnical & Foundation Engg Division. A detailed soil investigation was suggested by the client for obtaining the soil profile and recommendation of the most suitable foundation system for the proposed construction of the Residential Building. This report comprises the details of soil investigation, analysis of field and lab test results and recommendation of the most suitable foundation system. The site is for the Geotechnical Investigation report for the proposed construction of Residential Building (S+5 floors) at Old door no.26, new door no.18, Abhiramapuram 1st street, Chennai-600 018.

This work was authorized by. *M/s. Swathi Builders,*

Standard Penetration Testing boreholes were drilled at the site up to a maximum depth of 34.0 m below existing ground level. The investigation consists of drilling two boreholes, soil sampling, field and laboratory testing and preparation of a Geotechnical Investigation report.

The proposed site has plain terrain in which the borehole has been tested. The site was cleaned while the start of a geotechnical investigation. The total number of boreholes has been decided as two numbers as agreed by the Client and the Consultant. The borehole has been located in the maximum loaded area of the proposed site; the locations of the borehole were chosen by the Client. The location of a borehole is shown in the borehole location drawing. The nature of field tests includes standard penetration tests, disturbed sampling through split spoon sampler as per GBEI/QSP/08, identification of different soil layers and location of groundwater table complete logging of the borehole etc. The depth of the borehole terminated to a maximum depth of 34.0 m from EGL.

SCOPE OF WORK

The scope of this investigation is to:

i) To determine the probable subsurface conditions such as stratification, denseness or hardness of the strata, the position of the groundwater table etc.
ii) To give a probable range of safe bearing capacity for the structure. To accomplish these purposes, the study was conducted in the following phases.
iii) Drilling boreholes in order to determine site stratification and to collect disturbed & undisturbed soil samples for laboratory testing.
iv) Testing on selected soil samples in the laboratory to determine the physical and engineering properties of the soil samples.

v) Analysing all field and laboratory data in order to develop engineering recommendations for foundation design.

Two boreholes were drilled to a maximum depth of 34.0 m. Soil samples were collected for visual identification, classification and laboratory testing. The Key Plan of the borehole is presented in Appendix ~A~, the bore log subsoil profile is presented in Appendix ~B~, the laboratory test results are given in Appendix ~C~

EXPLORATION PROGRAM & TECHNIQUES

After the visual inspection of the site, the subsurface investigation was carried out as mentioned below:

Two exploration boreholes were drilled to a maximum depth of 34.0 m.

BH - 1 was started on 16.04.2023 and completed on 19.04.2023

BH - 2 was started on 19.04.2023 and completed on 20.04.2023.

Rotary drilling was performed using water as drilling fluid in the subsoil with a casing pipe to stabilize the borehole up to the required depth. Field testing and sampling were conducted in accordance with IS: 2131-1981. Standard Penetration Test (SPT) was performed on the subsoil. In this test, a standard split spoon length of about 450 mm and cutting-edge diameter of 51/35 mm initially penetrates the soil for 15cm to bypass the expected accumulated sludge at the bottom of the hole by means of a 63.5 kg (140 lb) hammer falling freely along with a guide from a height of 750 mm. The total number of rows of blows (N) required, advancing the spoon into the bore, for another two successive 15cm (a total of 30 cm) is recorded as a measure of the soil relative density or consistency as given in Table ~A~ Along with, for further drilling using NX impregnated Tungsten Carbide cutter to be used to a depth till Weathered rock and NX impregnated Diamond cutter to be used in case of hard rock.

The fieldwork was carried out under Geo Build Engineering India Pvt Ltd. and a representative from the client in accordance with Indian Standard mentioned earlier. The drilling rig was used for the exploration of a calyx rig with the hand-operated machine, so the SPT was done manually on inspection of our engineer.

Soil Conditions at the site for proposed buildings were explored by BH 1 and 2. Boring location details are presented on bore log. The boring's number and location was selected to cover the proposed built up area with due consideration to the presence of S+5 floors buildings BH 1 and 2

were drilled in the front open space of the site. BH 1 and 2 were drilled 34.0 m and 34.0 m below EGL and terminated at confirmed hard strata weathered rock also SPT "N">= 100 in three successive tests. Borings were drilled beyond 34.0 m depth due to the presence of thick layers of clay soil and weak soil layers between 1.0 m to 4.0 m and 13.5 m to 21.0 m. Tests were conducted to determine the pertinent index and engineering analyses to develop the required design data.

LABORATORY TESTING PROGRAM

All the extracted soil samples were brought to the Geotechnical & Materials Testing Laboratory of Geo Build Engineering for further examination in accordance with IS: 1498-1970. Collected samples were subjected to the following physical tests.

Disturbed soil samples (DS):

1. Natural Moisture Content (IS: 2720 Part 2)-1973
2. Atterberg Limits (IS: 2720 Part V — 1985
3. Grain Size Analysis (IS: 2720 Part IV — 1985)
4. Differential Free Swell Test (IS: 2720 part 40 -1977)
5. Specific gravity (IS: 2720 part 3/sec1)-1980

Undisturbed soil samples (UDS):

1. Unconfined Compression Test (IS 2720 (Part 10): 1991)
2. Direct Shear Test (IS-2720-PART-13-1986)
3. Tri-axial Shear Test (IS 2720-11 (1993)
4. Consolidation Test on Clay (IS:2720(Part 15)-1986)

LABORATORY TESTS ON ROCKS

1. Bulk Density
2. Point Load Test
3. Unconfined compressive strength
4. Brazilian Test

CHEMICAL ANALYSIS ON SOIL (IS 2720:P-26) AND WATER (IS 3025:P-11)

1. Sulphate Content (SO4)
2. Chloride Content (Cl)
3. pH Value

The laboratory test results are given in Appendix ~C~.

SUBSURFACE SOIL DESCRIPTION

Borehole no: 1

In the case of BH-1, Brownish Clay is followed by brownish grey moderately weathered. The index and shear strength properties of soil collected at BH 1 in different depths were listed in the Laboratory test results. The borehole was terminated at 34.0 m depth from the existing ground level (EGL). The groundwater table was located at a depth of 3.65 m below the existing ground level. The stratum is stiff at the top and very dense at a depth of 29.0 m. At a depth of 29.0 m to 34.0 m as moderately weathered rock the RQD more 65 % its indicate that quality of rock good.

Borehole no: 2

In the case of BH-2, Brownish clay followed by brownish grey moderately weathered. The index and shear strength properties of soil collected at BH 2 in different depths were listed in the Laboratory test results. The borehole was terminated at 34.0 m depth from the existing ground level (EGL). The groundwater table was located at a depth of 3.65 m below the existing ground level. The stratum is firm at the top and very dense at a maximum depth of 29.0 m. At a depth of 29.0 m to 34.0 m as moderately weathered rock the RQD more 60 % its indicate that quality of rock good.

GROUNDWATER

A groundwater table was observed at the depth of 3.65 m for all the boreholes from the existing ground level during the time of field investigation. However, it will fluctuate due to seasonal variations and local sewerage disposal practices. Groundwater level at the ground surface is assumed in the design of the foundation to consider the worst conditions (submerged Conditions).

FOUNDATION RECOMMENDATIONS

Based on the borehole information and laboratory test results in addition to the nature of the structure, the recommendations for the proposed structure are given below The following is a summary of recommendations for a suitable type of foundation. One of the important aspects of any foundation system is to satisfy the settlement criteria apart from bearing capacity criteria. As per IS 8009 (part I) 1976 Sec 9.1.1 De Beer for the calculation of Immediate and Consolidation Settlement.

PILE FOUNDATION

Data from boring infer the presence of soil profiles with weak soil layers between 1.0 m to 4.0 m and 13.5 m to 21.0 m, also SPT N value is Low . For the proposed building with expected column loads and encountered soil profiles building with a shallow foundation will undergo high total settlements due to the consolidation of very clay and can experience sudden settlements in case of a design seismic event. Therefore, to minimize such problems it was recommended to provide a Tractor Mounted Direct Mud Circulation (DMC) Bored Cast In-Situ Pile foundation. This type of pile installation work will have low construction vibrations otherwise it may affect the existing adjacent building's foundations and also lead to objections from adjacent building owners. For this site it was recommended to provide 30.0 and 28.0 m total and effective length piles below EGL with a top 1-M pile cut-off for pile caps and tie beams. All piles should have at least 1.5-M embedment into hard stratum weathered rock with SPT "N" >> 100.

PILE CAPACITY SPECIFICATION				
Pile Length (m)	Effective Pile length below cut off level (m)	Pile diameter (mm)	Safe Load Carrying Capacity (kN)	Uplift Resistance (kN)
30	28	500	675	486
30	28	600	900	590
30	28	750	1340	750

Note:-

1. Pile Load Test must be conducted as per relevant IS Code to confirm the above-estimated pile capacities before completion of the installation of all piles.
2. Pile Installation must be done with extreme care to prevent "Necking" and "Buldging" problems due to the presence of thick very soft to soft clay layers
3. Groundwater level was assumed to rise to ground level in worst-case conditions.
4. Limiting AA. End Bearing Pressure in "Hard Rock" as per IRC code was 500 tons/m^2. Therefore q_b (all) is limited to 300 tons/m^2 in shale

UPLIFT CAPACITY

The uplift capacity of piles shall be considered as per IS 2911-1-1, Clause 6.3.2

PILE GROUPING

The group efficiency shall be worked out based on the number of Piles in a group. Piles shall have a minimum spacing of 2.5 times diameter centre to centre or a minimum of 1.5 times diameter as clear spacing in order to mobilise frictional resistance, which is a key factor in achieving better Pile capacities. Larger spacing is always preferable, in case of bored piles.

PILE TESTING

The group efficiency shall be worked out based on the number of Piles in a group. However, Pile load tests are recommended to observe the performance of the Piles and to re-confirm the theoretical Pile capacities. Load tests are to be carried out after a minimum period of 1 week after driving Pile.

Pile load tests should be conducted by loading up to 1.5 times the service load on the working Pile, while a minimum of two (2) times the service load on Pilot Piles. A pile load test can be conducted for a minimum of 2 % of the total number of piles for the project.

DESCRIPTION OF PILE SOCKETING

- The pile is to be socketed into a minimum depth of 1.5 D in solid rock or weathered rock or as per IS 14593:1998 standards.
- Extreme care should be taken to wash the base of a borehole clean before depositing concrete.
- In the case of socketing in the fractured rock or weak rocks, it is possible to develop the full structural capacity of the pile by providing greater penetration into such rocks in order to carry some load in shear between concrete and the rock.
- Apart from the calculation for pile carrying capacities, a pile load test is to be conducted for accurate results.
- Beyond the critical depth, the values of overburden pressure are constant but we are restricted to a depth to critical depth alone so that the shaft resistance is very less when compared to end resistance.
- The skin friction in a clay layer might be developed completely after a certain period of time.
- In this, pile depth and distance vary from various boreholes so that the pile carrying capacities are calculated separately.
- The pile carrying capacities significantly implies that frictional resistance is greater than end bearing resistance which implies that it is a Bored cast in situ -friction pile.

GENERAL GUIDELINES IN SOIL FILLING

If the foundation material is fine soil (clay and silt) it should be stiff. If the foundation soil is coarse-grained (sand or gravel) it should be dense. Soft, loose, compressible, or organic topsoil is not acceptable for foundation soil and in such cases, the existing weak soil should be replaced up to stiff or dense soil strata below the foundation with well compacted good quality granular soil. The minimum width of a replacement shall be the length of reinforcement plus 1 meter and this will ensure that the foundation soil has sufficient bearing capacity to withstand bearing pressures in both static and as well as seismic conditions. The foundation may be located on the compacted granular soil fill.

GENERAL COMMENTS

The recommendations for foundation design and construction are based on the information obtained from the boreholes drilled at the site. When foundation construction is underway, the recommendations of this report should be checked through field inspection, to validate the information for use during the construction stage. Any variation in underground conditions revealed by the borehole should be brought to our attention for alternate recommendations if needed. The Professional Services performed for the preparation of a report were accomplished in accordance with current and locally accepted geotechnical engineering principles and practices. The recommendations presented in this report are based upon the data obtained from the borings at the indicated locations and/or from other information discussed in this report. In the case of pile foundation, the pile must be rested on the harder rock stratum, if the depth of 1.00m is not strong the pile has to be advanced to till the harder rock stratum.

EXCAVATION

Excavation through the overburdened soil can be carried out by conventional equipment such as dozers and poclain excavators. Under-excavation shall not be done, thereby not disturbing the existing foundation. Since the proposed structure is nearby the existing building it should be careful that the existing foundation not be disturbed by any causes

DRAINAGE

It is recommended to design an effective rainwater drainage system to get rid of the consequences of the rainwater percolation into these layers. The site should be graded so as to direct rainwater and water away from all planned structures.

FOUNDATIONS ON FILLS

In such cases, the foundations have to be built under controlled conditions with proper compaction that can be designed as a normal foundation. Uncontrolled fills should be excavated and they should be either refilled with controlled fill or foundation should commence from Natural ground level. The Report and SBC calculation were completely based on the boreholes terminated; apart from this, any weak layer encountered during excavations should also be reported to Geo build engineering India Pvt Ltd

CERTIFICATION

This report is issued with the design of Pile Foundation along with The Geotechnical Investigation report for the proposed construction of Residential Building (S+5 floors) at Old door no.26, New door no.18, Abhiramapuram 1st street, Chennai-600 018. At this site, the number of a borehole (Two boreholes) and depth of exploration are also terminated to a maximum depth of 34.0 m. The report (Safe Bearing capacity) is mainly based on the investigation done in and around boreholes explored for Residential Building. The method to adopt a suitable method of Ground improvement techniques as per IS 13094:1992, before laying the foundation System. Enough care may be taken to design a suitable dewatering system while the construction of the foundation is in progress so that the bottom of the excavation and foundation layer shall be relatively dry. The water seeking trees around the proposed structure is also to be removed to avoid shrinkage cracks.

Yours Truly,

For GEO BUILD ENGINEERING INDIA PVT LTD

Er.S.Sakthi Raja, M.E (Geotech)
(Senior Engineer - Design)
CMDA Reg No - GTE/19/04/018

Er.B.Prakash, M.E (Geotech)
(Engineer - Design)

CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
'ThalamuthuNatarajan Building', No.1, Gandhi Irwin Road,
Egmore, Chennai-600 008.

PROFESSIONAL REGISTRATION CERTIFICATE

This is to certify that the **Thiru S.SAKTHI RAJA** has enrolled as **Registered Geo-Technical Engineer (RGTE)** with Chennai Metropolitan Development Authority (CMDA) who has the qualification of **M.E.,(Soil Mechanics & Foundation Engg.)** and experience in the relevant field for **7 years**.

He has been given the Registration No.**GTE/19/04/018** on **08.04.2019.** 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 **07.04.2024**.



(R.SHIVAKUMAR)

APPENDIX - A

KEY PLAN OF BORE HOLES


BreadSpread
BreadSpread
Sreshta chandini
BH-2
1st St
BH-1

ISO/IEC 17025 Accredited Testing Laboratory
by NABL Vide Certificate No TC-8781

APPENDIX - B

BORE LOG & SUB SOIL PROFILE

SOIL BORE LOG PROFILE FOR BORE HOLE: 1

PROJECT: GEOTECHNICAL INVESTIGATION REPORT FOR THE PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING (S+5 FLOORS) AT CHENNAI-600 018.

BH NO	1	**Ground water level**	-3.65 m from EGL
Site	Abhiramapuram	**Reduced level**	0.0 m from road level
Día of boring	150 mm	**Date of starting**	16.04.2023
Type of boring	Rotary (Calyx) – Wash Boring	**Date of completion**	19.04.2023

Drilling Depth below EGL (m)	Ground water level	Soil Profile	Description / Classification of Soil	Depth of Samples Collected (m)	Standard Penetration Test (SPT) In cm				Relative Density / Consistency
					15	30	45	N	
1.0	-3.65 m		Brownish clay	1.0	5	5	7	12	Stiff
2.0			Brownish clay	2.0	6	6	8	14	Stiff
3.0			Brownish clay	3.0	4	6	8	14	Stiff
4.0			Brownish clayey sand	4.0	6	5	7	12	Medium
5.0			Brownish silty sand	5.0	6	10	11	21	Medium
6.0			Brownish sand	6.0	7	6	5	11	Medium
7.5			Brownish sand	7.5	8	6	4	10	Medium
9.0			Brownish sand	9.0	9	8	7	15	Medium
10.5			Brownish sand	10.5	7	8	6	14	Medium
12.0			Brownish sand	12.0	8	11	12	23	Medium
13.5			Brownish sand	13.5	2	3	5	8	Loose
15.0			Brownish sand	15.0	4	5	4	9	Loose
16.5			Blackish silty sand	16.5	3	4	4	8	Loose
18.0			Blackish clay	18.0	4	5	4	9	Stiff
19.5			Blackish clay	19.5	3	4	4	8	Stiff
21.0			Blackish clay	21.0	3	3	4	7	Firm
22.0			Blackish clayey sand	22.0	5	6	7	13	Medium
24.0			Blackish clay	24.0	6	6	8	14	Stiff
25.5			Blackish clay	25.5	7	6	8	14	Stiff

27.0		Blackish silty sand	27.0	10	13	16	29	Dense
28.5		Blackish silty sand	28.5	4	Hammer Rebound for 50 No of Blows With 12 cm		>50	Very dense
29.0		Brownish SDR	29.0	SPT Rebound			>50	Very dense
29.0-31.0		Brownish grey moderately weathered	31.0	CR-65%, RQD-56%			-	-
31.0-32.5		Brownish grey moderately weathered	32.5	CR-68%, RQD-48%			-	-
32.5-34.0		Brownish grey moderately weathered	34.0	CR-65%, RQD-54%			-	-
Bore hole termination depth at = 34.0 m from Existing ground level								

SOIL BORE LOG PROFILE FOR BORE HOLE: 2

PROJECT: GEOTECHNICAL INVESTIGATION REPORT FOR THE PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING (S+5 FLOORS) AT CHENNAI-600 018.

BH NO	2	**Ground water level**	-3.65 m from EGL
Site	Abhiramapuram	**Reduced level**	0.0 m from road level
Día of boring	150 mm	**Date of starting**	19.04.2022
Type of boring	Rotary (Calyx) – Wash Boring	**Date of completion**	20.04.2023

Drilling Depth below EGL (m)	Ground water level	Soil Profile	Description / Classification of Soil	Depth of Samples Collected (m)	Standard Penetration Test (SPT) In cm				Relative Density / Consistency
					15	30	45	N	
1.0	-3.65 m		Brownish clay	1.0	2	3	4	7	Firm
2.0			Brownish clay	2.0	3	4	6	10	Stiff
3.0			Brownish clay	3.0	4	3	4	7	Firm
4.0			Brownish sand	4.0	3	6	6	12	Medium
5.0			Brownish sand	5.0	7	7	8	15	Medium
6.0			Brownish sand	6.0	5	5	5	10	Medium
7.5			Brownish sand	7.5	3	5	6	11	Medium
9.0			Brownish sand	9.0	7	9	9	18	Medium
10.5			Brownish sand	10.5	8	9	11	20	Medium
12.0			Brownish sand	12.0	6	7	7	14	Medium
13.5			Brownish clay	13.5	2	2	3	5	Firm
15.0			Brownish clay	15.0	1	1	2	3	Firm
16.5			Blackish clay	16.5	2	3	3	6	Firm
18.0			Blackish clay	18.0	2	2	3	5	Firm
19.5			Blackish clay	19.5	2	2	3	5	Firm
21.0			Blackish clayey sand	21.0	6	6	5	11	Medium
22.5			Blackish sand	22.5	7	8	7	15	Medium
24.5			Blackish sand	24.5	9	8	11	19	Medium
25.5			Blackish clayey sand	25.5	9	10	14	24	Medium

27.0		Blackish clayey sand	27.0	10	14	18	32	Medium
28.5		Blackish clayey sand	28.5	8	Hammer Rebound for 50 No of Blows With 12 cm		>50	Very dense
29.0		Brownish SDR	29.0	SPT Rebound			>50	Very dense
29.0-31.0		Brownish grey moderately weathered	31.0	CR-60%, RQD-48%			>100	-
31.0-32.5		Brownish grey moderately weathered	32.5	CR-65%, RQD-52%			>100	-
32.5-34.0		Brownish grey moderately weathered	34.0	CR-61%, RQD-48%			>100	-
Bore hole termination depth at = 34.0 m from Existing ground level								

APPENDIX - C

LABORATORY TEST RESULTS

TABLE NO: 1

LABORATORY TEST RESULTS

Client (^)	***M/s. Swathi Builders***	**Project (^)**	**GEOTECHNICAL INVESTIGATION REPORT FOR THE PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING (S+5 FLOORS) AT CHENNAI-600 018.**

Bore Hole No	1	Sampled date	19-04-2023	Tested Date	20-04-2023	Reporting Date	22-05-2023

Depth (m)	Soil Description / Classification	Is classification	Index Properties					Specific Gravity	Grain Size Analysis (%) Wet / Dry				
			(NMC) %	Liquid Limit, %	Plastic Limit %	Plasticity Index	Free Swell Index %		Gravel %	Coarse Sand %	Medium Sand %	Fine Sand %	Silt & Clay %
1.0	Brownish clay	CI	18	41	21	20	30	2.70	7	3	14	5	71
2.0	Brownish clay	CI	19	32	17	15	30	2.71	1	0	7	10	82
3.0	Brownish clay	CH	31	56	28	28	50	2.70	0	0	7	23	70
4.0	Brownish clayey sand	SC	24	28	12	16	20	2.67	0	0	6	62	32
5.0	Brownish silty sand	SM	20	NON - PLASTIC			0	2.65	0	0	15	73	12
6.0	Brownish sand	SP-SM	24				0	2.65	0	0	13	81	6
7.5	Brownish sand	SP-SM	22				0	2.65	0	0	15	77	8
9.0	Brownish sand	SP-SM	21				0	2.65	0	0	18	77	5
10.5	Brownish sand	SP-SM	21				0	2.65	0	0	17	78	5
12.0	Brownish sand	SP-SM	21				0	2.65	0	0	15	79	6
13.5	Brownish sand	SP-SM	23				0	2.65	0	0	18	75	7

15.0	Brownish sand	SM	31	NON - PLASTIC			0	2.65	0	0	14	72	14
16.5	Blackish silty sand	SM	26				0	2.66	0	0	17	59	24
18.0	Blackish clay	CI	43	39	18	21	40	2.69	2	1	12	19	66
19.5	Blackish clay	CH	39	56	21	35	60	2.70	1	0	12	13	74
21.0	Blackish clay	CH	53	51	25	26	60	2.72	0	0	1	1	98
22.0	Blackish clayey sand	SC	23	48	23	25	30	2.67	0	0	13	46	41
24.0	Blackish clay	CH	36	51	21	30	50	2.71	0	0	4	13	83
25.5	Blackish clay	CH	37	52	22	30	50	2.70	0	0	10	11	79
27.0	Blackish silty sand	SM	16	NON - PLASTIC			0	2.66	0	2	26	51	21
28.5	Blackish silty sand	SM	16				0	2.67	13	5	27	25	30
29.0	Brownish SDR	-	SPT Sample Recovery Nil										
29.0-31.0	Brownish grey moderately weathered rock	-	CR-65%, RQD-56%										
31.0-32.5	Brownish grey moderately weathered rock	-	CR-68%, RQD-48%										
32.5-34.0	Brownish grey moderately weathered rock	-	CR-65%, RQD-54%										

Er. S. Sakthi Raja, M.E (Geotech)
(Technical Manager)

TABLE NO: 2

LABORATORY TEST RESULTS

Client (^)		***M/s. Swathi Builders***			**Project (^)**	**GEOTECHNICAL INVESTIGATION REPORT FOR THE PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING (S+5 FLOORS) AT CHENNAI-600 018.**								
Bore Hole No	2	Sampled date	20-04-2023		Tested Date	21-04-2023			Reporting Date	22-05-2023				
Depth (m)	Soil Description / Classification	Is classification	Index Properties					Specific Gravity	Grain Size Analysis (%) Wet / Dry				
			(NMC) %	Liquid Limit, %	Plastic Limit %	Plasticity Index	Free Swell Index %		Gravel %	Coarse Sand %	Medium Sand %	Fine Sand %	Silt & Clay %
1.0	Brownish clay	CI	22	41	22	19	40	2.68	0	0	2	12	56
2.0	Brownish clay	CI	26	44	21	23	40	2.68	0	0	2	39	59
3.0	Brownish clay	CH	27	52	25	27	50	2.71	0	0	6	7	87
4.0	Brownish sand	SP-SM	21	NON - PLASTIC			0	2.65	0	0	17	74	9
5.0	Brownish sand	SP-SM	19				0	2.65	0	0	23	67	10
6.0	Brownish sand	SP-SM	22				0	2.65	0	0	6	88	6
7.5	Brownish sand	SP-SM	23				0	2.65	0	2	63	30	5
9.0	Brownish sand	SP-SM	24				0	2.65	0	1	48	44	7
10.5	Brownish sand	SP-SM	25				0	2.65	0	0	2	90	8
12.0	Brownish sand	SP-SM	23				0	2.65	0	0	17	73	10
13.5	Brownish clay	CH	47	72	32	40	60	2.72	0	0	1	5	94

15.0	Brownish clay	CH	42	54	25	29	40	2.68	0	0	3	44	53
16.5	Blackish clay	CH	45	52	27	25	40	2.72	0	0	0	2	98
18.0	Blackish clay	CH	48	54	28	26	40	2.72	1	1	1	1	96
19.5	Blackish clay	CH	49	64	30	34	60	2.70	1	1	2	19	77
21.0	Blackish clayey sand	SC	20	32	16	16	20	2.66	1	1	8	61	29
22.5	Blackish sand	SP	21	NON - PLASTIC			0	2.65	0	0	72	21	2
24.5	Blackish sand	SP	19				0	2.65	0	1	73	23	3
25.5	Blackish clayey sand	SC	18	30	12	18	20	2.67	0	3	32	22	43
27.0	Blackish clayey sand	SC	16	32	15	17	20	2.67	0	2	4	50	44
28.5	Blackish clayey sand	SC	14	28	12	16	20	2.67	9	10	23	18	40
29.0	Brownish SDR	-	SPT Sample Recovery Nil										
29.0-31.0	Brownish grey moderately weathered rock	-	CR-60%, RQD-48%										
31.0-32.5	Brownish grey moderately weathered rock	-	CR-65%, RQD-52%										
32.5-34.0	Brownish grey moderately weathered rock	-	CR-61%, RQD-48%										

Er. S. Sakthi Raja, M.E (Geotech)
(Technical Manager)

APPENDIX - D

WATER TEST RESULTS

CLIENT: ***M/s. Swathi Builders***

SITEADDRESS: Geotechnical Investigation report for the proposed construction of Residential Building (S+5 floors) at Old door no.26, New door no.18, Abhiramapuram 1st street, Chennai-600 018.

Table: WATER TEST ANALYSIS

Chemical Analysis Results conducted on Water Sample collected from Boreholes					
Location	***pH***		***Chlorides (ppm)***	***Sulphates (ppm)***	***Colour & odor***
BH - 1(CH: 144+728)	**7.25**		**346.56**	**723.4**	**Colourless & Odorless**
PERMISSIBLE VALUE	**<7**	**>7**	**2000**	**400**	**---**
	Acidic	**Alkaline**			

Description and recommendation of the chemical analysis

The Water sample has been collected from the borehole points we done during soil investigations.

The pH value is more than 7 so it indicates it has Basic content. The colour of sample is Crystal white (colourless) and with no odour.

Chloride in concrete is harmful and there is an increased risk of embedded steel being corroded. To minimize the chances of deterioration, the maximum total acid soluble Chloride content in the concrete at the time of placing for different type/use of concrete has been limited as per IS 456:2000 table no:1. Chlorides in water are more of a taste than a health concern, although high concentrations may be harmful to people with heart or kidney problems. Here the chlorides content in sample is less than permissible limit.

Sulphates are present in most cement and in some aggregates. Excessive amount of water-soluble sulphate can cause expansion and disruption of concrete. To prevent this, the total water-soluble sulphate content of the concrete mix expressed as SO3 has been limited to 4% by mass of

cement; which is same as was provided in IS 456: 2000. Since the sulphate content in sample is higher than permissible limit it is not suitable for construction purposes. Overall, the Chlorides content is lesser than permissible limits but, the Sulphates (So3) content is more than the Permissible limit, so this water is not suitable for mixing concrete for RCC.

Reference as per IS 456:2000

Table 1 Permissible Limit for Solids
(*Clause* 5.4)

Sl No.		Tested as per	Permissible Limit, *Max*
i)	Organic	IS 3025 (Part 18)	200 mg/l
ii)	Inorganic	IS 3025 (Part 18)	3 000 mg/l
iii)	Sulphates (as SO_3)	IS 3025 (Part 24)	400 mg/l
iv)	Chlorides (as Cl)	IS 3025 (Part 32)	2 000 mg/l for concrete not containing embedded steel and 500 mg/l for reinforced concrete work
v)	Suspended matter	IS 3025 (Part 17)	2 000 mg/l

CERTIFICATION

The total no of pages in this report is 25; this report is issued by Geo Build Engineering India Pvt Ltd for the project, **Geotechnical Investigation report for the proposed construction of Residential Building (S+5 floors) at Old door no.26, New door no.18, Abhiramapuram 1st street, Chennai-600 018.** All the above tests were done within our laboratory.

Yours Truly,

For GEO BUILD ENGINEERING INDIA PVT LTD

Er. S. Sakthi Raja, M. E (Geotech)
(Senior Engineer - Design)
CMDA Reg No - GTE/19/04/018

Er. B.Prakash, M.E(Geotech)
(Engineer - Design)

NOTE:

1. The results enclosed are only related to the sample tested by us.

2. The report shall not be reproduced in full or part without written permission from Geo Build Engineering India Pvt Ltd.

3. All the lab related tested values are as per the standard conditions followed by the lab.

4 Symbol (^) indicates details given by client.

5. Samples will be disposed after 30 days from sample receipt date at lab.

6. Statement of conformity not reported, so Decision rule is not applicable

LIST OF METHOD USED AS FOLLOWED

➢ IS 2720 (Part 2);1973	Natural moisture content
➢ IS 2720 (Part 3);1980	Specific Gravity test on Soils
➢ IS 2720: Part 4 :1985	Grain size Analysis Dry Sieve Analysis
➢ IS 2720: Part 4 :1985	Grain size Analysis Wet Sieve Analysis
➢ IS 2720 (Part 5):1958	Liquid limit test
➢ IS 2720 (Part 5):1985	Plastic limit test
➢ IS 2720 (Part 7);1980	Proctor density-Light (standard) compaction
➢ IS 2720 (Part 8);1983	Proctor density-Heavy (modified) compaction
➢ IS 2720 (Part 16);1987	Laboratory California Bearing ratio
➢ IS 2720 (Part 28);1974	Dry density Determination by Sand Replacement method
➢ IS 2720 (Part 29);1975	Dry density Determination by Core cutter method
➢ IS 2720 (Part 40);1977	Free Swell Index
➢ Is 6403:1981	code of practice for determination of bearing capacity of shallow foundation
➢ IS:2911 -1980	code of practice for design and construction of pile foundation - part iii – Bored cast in situ pile
➢ Is 8009 (part I)-1878	code of practice for calculations of settlements of foundations
➢ IS 14593:1998	Pile foundation on Rock

NOTE

ABBREVIATION:

WN	=	Natural Moisture content (%)
WL	=	Liquid limit (%)
WP	=	Plasticity Limit (%)
IP	=	Plasticity Index (%)
F.S.I	=	Free Swell Index (%)
IS	=	Indian Standard Classification
ML	=	Inorganic clay
CL	=	Low compressibility Clay of WL < 35%
CI	=	Inorganic Clay of 35% < WL <50%
CH	=	High Compressibility Clay of WL > 50%
SW	=	Well graded sand
SP	=	Poorly graded sand
SM	=	Silty Sand
GW	=	Well graded gravel
GP	=	Poorly graded gravel
SDR	=	Soft Disintegrated Rock
RQD	=	Rock Quality Designation
CR	=	Core recovery
RMR	=	Rock Mass Rating

Table No: ~A~.

Correlations of SPT N values with Common properties of soils

A) Granular Soil

Standard Penetration No., SPT N	Description	Relative Density, Dr %	Approx. Angle of Internal Friction, Φ°	Approx. Rang of Most. Unit Wt,ע kN/m3
< 4	Very loose	< 20	< 29	11-16
4-10	Loose	20-40	29-30	14-18
10-30	Medium	40-60	30-36	17-20
30-50	Dense	60-80	36-41	17-22
> 50	Very Dense	> 80	> 41	20-29

B) Cohesive Soil

Standard Penetration No., SPT N	Description	Unconfined Compressive Strength, kPa	Approx. Rang of Most. Unit Wt.,,ע kN/m3
< 2	Very Soft	0-25	14.4-16
2-4	Soft	25-50	16-17.4
4-8	Firm (medium)	50-100	17.6-19.2
8-15	Stiff	100-200	19.2-20.8
15-30	Very Stiff	200-400	20.8-22.4
> 30	Hard	> 400	> 20

Note: These values are most appropriate values in general. However, the soil properties vary between sites to site and hence it shall be used only for guidance

End of Report



our services doesn't just end there

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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

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