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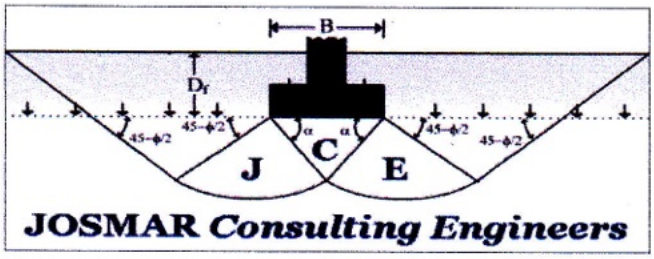
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JOSMAR CONSULTING ENGINEERS

GEOTECHNICAL ENGINEERING DIVISION



GEOTECHNICAL INVESTIGATION REPORT

Client:

Ms. Shikha Khurana and Mrs. Pooja Khurana

Site Address:

Old Door No. 16,
New Door No. 35,
Masilamani road,
Balaji Nagar,
Royapettah,
Chennai – 600014.

REPORT NO. JCE/GEOTECH/2022/102

Rev-0 **23/03/2023**

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ISO 9001:2008 CERTIFIED

Client File # 22-I-102

23rd March 2023

Ms. Shikha Khurana and Mrs. Pooja Khurana

Site Address:

Old Door No. 16,
New Door No. 35,
Masilamani road,
Balaji Nagar,
Royapettah,
Chennai – 600014.

Subject: **GEOTECHNICAL INVESTIGATION REPORT FOR THE PROPOSED CONSTRUCTION OF (STILT+5) RESIDENTIAL BUILDING AT ROYAPETTAH, CHENNAI.**

Dear Sir,

We are pleased to hereby transmit one (01) original and one (01) photocopy of our Geotechnical Investigation Report for the above captioned project.

Should you have any questions, please do not hesitate to contact this office.

Please note that our final report is deemed acceptable to you, if we do not hear from you in writing within 10 calendar days from the date that you received it.

It has been a pleasure being of service to you on this project. Assuring you of our continued co-operation, we remain.

Yours Truly,

FOR JOSMAR CONSULTING ENGINEERS
(Geotechnical, Survey & Materials Consultant)

for A.Berlinfrancis

Er.S.RAVICHANDRAN. M.E.,PhD
CEO

JOSMAR CONSULTING ENGINEERS CHENNAI-42

No. 9, Officers Colony, 100 Feet By Pass Road, Opp. I.O.B. Bank, Velachery, Chennai - 600 042.
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Website: www.josmarconsulting.com

GEOTECHNICAL INVESTIGATION REPORT FOR THE PROPOSED CONSTRUCTION OF (STILT+5) RESIDENTIAL BUILDING AT ROYAPETTAH, CHENNAI.

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INTRODUCTION

This report presents the results of the geotechnical investigations carried out by JOSMAR Consulting Engineers - Geotechnical Engineering Division for the proposed construction of (Stilt+5) Residential Building, located at Old Door No. 16, New Door No. 35, Masilamani road, Balaji Nagar, Royapettah, Chennai – 600014.

This work was authorized by the Client **Ms. Shikha Khurana and Mrs. Pooja Khurana.**
One borehole has been requested by the client for the land area measuring about 6830 Sqft as per patta (or) 6527 sq.ft as per document. Our recommendations are based on this one borehole only.

Standard penetration tests were conducted at the borehole drilled at site, up to a depth of 23.00m below existing ground level.

The investigation consists of drilling one borehole, soil sampling, field and laboratory testing and preparation of a Geotechnical Report for the proposed construction of (Stilt+5) Residential Building.

SCOPE OF WORK

The scope of this investigation is to:

i) Determine the soil profile of the site, with ground water observation.
ii) Recommend a suitable foundation system.

One (1) borehole was drilled at site, up to a maximum depth of 23.00m.

Soil samples were collected for visual identification, classification and laboratory testing.
Key plan & borehole location plan are presented in Appendix- A.
Borehole logs and its cross section is presented in Appendix- B.
Laboratory test results are presented in Appendix- C.
Raft design settlement calculations are presented in Appendix-D.
Pile foundation design calculations are presented in Appendix- E.

SITE DESCRIPTION

The site for the proposed construction of (Stilt+5) Residential Building, located at Old Door No. 16, New Door No. 35, Masilamani road, Balaji Nagar, Royapettah, Chennai – 600014.

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EXPLORATION PROGRAM & TECHNIQUES

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

Borehole-1 was drilled to a maximum depth of 23.00m.

BH-1 was started on 09th November 2022 and completed on 11th November 2022

Borehole was drilled at site, as shown in the AutoCAD drawing in order to obtain an average soil profile of the site. Rotary drilling was performed using water as drilling fluid in the sub soil with casing pipe to stabilize the bore hole up to the required depth. Field testing and sampling are conducted in accordance with IS: 2131-1981.

Standard penetration tests (SPTs) were performed at the sub soil. In this test, a standard split spoon (IS: 9640-1980) of length about 450 mm and external/ internal diameter of 51/35 mm initially penetrates the soil for 15 cm to bypass the expected accumulated sludge at the bottom of the hole by means of a 63.5 kg (140 lbs.) hammer falling freely along a guide from a height of 750 mm.

The total number of blows (N) required, to advance 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.

The field work was carried out under the close supervision of our engineer in accordance with Indian Standard mentioned earlier.

LABORATORY TESTING PROGRAM

All the extracted soil samples were brought to the Geotechnical & Materials Testing Laboratory of JOSMAR Consulting Engineers for further examination in accordance with IS: 1498-1970. Selected soil samples were subjected to the following physical tests.

1. Moisture Content (IS: 2720 Part II- 1973)
2. Sieve Analysis (IS: 2720 Part IV- 1985)
3. Liquid limit (IS: 2720 Part V- 1985)
4. Plastic Limit and Plasticity Index (IS: 2720 Part VI- 1972)
5. Differential Free swell Index (IS 2720 Part 40 – 1977)

The laboratory test results are presented in appendix- C.

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SUBSURFACE SOIL DESCRIPTION

Based on the borehole information, the sub-soil profile at the proposed site is given below.

BH-1

Borehole No.	Depth (m)	Soil Description	Relative density / Consistency
01	0.00 to 1.20	Filling materials (bricks and brown soil)	-
	1.20 to 19.00	Brown, greyish black & yellowish white poorly graded sand-silt mixtures (SP-SM) & clayey sand (SC)	Loose to very dense
	19.00 to 20.00	Completely weathered rock	Very dense
	20.00 to 23.00	Brownish grey highly to moderately weathered rock	TCR=9.20% to 12.60%, RQD=0%

GROUND WATER

Water was encountered at a depth of 1.20m below ground level during the time of field investigation. However, it may fluctuate due to seasonal variations and local sewerage disposal practices.

FOUNDATION ANALYSIS

Based on the borehole information and laboratory test results, spread foundation (Raft) is feasible for the proposed building. An estimation of raft foundation taking 12.00m as width of raft placed at 2.00m below the existing ground level. An allowable bearing pressure of 125 kpa is determined and the corresponding settlement shows 57mm which is within the allowable limit for settlement of 75mm for raft foundation as per IS 1904-1986. Hence raft foundation is feasible for the proposed building. The bearing capacity and settlement calculations of raft foundation are presented in Appendix-D.

Pile foundation system can also be adopted as an alternative foundation system for the proposed building. Pile length of 20.00m depth below the existing ground level has been analysed. At 20.00m depth, weathered rock layer is encountered. The pile capacity calculations are presented in appendix-E.

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FOUNDATION RECOMMENDATIONS

Option a) RAFT FOUNDATION

- Raft foundation shall be adopted for the proposed structure.
- Allowable bearing pressure of 125 kN/m^2 shall be taken for design purpose.
- The raft foundation shall be placed at a depth of 2.0m below the existing ground level.
- Size of the raft taken for calculation is 12m x 24m.
- Dewatering may be required during construction stage since the water table is observed at shallow depth.
- A value of 12,500 kN/m^3 can be used as modulus of sub grade reaction for the design of raft foundation.
- Grade beams shall be adopted in order to minimize the differential settlements.
- Expected settlements shall be less than the permissible limits for the foundation and the differential settlement shall be considered up to 75% of the expected total settlement.

Note:
The above recommendations are given by assuming similar soil strata in the whole site area. In case of any variations in the soil profile, the above recommendations are not applicable and further investigation may be carried out. Since the site is a vast area additional boreholes are recommended to validate the results obtained in this boreholes.

Option b) PILE FOUNDATION

Pile foundation system shall be adopted for the proposed structure by terminating the piles in the deep strata. It is a normal practice to adopt same pile length, for better interaction and to achieve uniform settlement. **Pile load tests have to be done in order to confirm the calculated pile capacities.** Under each column, there should be a pile cap to transfer the support load to the carrying piles. The bottom level of the all pile caps shall be kept at 1.0m below the ground level. The plan and dimensions of pile caps could be estimated according to the required number of piles and considered center to center spacing between piles.

A pile length of 20.00m depth has been analysed below the existing ground level. The corresponding pile capacities are given. Selection of pile length was estimated according to the soil profile and soil stiffness as obtained from SPT values.

PILE CAPACITIES

The piles utilizing friction and end bearing capacities are adopted for the proposed structure. The pile capacities of the bored, cast in situ piles are worked out considering a depth of 20.00m below

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the existing ground level. Estimation of pile capacities are given below with reference to the boreholes drilled at site.

PILE LOAD CAPACITIES				
Pile Depth (m)	**Pile Diameter (mm)**	**(Factor of Safety=2.5) Allowable Pile Load Capacity (kN)**	**Lateral load bearing capacity (kN)**	**Uplift Resistance (kN)**
20.00	600	630	50.40	310
20.00	750	1020	81.60	380
20.00	1000	2020	161.60	510

Note:

The above recommendations are given by assuming similar soil strata in the whole site area. In case of any variations in the soil profile, the above recommendations are not applicable and further investigation may be carried out. Since the site is a vast area additional boreholes are recommended to validate the results obtained in this boreholes.

PILE GROUPING

The group efficiency shall be worked out based on number of piles in a group. Piles shall have a minimum spacing of 2.5 times diameter centre to centre or minimum 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 GROUP EFFICIENCY

Pile group efficiency will depend on the pattern of arrangement of piles and number of piles in a group. An efficiency of about 60 to 70% shall be considered for the onsite soil condition, in general. However, it shall be decided based on pile load tests. Sequence of casting of piles shall be such that the adjacent piles do not get affected during pile drilling. Tremmie concrete shall be carried out in order to minimize segregation. Water-cement ratio shall also be controlled in order not to be affected by water, existing inside the pile boring. Gradual pull out of pile casing is necessary, to avoid necking of piles.

UPLIFT CAPACITY

Uplift capacity of piles shall be considered as 50% of the ultimate frictional capacity of piles.

PILE TESTING

The group efficiency shall be worked out based on 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 to be carried out after a minimum period of 1 week after driving of pile.

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Pile load tests should be conducted by loading up to 1.5 times the service load on working pile, while minimum two times the service load on pilot piles. A minimum of two (2) pile load tests can be conducted for this project.

FOUNDATION CONSIDERATIONS

A PCC (Plain Cement Concrete) layer of 10cm thickness is recommended below the foundation. Any over excavation in the foundation trenches should be re-filled by plain concrete and any disturbed and loose materials found in the foundation trenches should be removed before placement of PCC. Plate load test shall be carried out during construction period, to confirm the bearing pressure.

BACKFILLING AND COMPACTION

Excavated soil is not recommended to be used as general backfill material. As per general practice, the backfill materials should not contain more than 15% fines passing 0.075mm sieve, retain 40% on 4.75mm size sieve while the maximum size of gravel allowed is 50mm. Backfilling materials shall be placed in horizontal layers not exceeding 25cm thickness and each layer shall be compacted to at least 95% of the maximum dry density.

EXCAVATION

Excavation through the overburden soil can be carried out by conventional equipment such as dozers and JCB.

GENERAL COMMENTS

The recommendations for the foundation design and constructions are based on the information obtained from the one borehole drilled at 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 the underground conditions revealed by the borehole should be brought to our attention for alternate recommendations, if needed.

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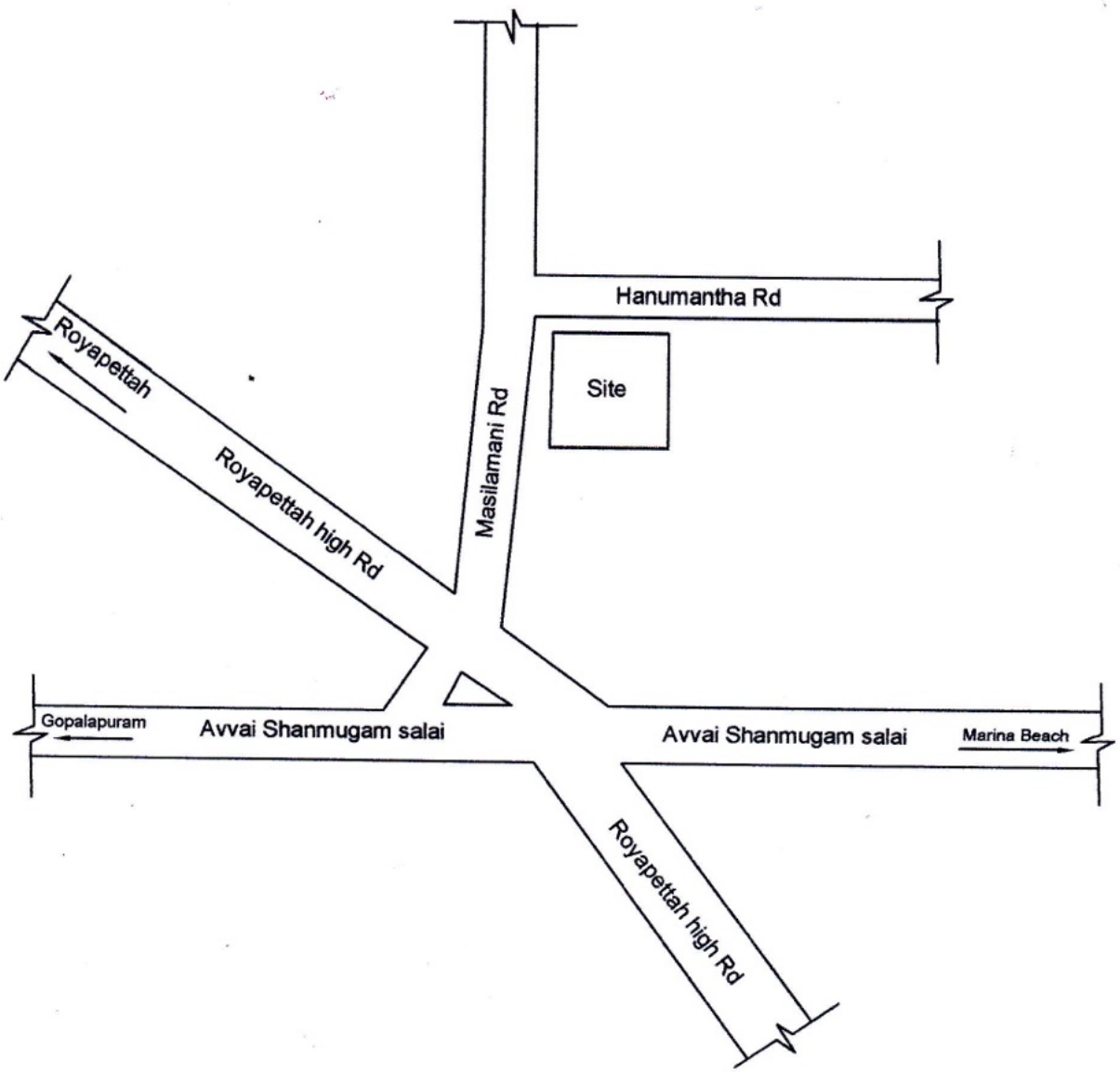
APPENDIX- A

KEY PLAN &
BORE HOLE LOCATION PLAN

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KEY PLAN

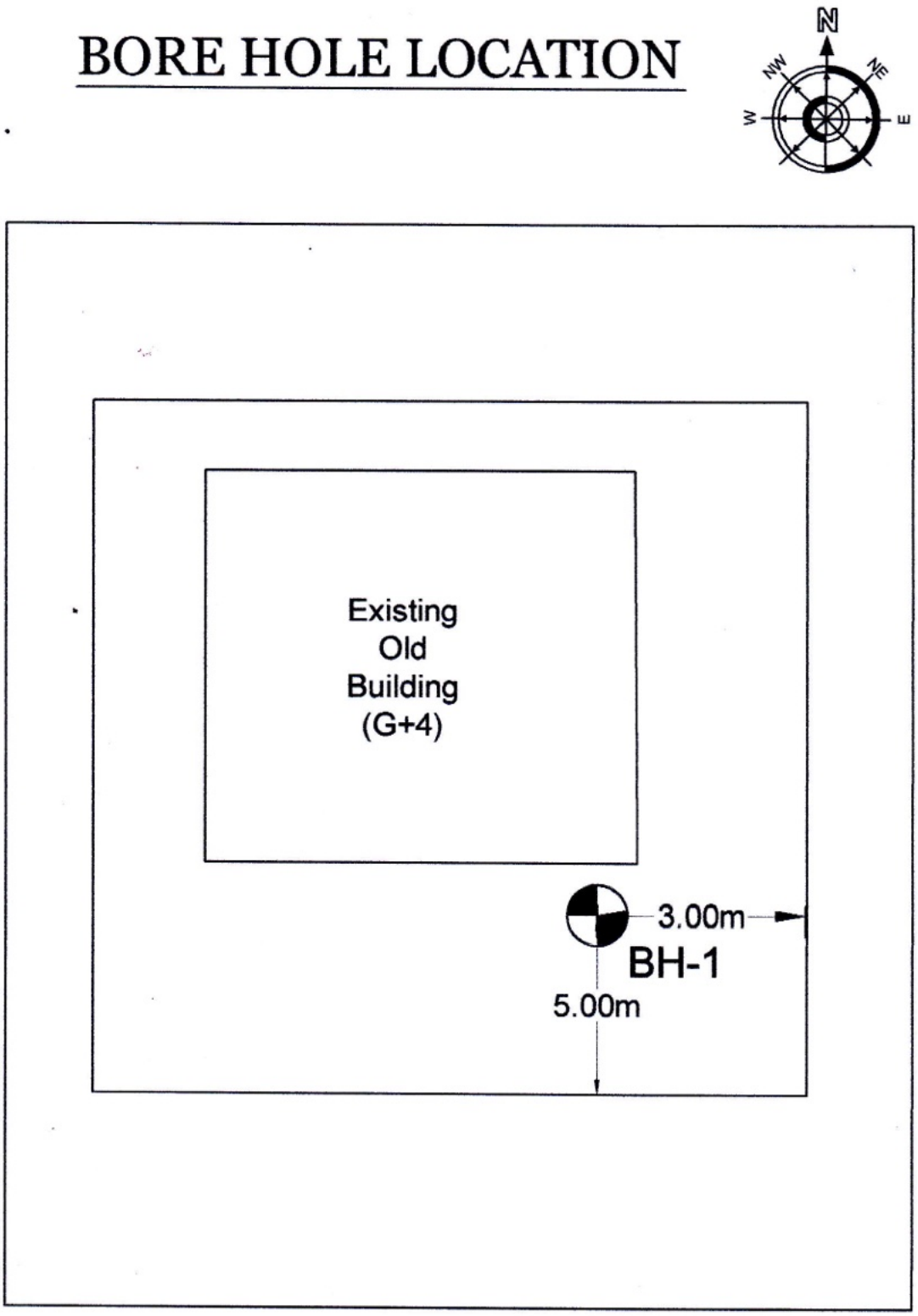




Title : **SITE KEY PLAN**	Client: **Ms. Shikha Khurana and Mrs. Pooja Khurana**		JOSMAR *Consulting Engineers* NO: 9,OFFICERS COLONY,100 FEET BYE PASS ROAD, OPP TO INDIAN OVERSEAS BANK, VELACHERY,CHENNAI - 600 042. PHONE NO:044-22593067/76, E-mail : josmar.consultants@gmail.com
Site : **Masilamani road, Balaji Nagar, Royapettah, Chennai - 600014**	Scale : N T S	File no : 1	
	Date :16.11.2022	Drg no : 1	
	Drn by: Berlin	Sheet no : 1/2	

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BORE HOLE LOCATION



Title : BORE HOLE LOCATION	Client: **Ms. Shikha Khurana and Mrs. Pooja Khurana**	
Site : **Masilamani road, Balaji Nagar, Royapettah, Chennai - 600014**	Scale : NTS	File no : 2
	Date :16.11.2022	Drg no : 2
	Drn by: Berlin	Sheet no : 2/2

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APPENDIX- B

BORE HOLE LOG

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BORE HOLE LOG

		Elevation Of G.L	: 0.00m
Client	: M/s.Skyline Construction	Water Table	: 1.20m
Project	: (Stilt+5) Residential Apartment	Type Of Boring	: Rotary
Location	: Royapettah	Dia of Boring	: 100mm
Bore hole No	: 1	Started on	: 09.11.2022
Final Depth	: 23.00m	Ended on	: 11.11.2022
Site Address	: Masilamani road, Royapettah, Chennai - 600014.		

Depth (m)	GWL	SYMBOL	DESCRIPTION	SPT COUNT 0 -15 cm	15 -30 cm	30 -45 cm	N- Value	Relative Density /Consistency
0.0 - 1.0			Filling soil (bricks and brown soil)					
1.5 - 2.0			Brownish poorly graded sand-silt mixtures (SP-SM)	9	9	10	19	Medium dense
2.5 - 3.0			Brownish silty sand (SM)	10	11	12	23	Medium dense
3.5 - 4.5			Brownish poorly graded sand-silt mixtures (SP-SM)	4	4	5	9	Loose
5.5 - 6.0			Ditto	4	5	5	10	Medium dense
7.0 - 7.5			Greyish black poorly graded sand-silt mixtures (SP-SM)	7	11	12	23	Medium dense
8.5 - 9.0			Ditto	8	12	14	26	Medium dense

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BORE HOLE LOG

		Elevation Of G.L	: 0.00m
Client	: M/s.Skyline Construction	Water Table	: 1.20m
Project	: (Stilt+5) Residential Apartment	Type Of Boring	: Rotary
Location	: Royapettah	Dia of Boring	: 100mm
Bore hole No	: 1	Started on	: 09.11.2022
Final Depth	: 23.00m	Ended on	: 11.11.2022
Site Address	: Masilamani road, Royapettah, Chennai - 600014.		

Depth (m)	GWL	SYMBOL	DESCRIPTION	SPT COUNT 0 -15 cm	15 -30 cm	30 -45 cm	N- Value	Relative Density /Consistency
10.5			Ditto	10	12	16	28	Medium dense
11.0								
11.5								
12.0			Ditto	15	50/14cm (P)			Very Dense
12.5								
13.0								
13.5								
14.0			Greyish black clayey sand (SC)	11	50/13cm (P)			Very Dense
14.5								
15.0								
15.5								
16.0			Ditto	12	50/10cm (P)			Very Dense
16.5								
17.0								
17.5								
18.0			Yellowish white silty sand (SM)	32	50/6cm (P)			Very dense
18.5								
19.0								
19.5			Completely weathered rock	50/0 cm (P)				Rebound
20.0								

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BORE HOLE LOG

		Elevation Of G.L :	0.00m
Client	: M/s. Skyline Construction	**Water Table** :	1.20m
Project	: (Stilt+5) Residential Apartment	**Type Of Boring** :	Rotary
Location	: Royapettah	**Dia of Boring** :	100mm
Bore hole No	: 1	**Started on** :	09.11.2022
Final Depth	: 23.00m	**Ended on** :	11.11.2022
Site Address	: Masilamani road, Royapettah, Chennai - 600014.		

Depth (m)	GWL	SYMBOL	DESCRIPTION	SPT COUNT 0 -15 cm	15 -30 cm	30 -45 cm	N- Value	Core Recovery Parameters
20.5								
21.0			Brownish grey highly to moderately weathered rock	Rock drilling with diamond bit				TCR=9.20%, RQD=0%
21.5								
22.0								
22.5			Ditto	Rock drilling with diamond bit				TCR=12.6%, RQD=0%
23.0			BH-1 terminated at a depth of 23.0m in Rock strata.					
23.5								
24.0								
24.5								
25.0								
25.5								
26.0								
26.5								
27.0								
27.5								
28.0								
28.5								
29.0								
29.5								
30.0								

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APPENDIX- C

LABORATORY TEST RESULTS

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PHYSICAL ANALYSIS OF SOIL- BH- 1

DEPTH M	W_N %	W_L %	W_P %	I_P %	FSI %	IS	GRAVEL %	COARSE SAND %	MEDIUM SAND %	FINE SAND %	SILT+ CLAY %
2.00	21	Non Plastic				SP-SM	0	0	15	72	12
3.00	19	Non Plastic				SM	0	0	20	66	14
4.50	21	Non Plastic				SP-SM	1	1	35	53	11
6.00	20	Non Plastic				SP-SM	0	0	44	46	9
7.50	17	Non Plastic				SP-SM	0	1	42	48	9
9.00	17	Non Plastic				SP-SM	0	1	43	50	6
10.50	19	Non Plastic				SP-SM	0	0	27	63	11
12.00	19	Non Plastic				SP-SM	0	1	44	48	7
14.00	16	35	23	12	-	SC	0	0	37	29	34
16.00	23	30	20	10	-	SC	0	0	38	35	27
18.00	16	Non Plastic				SM	14	3	25	32	27
20.00	15	Non Plastic				GP	51	20	15	10	4

ABBREVIATION:

W_N = Natural Moisture content (%)

W_L = Liquid limit (%)

W_P = Plasticity Limit (%)

I_P = Plasticity Index (%)

FSI = Free Swell Index (%)

IS = Indian Standard Classification

SM = Silty sand

SP = Poorly graded sand

SP-SM = Poorly graded sand-silt mixtures

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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.,ɣ kN/m^3
< 4	Very loose	< 20	< 29	11-16
4-10	Loose	20-40	29-30	14-18
10-30	Medium Dense	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., , ɣkN/m^3
< 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

Keeping Samples:

1. Soil samples will be kept up to 15 days from the date of submission of report.
2. Sample disposal will be carried out for every 15 days.

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APPENDIX- D

RAFT DESIGN AND SETTLEMENT CALCULATION

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COMPUTATION OF BEARING CAPACITY AS PER IS: 6403:1981 FOR BH-1

1 Geometrical Data :

Shape of the Foundation	Rectangle	
Shape considered for bearing capacity design	Rectangle	
Size of Foundation (B)	**12.00**	m
Length to Breadth Ratio of Foundation (L/B)	2	
Depth of Foundation below E.G.L. (D_f):	**2.00**	m
Inclination of Vertical Load with the Vertical (α)	0.00	Deg.

2 Soil Data :

Type of Bearing Strata :	Sand	
Design SPT "N" value of the Bearing Strata:	31	
Type of Shear Failure:	General	
Angle of Shearing Resistance - Limited to:	34	Deg.

3 Design Parameters:

Saturated Density of Soil above the foundation detph (γ_{bulk})	17.00	kN/m^3
Effective Overburden pressure at foundation level (q)	14.40	kPa
Water Table Correction Factor (w')	0.50	

Bearing Capacity Factors:

N_c = N/A
N_q = 29.44
N_γ = 41.06

Shape Factors:

S_c = N/A
S_q = 1.10
S_γ = 0.80

Depth Factors :

D_c = N/A
D_q = 1.031
D_γ = 1.031

Inclination Factor:

I_c = N/A
I_q = 1.000
I_γ = 1.000

4 Ultimate Bearing Capacity (Qu) :

$Qu=q*(Nq-1)*Sq*Dq*Iq + 0.5*B*g*Ng*Sg*Dg*Ig*w'$ 2192 kPa

5 Safe Bearing Capacity (Qsafe) :

Factor of Safety (F.S.) : 2.50

Qsafe : 876.95 kPa

$Q_{safe\ limited\ to}$ 125 kPa

This value of bearing capacity 125 kPa has to fulfill the settlement limit 75mm

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Settlement Calculation as per IS 8009- Part-1 for BH-1

Immediate settlement = q x B x (1-m²) x If / Es

q - Allowable bearing pressure =	125	kPa
B - width of foundation =	12.00	m
m - poisson's ratio of soil =	0.30	
If - Influence factor (Rectangle) =	1.53	
Es-Modulus of Elasticity of Soil =	36476	kPa
Immediate settlement = q x B x (1-m²) x If / Es =	0.05726	
Immediate Settlement =	**57**	**mm**

SAFE BEARING CAPACITY BASED ON SETTLEMENT

DEPTH	WIDTH	ALLOWABLE SETTLEMENT	SAFE BEARING CAPACITY
2.00m	12.00m	75mm	125 kPa

Pressure influence up to 23.00m due to foundation loads has been considered. An immediate settlement of 57mm has been estimated, it is within the maximum allowable limit of settlement 75mm. Hence Raft foundation shall be adopted.

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TABLE FOR CORRECTION OF SPT VALUES as per IS :2131-1981

CLIENT : Ms. Shikha Khurana and Mrs. Pooja Khurana

PROJECT : Stilt+5 Residential Building

LOCATION : Royapettah, Chennai

Depth (m)	Field SPT N- Values BH-1	Over burden pressure (t/m^2)	Over burden correction factor (C_n)	Over burden Correction (N')	Dilatancy correction (N'')	Corrected N Values
2.00	19*	3.2	1.36	26	20	20
3.00	23	4.2	1.30	30	22	22
4.50	9	5.7	1.17	11	N/A	11
6.00	10	7.2	1.12	11	N/A	11
7.50	23	8.7	1.02	23	19	19
9.00	26	10.2	1.00	26	21	21
10.50	28	11.7	0.95	27	21	21
12.00	>50	13.2	0.90	N/A	N/A	50
14.00	>50	15.2	0.87	N/A	N/A	50
16.00	>50	17.2	0.81	N/A	N/A	50
18.00	>50	19.2	0.80	N/A	N/A	50
20.00	>50	21.2	0.80	N/A	N/A	50
21.50	100	22.7	0.80	80	N/A	80
23.00	100	24.2	0.80	80	N/A	80

Note: N/A- Not Applicable

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APPENDIX- E

PILE FOUNDATION DESIGN CALCULATION

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Client : Ms. Shikha Khurana & Mrs. Pooja Khurana
Project : Stilt+5 Residential Building
Site : Royapettah

DESIGN OF PILE FOUNDATION

1.0 Type of Installation of Pile — **Bored Cast in Situ**

1.1 Geometrical Data

Assumed Diameter of pile (D)	:	600 mm
Length of Pile	:	20.00 m

1.2 Design of Pile for Vertical Compression

1.2.1 Computation of Skin Resistance:

1.2.1.2 Layer- II

Type of Strata	:	Brownish, greyish black & poorly graded sand-silt mixtures (SP-SM) and clayey sand (SC)
Average SPT of the strata,N	:	32
Bulk density of the strata, γ	:	18.00 kN/m^3
Angle of shearing resistance - limited to	:	34 Deg
tan phi		0.67
Top of strata	:	2.00 m
Bottom of strata	:	20.00 m
Average thickness of strata, l_c	:	18.00 m
Effective overburden pressure at the middle of the strata,σ_{middle}	:	72.00 kN/m^2
Coef. Earth pressure at rest , k		0.47
Skin resistance of the pile, q_s	:	**775.06 kN**
(q_s: σ *k*tanϕ *pi()*d*lc)		

1.2.2 Computation of End Bearing Resistance:

Type of Bearing Strata	:	Weathered Rock (rock is treated as soil)
Dia of pile	:	0.60 m
Cross-Sectional Area of pile,Ap	:	0.28 m^2
R.L of bottom of pile	:	20.00 m
SPT-value of the Bearing Strata	:	50
Angle of Shearing resistance	:	34
Bearing Capacity Factor(Nq)	:	40
Effecitve Over Burden Pressure at the bottom of pile (qu)	:	72.00 kN/m^2
Ultimate End Bearing Resistance (Qp)	:	**814.30 kN**
(Qp=Ap*Nq*qu)		

1.3.0

Ultimate Load Carrying Capacity (Qs+Qp)	:	1589.36 kN
Safe Load Carrying Capacity (Qsafe =Qu/2.5)	:	635.75 kN
Say	:	**630 kN**
Lateral Load Bearing Capacity	:	**50.40 kN**
Ultimate uplift resistance	:	775.06 kN
Safe Uplift resistance	:	310.02 kN
Say	:	**310 kN**

JOSMAR CONSULTING ENGINEERS CHENNAI-42

Client : Ms. Shikha Khurana & Mrs. Pooja Khurana
Project : Stilt+5 Residential Building
Site : Royapettah

DESIGN OF PILE FOUNDATION

1.0 Type of Installation of Pile — **Bored Cast in Situ**

1.1 Geometrical Data

Assumed Diameter of pile (D)	:	750 mm
Length of Pile	:	20.00 m

1.2 Design of Pile for Vertical Compression

1.2.1 Computation of Skin Resistance:

1.2.1.2 Layer- II

Type of Strata	:	Brownish, greyish black & poorly graded sand-silt mixtures (SP-SM) and clayey sand (SC)
Average SPT of the strata,N	:	32
Bulk density of the strata, γ	:	18.00 kN/m^3
Angle of shearing resistance - limited to	:	34 Deg
tan phi		0.67
Top of strata	:	2.00 m
Bottom of strata	:	20.00 m
Average thickness of strata, l_c	:	18.00 m
Effective overburden pressure at the middle of the strata,σ_{middle}	:	72.00 kN/m^2
Coef. Earth pressure at rest , k		0.47
Skin resistance of the pile, q_s	:	**968.83 kN**
(q_s: σ *k*tanϕ *pi()*d*lc)		

1.2.2 Computation of End Bearing Resistance:

Type of Bearing Strata	:	Weathered Rock (rock is treated as soil)
Dia of pile	:	0.75 m
Cross-Sectional Area of pile,Ap	:	0.44 m^2
R.L of bottom of pile	:	20.00 m
SPT-value of the Bearing Strata	:	50
Angle of Shearing resistance	:	34
Bearing Capacity Factor(Nq)	:	40
Effecitve Over Burden Pressure at the bottom of pile (qu)	:	90.00 kN/m^2
Ultimate End Bearing Resistance (Qp)	:	**1590.44 kN**
(Qp=Ap*Nq*qu)		

1.3.0

Ultimate Load Carrying Capacity (Qs+Qp)	:	2559.26 kN
Safe Load Carrying Capacity (Qsafe =Qu/2.5)	:	1023.70 kN
Say	:	**1020 kN**
Lateral Load Bearing Capacity	:	**81.60 kN**
Ultimate uplift resistance	:	968.83 kN
Safe Uplift resistance	:	387.53 kN
Say	:	**380 kN**



Client : Ms. Shikha Khurana & Mrs. Pooja Khurana
Project : Stilt+5 Residential Building
Site : Royapettah

DESIGN OF PILE FOUNDATION

1.0 Type of Installation of Pile — **Bored Cast in Situ**

1.1 Geometrical Data

Assumed Diameter of pile (D)	:	1000 mm
Length of Pile	:	20.00 m

1.2 Design of Pile for Vertical Compression

1.2.1 Computation of Skin Resistance:

1.2.1.2 Layer- II

Type of Strata	:	Brownish, greyish black & poorly graded sand-silt mixtures (SP-SM) and clayey sand (SC)
Average SPT of the strata,N	:	32
Bulk density of the strata, γ	:	18.00 kN/m^3
Angle of shearing resistance - limited to	:	34 Deg
tan phi		0.67
Top of strata	:	2.00 m
Bottom of strata	:	20.00 m
Average thickness of strata, l_c	:	18.00 m
Effective overburden pressure at the middle of the strata,σ_{middle}	:	72.00 kN/m^2
Coef. Earth pressure at rest , k		0.47
Skin resistance of the pile, q_s	:	**1291.77 kN**
(q_s: σ *k*tanϕ *pi()*d*lc)		

1.2.2 Computation of End Bearing Resistance:

Type of Bearing Strata	:	Weathered Rock (rock is treated as soil)
Dia of pile	:	1.00 m
Cross-Sectional Area of pile,Ap	:	0.79 m^2
R.L of bottom of pile	:	20.00 m
SPT-value of the Bearing Strata	:	50
Angle of Shearing resistance	:	34
Bearing Capacity Factor(Nq)	:	40
Effecitve Over Burden Pressure at the bottom of pile (qu)	:	120.00 kN/m^2
Ultimate End Bearing Resistance (Qp)	:	**3769.92 kN**
(Qp=Ap*Nq*qu)		

1.3.0

Ultimate Load Carrying Capacity (Qs+Qp)	:	5061.69 kN
Safe Load Carrying Capacity (Qsafe =Qu/2.5)	:	2024.68 kN
Say	:	**2020 kN**
Lateral Load Bearing Capacity	:	**161.60 kN**
Ultimate uplift resistance	:	1291.77 kN
Safe Uplift resistance	:	516.71 kN
Say	:	**510 kN**

JOSMAR CONSULTING ENGINEERS CHENNAI-42



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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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