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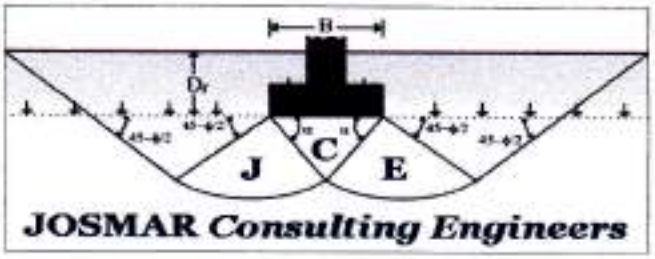
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JOSMAR CONSULTING ENGINEERS

GEOTECHNICAL ENGINEERING DIVISION



GEOTECHNICAL INVESTIGATION REPORT

Client:

Mr. C. Dhilip Kumar & Others

Site Address:

Old Door No. 5, New Door No. 9,
Survey No. 6974,
Thirumurthy street,
T Nagar,
Chennai – 600017.

REPORT NO. JCE/GEOTECH/2022/104

Rev-0 **22/11/2022**

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Client-File # 22-I-104
Mr. C. Dhilip Kumar & Others

22nd November 2022

Site Address:

Old Door No. 5, New Door No. 9,
Survey No. 6974,
Thirumurthy street,
T Nagar,
Chennai – 600017.

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

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

JOSMAR CONSULTING ENGINEERS CHENNAI-42

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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. 5, New Door No. 9, Survey No. 6974, Thirumurthy street, T Nagar, Chennai – 600017.

This work was authorized by the Client **Mr. C. Dhilip Kumar & Others**

Four boreholes have been requested by the client for the land area measuring about 6426 Sqft. Our recommendations are based on these four boreholes only.

Standard penetration tests were conducted at the borehole drilled at site, up to a depth of 24.00m below existing ground level.

The investigation consists of drilling four boreholes, 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) Drilling the boreholes up to required depth by conducting SPT test at the required interval and Rock coring using core barrel.
ii) Testing the soil samples by required laboratory tests as per IS code.
iii) Determination of subsurface profile with groundwater level.
iv) Preparation of geotechnical report with suitable foundation recommendation.

Four (4) boreholes were drilled at site, up to a maximum depth of 24.00m.
Soil samples were collected for visual identification, classification and laboratory testing.

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.
Spread foundation design and 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 is located at Old Door No. 5, New Door No. 9, Survey No. 6974, Thirumurthy street, T Nagar, Chennai – 600017.

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EXPLORATION PROGRAM & TECHNIQUES

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

BH-1 was started on 11th November 2022 and completed on 13th November 2022, drilled up to 25.00m.

BH-2 was started on 12th November 2022 and completed on 14th November 2022, drilled up to 27.00m.

BH-3 was started on 15th November 2022 and completed on 17th November 2022, drilled up to 27.00m.

BH-4 was started on 16th November 2022 and completed on 18th November 2022, drilled up to 27.00m.

Boreholes were 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)

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4. Plastic Limit and Plasticity Index (IS: 2720 Part VI- 1972)
5 Differential free swell Index (IS: 2720 Part 40, 1977)
6. Point Load strength Index (IS: 8764-1998)

The laboratory test results are presented in appendix- C.

SUBSURFACE SOIL DESCRIPTION

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

Borehole No.	Depth (m)	Soil Description	SPT N Value Range	Relative density / Consistency
01	0.00 to 1.50	Filling materials (bricks and plastic waste)		-
	1.50 to 8.50	Brownish and blackish medium plastic silty clay (CI)	13 to 27	Stiff to very stiff
	8.50 to 17.00	Greyish black and greyish brown silty sand (SM)	26 to >50	Medium dense to Very dense
	17.00 to 19.00	Greyish brown medium plastic silty clay (CI)	>50	Hard
	19.00 to 21.00	Greyish yellow silty sand (SM)	>50	Very dense
	21.00 to 22.00	Yellowish brown highly weathered sedimentary rock	>50	Very dense
	22.00 to 25.00	Yellowish brown sedimentary shale rock	-	TCR = Nil to 16.66%, RQD = Nil

Borehole No.	Depth (m)	Soil Description	SPT N Value Range	Relative density / Consistency
02	0.00 to 1.00	Filling materials (bricks and plastic waste)	-	-
	1.00 to 2.50	Greyish brown silty sand (SM)	37	Dense
	2.50 to 4.00	Black medium plastic silty clay (CI)	18	Very stiff
	4.00 to 23.00	Blackish, Yellowish grey and Greyish silty sand (SM) & clayey sand (SC)	13 to >50	Medium dense

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	23.00 to 24.00	Highly weathered sedimentary rock		Very dense
	24.00 to 27.00	Yellowish brown sedimentary shale rock	-	TCR = 14.00% to 38.60%, RQD = Nil to 34%

Borehole No.	Depth (m)	Soil Description	SPT N Value Range	Relative density / Consistency
03	0.00 to 1.10	Filling materials (bricks and plastic waste)	-	-
	1.10 to 2.50	Brownish medium plastic silty clay (CI)	13	Stiff
	2.50 to 23.00	Brownish, blackish, greyish brown silty sand (SM) and clayey sand (SC)	10 to >50	Medium dense to very dense
	23.00 to 24.00	Highly weathered sedimentary rock	>50	Very dense
	24.00 to 27.00	Yellowish brown sedimentary shale rock	-	TCR = 21.30% to 40.00%, RQD = Nil to 32%

Borehole No.	Depth (m)	Soil Description	SPT N Value Range	Relative density / Consistency
04	0.00 to 1.10	Filling materials (bricks and plastic waste)	-	-
	1.10 to 2.50	Brownish black medium plastic silty clay (CI)	16	Very stiff
	2.50 to 23.00	Brownish, Brownish black, greyish silty sand (SM) and clayey sand (SC)	12 to >50	Medium dense to very dense
	23.00 to 24.00	Highly weathered sedimentary rock	>50	Very dense
	24.00 to 27.00	Yellowish grey and brown sedimentary shale rock	-	TCR = 13.30% to 64.00%, RQD = Nil to 49.30%



GROUND WATER

Water was encountered at a depth of 1.00m 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 (IRaft) is not 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 200 kpa is determined and the corresponding settlement shows 143mm which is not within the allowable limit for settlement of 75mm for raft foundation as per IS 1904-1986. Hence raft foundation is not feasible for the proposed building. The bearing capacity and settlement calculations are presented in Appendix-D.

Hence pile foundation system is adopted. Pile length of 18.00m, 20.00m and 24.00m depth below the existing ground level has been analysed. At 18.00m depth, very dense sand layer is encountered except borehole-1 where hard clayey soil is encountered. At 20.00m depth, very dense sand layer is encountered and at 24.00m depth, sedimentary shale rock is encountered. The pile capacity calculations are presented in appendix-E.

FOUNDATION RECOMMENDATIONS

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 18.00m, 20.00m and 24.00m 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 18.00m, 20.00m and 24.00m below the existing ground level. Estimation of pile capacities are given below with reference to the boreholes drilled at site.

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PILE LOAD CAPACITIES (Ref BH-1 & 4)				
Pile Depth (m)	Pile Diameter (mm)	(Factor of Safety=2.5) Allowable Pile Load Capacity (kN)	Lateral load bearing capacity (kN)	Uplift Resistance (kN)
18.00	600	610	48.8	290
18.00	750	950	76	510
18.00	1000	1410	112.8	680
18.00	1200	1820	145.6	820

PILE LOAD CAPACITIES (Ref BH-1 & 4)				
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	680	54.4	350
20.00	750	1080	86.4	440
20.00	1000	2100	168	590
20.00	1200	3170	253.6	710

PILE LOAD CAPACITIES (Ref BH-4)				
Pile Depth (m)	Pile Diameter (mm)	(Factor of Safety=2.5) Allowable Pile Load Capacity (kN)	Lateral load bearing capacity (kN)	Uplift Resistance (kN)
24.00	750	1270	101.6	580
24.00	1000	2360	188.8	770
24.00	1200	3620	289.6	930

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.

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

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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 EFFICENCY

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. 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.

BACKFILLING AND COMPACTION

Excavated soil is not recommended to be used as general backfill material as it is plastic and swelling in nature. 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 these four boreholes drilled at site. When foundation construction is underway, the

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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 boreholes should be brought to our attention for alternate recommendations, if needed.

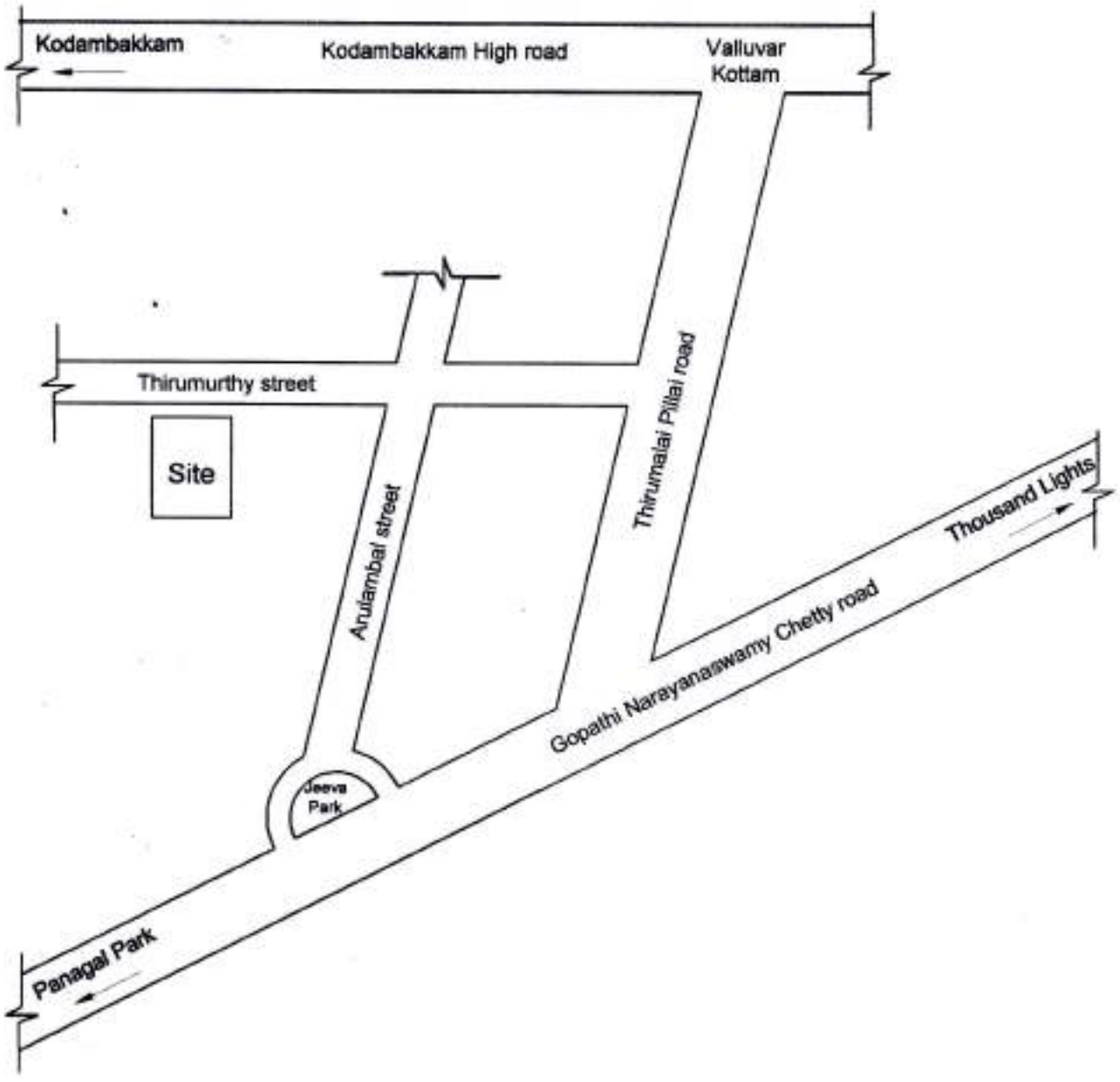
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APPENDIX- A

KEY PLAN &
BORE HOLE LOCATION PLAN

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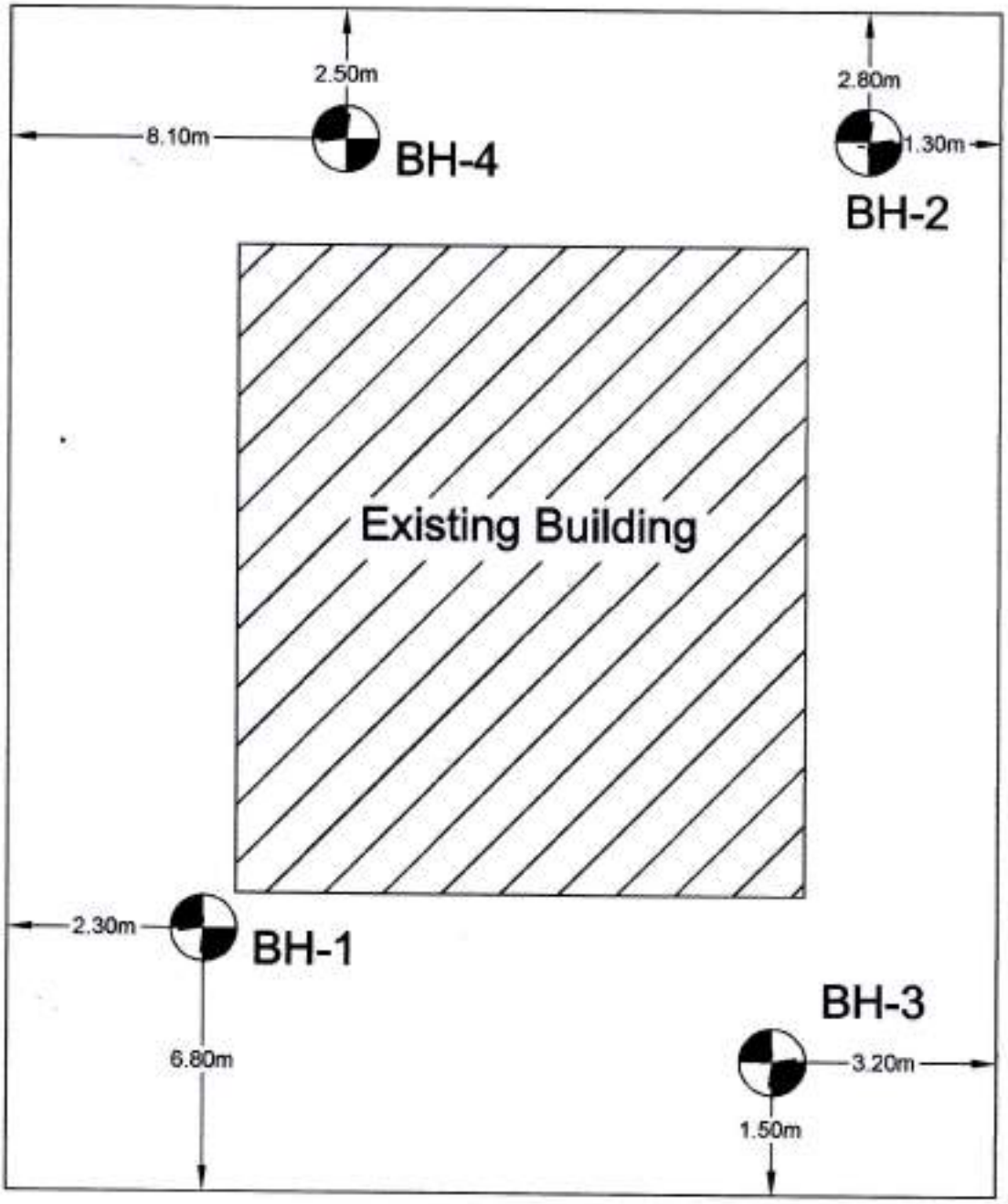
KEY PLAN



Title : **SITE KEY PLAN**	Client: Mr. C. Dhilip Kumar & Others		JOSMAR *Consulting Engineers* NO: 9,OFFICERS COLONY,100 FEET BYE PASS ROAD, OPP TO INDIAN OVERSEAS BANK, VELACHERY,CHENNAI - 600 042. PHONE NO:044-22593067/78 E-mail : josmar.consultants@gmail.com
Site : **Old No. 5, New No. 9, Survey No. 6974, Thirumurthy street, T Nagar, Chennai - 600017**	Scale : NTS	File no : 1	
	Date :21.11.2022	Drg no : 1 / 2	
	Drn by: Berlin	**Report no : JCE/GEOTECH/2022/104**	

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BORE HOLE LOCATION



Title : **BORE HOLE LOCATION**	Client: Mr. C. Dhilip Kumar & Others		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 : **Old No. 5, New No. 9, Survey No. 6974, Thirumurthy street, T Nagar, Chennai - 600017**	Scale : NTS	File no : 2	
	Date :21.11.2022	Drg no : 2 / 2	
	Drn by: Berlin	**Report no : JCE/GEOTECH/2022/104**	

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APPENDIX- B

BORE HOLE LOGS &

CROSS SECTION

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BORE HOLE LOG

Client	: Mr. C. Dhilip Kumar & Others	**Elevation Of G.L**	: 0.00m
Project	: (Stilt+5) Residential Building	**Water Table**	: 1.00m
Location	: T Nagar	**Type Of Boring**	: Rotary
Bore hole No	: 1	**Dia of Boring**	: 150mm
Final Depth	: 25.00m	**Started on**	: 11.11.2022
Site Address	: Thirumurthy street, T Nagar, Chennai - 600017.	**Ended on**	: 13.11.2022

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 plastic waste)					
1.0 – 2.0			Brown medium plastic silty clay (CI)	4	5	8	13	Stiff
2.0 – 3.0			Ditto	6	8	9	17	Very stiff
3.0 – 4.0			Blackish medium plastic silty clay (CI)	8	10	11	21	Very stiff
4.0 – 5.0			Blackish low plastic silty clay (CL)	6	12	15	27	Very stiff
5.0 – 6.0			Ditto	6	6	8	14	Stiff
6.0 – 7.0			Greyish black silty sand (SM)	17	13	21	34	Dense
7.0 – 8.0								
8.0 – 9.0								
9.0 – 10.0								

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BORE HOLE LOG

Client	: Mr. C. Dhilip Kumar & Others	**Elevation Of G.L** :	0.00m
Project	: (Stilt+5) Residential Building	**Water Table** :	1.00m
Location	: T Nagar	**Type Of Boring** :	Rotary
Bore hole No	: 1	**Dia of Boring** :	150mm
Final Depth	: 25.00m	**Started on** :	11.11.2022
Site Address	: Thirumurthy street, T Nagar, Chennai - 600017.	**Ended on** :	13.11.2022

Depth (m)	GWL	SYMBOL	DESCRIPTION	SPT COUNT 0 -15 cm	15 -30 cm	30 -45 cm	N- Value	Relative Density /Consistency
10.5			Ditto	16	18	24	42	Dense
11.0								
11.5								
12.0			Ditto	7	11	15	26	Medium dense
12.5								
13.0								
13.5			Ditto	24	50/13cm (P)			Very Dense
14.0								
14.5								
15.0								
15.5			Greyish brown silty sand (SM)	31	50/10cm (P)			Very Dense
16.0								
16.5								
17.0								
17.5			Greyish brown medium plastic silty clay (CI)	26	50/12cm (P)			Hard
18.0								
18.5								
19.0								
19.5			Greyish yellow silty sand (SM)	50/5 cm (P)				Very dense
20.0								

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BORE HOLE LOG

Client	: Mr. C. Dhilip Kumar & Others	**Elevation Of G.L**	: 0.00m
Project	: (Stilt+5) Residential Building	**Water Table**	: 1.00m
Location	: T Nagar	**Type Of Boring**	: Rotary
Bore hole No	: 1	**Dia of Boring**	: 150mm
Final Depth	: 25.00m	**Started on**	: 11.11.2022
Site Address	: Thirumurthy street, T Nagar, Chennai - 600017.	**Ended on**	: 13.11.2022

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								
21.5			Yellowish brown highly weathered sedimentary rock	50/0 cm (P)				SPT Rebound
22.0			Single tube core barrel with diamond bit used					
22.5								
23.0			Yellowish brown sedimentary shale rock	Rock drilling				TCR = Nil, RQD = Nil
23.5								
24.0								
24.5			Yellowish brown sedimentary shale rock	Rock drilling				TCR = 16.66%, RQD = Nil
25.0								
25.5			BH-1 terminated at a depth of 25.0m in Rock strata.					
26.0								
26.5								
27.0								
27.5								
28.0								
28.5								
29.0								
29.5								
30.0								

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BORE HOLE LOG

Client	: Mr. C. Dhilip Kumar & Others	**Elevation Of G.L** :	0.00m
Project	: (Stilt+5) Residential Building	**Water Table** :	1.00m
Location	: T Nagar	**Type Of Boring** :	Rotary
Bore hole No	: 2	**Dia of Boring** :	150mm
Final Depth	: 27.00m	**Started on** :	12.11.2022
Site Address	: Thirumurthy street, T Nagar, Chennai - 600017.	**Ended on** :	14.11.2022

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 plastic waste)					
1.0 – 2.5			Greyish brown silty sand (SM)	15	17	20	37	Dense
2.5 – 4.0			Black medium plastic silty clay (CI)	19	10	8	18	Very stiff
4.0 – 5.5			Black silty sand (SM)	8	9	10	19	Medium dense
5.5 – 7.0			Black clayey sand (SC)	7	5	8	13	Medium dense
7.0 – 8.5			Ditto	4	6	8	14	Medium dense
8.5 – 10.0			Greyish silty sand (SM)	6	7	9	16	Medium dense

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BORE HOLE LOG

Client	: Mr. C. Dhilip Kumar & Others	Elevation Of G.L	: 0.00m
Project	: (Stilt+5) Residential Building	Water Table	: 1.00m
Location	: T Nagar	Type Of Boring	: Rotary
Bore hole No	: 2	Dia of Boring	: 150mm
Final Depth	: 27.00m	Started on	: 12.11.2022
Site Address	: Thirumurthy street, T Nagar, Chennai - 600017.	Ended on	: 14.11.2022

Depth (m)	GWL	SYMBOL	DESCRIPTION	SPT COUNT 0 -15 cm	15 -30 cm	30 -45 cm	N- Value	Relative Density /Consistency
10.5			Ditto	8	9	11	20	Medium dense
11.0								
11.5								
12.0			Ditto	9	12	15	27	Medium dense
12.5								
13.0								
13.5								
14.0			Ditto	15	18	25	43	Dense
14.5								
15.0								
15.5								
16.0			Yellowish grey clayey sand (SC)	19	50/14cm (P)			Very dense
16.5								
17.0								
17.5								
18.0			Yellowish grey clayey sand (SC)	50/14cm (P)				Very dense
18.5								
19.0								
19.5								
20.0			Ditto	50/5 cm (P)				Very dense

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BORE HOLE LOG

Client	: Mr. C. Dhilip Kumar & Others	**Elevation Of G.L** :	0.00m
Project	: (Stilt+5) Residential Building	**Water Table** :	1.00m
Location	: T Nagar	**Type Of Boring** :	Rotary
Bore hole No	: 2	**Dia of Boring** :	150mm
Final Depth	: 27.00m	**Started on** :	12.11.2022
Site Address	: Thirumurthy street, T Nagar, Chennai - 600017.	**Ended on** :	14.11.2022

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								
21.5								
22.0			Greyish silty sand (SM)	50/13cm (P)				Very dense
22.5								
23.0								
23.5			Highly weathered sedimentary rock	50/0cm (P)				SPT Rebound
24.0			Single tube core barrel with diamond bit used					
24.5								
25.0			Yellowish brown sedimentary shale rock	Rock drilling				TCR = 14.00%, RQD = Nil
25.5								
26.0								
26.5			Yellowish brown sedimentary shale rock	Rock drilling				TCR = 38.60%, RQD = 34%
27.0								
27.5			BH-2 terminated at a depth of 27.0m in Rock strata.					
28.0								
28.5								
29.0								
29.5								
30.0								

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BORE HOLE LOG

Client	: Mr. C. Dhilip Kumar & Others	**Elevation Of G.L** :	0.00m
Project	: (Stilt+5) Residential Building	**Water Table** :	1.00m
Location	: T Nagar	**Type Of Boring** :	Rotary
Bore hole No	: 3	**Dia of Boring** :	150mm
Final Depth	: 27.00m	**Started on** :	15.11.2022
Site Address	: Thirumurthy street, T Nagar, Chennai - 600017.	**Ended on** :	17.11.2022

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 plastic waste)					
1.5 – 2.5			Brownish medium plastic silty clay (CI)	5	6	7	13	Stiff
3.0 – 3.5			Brownish silty sand (SM)	7	5	9	14	Medium dense
4.0 – 4.5			Black silty sand (SM)	8	9	11	20	Medium dense
5.5 – 6.0			Ditto	9	10	12	22	Medium dense
7.0 – 7.5			Blackish clayey sand (SC)	5	5	7	12	Medium dense
8.5 – 9.0			Brownish silty sand (SM)	6	5	5	10	Medium dense
9.5 – 10.0								

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BORE HOLE LOG

Client	: Mr. C. Dhilip Kumar & Others	**Elevation Of G.L** :	0.00m
Project	: (Stilt+5) Residential Building	**Water Table** :	1.00m
Location	: T Nagar	**Type Of Boring** :	Rotary
Bore hole No	: 3	**Dia of Boring** :	150mm
Final Depth	: 27.00m	**Started on** :	15.11.2022
Site Address	: Thirumurthy street, T Nagar, Chennai - 600017.	**Ended on** :	17.11.2022

Depth (m)	GWL	SYMBOL	DESCRIPTION	SPT COUNT 0 -15 cm	15 -30 cm	30 -45 cm	N- Value	Relative Density /Consistency
10.5			Ditto	8	9	11	20	Medium dense
11.0								
11.5								
12.0			Ditto	10	6	7	13	Medium dense
12.5								
13.0								
13.5								
14.0			Greyish brown clayey sand SC)	15	18	20	38	Dense
14.5								
15.0								
15.5								
16.0			Greyish brown silty sand (SM)	19	50/5cm (P)			Very dense
16.5								
17.0								
17.5								
18.0			Greyish brown clayey sand (SC)		50/8cm (P)			Very dense
18.5								
19.0								
19.5								
20.0			Ditto		50/7 cm (P)			Very dense

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BORE HOLE LOG

Client	: Mr. C. Dhilip Kumar & Others	**Elevation Of G.L** :	0.00m
Project	: (Stilt+5) Residential Building	**Water Table** :	1.00m
Location	: T Nagar	**Type Of Boring** :	Rotary
Bore hole No	: 3	**Dia of Boring** :	150mm
Final Depth	: 27.00m	**Started on** :	15.11.2022
Site Address	: Thirumurthy street, T Nagar, Chennai - 600017.	**Ended on** :	17.11.2022

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								
21.5			Brownish grey silty sand (SM)	50/6 cm (P)				Very dense
22.0								
22.5								
23.0								
23.5			Highly weathered sedimentary rock	50/0cm (P)				SPT Rebound
24.0			Single tube core barrel with diamond bit used					
24.5								
25.0			Yellowish brown sedimentary shale rock	Rock drilling with diamond bit				TCR = 21.30%, RQD = Nil
25.5								
26.0								
26.5			Yellowish brown sedimentary shale rock	Rock drilling with diamond bit				TCR = 40.00%, RQD = 32%
27.0								
27.5			BH-3 terminated at a depth of 27.0m in Rock strata.					
28.0								
28.5								
29.0								
29.5								
30.0								

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BORE HOLE LOG

Client	: Mr. C. Dhilip Kumar & Others	**Elevation Of G.L** :	0.00m
Project	: (Stilt+5) Residential Building	**Water Table** :	1.00m
Location	: T Nagar	**Type Of Boring** :	Rotary
Bore hole No	: 4	**Dia of Boring** :	150mm
Final Depth	: 27.00m	**Started on** :	16.11.2022
Site Address	: Thirumurthy street, T Nagar, Chennai - 600017.	**Ended on** :	18.11.2022

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 plastic waste)					
1.0 – 2.5			Brownish black medium plastic silty clay (CI)	4	7	9	16	Very stiff
2.5 – 3.5			Brownish black silty sand (SM)	5	7	11	18	Medium dense
3.5 – 4.5			Ditto	4	5	7	12	Medium dense
4.5 – 5.5			Ditto	5	5	7	12	Medium dense
5.5 – 7.5			Brownish clayey sand (SC)	7	10	12	22	Medium dense
7.5 – 9.0			Ditto	8	12	14	26	Medium dense
9.0 – 10.0								

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BORE HOLE LOG

Client	: Mr. C. Dhilip Kumar & Others	Elevation Of G.L	: 0.00m
Project	: (Stilt+5) Residential Building	Water Table	: 1.00m
Location	: T Nagar	Type Of Boring	: Rotary
Bore hole No	: 4	Dia of Boring	: 150mm
Final Depth	: 27.00m	Started on	: 16.11.2022
Site Address	: Thirumurthy street, T Nagar, Chennai - 600017.	Ended on	: 18.11.2022

Depth (m)	GWL	SYMBOL	DESCRIPTION	SPT COUNT 0 -15 cm	15 -30 cm	30 -45 cm	N- Value	Relative Density /Consistency
10.5			Greyish silty sand (SM)	9	7	10	17	Medium dense
11.0								
11.5								
12.0			Ditto	10	8	12	20	Medium dense
12.5								
13.0								
13.5								
14.0			Ditto	15	15	20	35	Dense
14.5								
15.0								
15.5								
16.0			Ditto	16	18	22	40	Dense
16.5								
17.0								
17.5								
18.0			Ditto	50/14cm (P)				Very dense
18.5								
19.0								
19.5								
20.0			Ditto	25	50/11cm (P)			Hard

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BORE HOLE LOG

Client	: Mr. C. Dhilip Kumar & Others	**Elevation Of G.L** :	0.00m
Project	: (Stilt+5) Residential Building	**Water Table** :	1.00m
Location	: T Nagar	**Type Of Boring** :	Rotary
Bore hole No	: 4	**Dia of Boring** :	150mm
Final Depth	: 27.00m	**Started on** :	16.11.2022
Site Address	: Thirumurthy street, T Nagar, Chennai - 600017.	**Ended on** :	18.11.2022

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								
21.5								
22.0			Ditto	30	50/13cm (P)			Hard
22.5								
23.0								
23.5			Highly weathered sedimentary rock		50/0cm (P)			SPT Rebound
24.0			Single tube core barrel with diamond bit used					
24.5								
25.0			Yellowish grey sedimentary shale rock		Rock drilling			TCR = 13.30%, RQD = Nil
25.5								
26.0								
26.5			Yellowish brown sedimentary shale rock		Rock drilling			TCR = 64.00%, RQD = 49.3%
27.0								
27.5			BH-4 terminated at a depth of 27.0m in Rock strata.					
28.0								
28.5								
29.0								
29.5								
30.0								

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CROSS SECTION OF BORE HOLES

Client : Mr. C. Dhilip Kumar & Others
Project : Stilt+5 Residential building
Location : T Nagar
Water Table : 1.00m

Depth (m)	BH-1		BH-2		BH-3		BH-4	
	SPT	SYM	SPT	SYM	SPT	SYM	SPT	SYM
0.5								
1.0								
1.5								
2.0	13		37		13		16	
2.5								
3.0	17		18		14		18	
3.5								
4.0								
4.5	21		19		20		12	
5.0								
5.5								
6.0	27		13		22		12	
6.5								
7.0								
7.5	14		14		12		22	
8.0								
8.5								
9.0	34		16		10		26	
9.5								
10.0								
10.5	42		20		20		17	
11.0								
11.5								
12.0	26		27		13		20	
13.0								
14.0	>50		43		38		35	
15.0								
16.0	>50		>50		>50		40	
17.0								
18.0	>50		>50		>50		>50	
19.0								
20.0	>50		>50		>50		>50	
21.0								
22.0	>50		>50		>50		>50	
23.0								
24.0	TCR = Nil, RQD = Nil		>50		>50		>50	
25.0	TCR=16.6% RQD = Nil							
26.0			TCR=14%, RQD=Nil		TCR=21.3%, RQD=Nil		TCR=13.3% RQD=Nil	
27.0			TCR=38.8%, RQD=34%		TCR=40%, RQD=32%		TCR=64%, RQD=49.3%	

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APPENDIX- C

LABORATORY TEST RESULTS

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PHYSICAL ANALYSIS OF SOIL- BH- 1

Sample No.	DEPTH (M)	W_N %	W_L %	W_P %	I_P %	FSI %	IS	GRAVEL (%)	COARSE SAND (%)	MEDIUM SAND (%)	FINE SAND (%)	SILT+CLAY %
1	2	25	39	19	20	33	CI	6	5	13	14	61
2	3	20	40	20	20	29	CI	0	1	2	47	50
3	4.5	35	35	15	20	59	CI	0	0	1	32	67
4	6	32	34	15	19	31	CL	0	0	2	41	57
5	7.5	36	29	0	29	38	CL	0	0	1	29	70
6	9	17	Non Plastic				SM	4	0	43	24	29
7	10.5	17					SM	0	0	39	28	32
8	12	16					SM	0	1	36	40	23
9	14	16					SM	11	5	33	29	23
10	16	15					SM	10	6	26	27	31
11	18	21	44	21	23	-	CI	0	0	1	16	83
12	20	16	Non Plastic				SM	1	2	53	17	27
13	22	11					GP	76	9	10	2	2

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PHYSICAL ANALYSIS OF SOIL- BH- 2

Sample No.	DEPTH (M)	W_N %	W_L %	W_P %	I_P %	FSI %	IS	GRAVEL (%)	COARSE SAND (%)	MEDIUM SAND (%)	FINE SAND (%)	SILT+CLAY %
16	2	21	Non Plastic				SM	0	0	4	71	26
17	3	32	44	0	44	33	CI	0	0	1	17	82
18	4.5	18	Non Plastic				SM	1	6	57	20	17
19	6	25	28	17	11	36	SC	1	1	23	39	36
20	7.5	22	28	17	11	33	SC	1	1	34	35	29
21	9	16	Non Plastic				SM	0	0	38	32	31
22	10.5	20					SM	0	0	41	31	27
23	12	15					SM	6	5	28	32	30
24	14	14					SM	5	4	27	33	32
25	16	14	28	15	13	-	SC	2	1	35	21	41
26	18	24	30	16	14	-	SC	6	3	38	25	28
27	20	29	32	18	14	-	SC	1	2	28	30	39
28	22	17	Non Plastic				SM	1	1	54	29	15

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PHYSICAL ANALYSIS OF SOIL- BH- 3

Sample No.	DEPTH (M)	W_N %	W_L %	W_P %	I_P %	FSI %	IS	GRAVEL (%)	COARSE SAND (%)	MEDIUM SAND (%)	FINE SAND (%)	SILT+CLAY %
32	2	28	36	19	17	30	CI	0	0	6	38	56
33	3	21	Non Plastic				SM	0	0	17	61	22
34	4.5	18					SM	0	1	52	35	12
35	6	18					SM	0	3	69	20	7
36	7.5	18	25	13	12	-	SC	0	0	44	31	25
37	9	17	Non Plastic				SM	0	0	41	31	28
38	10.5	22					SM	0	1	44	29	26
39	12	25					SM	1	2	36	34	27
40	14	16	34	18	16	-	SC	1	2	28	24	45
41	16	15	Non Plastic				SM	1	1	28	57	14
42	18	15	48	24	24	-	SC	0	0	20	35	44
43	20	22	45	22	23	-	SC	2	2	27	34	35
44	22	16	Non Plastic				SM	1	1	45	36	18
45	24	16					GP	41	39	18	1	1

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PHYSICAL ANALYSIS OF SOIL- BH- 4

Sample No.	DEPTH (M)	W_N %	W_L %	W_P %	I_P %	FSI %	IS	GRAVEL (%)	COARSE SAND (%)	MEDIUM SAND (%)	FINE SAND (%)	SILT+CLAY %
48	2	36	50	20	30	56	CI	0	0	3	13	84
49	3	26	Non Plastic				SM	0	0	8	73	19
50	4.5	21					SM	1	4	45	28	21
51	6	18					SM	5	7	51	26	11
52	7.5	15	34	16	18	50	SC	0	0	38	29	33
53	9	15	34	16	18	69	SC	0	0	38	29	32
54	10.5	16	Non Plastic				SM	0	1	41	32	25
55	12	16					SM	0	1	38	36	26
56	14	17					SM	19	5	25	26	25
57	16	16					SM	6	3	27	32	32
58	18	15					SM	5	6	37	16	35
59	20	17					SM	11	2	20	42	26
60	22	16					SM	1	3	18	43	35
61	24	9					GP	13	31	54	1	1

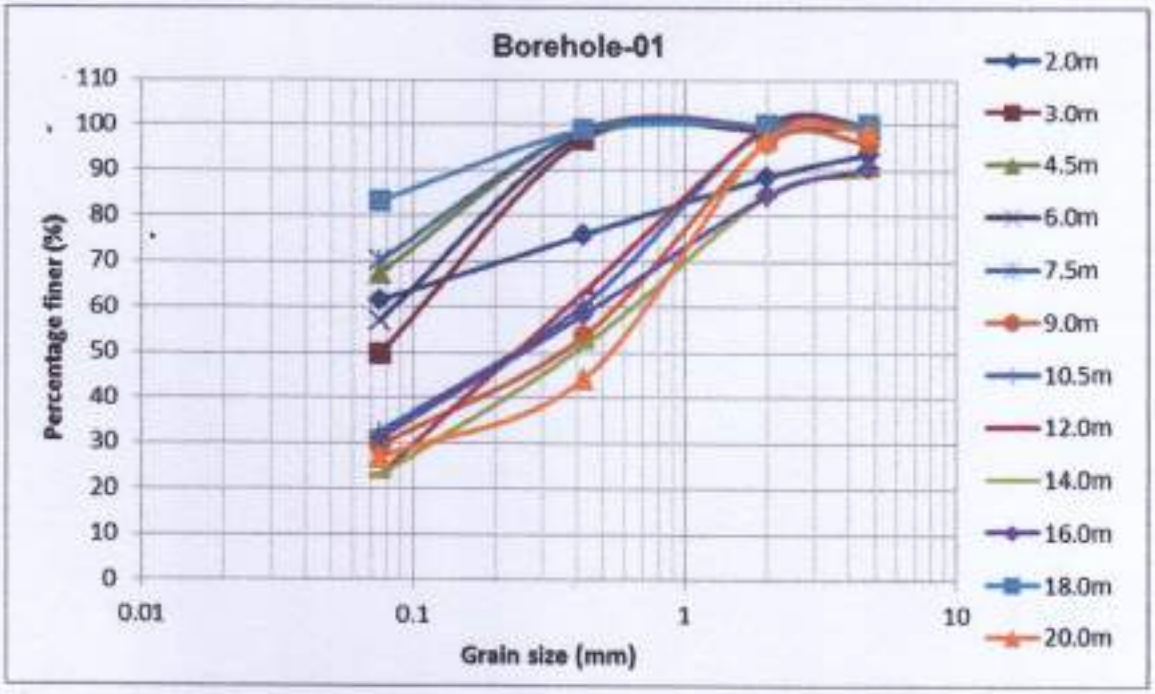
ABBREVIATION:

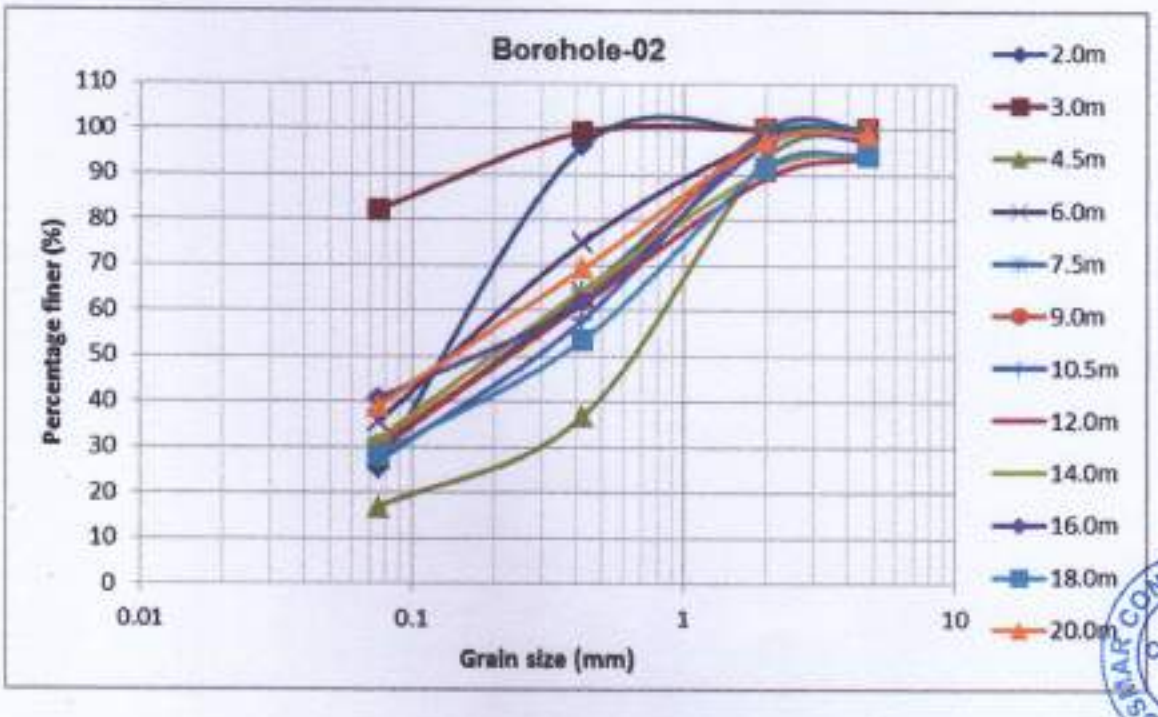
W_N = Natural Moisture content (%)
W_L = Liquid limit (%)
W_P = Plasticity Limit (%)

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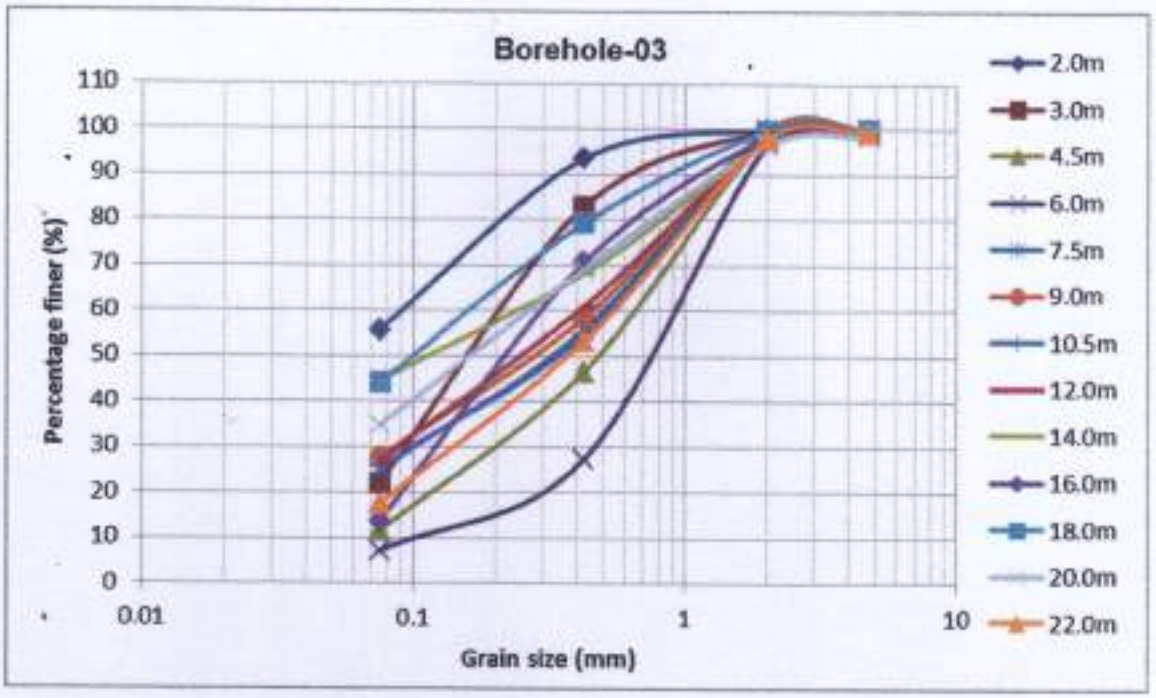
I_P	=	Plasticity Index (%)
FSI	=	Free Swell Index (%)
IS	=	Indian Standard Classification
CL	=	Low plastic silty clay
CI	=	Medium plastic silty clay
CH	=	High plastic silty clay
SM	=	Silty sand
SC	=	Clayey sand
SP	=	Poorly graded sand

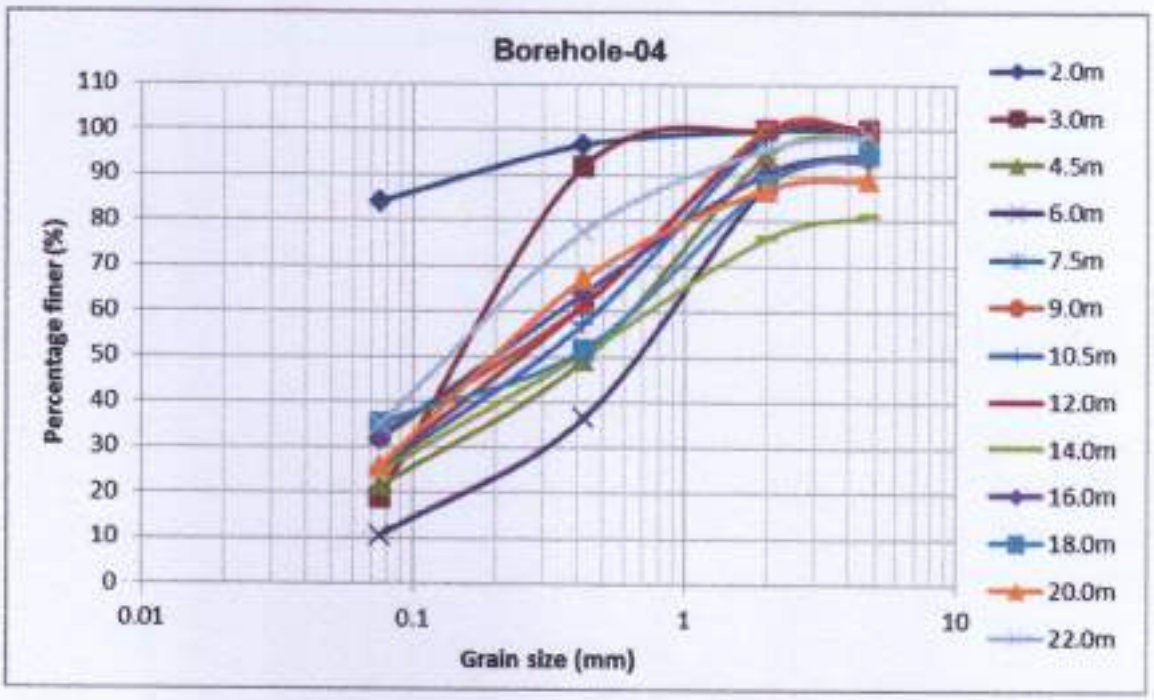
GRAIN SIZE DISTRIBUTION GRAPHS





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CLIENT	:	Mr. Dhilip Kumar & Others
PROJECT	:	Stilt+5 Residential Building
LOCATION	:	T Nagar, Chennai

As per Indian Standard the Point Load test calculations are calculated below

IS: 8764 - Amendment No.1 December 2006

(Page 6, clause 7.1.1) — Substitute the following for the existing formula:

$$I_s(50) = \frac{P}{D^{1.5}\sqrt{D_{50}}}$$

where

$I_s(50)$ = point load strength index in MPa (for the standard core size),
P = failure load in N,
D = core diameter in mm, and
D_{50} = standard core diameter (50 mm).

Bore hole No.	Depth (m)	Diameter (mm)	Height (mm)	L/D ratio	Weight (kg)	Failure Load (P) (N)	D_{50}	D^1.5	SQRT (D50)	$I_{s(50)}$, (N/mm^2)
BH- 1	23.5-25.0	50	47	0.94	0.216	1056.20	50	353.55	7.071	0.422
	23.5-25.0	50	44	0.88	0.209	1056.20	50	353.55	7.071	0.422
BH- 2	24.0-25.5	52	46	0.88	0.232	3168.61	50	374.98	7.071	1.195
	24.0-25.5	52	30	0.58	0.160	2640.51	50	374.98	7.071	0.996
BH-3	24.0-25.5	49	31	0.63	0.133	3168.61	50	343	7.071	1.306
	25.5-27.0	50	48	0.96	0.210	5281.02	50	353.55	7.071	2.112
BH-4	24.0-25.5	48	26	0.54	0.123	2112.41	50	332.55	7.071	0.898
	25.5-27.0	50	48	0.96	0.204	3168.61	50	353.55	7.071	1.267
	25.5-27.0	50	24	0.48	0.131	2640.51	50	353.55	7.071	1.056

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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.,γ 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., , γkN/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 :	clay	
Design SPT **"N"** value of the Bearing Strata:	13	
Type of Shear Failure:	General	
Undrained Shear Strength (Su):	**65**	kPa

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 = 5.140
N_q = N/A
N_γ = N/A

Shape Factors:

S_c = 1.100
S_q = N/A
S_γ = N/A

Depth Factors :

D_c = 1.033
D_q = N/A
D_γ = N/A

Inclination Factor:

I_c = 1.0000
I_q = N/A
I_γ = N/A

4 Ultimate Bearing Capacity (Qu) :

Qu=Cu*Nc*Sc*Dc*Ic 379.76 kPa

5 Safe Bearing Capacity (Qsafe) :

Factor of Safety (F.S.) : 2.50
Qsafe : 151.90 kPa

$Q_{safe\ limited\ to}$ 150 kPa

This value of bearing capacity (150 kPa) has to fulfill the settlement limit of 125mm

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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 =	150	kPa
B - width of foundation =	12.00	m
m - poisson's ratio of soil =	0.50	
If - Influence factor (Rectangle) =	1.53	
Es-Modulus of Elasticity of Soil =	26880	kPa
Immediate settlement = q x B x (1-m²) x If / Es =	0.07684	
Immediate Settlement =	**77**	**mm**

SAFE BEARING CAPACITY BASED ON SETTLEMENT

DEPTH	WIDTH	ALLOWABLE SETTLEMENT	SAFE BEARING CAPACITY
2.00m	12.00m	125mm	150 kPa

Pressure influence up to 24.00m due to foundation loads has been considered. Total settlement of 402mm (Immediate settlement = 77mm and consolidation settlement = 325mm) has been estimated which is not within the maximum allowable limit of settlement 125mm. Hence raft foundation shall not be adopted.

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

CLIENT : Mr. Dhilip Kumar & Others

PROJECT : Stilt+5 Residential Building

LOCATION : T Nagar, 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	13	3.0	N/A	13	N/A	13
3.00	17	4.0	N/A	17	N/A	17
4.50	21	5.5	N/A	21	N/A	21
6.00	27	7.0	N/A	27	N/A	27
7.50	14	8.5	N/A	14	N/A	14
9.00	34	10.0	1.00	34	25	25
10.50	42	11.5	0.95	40	27	27
12.00	26	13.0	0.90	23	19	19
14.00	>50	15.0	0.86	N/A	N/A	50
16.00	>50	17.0	0.82	N/A	N/A	50
18.00	>50	19.0	N/A	>50	N/A	50
20.00	>50	21.0	0.77	N/A	N/A	50
22.00	>50	23.0	0.75	N/A	N/A	50
24.00	>50	25.0	0.73	N/A	N/A	50

JOSMAR CONSULTING ENGINEERS CHENNAI-42

Note: N/A- Not Applicable

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JOSMAR CONSULTING ENGINEERS

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

CLIENT : Mr. Dhilip Kumar & Others

PROJECT : Stilt+5 Residential Building

LOCATION : T Nagar, Chennai

Depth (m)	Field SPT N- Values BH-2	Over burden pressure (t/m^2)	Over burden correction factor (C_n)	Over burden Correction (N')	Dilatancy correction (N'')	Corrected N Values
2.00	37	3.0	1.37	51	33	33
3.00	18	4.0	N/A	18	N/A	18
4.50	19	5.5	1.18	22	19	19
6.00	13	7.0	N/A	13	N/A	13
7.50	14	8.5	N/A	14	N/A	14
9.00	16	10.0	1.00	16	16	16
10.50	20	11.5	0.95	19	17	17
12.00	27	13.0	0.90	24	20	20
14.00	43	15.0	0.86	37	26	26
16.00	>50	17.0	0.82	N/A	N/A	50
18.00	>50	19.0	0.80	N/A	N/A	50
20.00	>50	21.0	0.77	N/A	N/A	50
22.00	>50	23.0	0.75	N/A	N/A	50
24.00	>50	25.0	0.73	N/A	N/A	50

JOSMAR CONSULTING ENGINEERS CHENNAI-42

Note: N/A- Not Applicable

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JOSMAR CONSULTING ENGINEERS

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

CLIENT : Mr. Dhilip Kumar & Others

PROJECT : Stilt+5 Residential Building

LOCATION : T Nagar, Chennai

Depth (m)	Field SPT N- Values BH-3	Over burden pressure (t/m^2)	Over burden correction factor (C_n)	Over burden Correction (N')	Dilatancy correction (N'')	Corrected N Values
2.00	13	3.0	N/A	13	N/A	13
3.00	14	4.0	1.30	14	N/A	14
4.50	20	5.5	1.18	24	19	19
6.00	22	7.0	1.11	22	19	22
7.50	12	8.5	1.05	12	N/A	12
9.00	10	10.0	1.00	10	N/A	10
10.50	20	11.5	0.95	19	17	17
12.00	13	13.0	0.90	12	N/A	12
14.00	38	15.0	0.86	33	24	24
16.00	>50	17.0	0.82	N/A	N/A	50
18.00	>50	19.0	0.80	N/A	N/A	50
20.00	>50	21.0	0.77	N/A	N/A	50
22.00	>50	23.0	0.75	N/A	N/A	50
24.00	>50	25.0	0.73	N/A	N/A	50

Note: N/A- Not Applicable

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JOSMAR CONSULTING ENGINEERS CHENNAI-42

JOSMAR CONSULTING ENGINEERS

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

CLIENT : Mr. Dhilip Kumar & Others

PROJECT : Stilt+5 Residential Building

LOCATION : T Nagar, Chennai

Depth (m)	Field SPT N- Values BH-4	Over burden pressure (t/m^2)	Over burden correction factor (C_n)	Over burden Correction (N')	Dilatancy correction (N'')	Corrected N Values
2.00	16	3.0	N/A	16	N/A	16
3.00	18	4.0	1.30	18	17	17
4.50	12	5.5	1.18	14	N/A	14
6.00	12	7.0	1.11	12	N/A	12
7.50	22	8.5	1.05	22	19	19
9.00	26	10.0	1.00	26	21	21
10.50	17	11.5	0.95	16	16	16
12.00	20	13.0	0.90	18	17	17
14.00	35	15.0	0.86	30	23	23
16.00	40	17.0	0.82	33	24	24
18.00	>50	19.0	0.80	N/A	N/A	50
20.00	>50	21.0	0.77	N/A	N/A	50
22.00	>50	23.0	0.75	N/A	N/A	50
24.00	>50	25.0	0.73	N/A	N/A	50

Note: N/A- Not Applicable

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CONSOLIDATION SETTLEMENT CALCULATION (BH-01)

Considering BH-1, at a depth of **5.25** **m**

P_o = 1 x 18 + 4.25 x 8

= 52.0 kN/m^2

e_o = 0.81

C_c = 0.16

Mid Depth (Z/B) = 0.27

Factor (σ_z/q) = 0.90 (Refer book Donald P. Coduto, From 10.9 pressure bulb chart, correlate Z/B and σz/q values)

Allowable foundation pressure (SBC) = 150 kN/m^2

Increase in pressure due to foundation at a depth of 5.25 m below existing ground level

σ_z = Factor x SBC of soil

= 135 kN/m^2

$$S_c = \frac{0.16}{1+0.81} \times 650 \times \log\left\{\frac{52.0+135}{52.0}\right\}$$

= 325.41 mm

Sc = 325 mm

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APPENDIX- E

PILE FOUNDATION DESIGN CALCULATION

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Client	Mr. Dhilip Kumar & Others
Project	Stilt+5 Residential Building
Site	T Nagar
Pile installation type	Bored cast insitu
Borehole reference	4
Pile diameter	0.6 m
Pile length	18.0 m

1.SKIN RESISTANCE OF PILE

Layer	Strata	Strata top (m)	Strata bottom (m)	Strata thickness (m)	SPT N	Bulk density (kN/m^3)	Undrained shear strength (kN/m^2)	Adhesion factor	Angle of internal friction (Φ)	Tan (Φ)	Effective overburden pressure (kN/m2)	Coefficient of earth pressure (K)	Skin resistance (kN)
II	Brownish black medium plastic silty clay (CI)	1.1	2.5	1.4	16	18	80	0.55					116.05
III	Brownish, blackish and greyish silty sand (SM) & clayey sand (SC)	2.5	18	15.5	22	18			30	0.577	73.2	0.500	616.69

2. END BEARING RESISTANCE OF PILE

Layer	Strata	Diameter of pile (m)	Cross sectional area of pile (Ap) (m^2)	R.L of bottom of pile (m)	SPT N	Undrained shear strength (pile tip) (kN/m^2)	Bearing capacity factor (Nc)	Angle of internal friction (Φ)	Effective height (m)	Bulk unit weight (kN/m^2)	Effective overburden pressure (Pile toe) (kN/m2)	Bearing capacity factor (Nq)	End bearing resistance (kN)
III	Greyish silty sand (SM)	0.6	0.283	18.0	50			34	9	18	72	40	814.30

Ultimate Load Carrying Capacity (Qs+Qp)		1547.05 kN
Safe Load Carrying Capacity (Qsafe =Qu/2.5)		**618.82** kN
	Say	**610** kN
Lateral Load Bearing Capacity		**48.8** kN
Ultimate uplift resistance		732.74 kN
Safe Uplift resistance		**293.10** kN
	Say	**290** kN

JOSMAR CONSULTING ENGINEERS CHENNAI-42

JOSMAR CONSULTING ENGINEERS

Client	Mr. Dhilip Kumar & Others
Project	Stilt+5 Residential Building
Site	T Nagar
Pile installation type	Bored cast insitu
Borehole reference	1
Pile diameter	0.75 m
Pile length	18.0 m

1.SKIN RESISTANCE OF PILE

Layer	Strata	Strata top (m)	Strata bottom (m)	Strata thickness (m)	SPT N	Bulk density (kN/m^3)	Undrained shear strength (kN/m^2)	Adhesion factor	Angle of Internal friction (Φ)	Tan (Φ)	Effective overburden pressure (kN/m2)	Coefficient of earth pressure (K)	Skin resistance (kN)
II	Brownish, blackish low to medium plastic silty clay (CL) & (CI)	1.5	8.5	7	18	18	92	0.5					758.31
III	Greyish black and brown silty sand (SM)	8.5	17	8.5	40	18			33	0.649	90	0.455	532.41
IV	Greyish brown medium plastic silty clay (CI)	17	18	1	50	200	250	0.5					294.38

2. END BEARING RESISTANCE OF PILE

Layer	Strata	Diameter of pile (m)	Cross sectional area of pile (Ap) (m^2)	R.L of bottom of pile (m)	SPT N	Undrained shear strength (pile tip) (kN/m^2)	Bearing capacity factor (Nc)	Angle of Internal friction (Φ)	Effective height (m)	Bulk unit weight (kN/m^2)	Effective overburden pressure (Pile toe) (kN/m2)	Bearing capacity factor (Nq)	End bearing resistance (kN)
III	Greyish brown medium plastic silty clay (CI)	0.75	0.442	18	50	200	9						795.22

Ultimate Load Carrying Capacity (Qs+Qp)		2380.31 kN
Safe Load Carrying Capacity (Qsafe =Qu/2.5)		**952.13 kN**
	Say	**950 kN**
Lateral Load Bearing Capacity		**76 kN**
Ultimate uplift resistance		1290.72 kN
Safe Uplift resistance		**516.29 kN**
	Say	**510 kN**

JOSMAR CONSULTING ENGINEERS CHENNAI-42

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JOSMAR CONSULTING ENGINEERS

Client	Mr. Dhilip Kumar & Others
Project	Stilt+5 Residential Building
Site	T Nagar
Pile installation type	Bored cast insitu
Borehole reference	1
Pile diameter	1 m
Pile length	18.0 m

1.SKIN RESISTANCE OF PILE

Layer	Strata	Strata top (m)	Strata bottom (m)	Strata thickness (m)	SPT N	Bulk density (kN/m^3)	Undrained shear strength (kN/m^2)	Adhesion factor	Angle of Internal friction (Φ)	Tan (Φ)	Effective overburden pressure (kN/m2)	Coefficient of earth pressure (K)	Skin resistance (kN)
II	Brownish, blackish low to medium plastic silty clay (CL) & (CI)	1.5	8.5	7	18	18	92	0.5					1011.08
III	Greyish black and brown silty sand (SM)	8.5	17	8.5	40	18			33	0.649	90	0.455	709.88
IV	Greyish brown medium plastic silty clay (CI)	17	18	1	50	200	250	0.5					392.50

2. END BEARING RESISTANCE OF PILE

Layer	Strata	Diameter of pile (m)	Cross sectional area of pile (Ap) (m^2)	R.L of bottom of pile (m)	SPT N	Undrained shear strength (pile tip) (kN/m^2)	Bearing capacity factor (Nc)	Angle of Internal friction (Φ)	Effective height (m)	Bulk unit weight (kN/m^3)	Effective overburden pressure (Pile toe) (kN/m2)	Bearing capacity factor (Nq)	End bearing resistance (kN)
IV	Greyish brown medium plastic silty clay (CI)	1	0.785	18	50	200	9						1413.72

Ultimate Load Carrying Capacity (Qs+Qp)		3527.18 kN
Safe Load Carrying Capacity (Qsafe =Qu/2.5)		**1410.87** kN
	Say	**1410** kN
Lateral Load Bearing Capacity		**112.8** kN
Ultimate uplift resistance		1720.96 kN
Safe Uplift resistance		**688.39** kN
	Say	**680** kN

JOSMAR CONSULTING ENGINEERS CHENNAI-42

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JOSMAR CONSULTING ENGINEERS

Client	Mr. Dhilip Kumar & Others
Project	Stilt+5 Residential Building
Site	T Nagar
Pile installation type	Bored cast insitu
Borehole reference	1
Pile diameter	1.2 m
Pile length	18.0 m

1.SKIN RESISTANCE OF PILE

Layer	Strata	Strata top (m)	Strata bottom (m)	Strata thickness (m)	SPT N	Bulk density (kN/m^3)	Undrained shear strength (kN/m^2)	Adhesion factor	Angle of Internal friction (Φ)	Tan (Φ)	Effective overburden pressure (kN/m2)	Coefficient of earth pressure (K)	Skin resistance (kN)
II	Brownish, blackish low to medium plastic silty clay (CL) & (CI)	1.5	8.5	7	18	18	92	0.5					1213.30
III	Greyish black and brown silty sand (SM)	8.5	17	8.5	40	18			33	0.649	90	0.455	851.86
IV	Greyish brown medium plastic silty clay (CI)	17	18	1	50	200	250	0.5					471.00

2. END BEARING RESISTANCE OF PILE

Layer	Strata	Diameter of pile (m)	Cross sectional area of pile (Ap) (m^2)	R.L of bottom of pile (m)	SPT N	Undrained shear strength (pile tip) (kN/m^2)	Bearing capacity factor (Nc)	Angle of Internal friction (Φ)	Effective height (m)	Bulk unit weight (kN/m^2)	Effective overburden pressure (Pile toe) (kN/m2)	Bearing capacity factor (Nq)	End bearing resistance (kN)
IV	Greyish brown medium plastic silty clay (CI)	1.2	1.131	18	50	200	9						2035.76

Ultimate Load Carrying Capacity (Qs+Qp)		4571.91 kN
Safe Load Carrying Capacity (Qsafe =Qu/2.5)		**1828.76** kN
	Say	**1820** kN
Lateral Load Bearing Capacity		**145.6** kN
Ultimate uplift resistance		2065.16 kN
Safe Uplift resistance		**826.06** kN
	Say	**820** kN

JOSMAR CONSULTING ENGINEERS CHENNAI-42

JOSMAR CONSULTING ENGINEERS

Client	Mr. Dhilip Kumar & Others
Project	Stilt+5 Residential Building
Site	T Nagar
Pile installation type	Bored cast insitu
Borehole reference	4
Pile diameter	0.6 m
Pile length	20.0 m

1.SKIN RESISTANCE OF PILE

Layer	Strata	Strata top (m)	Strata bottom (m)	Strata thickness (m)	SPT N	Bulk density (kN/m^3)	Undrained shear strength (kN/m^2)	Adhesion factor	Angle of internal friction (Φ)	Tan (Φ)	Effective overburden pressure (kN/m2)	Coefficient of earth pressure (K)	Skin resistance (kN)
II	Brownish black medium plastic silty clay (CI)	1.1	2.5	1.4	16	18	80	0.55					116.05
III	Brownish, greyish silty sand and clayey sand (SM) & (SC)	2.5	20	17.5	27	18			30	0.577	81.2	0.500	772.36

2. END BEARING RESISTANCE OF PILE

Layer	Strata	Diameter of pile (m)	Cross sectional area of pile (Ap) (m^2)	R.L of bottom of pile (m)	SPT N	Undrained shear strength (pile tip) (kN/m^2)	Bearing capacity factor (Nc)	Angle of internal friction (Φ)	Effective height (m)	Bulk unit weight (kN/m^3)	Effective overburden pressure (Pile toe) (kN/m2)	Bearing capacity factor (Nq)	End bearing resistance (kN)
III	Greyish silty sand (SM)	0.6	0.283	20.0	50			34	9	18	72	40	814.30

Ultimate Load Carrying Capacity (Qs+Qp)		1702.71 kN
Safe Load Carrying Capacity (Qsafe =Qu/2.5)		**681.09 kN**
	Say	**680 kN**
Lateral Load Bearing Capacity		**54.4 kN**
Ultimate uplift resistance		888.41 kN
Safe Uplift resistance		**355.36 kN**
	Say	**350 kN**

JOSMAR CONSULTING ENGINEERS CHENNAI-42

JOSMAR CONSULTING ENGINEERS

Client	Mr. Dhilip Kumar & Others
Project	Stilt+5 Residential Building
Site	T Nagar
Pile installation type	Bored cast insitu
Borehole reference	4
Pile diameter	0.75 m
Pile length	20.0 m

1.SKIN RESISTANCE OF PILE

Layer	Strata	Strata top (m)	Strata bottom (m)	Strata thickness (m)	SPT N	Bulk density (kN/m^3)	Undrained shear strength (kN/m^2)	Adhesion factor	Angle of internal friction (Φ)	Tan (Φ)	Effective overburden pressure (kN/m2)	Coefficient of earth pressure (K)	Skin resistance (kN)
II	Brownish black medium plastic silty clay (CI)	1.1	2.5	1.4	16	18	80	0.55					145.07
III	Brownish, greyish silty sand and clayey sand (SM) & (SC)	2.5	20	17.5	27	18			30	0.577	81.2	0.500	965.45

2. END BEARING RESISTANCE OF PILE

Layer	Strata	Diameter of pile (m)	Cross sectional area of pile (Ap) (m^2)	R.L of bottom of pile (m)	SPT N	Undrained shear strength (pile tip) (kN/m^2)	Bearing capacity factor (Nc)	Angle of internal friction (Φ)	Effective height (m)	Bulk unit weight (kN/m^2)	Effective overburden pressure (Pile toe) (kN/m2)	Bearing capacity factor (Nq)	End bearing resistance (kN)
III	Greyish silty sand (SM)	0.75	0.442	20.0	50			34	11.25	18	90	40	1590.44

Ultimate Load Carrying Capacity (Qs+Qp)		2700.95 kN
Safe Load Carrying Capacity (Qsafe =Qu/2.5)		**1080.38 kN**
	Say	**1080 kN**
Lateral Load Bearing Capacity		**86.4 kN**
Ultimate uplift resistance		1110.51 kN
Safe Uplift resistance		**444.21 kN**
	Say	**440 kN**

JOSMAR CONSULTING ENGINEERS CHENNAI-42

JOSMAR CONSULTING ENGINEERS

Client	Mr. Dhilip Kumar & Others
Project	Stilt+5 Residential Building
Site	T Nagar
Pile installation type	Bored cast insitu
Borehole reference	4
Pile diameter	1 m
Pile length	20.0 m

1.SKIN RESISTANCE OF PILE

Layer	Strata	Strata top (m)	Strata bottom (m)	Strata thickness (m)	SPT N	Bulk density (kN/m^3)	Undrained shear strength (kN/m^2)	Adhesion factor	Angle of Internal friction (Φ)	Tan (Φ)	Effective overburden pressure (kN/m2)	Coefficient of earth pressure (K)	Skin resistance (kN)
II	Brownish black medium plastic silty clay (CI)	1.1	2.5	1.4	16	18	80	0.55					193.42
III	Brownish, greyish silty sand and clayey sand (SM) & (SC)	2.5	20	17.5	27	18			30	0.577	81.2	0.500	1287.26

2. END BEARING RESISTANCE OF PILE

Layer	Strata	Diameter of pile (m)	Cross sectional area of pile (Ap) (m^2)	R.L of bottom of pile (m)	SPT N	Undrained shear strength (pile tip) (kN/m^2)	Bearing capacity factor (Nc)	Angle of Internal friction (Φ)	Effective height (m)	Bulk unit weight (kN/m^2)	Effective overburden pressure (Pile toe) (kN/m2)	Bearing capacity factor (Nq)	End bearing resistance (kN)
III	Greyish silty sand (SM)	1	0.785	20.0	50			34	15	18	120	40	3769.92

Ultimate Load Carrying Capacity (Qs+Qp)		5250.61 kN
Safe Load Carrying Capacity (Qsafe =Qu/2.5)		**2100.24 kN**
	Say	**2100 kN**
Lateral Load Bearing Capacity		**168 kN**
Ultimate uplift resistance		1480.69 kN
Safe Uplift resistance		**592.27 kN**
	Say	**590 kN**

JOSMAR CONSULTING ENGINEERS CHENNAI-42

JOSMAR CONSULTING ENGINEERS

Client	Mr. Dhilip Kumar & Others
Project	Stilt+5 Residential Building
Site	T Nagar
Pile installation type	Bored cast insitu
Borehole reference	4
Pile diameter	1.2 m
Pile length	20.0 m

1.SKIN RESISTANCE OF PILE

Layer	Strata	Strata top (m)	Strata bottom (m)	Strata thickness (m)	SPT N	Bulk density (kN/m^3)	Undrained shear strength (kN/m^2)	Adhesion factor	Angle of Internal friction (Φ)	Tan (Φ)	Effective overburden pressure (kN/m2)	Coefficient of earth pressure (K)	Skin resistance (kN)
II	Brownish black medium plastic silty clay (CI)	1.1	2.5	1.4	16	18	80	0.55					232.11
III	Brownish, greyish silty sand and clayey sand (SM) & (SC)	2.5	20	17.5	27	18			30	0.577	81.2	0.500	1544.71

2. END BEARING RESISTANCE OF PILE

Layer	Strata	Diameter of pile (m)	Cross sectional area of pile (Ap) (m^2)	R.L of bottom of pile (m)	SPT N	Undrained shear strength (pile tip) (kN/m^2)	Bearing capacity factor (Nc)	Angle of Internal friction (Φ)	Effective height (m)	Bulk unit weight (kN/m^2)	Effective overburden pressure (Pile toe) (kN/m2)	Bearing capacity factor (Nq)	End bearing resistance (kN)
III	Greyish silty sand (SM)	1.2	1.131	20.0	50			34	17	18	136	40	6152.51

Ultimate Load Carrying Capacity (Qs+Qp)		7929.33 kN
Safe Load Carrying Capacity (Qsafe =Qu/2.5)		**3171.73** kN
	Say	**3170** kN
Lateral Load Bearing Capacity		**253.6** kN
Ultimate uplift resistance		1776.82 kN
Safe Uplift resistance		**710.73** kN
	Say	**710** kN

JOSMAR CONSULTING ENGINEERS CHENNAI-42

JOSMAR CONSULTING ENGINEERS

Client	Mr. Dhilip Kumar & Others
Project	Stilt+5 Residential Building
Site	T Nagar
Pile installation type	Bored cast insitu
Borehole reference	4
Pile diameter	0.75 m
Pile length	24.0 m

1.SKIN RESISTANCE OF PILE

Layer	Strata	Strata top (m)	Strata bottom (m)	Strata thickness (m)	SPT N	Bulk density (kN/m^3)	Undrained shear strength (kN/m^2)	Adhesion factor	Angle of internal friction (Φ)	Tan (Φ)	Effective overburden pressure (kN/m2)	Coefficient of earth pressure (K)	Skin resistance (kN)
II	Brownish black medium plastic silty clay (CI)	1.1	2.5	1.4	16	18	80	0.55					145.07
III	Brownish black, greyish silty sand (SM) & Clayey sand (SC)	2.5	24	21.5	31	18			33	0.649	97.2	0.455	1454.42

2. END BEARING RESISTANCE OF PILE

Layer	Strata	Diameter of pile (m)	Cross sectional area of pile (Ap) (m^2)	R.L of bottom of pile (m)	SPT N	Undrained shear strength (pile tip) (kN/m^2)	Bearing capacity factor (Nc)	Angle of internal friction (Φ)	Effective height (m)	Bulk unit weight (kN/m^2)	Effective overburden pressure (Pile toe) (kN/m2)	Bearing capacity factor (Nq)	End bearing resistance (kN)
III	Highly weaathered sedimentary rock	0.75	0.442	24.0	50			34	11.25	18	90	40	1590.44

Ultimate Load Carrying Capacity (Qs+Qp)		3189.93 kN
Safe Load Carrying Capacity (Qsafe =Qu/2.5)		**1275.97 kN**
	Say	**1270 kN**
Lateral Load Bearing Capacity		**101.6 kN**
Ultimate uplift resistance		1454.42 kN
Safe Uplift resistance		**581.77 kN**
	Say	**580 kN**

JOSMAR CONSULTING ENGINEERS CHENNAI-42

JOSMAR CONSULTING ENGINEERS

Client	Mr. Dhilip Kumar & Others
Project	Stilt+5 Residential Building
Site	T Nagar
Pile installation type	Bored cast insitu
Borehole reference	4
Pile diameter	1 m
Pile length	24.0 m

1.SKIN RESISTANCE OF PILE

Layer	Strata	Strata top (m)	Strata bottom (m)	Strata thickness (m)	SPT N	Bulk density (kN/m^3)	Undrained shear strength (kN/m^2)	Adhesion factor	Angle of internal friction (Φ)	Tan (Φ)	Effective overburden pressure (kN/m2)	Coefficient of earth pressure (K)	Skin resistance (kN)
II	Brownish black medium plastic silty clay (CI)	1.1	2.5	1.4	16	18	80	0.55					193.42
III	Brownish black, greyish silty sand (SM) & Clayey sand (SC)	2.5	24	21.5	31	18			33	0.649	97.2	0.455	1939.23

2. END BEARING RESISTANCE OF PILE

Layer	Strata	Diameter of pile (m)	Cross sectional area of pile (Ap) (m^2)	R.L of bottom of pile (m)	SPT N	Undrained shear strength (pile tip) (kN/m^2)	Bearing capacity factor (Nc)	Angle of internal friction (Φ)	Effective height (m)	Bulk unit weight (kN/m^2)	Effective overburden pressure (Pile toe) (kN/m2)	Bearing capacity factor (Nq)	End bearing resistance (kN)
III	Highly weaathered sedimentary rock	1	0.785	24.0	50			34	15	18	120	40	3769.92

Ultimate Load Carrying Capacity (Qs+Qp)		5902.58 kN
Safe Load Carrying Capacity (Qsafe =Qu/2.5)		**2361.03 kN**
	Say	**2360 kN**
Lateral Load Bearing Capacity		**188.8 kN**
Ultimate uplift resistance		1939.23 kN
Safe Uplift resistance		**775.69 kN**
	Say	**770 kN**

JOSMAR CONSULTING ENGINEERS CHENNAI-42

JOSMAR CONSULTING ENGINEERS

Client	Mr. Dhilip Kumar & Others
Project	Stilt+5 Residential Building
Site	T Nagar
Pile installation type	Bored cast insitu
Borehole reference	4
Pile diameter	1.2 m
Pile length	24.0 m

1.SKIN RESISTANCE OF PILE

Layer	Strata	Strata top (m)	Strata bottom (m)	Strata thickness (m)	SPT N	Bulk density (kN/m^3)	Undrained shear strength (kN/m^2)	Adhesion factor	Angle of internal friction (Φ)	Tan (Φ)	Effective overburden pressure (kN/m2)	Coefficient of earth pressure (K)	Skin resistance (kN)
II	Brownish black medium plastic silty clay (CI)	1.1	2.5	1.4	16	18	80	0.55					232.11
III	Brownish black, greyish silty sand (SM) & Clayey sand (SC)	2.5	24	21.5	31	18			33	0.649	97.2	0.455	2327.08

2. END BEARING RESISTANCE OF PILE

Layer	Strata	Diameter of pile (m)	Cross sectional area of pile (Ap) (m^2)	R.L of bottom of pile (m)	SPT N	Undrained shear strength (pile tip) (kN/m^2)	Bearing capacity factor (Nc)	Angle of internal friction (Φ)	Effective height (m)	Bulk unit weight (kN/m^2)	Effective overburden pressure (Pile toe) (kN/m2)	Bearing capacity factor (Nq)	End bearing resistance (kN)
III	Highly weaathered sedimentary rock	1.2	1.131	24.0	50			34	18	18	144	40	6514.42

Ultimate Load Carrying Capacity (Qs+Qp)		9073.61 kN
Safe Load Carrying Capacity (Qsafe =Qu/2.5)		**3629.44 kN**
	Say	**3620 kN**
Lateral Load Bearing Capacity		**289.6 kN**
Ultimate uplift resistance		2327.08 kN
Safe Uplift resistance		**930.83 kN**
	Say	**930 kN**

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THE LANDLENS SUITE

Eight ways to know a piece of land before you pay for it.

This report covers one part of the picture. These cover the rest, drawn from the same government records, for any property in Tamil Nadu.

LandLens One
Ask anything about a property and get an answer grounded in live government records, with the sources shown.
/landlens/one

Verify My Land
Every record check run on one property and returned as a single report.
/landlens/verify-my-land

Legal Opinion
An advocate's written opinion on the title, built on the records we pull for it.
/landlens

One Map
Every layer on one map: the parcel, its boundary, zoning, water bodies and what sits around it.
/landlens/one/map

PriceMap
What land actually changed hands for around this plot, taken from the registered deeds.
/landlens/pricemap

Build Scope
What you are allowed to build here: floor space, height, coverage and setbacks.
/landlens/build-scope

Property Tracker
Watch a property and hear about it when something new is registered against it.
/landlens/property-tracker

Deal Room
Run the transaction in one place: documents, stamping, signatures and the parties.
/landlens/deal-room

FREE TOOLS · NO ACCOUNT NEEDED

Twenty-four checks you can run yourself, at no cost.

Records and verification

The registers themselves, read for you.

- Encumbrance Certificate
- Patta and Chitta
- Field Measurement Sketch
- EC Analyzer
- Bank charge check
- Court case search
- Seller background check
- Approval check by survey

Value and duty

What it is worth and what it costs to register.

- Guideline value by street
- Guideline value by survey
- Stamp duty and registration fees
- Capital gains
- Floor space index
- Area unit converter

Zoning and land use

What the plan says can happen on this land.

- Land use zone finder
- CMDA land use check
- Coastal regulation zone
- Master plan check
- Water bodies finder
- Airport height clearance

Registers and directories

Who holds it, and which office keeps the record.

- Find your registering office
- Temple property check
- Waqf property check
- RERA register

Every free tool
/tools

Services we run for you
/services

The LandLens suite
/landlens/one

Verified RealEstate™

Every claim in this document traces back to a government record.

- Legal opinions, due diligence and title verification
- Building plan, layout and sub-division approvals
- Completion and occupancy certificates, regularisation
- Escrow, negotiation and NRI property management
- Land survey, soil testing, architecture and construction

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Prepared from the registers named on the page each finding sits on. Where a register could not be read, this document says so in its place rather than leaving the gap to be read as a clean result.