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THE SPIRIT OF ENGINEERING

GEO MARINE CONSULTANTS (P) LTD.,

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NAME OF PROJECT

GEOTECHNICAL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING CONSISTING OF STILT + 5 UPPER FLOORS AT BLOCK NO. 14, R. SURVEY NO. 563/1, DOOR NO. 64, ARATHOON ROAD, ROYAPURAM, CHENNAI- 600 013

CLIENT

M/S NAVIN BUILDERS (A UNIT OF VASUDHA ENTERPRISES)
NAVIN'S TRIUMPH,
NO. 802 & 804, ANNA SALAI
NANDANAM, CHENNAI-600 035

TITLE

GEOTECHNICAL INVESTIGATION REPORT

REPORT NO.: GT- 2752

DATE	REVISON	DESCRIPTION		AUTHORISED SIGNATORY
12/03/2024	FIRST SUBMISSION	SUBMISSION OF DRAFT GEOTECHNICAL REPORT	SIGN	GEO MARINE CONSULTANTS PVT. LTD. Chennai 600 041
			DATE	12/03/2024
			DESIGNATION	MANAGING DIRECTOR
			NAME	**DR. C.V. PRASAD**

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REPORT TEXT

CHAPTER-1

INTRODUCTION

1.0 PROJECT INFORMATION MATRIX:

NATURE OF PROJECT	: **PROPOSED RESIDENTIAL BUILDING**
STRUCTURE	: **STILT + 5 UPPER FLOORS**
PROJECT OWNER	: **M/S NAVIN BUILDERS (A UNIT OF VASUDHA ENTERPRISES)**
PROJECT LOCATION	: **ROYAPURAM, CHENNAI**
JOB CODE	: **GT-2752**

1.1 SCOPE OF WORK:

1.1.1 FIELD WORK:

- Conducting two soil investigation bore holes of 150 mm diameter in Soil & Overburden. In case of rock formation NX Diameter with Core barrel shall be adopted to progress the drilling up the termination depth.
- Conducting Standard Penetration Test (SPT) within the borehole at:
  - Every 1.0m depth interval up to 6.0m.
  - From 6.0m to 10.5m depth SPT is conducted at every 1.5m depth interval

  The depth of investigation is 10.5m below the existing ground level.
- Collection of disturbed soil samples at SPT location and undisturbed samples from the clayey strata with SPT-value greater than 2 to less than 15 if met within the investigation depth
- Collection of water samples if groundwater table met within the investigation depth

1.1.2 LABORATORY WORK:

- Natural Moisture Content
- Atterberg's limits
- Grain Size Analysis
- Consolidation test on undisturbed samples if applicable
- Chemical Analysis test on soil and water samples to give pH, Chlorides and Sulphates

1.2 STRUCTURE OF THE REPORT:

- Contents
- Introduction
- Investigation Methodology & Test Results
- Sub-Surface Stratification
- Foundation System
- Recommendation
- Annexure

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CHAPTER-2

INVESTIGATION METHODOLOGY & TEST RESULTS

2.0 PREAMBLE:

Two soil investigation borehole was put as per the planning of the engineer in-charge and these locations are shown in Fig.2.0. The equipment used and the methodology adopted to carry out the fieldwork is described below.

2.1 METHODOLOGY OF FIELD WORK:

2.1.1 EQUIPMENT USED AND METHOD OF DRILLING:

All the boreholes were sunk by conventional rotary drilling rigs. For borehole Methodology followed for boring conformed to IS: 1892 -2000. Boring was progressed by the cutting action of rotating bit with water circulation and stabilizing the side of the boreholes by using casing pipes/bentonite slurry up to required depth to prevent collapse of sidewall. Boring was continued by normal boring process using MS soil cutter in soil. However, Tungsten Carbide (TC) bit drilling was resorted to drill in highly weathered rock stratum where the normal boring process became slow. Diamond Core (DC) bit drilling was adopted in moderately weathered rock formations where penetration using TC bit was became slow.

2.1.2 STANDARD PENETRATION TESTS:

This is a field test to determine "Penetration Resistance of Stratum at the Test Depth". This has been conducted in the boreholes generally up to refusal depth using procedures described in IS: 2131- 2002. In this test, split spoon sampler (50.8 mm OD and 35 mm ID) has replaced driving bit. Sampler is then driven by dropping 63.5 kg hammer on top of driving collar with free fall of 75 cm. The length of sampler is 60 cm.

The tests were conducted at the depth intervals indicated in Chapter-1 (Sec.1.1.1).

2.1.3 COLLECTION OF SOIL SAMPLES:

2.1.3.1 DISTURBED SAMPLES:

The SPT-samples collected were used as disturbed soil samples. These samples were used for visual and physical identification and for conducting laboratory classification tests as per I.S.1498-1970.

2.1.3.2 UNDISTURBED SAMPLES:

From the soft to stiff clay layer, representative undisturbed samples were collected. These samples were used primarily to establish the compressibility parameters to estimate the settlements of shallow foundation system wherever applicable.

2.1.4 COLLECTION OF GROUND WATER SAMPLES:

One representative water sample from each borehole was collected after 24 hours of completing the borehole if water table met within the investigated depth.

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SITE PLAN

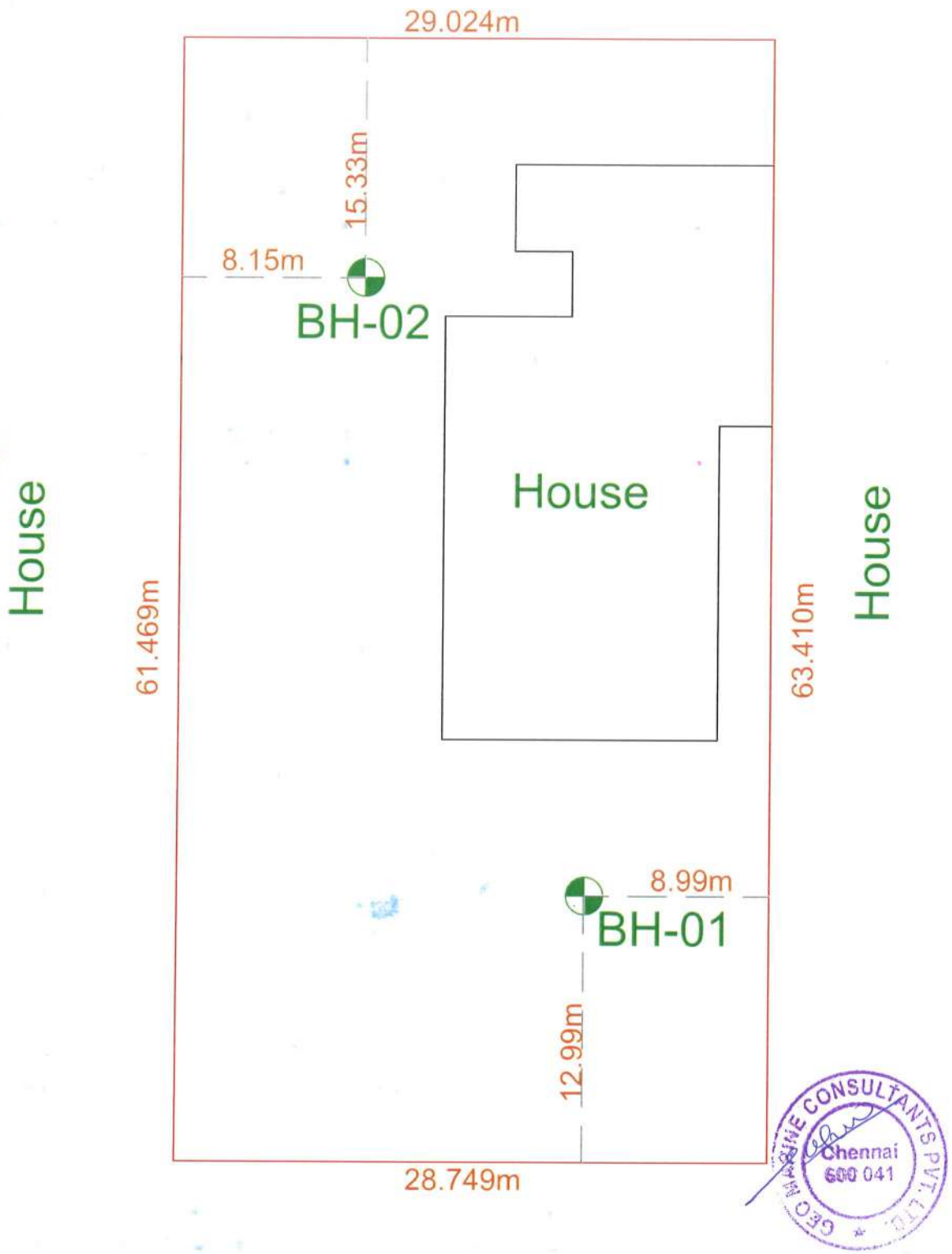


FIG. 2.0 SITE PLAN SHOWING THE FIELD INVESTIGATION BOREHOLE LOCATION

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SITE INVESTIGATION RECORD

BORE HOLE No.	BH-01						
SHEET	1	OF	2				
PROJECT NAME	PROPOSED CONSTRUCTION OF A RESIDENTIAL BUILDING					DIA OF BORE HOLE	150mm ✓ / NX
LOCATION	Royapuram, Chennai	MACHINE No.	CR-06	Free Fall Energy (%)	60	BORE START DATE	29/02/2024
STRUCTURE	Stilt + 5 Upper Floors	DRILLING METHOD	Rotary	CO-ORDINATES	N -	BORE END DATE	29/02/2024
JOB CODE	GT-2752	FLUSHING MEDIUM	Bentonite		E -	TOTAL DRILL DAYS	1

Depth below E.G.L. (m)	Date	Drilling progress per metre: Time Hr.	Time Min.	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	15-30	30-45	SPT Value: N80	SPT Value: N	Sample Details: Depth	No.	Type	RL (m)	Layer Data: Legend	No	Depth	Geotechnical Description
1	29/02/2024	11	00	SC	-	-													
		To																	
		11	01				10	12	13	-	25	0.50	1	SS					
		11	15									0.95							Brown,Moist,Poorly Graded,Fine & Medium Sand Grains,Medium Dense,**Poorly Graded-Silty SAND (SP-SM)**
		To		SC	-	-													
		11	16				9	12	13	-	25	1.25	2	SS	-1.25				
		11	26									1.70							
		To		SC	-	-													
2		11	27				10	15	25	-	40	2.00	3	SS	-2.0		L1	2.0	
		11	35									2.45							
		To		SC	-	-													
		11	36																
3							20	20	23	-	43	3.00	4	SS	-3.0				Brown,Moist,Poorly Rgaded,Fine & Medium Sand Grains,Dense,**Silty SAND (SM)**
		11	47									3.45							
		To		SC	-	-													
		11	48																
4							30	37	60	-	97	4.00	5	SS	-4.0		L2	4.0	
		11	58									4.45							
		To		SC	-	-													
		11	59																
5							30	55	SPT-hammer rebound	-	>100	5.00	6	SS	-5.0				
		12	11									5.30							
		To		SC	-	-													
		12	12																
6							55	SPT Hammer Rebound		-	>100	6.00	7	SS	-6.0				Brown,Moist,Poorly Graded,Fine & Medium Sand Grains,Very Dense,**Poorly Graded-Silty SAND (SP-SM) & Silty SAND (SM)**
		12	30									6.15							
		To		SC	-	-													
7		12	31																
							28	30	51	-	81	7.50	8	SS	-7.5		L3	7.5	
												7.95							
8		12	50																
		To		SC	-	-													
		12	52																
9							31	32	34	-	66	9.00	9	SS	-9.0				Brown,Moist,Fine & Medium Sand Grains Mixture,Very Dense,**Sandy SILT (ML) With Non Plasticity**
												9.45							
		14	00																
10		To		SC	-	-													
		14	02																

CS - Core Sample	DS - Disturbed Sample	LOGGED	S.Stephen raj	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	29/02/2024	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	S.Tysonraj	WATER TABLE (m) 2.50	
WS - Wash Sample	DB - Diamond Bit	DATE	04/03/2024	CASING DEPTH (m) 0.00	

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SITE INVESTIGATION RECORD

BORE HOLE No.	BH-02						
SHEET	1	OF	2				
PROJECT NAME	PROPOSED CONSTRUCTION OF A RESIDENTIAL BUILDING					DIA OF BORE HOLE	150mm ✓ / NX
LOCATION	Royapuram, Chennai	MACHINE No.	CR-06	Free Fall Energy (%)	60	BORE START DATE	01/03/2024
STRUCTURE	Stilt + 5 Upper Floors	DRILLING METHOD	Rotary	CO-ORDINATES	N -	BORE END DATE	01/03/2024
JOB CODE	GT-2752	FLUSHING MEDIUM	Bentonite		E -	TOTAL DRILL DAYS	1

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min.	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	Blows/cm. 15-30	Blows/cm. 30-45	SPT Value: N80	SPT Value: N	Sample Details: Depth	No.	Type	RL (m)	Layer Data: Legend	No	Depth	Geotechnical Description
1	01/03/2024	10	55	SC	-	-													
		To																	
		10	56				5	7	9	-	16	0.50	1	SS	-0.5				Brown,Moist,Poorly Graded,Fine & Medium Sand Grains,Medium Dense,**Silty SAND (SM)**
		11	11									0.95							
		To		SC	-	-											L1	1.25	
		11	11				8	14	17	-	31	1.25	2	SS	-1.25				
		11	21									1.70							
		To		SC	-	-													
		11	22				11	17	22	-	39	2.00	3	SS	-2.0				Brown,Moist,Poorly Graded,Fine & Medium Sand Grains,Dense,**Poorly Graded-Silty SAND (SP-SM) & Silty SAND (SM)**
		12	20									2.45							
		To		SC	-	-													
		12	21				16	46	48	-	94	3.00	4	SS	-3.0		L2	3.0	
		14	00									3.45							
		To		SC	-	-													
		14	02				16	32	65	-	97	4.00	5	SS	-4.0				
		14	20									4.45							
		To		SC	-	-													
		14	22				40	13Cm Penet for 50Blows		-	>100	5.00	6	SS	-5.0				
		14	40									5.28							
		To		SC	-	-													
		14	42				51	SPT Hammer Rebound		-	>100	6.00	7	SS	-6.0				Brown,Moist,Poorly Graded,Fine & Medium Sand Grains,Very Dense,**Silty SAND (SM) & Poorly Graded-Silty SAND (SP-SM)**
		15	10									6.15							
		To		SC	-	-													
		15	12				46	12Cm Penet for 50Blows		-	>100	7.50	8	SS	-7.5				
		15	34									7.77							
		To		SC	-	-													
		15	37				29	40	57	-	97	9.00	9	SS	-9.0				
		15	56									9.45							
		To		SC	-	-													
		16	01																

CS - Core Sample	DS - Disturbed Sample	LOGGED	S.Stephen raj	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	01/03/2024	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	S.Tysonraj	WATER TABLE (m) 3.00	
WS - Wash Sample	DB - Diamond Bit	DATE	04/03/2024	CASING DEPTH (m) 0.00	

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SITE INVESTIGATION RECORD

BORE HOLE No.	BH-02						
SHEET	2	OF	2				
PROJECT NAME	PROPOSED CONSTRUCTION OF A RESIDENTIAL BUILDING					DIA OF BORE HOLE	150mm ✓ / NX
LOCATION	Royapuram, Chennai	MACHINE No.	CR-06	Free Fall Energy (%)	60	BORE START DATE	01/03/2024
STRUCTURE	Stilt + 5 Upper Floors	DRILLING METHOD	Rotary	CO-ORDINATES	N -	BORE END DATE	01/03/2024
JOB CODE	GT-2752	FLUSHING MEDIUM	Bentonite		E -	TOTAL DRILL DAYS	1

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min.	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	Blows/cm. 15-30	Blows/cm. 30-45	SPT Value: N80	SPT Value: N	Sample Details: Depth	No.	Type	RL (m)	Layer Data: Legend	No	Depth	Geotechnical Description
11	01/03/2024						36	10Cm Penet for 50Blows		-	>100	10.50 | 10.75 ⩛	10	SS	-10.5		L3	10.8	Brown,Moist,Poorly Graded,Fine & Medium Sand Grains,Very Dense,**Silty SAND (SM) & Poorly Graded-Silty SAND (SP-SM)**
12																			
13																			
14																			
15																			
16																			
17																			
18																			
19																			
20																			

CS - Core Sample	DS - Disturbed Sample	LOGGED	S.Stephen raj	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	01/03/2024	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	S.Tysonraj	WATER TABLE (m) 3.00	
WS - Wash Sample	DB - Diamond Bit	DATE	04/03/2024	CASING DEPTH (m) 0.00	

Borehole terminated at 10.5 m depth below E.G.L

FIG.2.2 Sub Soil Profile at BH-02 Location

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GRAIN SIZE DISTRIBUTION CURVE

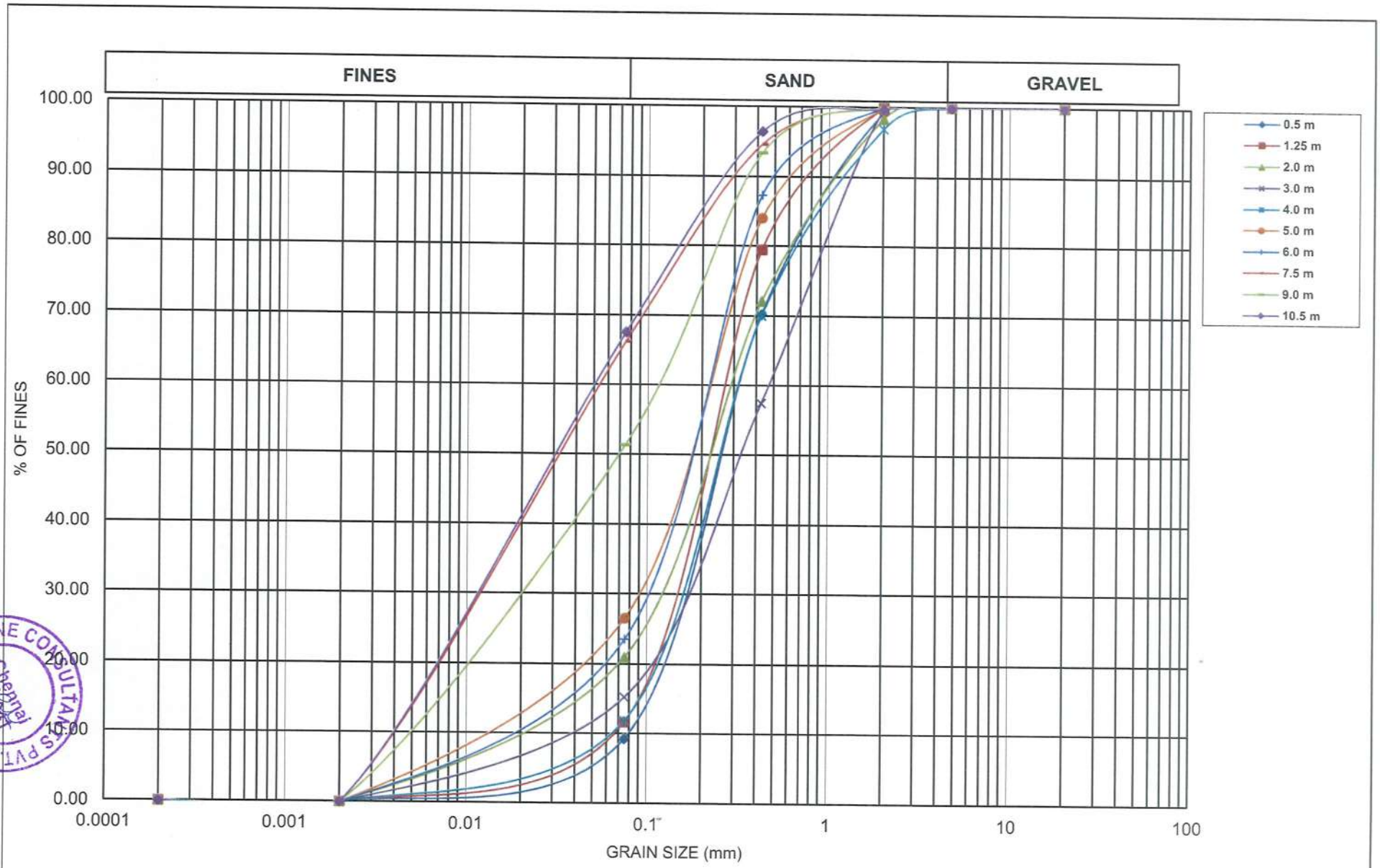


Fig. 2.3 GRAIN SIZE DISTRIBUTION CURVE - BH-01

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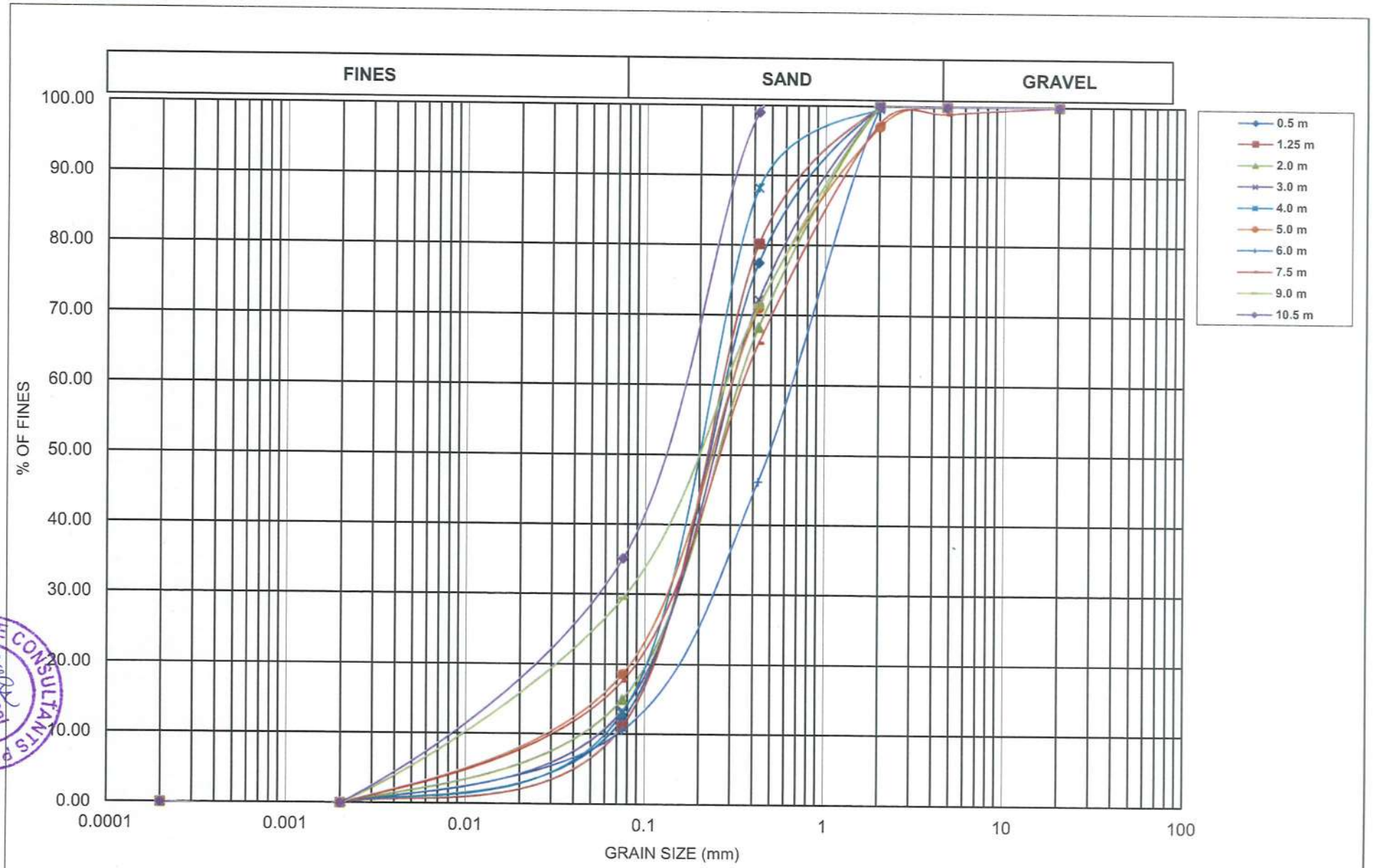


Fig. 2.4 GRAIN SIZE DISTRIBUTION CURVE - BH-02

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LABORATORY TEST RESULTS

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LABORATORY TEST REPORT

GEOMARINE CONSULTANTS PVT LTD- TESTING LABORATORY

NO.11 2nd MAIN ROAD, KANNAPA NAGAR, CHENNAI-600041

TC-11410

ULR NO.	:	TC114102400000480F	SAMPLE IDENTIFICATION NUMBER	: GMC/0224/837
REPORT ISSUED TO	:	M/S NAVIN BUILDERS (A UNIT OF VASUDHA ENTERPRISES)	TEST REPORT NUMBER	: GT-2752
DISCIPLINE/GROUP	:	MECHANICAL / SOIL AND ROCK	SAMPLE RECEIPT DATE	: 02/03/2024
SAMPLE DESCRIPTION	:	CLAY AND SOIL	PERIOD OF TESTING	: 04/03/2024 to 08/03/2024
SAMPLE CONDITION	:	SATISFACTORY	REPORT ISSUE DATE	: 09/03/2024
TEST METHOD	:	BUREAU OF INDIAN STANDARDS	NO. OF PAGES	: One

TABLE 2.1 LABORATORY CLASSIFICATION OF SOIL SAMPLES FROM BH-01

Sampling Depth (m)	"N" Value	Type of Sample	Moisture Content (%) AS PER IS 2720 (P-II) - 1973, RA-2015	LIQUID LIMIT (%) AS PER IS 2720 (P-V) - 1985, RA-2015	PLASTIC LIMIT (%) AS PER IS 2720 (P-V) - 1985, RA-2015	Plasticity Index (I_p= LL-PL)	SHRINKAGE LIMIT (%) AS PER IS 2720 (P-VI) - 1972, RA-2011	FREE SWELL INDEX (%) AS PER IS 2720 (P-XL) - 1977, RA-2011	SPECIFIC GRAVITY AS PER IS 2720 (P-III, SEC-1) - 1980, RA-2010	GRAIN SIZE ANALYSIS AS PER IS 2720 (P-IV) - 1985, RA-2015						DIRECT SHEAR TEST IS 2720 PART 13:1986 (RA 2016)		Uniformity Co-Efficient $C_U=D_{60}/D_{10}$	Co-Efficient of Curvature $C_c=D_{30}^2/(D_{10}xD_{60})$	Consistancy	Relative Density	IS-Notation		
										Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)	Cohesion (kg/cm^2)	ϕ (Degrees)					Fine Grain Soils	Gravely Soils	Sandy Soils
0.5	25	SPT	4.9	-	-	-	-	-	-	0.0	0.7	29.1	61.0	9.3		-	-	-	-	-	M.Dense	-	-	SP-SM
1.25	25	SPT	7.5	-	-	-	-	-	2.59	0.0	0.0	20.5	67.8	11.7		-	-	-	-	-	M.Dense	-	-	SP-SM
2.0	40	SPT	15	-	-	-	-	-	-	0.0	1.6	26.2	51.1	21.0		-	-	-	-	-	Dense	-	-	SM
3.0	43	SPT	14	-	-	-	-	-	-	0.0	0.3	42.3	42.2	15.3		-	-	-	-	-	Dense	-	-	SM
4.0	97	SPT	18	-	-	-	-	-	2.59	0.0	3.1	26.9	58.2	11.9		-	-	-	-	-	V.Dense	-	-	SP-SM
5.0	>100	SPT	20	-	-	-	-	-	-	0.0	0.1	15.8	57.5	26.6		-	-	-	-	-	V.Dense	-	-	SM
6.0	>100	SPT	18	-	-	-	-	-	-	0.0	0.0	12.6	63.8	23.6		-	-	-	-	-	V.Dense	-	-	SM
7.5	81	SPT	23	Little/No Plasticity				0	-	0.0	0.0	5.3	28.4	66.3		-	-	-	-	-	-	ML	-	-
9.0	66	SPT	19					-	-	0.0	0.0	6.6	42.0	51.4		-	-	-	-	-	-	ML	-	-
10.5	>100	SPT	21					10	-	0.0	0.2	3.3	28.9	67.6		-	-	-	-	-	-	ML	-	-

** END OF REPORT**

Terms and Conditions

(1) The test results furnished corresponds to the sample received

(2) The tested sample will not be retained for more than 45 days from the date of issue of test report except in the case as required by the applicable regulations.

(3) Any correction in this reports invalidates the reports

Authorised Signatory
A. VINOTH
(Technical Manager)

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Phone No.: 044-24481485, 044-24480305

LABORATORY TEST REPORT

GEOMARINE CONSULTANTS PVT LTD- TESTING LABORATORY

NO.11 2nd MAIN ROAD, KANNAPA NAGAR, CHENNAI-600041

TC-11410

ULR NO.	:	TC114102400000480F	SAMPLE IDENTIFICATION NUMBER	:	GMC/0224/837
REPORT ISSUED TO	:	M/S NAVIN BUILDERS (A UNIT OF VASUDHA ENTERPRISES)	TEST REPORT NUMBER	:	GT-2752
DISCIPLINE/GROUP	:	MECHANICAL / SOIL AND ROCK	SAMPLE RECEIPT DATE	:	02/03/2024
SAMPLE DESCRIPTION	:	CLAY AND SOIL	PERIOD OF TESTING	:	04/03/2024 to 08/03/2024
SAMPLE CONDITION	:	SATISFACTORY	REPORT ISSUE DATE	:	09/03/2024
TEST METHOD	:	BUREAU OF INDIAN STANDARDS	NO. OF PAGES	:	One

TABLE 2.2 LABORATORY CLASSIFICATION OF SOIL SAMPLES FROM BH-02

Sampling Depth (m)	"N" Value	Type of Sample	Moisture Content (%) AS PER IS 2720 (P-II) - 1973, RA-2015	LIQUID LIMIT (%) AS PER IS 2720 (P-V) - 1985, RA-2015	PLASTIC LIMIT (%) AS PER IS 2720 (P-V) - 1985, RA-2015	Plasticity Index (I_P= LL-PL)	SHRINKAGE LIMIT (%) AS PER IS 2720 (P-VI) - 1972, RA-2011	FREE SWELL INDEX (%) AS PER IS 2720 (P-XL) - 1977, RA-2011	SPECIFIC GRAVITY AS PER IS 2720 (P-III, SEC-1) - 1980, RA-2010	GRAIN SIZE ANALYSIS AS PER IS 2720 (P-IV) - 1985, RA-2015						DIRECT SHEAR TEST IS 2720 PART 13:1986 (RA 2016)		Uniformity Co-Efficient $C_U=D_{60}/D_{10}$	Co-Efficient of Curvature $C_c=D_{30}^2/(D_{10}xD_{60})$	Consistancy	Relative Density	IS-Notation		
										Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)	Cohesion (kg/cm^2)	ϕ (Degrees)					Fine Grain Soils	Gravely Soils	Sandy Soils
0.5	16	SPT	3.7	-	-	-	-	-	-	0.0	0.0	22.5	65.4	12.1		-	-	-	-	-	M.Dense	-	-	SM
1.25	31	SPT	4.4	-	-	-	-	-	-	0.0	0.0	19.8	69.0	11.2		-	-	-	-	-	Dense	-	-	SP-SM
2.0	39	SPT	6.7	-	-	-	-	-	2.60	0.0	0.0	31.7	53.3	15.0		-	-	-	-	-	Dense	-	-	SM
3.0	94	SPT	15	-	-	-	-	-	-	0.0	0.0	27.8	58.8	13.4		-	-	-	-	-	V.Dense	-	-	SM
4.0	97	SPT	20	-	-	-	-	-	-	0.0	0.3	11.5	75.2	13.1		-	-	-	-	-	V.Dense	-	-	SM
5.0	>100	SPT	16	-	-	-	-	-	2.60	0.0	2.8	26.1	52.4	18.7		-	-	-	-	-	V.Dense	-	-	SM
6.0	>100	SPT	14	-	-	-	-	-	-	0.0	0.2	53.6	35.7	10.6		-	-	-	-	-	V.Dense	-	-	SP-SM
7.5	>100	SPT	15	-	-	-	-	-	-	1.0	1.3	31.6	48.4	17.7		-	-	-	-	-	V.Dense	-	-	SM
9.0	97	SPT	17	Little/No Plasticity				-	-	0.0	0.0	28.6	41.9	29.5		-	-	-	-	-	V.Dense	-	-	SM
10.5	>100	SPT	22	-	-	-	-	-	-	0.0	0.0	0.9	63.9	35.2		-	-	-	-	-	V.Dense	-	-	SM

** END OF REPORT**

Terms and Conditions

(1) The test results furnished corresponds to the sample received

(2) The tested sample will not be retained for more than 45 days from the date of issue of test report except in the case as required by the applicable regulations.

(3) Any correction in this reports invalidates the reports

Authorised Signatory
A. VINOTH
(Technical Manager)

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CHEMICAL LABORATORY TEST RESULTS

GEOMARINE
THE SPIRIT OF ENGINEERING
Phone No.: 044-24480305

LABORATORY TEST REPORT
GEOMARINE CONSULTANTS PVT LTD- TESTING LABORATORY
NO.11 2nd MAIN ROAD, KANNAPA NAGAR EXTN,
KOTTIVAKKAM, CHENNAI

TC-11410

TABLE 2.3 RESULT OF CHEMICAL TEST ON WATER

URL NO	:TC114102400000481F	SAMPLE SOURCE	:CUSTOMER SUPPLIED
DISCIPLINE/GROUP	:CHEMICAL - WATER	SAMPLE ID	:GMC/0224/837
SAMPLE DESCRIPTION	:GROUND WATER	REPORT NUMBER	:GT-2752
SAMPLE CONDITION	:SATISFACTORY	RECEIVED DATE	:02/03/2024
TEST METHOD	:AS PER BIS	TEST PERIOD	:04/02/2024
NO. OF PAGES	:1 Of 1	ISSUE OF REPORT	:09/03/2024
REPORT ISSUED TO	:M/S NAVIN BUILDERS (A UNIT OF VASUDHA ENTERPRISES)		

S.NO.	SAMPLE REFERENCE	WATER			
		DEPTH OF SAMPLE (m)	pH AS PER IS 3025 (P-XI) - 2022	SULPHATES (mg/l) AS PER APHA 23rd Edn.2017-4500	CHLORIDES (mg/l) AS PER IS 3025(P-XXXII) - 1988, RA-2019
1.0	BH-01	2.5	7.8	297.9	200.6
2.0	BH-02	3.0	7.8	289.4	228.3

** END OF REPORT**

Authorised Signatory
A. VINOTH
(Technical Manager)

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Phone No.: 044-24480305

LABORATORY TEST REPORT
GEOMARINE CONSULTANTS PVT LTD- TESTING LABORATORY
NO.11 2nd MAIN ROAD, KANNAPA NAGAR EXTN,
KOTTIVAKKAM, CHENNAI

TC-11410

TABLE 2.4 RESULT OF CHEMICAL TEST ON SOIL

URL NO	:TC114102400000482F	SAMPLE SOURCE	:CUSTOMER SUPPLIED
DISCIPLINE/GROUP	:CHEMICAL-SOIL AND ROCK	SAMPLE ID	:GMC/0224/837
SAMPLE DESCRIPTION	:SOIL	REPORT NUMBER	:GT-2752
SAMPLE CONDITION	:SATISFACTORY	RECEIVED DATE	:02/03/2024
TEST METHOD	:AS PER BIS	TEST PERIOD	:08/03/2024
NO. OF PAGES	:1 Of 1	ISSUE OF REPORT	:09/03/2024
REPORT ISSUED TO	:M/S NAVIN BUILDERS (A UNIT OF VASUDHA ENTERPRISES)		

S.NO.	SAMPLE REFERENCE	SOIL (2:1)	
		DEPTH OF SAMPLE (m)	pH AS PER IS 2720 (P-XXVI) - 1987
1.0	BH-01	2.0	7.51
2.0	BH-02	2.0	7.65

** END OF REPORT**

Authorised Signatory
A. VINOTH
(Technical Manager)

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Phone No.: 044-24480305

LABORATORY TEST REPORT
GEOMARINE CONSULTANTS PVT LTD- TESTING LABORATORY
NO.11 2nd MAIN ROAD, KANNAPA NAGAR EXTN,
KOTTIVAKKAM, CHENNAI

TABLE 2.5 RESULT OF CHEMICAL TEST ON SOIL

		SAMPLE SOURCE	:CUSTOMER SUPPLIED
DISCIPLINE/GROUP	:CHEMICAL-SOIL AND ROCK	SAMPLE ID	:GMC/0224/837
SAMPLE DESCRIPTION	:SOIL	REPORT NUMBER	:GT-2752
SAMPLE CONDITION	:SATISFACTORY	RECEIVED DATE	:02/03/2024
TEST METHOD	:AS PER BIS	TEST PERIOD	:08/03/2024
NO. OF PAGES	:1 Of 1	ISSUE OF REPORT	:09/03/2024
REPORT ISSUED TO	:M/S NAVIN BUILDERS (A UNIT OF VASUDHA ENTERPRISES)		

S.NO.	SAMPLE REFERENCE	SOIL (2:1)		
		DEPTH OF SAMPLE (m)	SULPHATES (mg/l) AS PER APHA 23rd Edn.2017-4500	CHLORIDES (mg/l) AS PER IS 3025(P-XXXII) - 1988, RA-2019
1.0	BH-01	2.0	27.8	11.4
2.0	BH-02	2.0	31.0	21.2

** END OF REPORT**

Authorised Signatory
A. VINOTH
(Technical Manager)

Terms and Conditions

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CHAPTER-3

GEOLOGY & SUB-SURFACE STRATIFICATION

3.0 PREAMBLE:

Geotechnical investigation carried out at a specific site provides location specific sub surface engineering characteristics. However, in major project sites where the construction activities spread over a very large area location specific sub surface strata characteristics are studied together with the geological mapping data.

This is required to incorporate the impact of any documented macro-level geological characteristics of the region on the foundation design, irrespective of the location specific sub surface strata characteristics.

In view on the above, though it is beyond the scope of the present study to carry out macro-level geological investigation the regional geology based on the published data is presented and discussed.

3.1 CLIMATE AND RAINFALL:

The study area receives the rain under the influence of both southeast and northeast monsoons. Predominantly northeast monsoon contributes rainfall and most of the precipitation occurs in the form of cyclonic storm caused due to the depressions in Bay of Bengal. The north east monsoon occurs between October & December. The southwest monsoon rainfall is highly erratic and summer rains are negligible.

The normal annual rainfall over the study area varies from 1100 mm to 1200mm.

3.2 GEOMORPHOLOGY:

Chennai district forms part of coastal plains of northern Tamil Nadu. Major part of the district is having flat topography with very gentle slope towards east. The altitudes of land surface vary from 10 m above MSL in the west to sea level in the east.

Fluvial, marine and erosional landforms are noticed in the district. Marine transgression and regressions and neo-tectonic activity during the recent past have influenced the morphology and resulted in various present landforms.

Meandering streams with small sand bars are present along the course of Adyar River. The pediment and buried pediment in Guindy area in and around the reserved forest, is the only area where the ecological system is less disturbed, while the other areas are completely disturbed by built up area with large-scale human interference and pollution.

3.3 GEOLOGY OF CHENNAI DISTRICT:

Chennai district is underlain by various geological formations from ancient Archaean to the Recent Alluvium. The geological formations of the district can be grouped into three units, namely

i) Archaean crystalline rocks

ii) Gondwana (Consolidated Clay/Clayey Silt) and Tertiary sediments and

iii) Recent Alluvium.

The Archaean crystalline rocks of the district comprise chiefly of Charnockite, gneisses and the associated basic and ultra-basic intrusive dykes.

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3.4 GEOLOGICAL ORDER OF THE STUDY AREA:

The stratigraphy of the study area can be classified as recent formation which is underlain by basement rock of meta-igneous origin (hypersthene granite/ Charnockite rock)

↑ Deposits of Recent Age

---------- Eparchean Unconformity ----------

Archaean Basement Rock (Charnockite Rock / Hypersthene Granite)

3.5 DESIGN SUB SOIL PROFILE: (WRT Foundation Engineering Application)

The sub soil characteristics obtained at the test location are further processed to arrive at the design soil parameters required for the design of sub structure using the following shear strength correlations with respect to the Standard Penetration Test Values of different layers.

- For Coarse Grained Material, Ref. IS: 6403 to estimate Angle of Shearing Resistance (Reproduced and shown in Fig.A1)
- For Fine Grained Material, Ref. Terzaghi & Peck, 1948, to estimate Unconfined Compressive Strength (Reproduced and shown in Fig.A2)

Based on the above, the average design soil characteristics are given below:

REFERENCE BORE HOLE					BH-01	Ref R.L. of G.L. (m):			0.00		
Layer No.	Layer Thk. (m)			Type of Strata	Colour	Ave. Design SPT	Relative Density	Consistency	(γ) kN/m^3	Shear Parameters	
	Top BGL	Bottom BGL	Thickness							(C_u) kPa	(ϕ) Deg.
1.0	0.00	2.00	2.00	Silty Sand	Brown	25	Medium Dense	-	18.5	-	34.5
2.0	2.00	4.00	2.00	Silty Sand	Brown	42	Dense	-	20	-	39.2
3.0	4.00	7.50	3.50	Silty Sand	Brown	>100	Very Dense	-	21	-	42.5
4.0	7.50	10.80	3.30	Silty Sand	Brown	74	Very Dense	-	21	-	42.5

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REFERENCE BORE HOLE					BH-02	Ref R.L. of G.L. (m):			0.00		
Layer No.	Layer Thk. (m)			Type of Strata	Colour	Ave. Design SPT	Relative Density	Consistency	(γ) kN/m^3	Shear Parameters	
	Top BGL	Bottom BGL	Thickness							(C_u) kPa	(ϕ) Deg.
1.0	0.00	1.25	1.25	Silty Sand	Brown	16	Medium Dense	-	18	-	31.8
2.0	1.25	3.00	1.75	Silty Sand	Brown	35	Dense	-	19.5	-	37.375
3.0	3.00	10.80	7.80	Silty Sand	Brown	96	Very Dense	-	21	-	42.5

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CHAPTER-4

FOUNDATION SYSTEM

4.0 PREAMBLE:

In the design of foundation system, the stress-strain compatibility of the super structure, sub structure and the bearing strata should be satisfied both individually and as a combined system. In view of this, the following data are needed for the design of foundation system, defined in terms of the type of sub structure and the bearing strata characteristics.

- The super structure characteristics along with the loading pattern on the sub structure
- The sub soil characteristics that define the required substructure configuration for a safe transfer of super-structural loads to the bearing strata

Considering the above aspects of the foundation design, the suitable type of foundation system is presented below.

4.1 PROPOSED STRUCTURES:

An understanding of the proposed construction and the order of loads on the foundations is needed for choosing the appropriate foundation system. In the present case, the proposed structure is configured with stilt and five upper floor and is meant for residential occupancy. For this kind of structure, the column loads could vary between 1,500 kN to 2,000 kN.

The above-mentioned loads have no bearing on the design of either sub or super structures and are mentioned just to provide an insight to choose an appropriate foundation system with respect to subsoil conditions.

4.2 SUB SOIL FORMATION:

The sub soil in the project site consists of the following sub surface stratification:

0.0m to 1.25m/2.0m	Medium Dense, Silty Sand/ Poorly Graded- Silty Sand
1.25m/2.0m to 3.0m/4.0m	Dense, Silty Sand/ Poorly Graded-Silty Sand
3.0m/4.0m to 10.5m	Very Dense, Silty Sand/Poorly Graded-Silty Sand & Sandy Silt

4.3 FOUNDATION SYSTEM:

For the kind of proposed configuration and sub surface stratification, shallow foundation system is feasible. Provide the isolated footing at a depth of 1.5m below the existing ground level and design the footing for an allowable net safe bearing pressure of 250 kPa. All the footing shall rest on PCC of 100mm thickness.

Since the formation beyond the foundation level is coarse grained formation, the settlement analysis considers only immediate elastic settlements and no consolidation creep settlement is applicable.

Typical computations are presented in Annexure-I.



RECOMMENDATIONS

CHAPTER-5

RECOMMENDATIONS

5.1 RECOMMENDATION FOR SHALLOW FOUNDATION:

- For the kind of proposed structure, it is ideal to adopt shallow foundation system.
- Locate the footing at a depth of 1.5m below the existing ground level and design the foundation for an allowable net safe bearing pressure of 250 kPa.
- All footings shall be rest on M10 grade levelling coarse bed.
- It is ideal to saturate and compact the foundation bed before laying the PCC of 100mm thickness.
- Excavated earth is suitable for backfilling purposes

5.2 GENERAL RECOMMENDATIONS:

- The chlorides level in ground water & soil-water extract is well within the permissible limits. Hence, no special steel is required for the construction of foundation.
- Corresponding to the sulphate content in ground water and 2:1 Water-Soil extract use Table 4.0 of IS 456 for minimum cement content and maximum water cement ratio.
- The present project site falls in seismic zone-III as per IS 1893-P-I.

AUTHORISED SIGNATORY

DR. C. V. PRASAD
GEOMARINE CONSULTANTS PRIVATE LIMITED



ANNEXURE-I

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TYPICAL BEARING CAPACITY COMPUTATIONS FOR SHALLOW FOUNDATION

1.0 COMPUTATION OF BEARING CAPACITY AS PER IS:6403

1.1 Geometrical Data :

Shape of the Foundation	Square
Total Depth of Foundation Excavation (m)	1.50
Depth of Foundation Below E.G.L"Df" (m)	1.50
Thickness of soil replacement (m)	0.00
Breadth"B" (m)	1.00
Length"L" (m)	1.00
L/B	1.00
Inclination of Vertical Load with the Vertical (a)	0.00
Thickness of Fill (m)	0.00

1.2 Soil Data :

Type of Effective Bearing Strata :	Sand
Average SPT "N" of the bearing stratum:	28.00
Type of Shear Failure:	General
Angle of Shearing Resistance	35

1.3 Design Parameters:

Bulk Density of Soil above the foundation depth (γ_{bulk})	18.00
Water Table Correction Factor (w')	0.50
Effective Overburden pressure at foundation level including the thickness of fill (q)	12.00

Bearing Capacity Factors:

N_c = N/A
N_q = 35.77
N_g = 52.94

Shape Factors:

S_c = -
S_q = 1.20
S_g = 0.80

Depth Factors :

D_c = -
D_q = 1.03
D_g = 1.03

Inclination Factor:

I_c = 1.00
I_q = 1.00
I_g = 1.00

1.4 Ultimate Bearing Capacity (Qu) :

Qu=q*(Nq-1)*Sq*Dq*Iq + 0.5*B*g*Ng*Sg*Dg*Ig*w' 708.84 kPa
(g should be read as gama)

1.5 Safe Bearing Capacity (Qsafe) :

Factor of Safety (F.S.) :	2.50	
Qsafe :	284	kPa
Say Q_{safe}	**250**	**kPa**

2.0 Computation of Settlement as per IS:8009-Part I

Width of Footing Considered for Settlement Analysis:	5.00	m
Settlement per unit pressure (Avg N'=25) as per IS 8009 P-1, Fig. 9 (S_t):	12.00	mm
Settlement for Q_{safe} (S_{tQs}):	30.00	mm
Water table correction (w'):	0.50	
Rigidity Factor:	0.80	
Depth Factor:	0.76	
Corrected Settlement (S_{td}):	36.48	mm
	<50	**mm**

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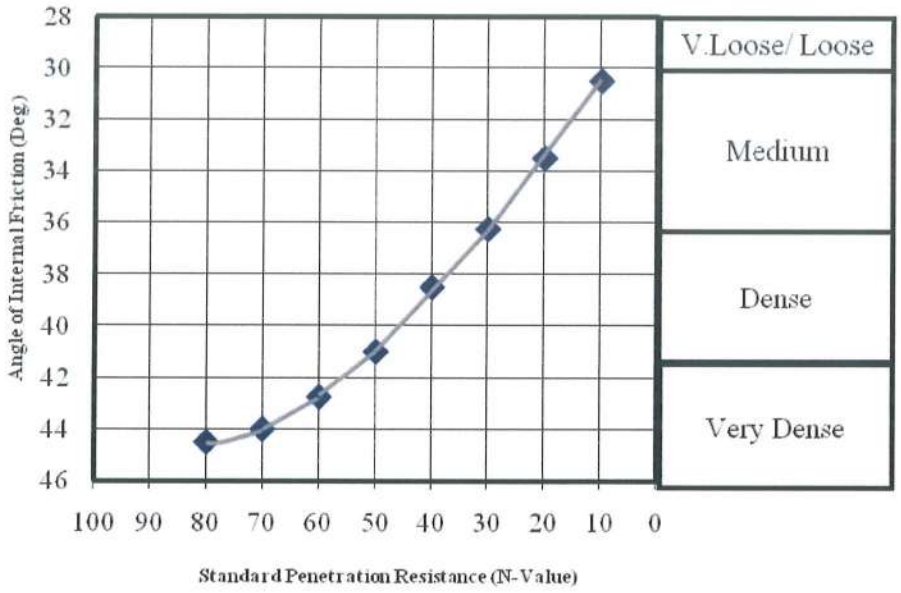


FIG. A1 Relation Ship between Angle of Internal Friction & N-value (Reproduced from IS:6403-1981)

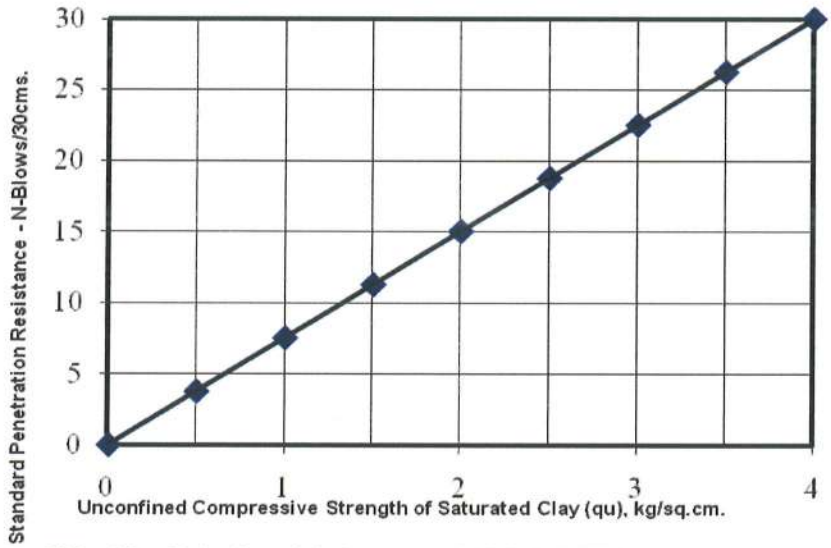


FIG. A2 : Relationship between UCC & SPT-Value (N) of Saturated Clay (AfterTerzhagi & Peck, 1948)

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SITE INVESTIGATION RECORD

BORE HOLE No.	01		
PAGE No.	01		
PROJECT NAME	NAVIN'S HOUSING	DIA OF BORE HOLE	150mm / 100mm
LOCATION	ROYAPURAM.	MACHINE No.	CHAINAGE (m)
STRUCTURE		DRILLING METHOD: Rotary	CO-ORDINATES N
JOB CODE		FLUSHING MEDIUM: Bentonite	CO-ORDINATES E
BORE START DATE	29/02/2024		
BORE END DATE	29/02/2024		
TOTAL DRILLING DAYS			

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	15-30	30-45	SPT 'N' Value	Sample Details: Depth	No.	Type	Layer Data: Depth (m)	Geotechnical Description
0	29/02/2024	11	00	SOIL CUTTER											
		11	01				10	12	13	25	0.50	1	S.S	0.50	Brownish Medium Dense Fine Sand
1		11	15												
		11	26				9	12	13	25	1.25	2	S.S.	1.25	-DO-
2		10	26												
		11	27				10	15	25	40	2.0	3	S.S.	2.0	Brownish Dense Fine Sand
3		11	35												
		11	36				20	20	23	43	3.0	4	S.S.	3.0	-DO-
4		11	47												
		11	48				30	37	60	97	4.0	5	SS	4.0	Brownish Very Dense Fine Sand
5		11	58												
		11	59				30	55	N7	100	5.0	6	S.S.	5.0	Brownish Very Dense to Dense Fine Sand
							Auger Hammering Rebound								
6		12	11												
		12	12				55	Auger Hammering Rebound		N7 100	6.0	7	S.S.	6.0	-DO-
7		12	30												
		12	31				28	30	51	81	7.50	8	S.S.	7.50	Brownish Very Dense Silty Sand
8															
9		12	50												
		12	52				31	32	34	66	9.0	9	SS	9.0	-DO-
10		14	00												
		14	02				20	50	Hammering Rebound	N7 100	10.50	10	S.S	10.50	Brownish Very Dense to Dense Silty Sand

CS - Core Sample	DS - Disturbed Sample	SUPERVISOR NAME	S. STEPHEN RAJ	PROJECT SITE DETAILS	
SS - Split Spoon Sample	SC - Soil Cutter	SIGNATURE		GROUND LEVEL (m)	2.80M
UDS-Undisturbed Sample	TCB - Tungsten Carbide Bit	DATE	29/02/2024	WATER TABLE (m)	
WS - Wash Sample	DB - Diamond Bit	CLIENT IN-CHARGE		CASING DEPTH (m)	

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ASHIQ 29/02

Bore hole Terminated at 10.50 Below the Ground level

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SITE INVESTIGATION RECORD

BORE HOLE No. 02
PAGE No. 01

PROJECT NAME	NAVIN'S HOUSING
LOCATION	ROYAPURAM
MACHINE No.	
CHAINAGE (m)	
STRUCTURE	
DRILLING METHOD	Rotary
CO-ORDINATES	N
JOB CODE	
FLUSHING MEDIUM	Bentonite
	E

DIA OF BORE HOLE: 150mm ✓ / 100mm
BORE START DATE: 01/03/2024
BORE END DATE: 01/03/2024
TOTAL DRILLING DAYS:

Depth below E.G.L (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	15-30	30-45	SPT 'N' Value	Sample Details: Depth	No.	Type	Layer Data: Depth (m)	Geotechnical Description
0	01/03/2024	10	55	SOIL CUTTER			5	7	9	16	0.50	1	SPLIT SPOON SAMPLE	0.50	Brownish Medium Dense Fine Sand
		10	56												
1		11	16				8	14	17	31	1.25	2		1.25	Brownish Dense Fine Sand
		11	11												
2		11	21				11	17	22	39	2.0	3		2.0	-DO-
		11	22												
3		12	20				16	46	48	94	3.0	4		3.0	Brownish Very Dense Silty Fine Sand
		12	21												
4		14	00				16	32	65	97	4.0	5		4.0	-DO-
		14	02												
5		14	20				40	130/4"	Hammer Rebound		5.0	6		5.0	Brownish Very Dense to Dense Fine Sand
		14	22					SPT		N>100					
6		14	40				51	After 8 Blows Hammer Rebound N>100 N>100			6.0	7		6.0	-DO-
		14	42												
7		15	10				46	120/4" SPT		N>100	7.50	8		7.50	-DO-
		15	12												
8															
9		15	34				29	40	57	97	9.0	9		9.0	Brownish Very Dense Silty Fine Sand
		15	37												
10		15	56				36	100/4" SPT		N>100	10.0	10		10.50	
		16	01												

Bore Hole Terminated at 10.50M Below the Ground Level

CS - Core Sample	DS - Disturbed Sample	SUPERVISOR NAME	S. STEPHEN RAJ	PROJECT SITE DETAILS	
SS - Split Spoon Sample	SC - Soil Cutter	SIGNATURE		GROUND LEVEL (m)	
UDS-Undisturbed Sample	TCB - Tungsten Carbide Bit	DATE	01/03/2024	WATER TABLE (m)	
WS - Wash Sample	DB - Diamond Bit	CLIENT IN-CHARGE		CASING DEPTH (m)	

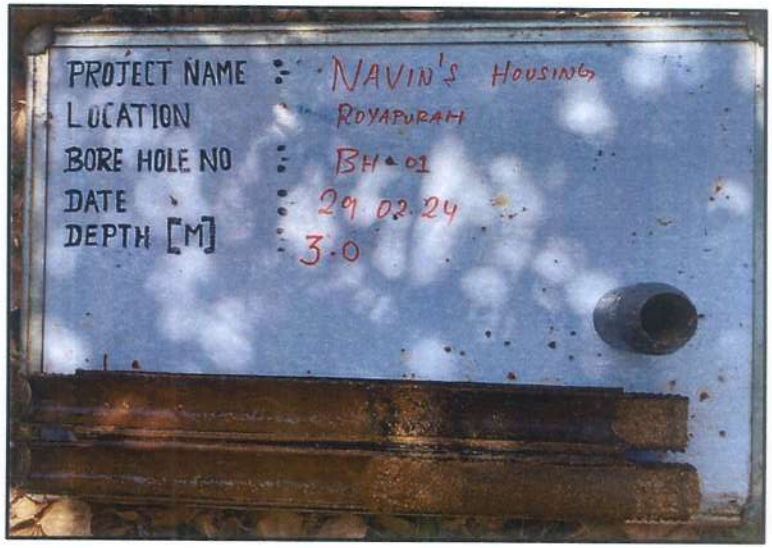
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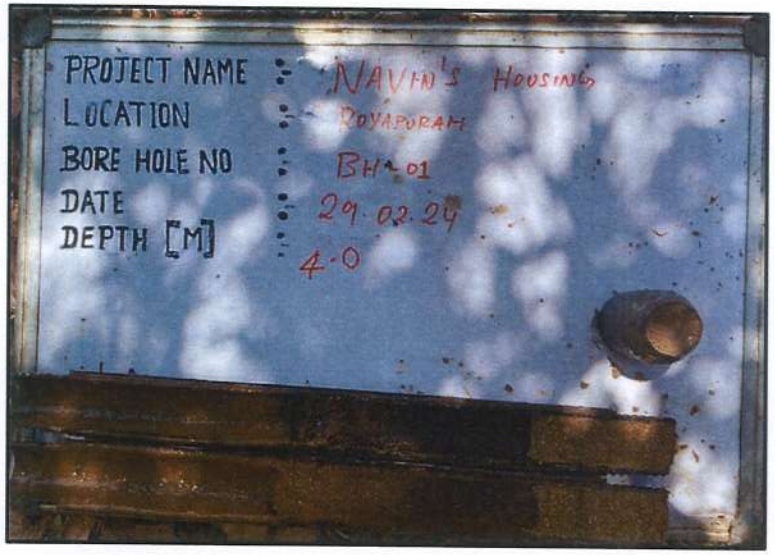


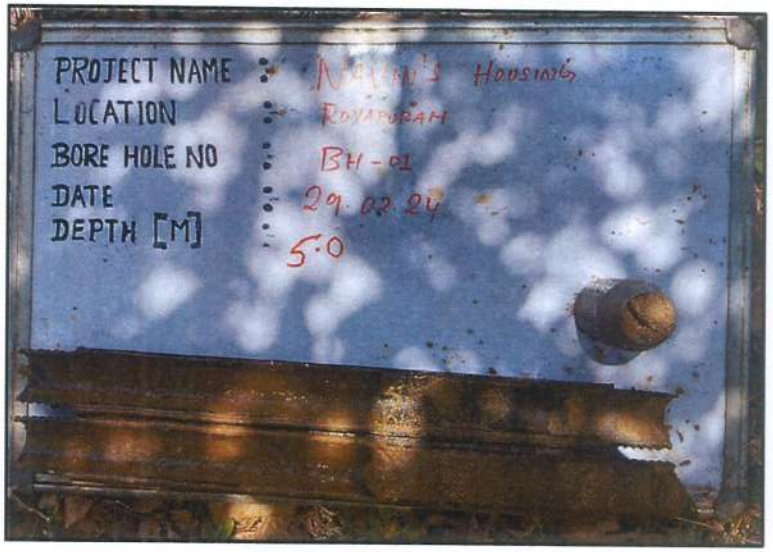




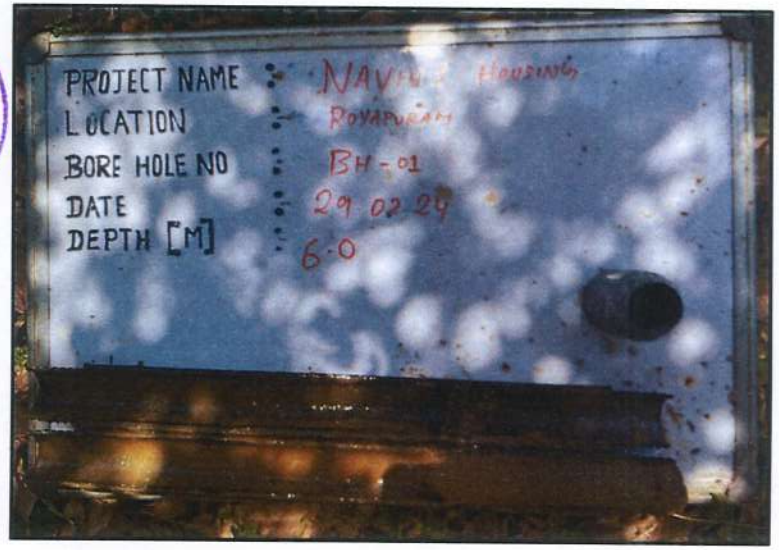
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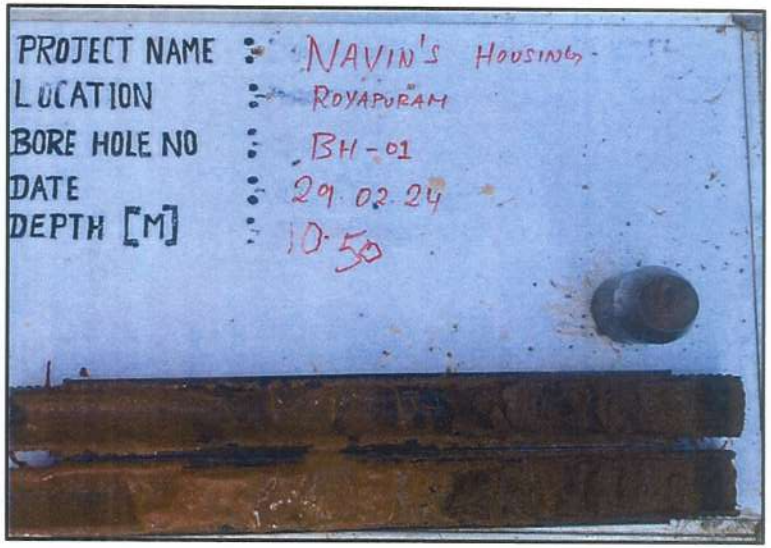
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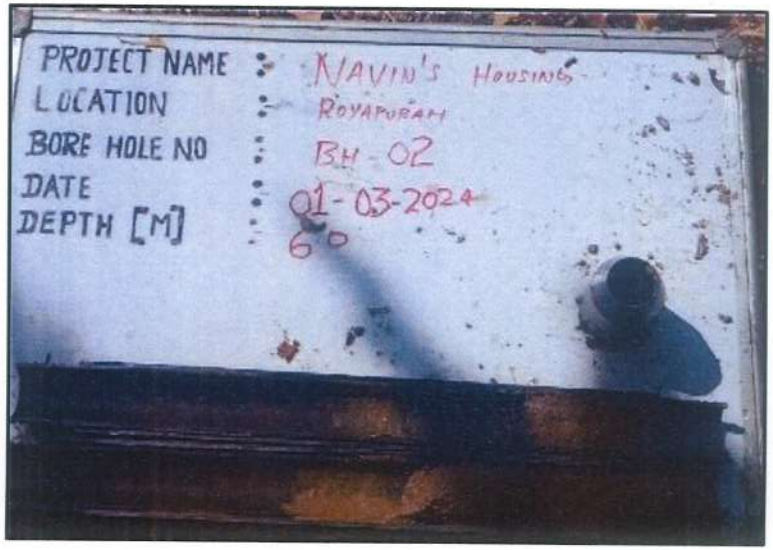
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Vastu & Property Management Tools

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