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THE SPIRIT OF ENGINEERING

RAMANIYAM
dreams accomodated

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PROJECT

GEOTECHNICAL INVESTIGATION FOR THE PROPOSED RESIDENTIAL BUILDING CONSISTING OF EXTENDED BASEMENT + STILT + 9 UPPER FLOORS AT BLOCK NO. 400 TO 403, MANASA APARTMENTS, 2nd AVENUE, ANNA NAGAR, CHENNAI – 600 040. LOCATED IN OLD S.NO. 207 (PT), T.S.NO. 91, BLOCK NO. 17 OF KOYEMBEDU VILLAGE.

CLIENT

M/s RAMANIYAM REAL ESTATES (P) LTD.,
RAMANIYAM CORPORATE OFFICE,
NO-1735, 2ND MAIN ROAD,
GANDHI NAGAR, ADYAR,
CHENNAI-6000 020.

TITLE

GEOTECHNICAL INVESTIGATION REPORT

REPORT NO.: GT- 2364

DATE	REVISON	DESCRIPTION		AUTHORISED SIGNATORY
25/05/2022	FIRST SUBMISSION	SUBMISSION OF GEOTECHNICAL REPORT	SIGN	
07/08/2023	1.0	UPDATION ON SURVEY NO. IN TITLE CONTENT	DATE OF FIRST SUBMISSION	25/05/2022
			DESIGNATION	**MANAGING DIRECTOR**
			NAME	**DR. C.V.PRASAD**

GEO MARINE CONSULTANTS PVT. LTD. Chennai 600 041

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REPORT TEXT

CHAPTER-1

INTRODUCTION

1.0 PROJECT INFORMATION MATRIX:

NATURE OF PROJECT	**: PROPOSED RESIDENTIAL BUILDING**
STRUCTURE	**: EXTENDED BASEMENT + STILT + 9 FLOORS**
PROJECT OWNER	**: M/s RAMANIYAM REAL ESTATES (P) LTD**
PROJECT LOCATION	**: BLOCK NO. 400 TO 403, MANASA APARTMENTS, 2nd AVENUE, ANNA NAGAR, CHENNAI – 600 040**
JOB CODE	**: GT-2364**

1.1 SCOPE OF WORK:

1.1.1 FIELD WORK:

- Conducting three 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 12.0m, SPT is conducted at every 1.5m depth interval
  - From 12.0m to 20.0m SPT is conducted at every 2.0m depth interval
  - Beyond 20.0m SPT is conducted at every 2.5m depth interval till the termination depth.
- 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

CHAPTER-2

INVESTIGATION METHODOLOGY & TEST RESULTS

2.0 PREAMBLE:

Three soil investigation boreholes were 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.

NOTE ON GROUNDWATER TABLE RECORD:

- Groundwater table observation in geotechnical report is predominantly to arrive at foundation design criteria and shall not be construed as design guidelines for the design of dewatering systems

- ❖ The groundwater level indicated in the bore logs is specific to the duration of investigation and intensity of the monsoon rains during the time of investigation. Hence, the level shall be taken as guidelines only to plan the investigation for the dewatering system
- ❖ No foundation excavation or basement excavations if anticipated within the groundwater table zone shall be carried out without implementing groundwater lowering schemes

2.2 LABORATORY TESTING:

2.2.1 ON COARSE GRAINED SOIL:

On the representative samples, sieve analysis tests were conducted to arrive at grain size distribution. These tests were conducted as per I.S.2720 (part 4)-1985 and the results are presented in Tables-2.1 to 2.3. The graphical representation of grainsize distribution curve for the representative samples in each bore is presented in Fig. 2.5 to 2.7.

2.2.2 ON FINE GRAINED SOIL:

On the SPT sample index property tests were conducted to estimate consistency. These test results are presented in Tables-2.1 to 2.3. The graphical representation of hydrometer analyses curve for the representative samples in each bore is presented in Fig. 2.8 to 2.13.

2.2.3 CHEMICAL ANALYSIS TESTS:

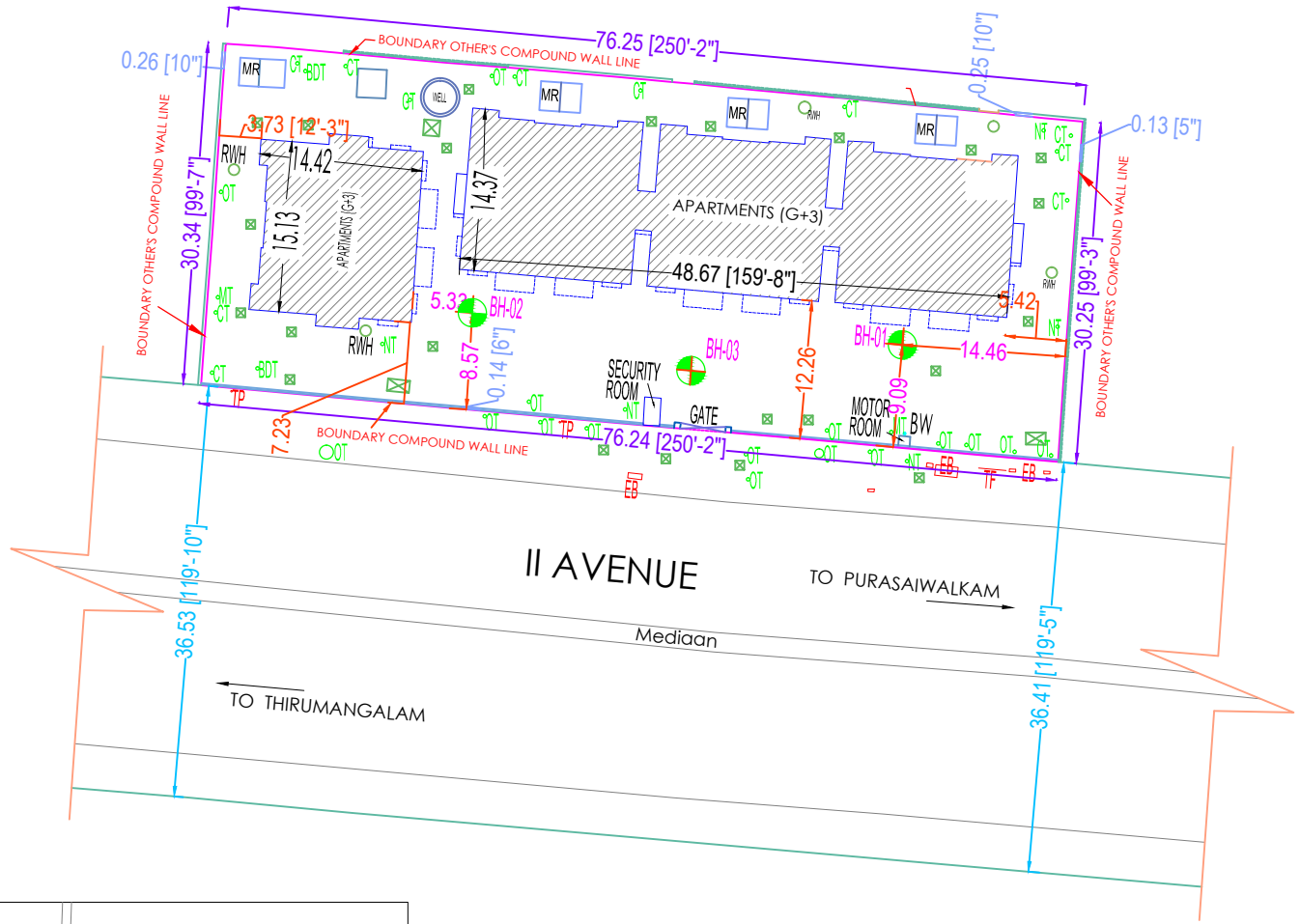
On representative soil and water samples chemical analysis tests were conducted to estimate pH, Chloride and Sulphates and these results are presented in Table - 2.4.

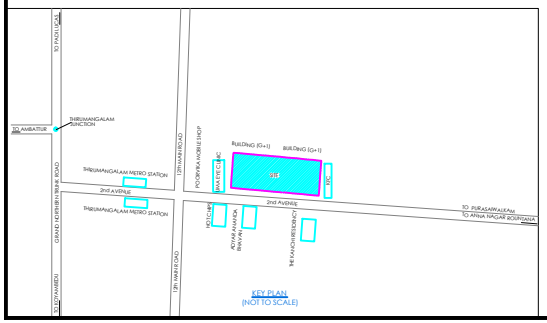
2.3 SUMMARY:

The locations of the field investigation boreholes are shown in site plan given in Fig.2.0. The average sub soil profiles encountered at each location along with their classification and engineering properties are presented in Figs.2.1 to 2.3.

Further, the cross sectional variation of the sub surface profile through different bore holes in vertical and horizontal direction longitudinally or transversely are presented in Figs.2.4.

SITE PLAN





AREA STATEMENT:

TOTAL LAND / PLOT SURVEYED AREA = 24,959 SQ.FT. (OR) 10.40 GROUNDS.

NOTE:
ALL DIMENSIONS ARE IN METRES, FEET & INCHES.

LEGEND:

TP-TELEPHONE POST
EB-ELECTRIC BOX
MR-MOTOR ROOM
BW-BORE WELL
RWH-RAIN WATER HARVESTING
MH-MAN HOLE
MT- MANGO TREE
CT- COCONUT TREE
NT- NEEM TREE
BDT- BADAM TREE
GT- GUAVA TREE
OT- OTHER TREE

SURVEYED BY:

abide landmark
SURVEYORS
#11(Old No:6A),Govindasamy street,
Kattabomman Block,
Jafferkhanpet,Chennai-600 083.
Mobile:9840166595
E.mail: abidelandmark@gmail.com

CLIENT

SITE
MANASA APARTMENTS, 2nd AVENUE,
ANNA NAGAR, CHENNAI-40.

	NAME	DATE
SURVEYED	K K K	27.09.2021
DRAWN	K K K	28.09.2021
CHECKED		
APPROVED		

TITLE

PLAN SHOWING THE DETAILED BOUNDARY MAP WITH TOPOGRAPHY

SCALE 1:300
SHEET A2
CODE ALS

DRAWING No: AN/75/2021
REV. R0

SOIL PROFILES

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SITE INVESTIGATION RECORD

BORE HOLE No.	BH-01		
SHEET	1	OF	3
DIA OF BORE HOLE	150mm ✓		
	NX		

PROJECT NAME	PROPOSED CONSTRUCTION OF A RESIDENTIAL BUILDING					BORE START DATE	18/04/2022
LOCATION	2nd Avenue, Anna Nagar	MACHINE No.	-	CHAINAGE (m)	-		
STRUCTURE	Extended Basement + Stilt + 9 Upper Floors	DRILLING METHOD	Rotary	CO-ORDINATES	N -	BORE END DATE	20/04/2022
JOB CODE	GT-2364	FLUSHING MEDIUM	Bentonite		E -	TOTAL DRILL DAYS	3

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	SPT Details: Blows/cm. 15-30	SPT Details: Blows/cm. 30-45	SPT 'N' Value	Sample Details: Depth	Sample Details: No.	Sample Details: Type	Sample Details: RL (m)	Layer Data: Legend	Layer Data: No	Layer Data: Depth	Geotechnical Description
1	18/04/2022	15	09	SC	-	-												
		To																
		15	10				7	11	19	30	1.00	1	SS	-1.0				
		15	37								1.45							
		To		SC	-	-												
2		15	38				12	13	20	33	2.00	2	SS	-2.0				Brown,Moist,Poorly Graded,Fine & Medium Grains Sand,Medium Dense to Dense,**Silty SAND (SM)**
		15	53								2.45							
		To		SC	-	-												
3		15	54				14	21	27	48	3.00	3	SS	-3.0				
		16	19								3.45							
		To		SC	-	-												
4		16	20				6	7	9	16	4.00	4	SS	-4.0		L1	4.0	
		16	45								4.45							
		To		SC	-	-												
5		16	48				8	6	9	15	5.00	5	SS	-5.0				Grey,Moist,Stiff,**Silty CLAY (CI)** Lean Clay of Medium Plasticity
		10	34								5.45							
		To		SC	-	-												
6		10	38				17	21	18	39	6.00	6	SS	-6.0		L2	6.0	
		10	53								6.45							
		To		SC	-	-												
7	19/04/2022	10	58															
							16	24	24	48	7.50	7	SS	-7.5				Grey Brown,Moist,Poorly Graded,Fine & Medium Grains Sand,Dense, **Silty SAND (SM)**
8		11	14								7.95							
		To		SC	-	-												
		11	16															
9							1	1	2	3	9.00	8	SS	-9.0		L3	9.0	
											9.45							
		11	32															Grey,Grey Brown,Moist,Poorly Graded, Fine & Medium Grains Sand,Very Loose,**Clayey Silty SAND (SC)**
		To		SC	-	-												
10		11	34															

CS - Core Sample	DS - Disturbed Sample	LOGGED	H.Shankar	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	19/04/2022	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	S.Tysonraj	WATER TABLE (m) 2.40	
WS - Wash Sample	DB - Diamond Bit	DATE	29/04/2022	CASING DEPTH (m) 0.00	

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SITE INVESTIGATION RECORD

BORE HOLE No.	BH-01		
SHEET	2	OF	3
DIA OF BORE HOLE	150mm ✓		
	NX		

PROJECT NAME	PROPOSED CONSTRUCTION OF A RESIDENTIAL BUILDING							BORE START DATE	18/04/2022
LOCATION	2nd Avenue, Anna Nagar	MACHINE No.	-	CHAINAGE (m)	-				
STRUCTURE	Extended Basement + Stilt + 9 Upper Floors	DRILLING METHOD	Rotary	CO-ORDINATES	N	-		BORE END DATE	20/04/2022
JOB CODE	GT-2364	FLUSHING MEDIUM	Bentonite		E	-		TOTAL DRILL DAYS	3

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	SPT Details: Blows/cm. 15-30	SPT Details: Blows/cm. 30-45	SPT 'N' Value	Sample Details: Depth	Sample Details: No.	Sample Details: Type	Sample Details: RL (m)	Layer Data: Legend	Layer Data: No	Layer Data: Depth	Layer Data: Geotechnical Description
11		11	49				3	3	5	**8**	10.50	9	SS	-10.5				Grey,Grey Brown,Moist,Poorly Graded, Fine & Medium Grains Sand,Very Loose & Loose,**Clayey Silty SAND (SC) & Silty SAND (SM)**
		To		SC	-	-					10.95							
		11	51															
12							5	7	11	**18**	12.00	10	SS	-12.0		L4	12.0	
											12.45							
		12	30															
13		**To**		SC	-	-												
		12	33															
14							8	9	14	**23**	14.00	11	SS	-14.0				Grey,Grey Brown,Moist,Poorly Graded, Fine & Medium Grains Sand,Medium Dense,**Clayey Silty SAND (SC)**
											14.45							
		14	05															
15	**19/04/2022**	**To**		SC	-	-												
		14	16															
16							8Cm Penete for 50Blows			**>100**	16.00	-	WS	-16.0		L5	16.0	
											16.08							
		14	55															
		To		SC	-	-												
17		15	30															
18							15	21	24	**45**	18.00	12	SS	-18.0				Grey,Yellow Brown,Moist,Fissile to Sub Fissile,**SHALE (CH)** Gondwana Formation
											18.45							
		16	13															
19		**To**		SC	-	-												
		16	34															
20							16	13Cm Penete for 50Blows		**>100**	20.00	13	SS	-20.0				
											20.28							

CS - Core Sample	DS - Disturbed Sample	LOGGED	H.Shankar	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	19/04/2022	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	S.Tysonraj	WATER TABLE (m) 2.40	
WS - Wash Sample	DB - Diamond Bit	DATE	29/04/2022	CASING DEPTH (m) 0.00	

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SITE INVESTIGATION RECORD

BORE HOLE No.	BH-01		
SHEET	3	OF	3
DIA OF BORE HOLE	150mm ✓		
	NX		

PROJECT NAME	PROPOSED CONSTRUCTION OF A RESIDENTIAL BUILDING							BORE START DATE	18/04/2022
LOCATION	2nd Avenue, Anna Nagar	MACHINE No.	-	CHAINAGE (m)	-				
STRUCTURE	Extended Basement + Stilt + 9 Upper Floors	DRILLING METHOD	Rotary	CO-ORDINATES	N	-		BORE END DATE	20/04/2022
JOB CODE	GT-2364	FLUSHING MEDIUM	Bentonite		E	-		TOTAL DRILL DAYS	3

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	SPT Details: Blows/cm. 15-30	SPT Details: Blows/cm. 30-45	SPT 'N' Value	Sample Details: Depth	Sample Details: No.	Sample Details: Type	Sample Details: RL (m)	Layer Data: Legend	Layer Data: No	Layer Data: Depth	Geotechnical Description
21		09	50															
		To		SC	-	-												Grey,Yellow Brown,Moist,Fissile to Sub Fissile,**SHALE (CH)** Gondwana Formation
22		10	26															
							29	30	41	**71**	22.50	14	SS	-22.5		L6	22.5	
23											22.95							Grey,Yellow Grey,Moist,Poorly Graded, Fine & Medium Grains Sand,Very Dense,**Cemented SAND (SC)** Gondwana Formation
24	20/04/2022	11	50															
		To		SC	-	-												
25		12	13															
							8Cm Penete for 50Blows			**>100**	25.00	15	SS	-25.0		L7	25.0	
26											25.08							
		14	03															Grey,Grey Green,Moist,Fissile & Sub Fissile,Hard,**SHALE (CI)** Gondwana Formation
27		To		SC	-	-												
		14	21															
							10Cm Penete for 50Blows			**>100**	27.50	16	SS	-27.5		L8	27.6	
28											27.60							
29																		
30																		

CS - Core Sample	DS - Disturbed Sample	LOGGED	H.Shankar	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	20/04/2022	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	S.Tysonraj	WATER TABLE (m) 2.40	
WS - Wash Sample	DB - Diamond Bit	DATE	29/04/2022	CASING DEPTH (m) 0.00	

Borehole terminated at 27.5 m depth below E.G.L

FIG.2.1 Sub Soil Profile at BH-01 Location

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SITE INVESTIGATION RECORD

BORE HOLE No.	BH-02		
SHEET	1	OF	3
DIA OF BORE HOLE	150mm ✓		
	NX		

PROJECT NAME	PROPOSED CONSTRUCTION OF A RESIDENTIAL BUILDING					BORE START DATE	21/04/2022
LOCATION	2nd Avenue, Anna Nagar	MACHINE No.	-	CHAINAGE (m)	-		
STRUCTURE	Extended Basement + Stilt + 9 Upper Floors	DRILLING METHOD	Rotary	CO-ORDINATES	N -	BORE END DATE	23/04/2022
JOB CODE	GT-2364	FLUSHING MEDIUM	Bentonite		E -	TOTAL DRILL DAYS	3

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	SPT Details: Blows/cm. 15-30	SPT Details: Blows/cm. 30-45	SPT 'N' Value	Sample Details: Depth	Sample Details: No.	Sample Details: Type	Sample Details: RL (m)	Layer Data: Legend	Layer Data: No	Layer Data: Depth	Layer Data: Geotechnical Description
		15	30															
			To	SC	-	-												
		15	33															
1	21/04/2022						7	8	9	17	1.00	1	SS	-1.0				Brown,Moist,Poorly Graded,Fine & Medium Grains Sand,Medium Dense, **Silty SAND (SM)**
		15	59								1.45							
			To	SC	-	-												
		16	02															
2							12	18	17	35	2.00	2	SS	-2.0		L1	2.0	
		16	32								2.45							
			To	SC	-	-												
		16	35															
3							18	20	22	42	3.00	3	SS	-3.0				
		10	12								3.45							
			To	SC	-	-												
		10	14															Brown,Moist,Poorly Graded,Fine & Medium Grains Sand,Dense & Medium Dense, **Silty SAND (SM)**
4							11	11	13	24	4.00	4	SS	-4.0				
		10	27								4.45							
			To	SC	-	-												
		10	29															
		10	45															
5			To	SC	-	-	10	15	18	33	5.00	5	SS	-5.0				
		10	46								5.45					L2	5.3	
		11	05				-	-	-	-	5.50	6	UDS	-5.5				
			To	SC	-	-												
6		11	08				6	14	19	33	6.00	7	SS	-6.0				
	22/04/2022										6.45							Grey,Black,Moist,Hard,**Sandy Silty CLAY (CI)** Sandy Clay of Medium Plasticity
		11	37															
			To	SC	-	-												
7		11	40															
							3	4	3	7	7.50	8	SS	-7.5		L3	7.5	
											7.95							
8		12	00															Grey,Black,Moist,Medium Stiff,**Silty CLAY (CH)** Clays of High Plasticity
			To	SC	-	-												
		12	04															
9							2	2	6	8	9.00	9	SS	-9.0		L4	9.0	
											9.45							
		12	18															
			To	SC	-	-												
10		12	22															

CS - Core Sample	DS - Disturbed Sample	LOGGED	N.Dhanasankar	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	22/04/2022	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	S.Tysonraj	WATER TABLE (m) 2.60	
WS - Wash Sample	DB - Diamond Bit	DATE	29/04/2022	CASING DEPTH (m) 0.00	

GEOMARINE
THE SPIRIT OF ENGINEERING

SITE INVESTIGATION RECORD

BORE HOLE No.	BH-02		
SHEET	2	OF	3
DIA OF BORE HOLE	150mm ✓		
	NX		

PROJECT NAME	PROPOSED CONSTRUCTION OF A RESIDENTIAL BUILDING					BORE START DATE	21/04/2022
LOCATION	2nd Avenue, Anna Nagar	MACHINE No.	-	CHAINAGE (m)	-		
STRUCTURE	Extended Basement + Stilt + 9 Upper Floors	DRILLING METHOD	Rotary	CO-ORDINATES	N -	BORE END DATE	23/04/2022
JOB CODE	GT-2364	FLUSHING MEDIUM	Bentonite		E -	TOTAL DRILL DAYS	3

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	RL (m)	Legend	Layer Data: No	Depth	Geotechnical Description
11		12	44				5	6	7	13	10.50	10	SS	-10.5				
		To		SC	-	-					10.95							Grey,Grey Brown,Moist,Poorly Graded, Fine & Medium Grains Sand,Loose & Medium Dense, **Clayey Silty SAND (SC)**
		12	47															
12							16	20	26	46	12.00	11	SS	-12.0		L5	12.0	
											12.45							
		14	26															
13		To		SC	-	-												
		14	33															
14	22/04/2022						11	21	23	44	14.00	12	SS	-14.0				
											14.45							
		15	03															
15		To		SC	-	-												Grey,Green Grey,Moist,Poorly Graded, Pred. Fine Grains Sand,Dense to Very Dense,**Sitly SAND (SM)**
		15	10															
16							30	39	30	69	16.00	13	SS	-16.0				
											16.45							
		15	39															
17		To		SC	-	-												
		16	23															
18							11	16	32	48	18.00	14	SS	-18.0		L6	18.0	
											18.45							
		10	15															
19	23/04/2022	To		SC	-	-												Grey,Yellow Brown,Moist,Fissile to Sub Fissile,**SHALE (CH)** Gondwana Formation
		11	20															
20							35	49	29	78	20.00	15	SS	-20.0		L7	20.0	
											20.45							Grey,Yellow Grey,Moist,Poorly Graded, Fine & Medium Grains Sand,Very Dense,**Cemented SAND (SC)**

CS - Core Sample	DS - Disturbed Sample	LOGGED	N.Dhanasankar	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	23/04/2022	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	S.Tysonraj	WATER TABLE (m) 2.60	*(F) - Sample Failed
WS - Wash Sample	DB - Diamond Bit	DATE	29/04/2022	CASING DEPTH (m) 0.00	

GEOMARINE
THE SPIRIT OF ENGINEERING

SITE INVESTIGATION RECORD

BORE HOLE No.	BH-02		
SHEET	3	OF	3
DIA OF BORE HOLE	150mm ✓		
	NX		

PROJECT NAME	PROPOSED CONSTRUCTION OF A RESIDENTIAL BUILDING							BORE START DATE	21/04/2022
LOCATION	2nd Avenue, Anna Nagar	MACHINE No.	-	CHAINAGE (m)	-				
STRUCTURE	Extended Basement + Stilt + 9 Upper Floors	DRILLING METHOD	Rotary	CO-ORDINATES	N	-		BORE END DATE	23/04/2022
JOB CODE	GT-2364	FLUSHING MEDIUM	Bentonite		E	-		TOTAL DRILL DAYS	3

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	SPT Details: Blows/cm. 15-30	SPT Details: Blows/cm. 30-45	SPT 'N' Value	Sample Details: Depth	Sample Details: No.	Sample Details: Type	Sample Details: RL (m)	Layer Data: Legend	Layer Data: No	Layer Data: Depth	Layer Data: Geotechnical Description
21		11	47															
		To		SC	-	-												
22		12	05															
							33	38	4Cm Penete for 50Blows	>100	22.50 / 22.84	16	SS	-22.5				
23																		
	23/04/2022	12	36															Grey,Yellow Grey,Moist,Poorly Graded, Fine & Medium Grains Sand,Very Dense,**Cemented SAND (SC) & Sitly SAND (SM) With Binder** Gondwana Formation
24		To		SC	-	-												
		12	47															
25							40	14Cm Penete for 52Blows		>100	25.00 / 25.29	17	SS	-25.0				
26		14	30															
		To		SC	-	-												
27		15	10															
							13Cm Penete for 55Blows			>100	27.50 / 27.68	18	SS	-27.5		L8	27.5	
28																L9	27.7	Grey,Grey Green,Moist,Fissile & Sub Fissile,Hard,**SHALE (CI)** Gondwana Formation
29																		
30																		

CS - Core Sample	DS - Disturbed Sample	LOGGED	N.Dhanasankar	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	23/04/2022	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	S.Tysonraj	WATER TABLE (m) 2.60	*(F) - Sample Failed
WS - Wash Sample	DB - Diamond Bit	DATE	29/04/2022	CASING DEPTH (m) 0.00	

Borehole terminated at 27.5 m depth below E.G.L

FIG.2.2 Sub Soil Profile at BH-02 Location

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THE SPIRIT OF ENGINEERING

SITE INVESTIGATION RECORD

BORE HOLE No.	BH-03		
SHEET	1	OF	3
DIA OF BORE HOLE	150mm ✓		
	NX		

PROJECT NAME	PROPOSED CONSTRUCTION OF A RESIDENTIAL BUILDING					BORE START DATE	25/04/2022
LOCATION	2nd Avenue, Anna Nagar	MACHINE No.	-	CHAINAGE (m)	-		
STRUCTURE	Extended Basement + Stilt + 9 Upper Floors	DRILLING METHOD	Rotary	CO-ORDINATES	N -	BORE END DATE	27/04/2022
JOB CODE	GT-2364	FLUSHING MEDIUM	Bentonite		E -	TOTAL DRILL DAYS	3

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	SPT Details: Blows/cm. 15-30	SPT Details: Blows/cm. 30-45	SPT 'N' Value	Sample Details: Depth	Sample Details: No.	Sample Details: Type	Sample Details: RL (m)	Layer Data: Legend	Layer Data: No	Layer Data: Depth	Layer Data: Geotechnical Description
		14	30															
			To	SC	-	-												
		14	32															
1							9	8	14	22	1.00	1	SS	-1.0				
		14	42								1.45							
			To	SC	-	-												
		14	44															
2							9	10	15	25	2.00	2	SS	-2.0				
		14	54								2.45							Brown,Moist,Poorly Graded,Fine & Medium Grains Sand,Medium Dense & Dense, **Silty SAND (SM)**
			To	SC	-	-												
		14	56															
3							21	18	22	40	3.00	3	SS	-3.0				
		15	07								3.45							
			To	SC	-	-												
		15	08															
4							10	16	22	38	4.00	4	SS	-4.0				
		15	28								4.45							
			To	SC	-	-												
	25/04/2022	15	30															
5							6	8	15	23	5.00	5	SS	-5.0		L1	5.0	
		15	40								5.45							Brown,Moist,Very Stiff,**Sandy Silty CLAY (Cl)** Sandy Clay of Medium Plasticity
			To	SC	-	-												
		15	42															
6							7	10	20	30	6.00	6	SS	-6.0		L2	6.0	
											6.45							
		15	56															
			To	SC	-	-												Grey,Moist,Poorly Graded,Fine Grains Sand,Medium Dense,**Silty SAND (SM)**
		15	59															
7							-	-	-	-	7.50	7	UDS	-7.5		L3	7.5	
		16	26															
8			To	SC	-	-												Grey,Black,Moist,**Silty CLAY (CH)** Clays of High Plasticity
		16	28															
9							2	2	2	4	9.00	8	SS	-9.0		L4	9.0	
											9.45							
		16	43															Grey,Grey Brown,Moist,Poorly Graded, Fine & Medium Grains Sand,Very Loose, **Clayey Silty SAND (SC)**
			To	SC	-	-												
10		16	44													L5	10.5	

CS - Core Sample	DS - Disturbed Sample	LOGGED	N.Dhanasankar	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	25/04/2022	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	S.Tysonraj	WATER TABLE (m) 2.60	
WS - Wash Sample	DB - Diamond Bit	DATE	29/04/2022	CASING DEPTH (m) 0.00	

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SITE INVESTIGATION RECORD

BORE HOLE No.	BH-03		
SHEET	2	OF	3

PROJECT NAME	PROPOSED CONSTRUCTION OF A RESIDENTIAL BUILDING	DIA OF BORE HOLE	150mm ✓ / NX
LOCATION	2nd Avenue, Anna Nagar	MACHINE No.	-
CHAINAGE (m)	-	BORE START DATE	25/04/2022
STRUCTURE	Extended Basement + Stilt + 9 Upper Floors	DRILLING METHOD	Rotary
CO-ORDINATES	N -	BORE END DATE	27/04/2022
JOB CODE	GT-2364	FLUSHING MEDIUM	Bentonite
CO-ORDINATES	E -	TOTAL DRILL DAYS	3

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	SPT Details: Blows/cm. 15-30	SPT Details: Blows/cm. 30-45	SPT 'N' Value	Sample Details: Depth	Sample Details: No.	Sample Details: Type	Sample Details: RL (m)	Layer Data: Legend	Layer Data: No	Layer Data: Depth	Geotechnical Description
11		09	15				6	10	13	23	10.50	9	SS	-10.5				Grey Brown,Moist,Fine & Medium Grains Sand,Medium Dense,**Clayey Silty SAND (SC)**
		To		SC	-	-					10.95							
		09	23															
12							5	27	25	52	12.00	10	SS	-12.0		L6	12.0	
											12.45							
		09	40															
13		To		SC	-	-												
		09	52															
14							8	15	25	40	14.00	11	SS	-14.0				Grey,Brown Grey,Moist,Poorly Graded, Fine & Medium Grains Sand,Dense to Very Dense,**Sitly SAND (SM)**
											14.45							
		10	27															
15	26/04/2022	To		SC	-	-												
		10	35															
16							14	30	8Cm Penete for 50Blows	>100	16.00	12	SS	-16.0		L7	16.0	
											16.38							
		10	51															
		To		SC	-	-												
17		11	30															
18							11	18	22	40	18.00	13	SS	-18.0				Grey Brown,Yellow Shades,Moist, Fissile to Sub Fissile,**SHALE (CH)** Gondwana Formation
											18.45							
		14	22															
19		To		SC	-	-												
		15	03															
20							17	19	25	44	20.00	14	SS	-20.0		L8	20.0	
											20.45							Grey,Grey Brown,Moist,Poorly Graded, Fine & Medium Grains Sand,Dense, **Cemented SAND (SC)**

CS - Core Sample	DS - Disturbed Sample	LOGGED	N.Dhanasankar	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	26/04/2022	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	S.Tysonraj	WATER TABLE (m) 2.60	
WS - Wash Sample	DB - Diamond Bit	DATE	29/04/2022	CASING DEPTH (m) 0.00	

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SITE INVESTIGATION RECORD

BORE HOLE No.	BH-03		
SHEET	3	OF	3
DIA OF BORE HOLE	150mm ✓		
	NX ✓		

PROJECT NAME	PROPOSED CONSTRUCTION OF A RESIDENTIAL BUILDING							BORE START DATE	25/04/2022
LOCATION	2nd Avenue, Anna Nagar	MACHINE No.	-	CHAINAGE (m)	-				
STRUCTURE	Extended Basement + Stilt + 9 Upper Floors	DRILLING METHOD	Rotary	CO-ORDINATES	N	-		BORE END DATE	27/04/2022
JOB CODE	GT-2364	FLUSHING MEDIUM	Bentonite		E	-		TOTAL DRILL DAYS	3

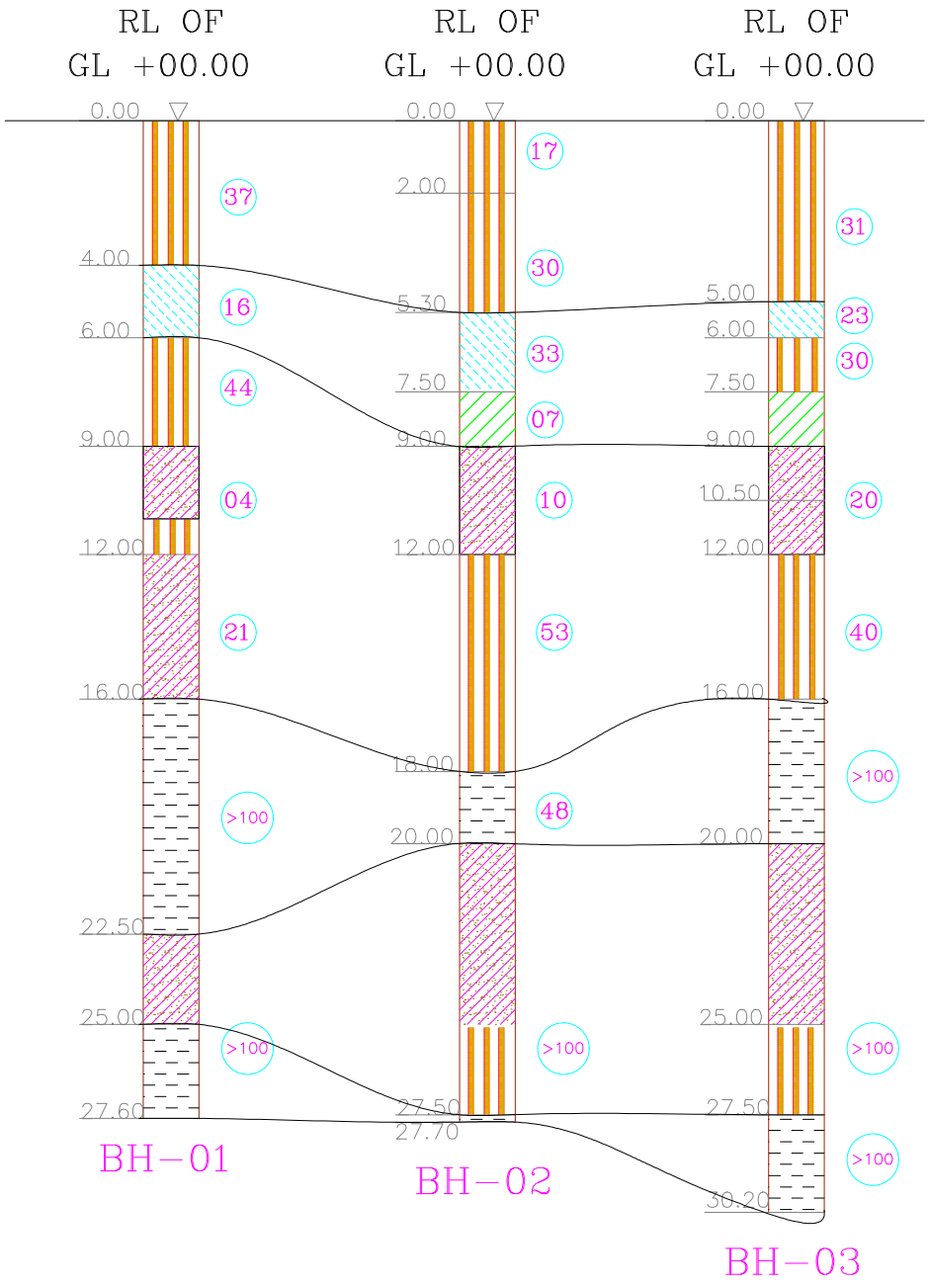
Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min.	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	SPT Details: Blows/cm. 15-30	SPT Details: Blows/cm. 30-45	SPT 'N' Value	Sample Details: Depth	Sample Details: No.	Sample Details: Type	Sample Details: RL (m)	Layer Data: Legend	Layer Data: No	Layer Data: Depth	Geotechnical Description
21		15	46	SC	-	-												
		To																
		16	01															
22	26/04/2022																	
							31	36	30	66	22.50	15	SS	-22.5				Grey,Grey Brown,Moist,Poorly Graded, Fine & Medium Grains Sand,Dense & Very Dense,**Cemented SAND (SC)** Gondwana Formation
23											22.95							
		16	32															
		To		SC	-	-												
24		16	40															
25							44	5Cm Penet for 50Blows		>100	25.00	16	SS	-25.0		L9	25.0	
											25.20							
26		Total Drilling time 22 mins		SC	-	-												Grey Brown,Moist,Poorly Graded, Fine & Medium Grains Sand,Very Dense, **Silty SAND (SM) With Binder**
27																		
	27/04/2022						30	2Cm Penete for 50Blows		>100	27.50	17	SS	-27.5		L10	27.5	
28											27.67							
		11	15															
		To		SC	-	-												Grey,Grey Green,Moist,Fissile & Sub Fissile,Hard,**SHALE (CI)** Gondwana Formation
29		11	36															
30							13Cm Penete for 52Blows			>100	30.00	18	SS	-30.0		L11	30.2	
											30.13							

CS - Core Sample	DS - Disturbed Sample	LOGGED	N.Dhanasankar	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	27/04/2022	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	S.Tysonraj	WATER TABLE (m) 2.60	
WS - Wash Sample	DB - Diamond Bit	DATE	29/04/2022	CASING DEPTH (m) 0.00	

Borehole terminated at 30 m depth below E.G.L

FIG.2.3 Sub Soil Profile at BH-03 Location

CROSS SECTION PROFILE



LEGEND

- SILTY CLAY (CI)
- CLAYEY SILTY SAND (SC)
- Silty CLAY (CI & CH)/ Silty SHALE
- SILTY CLAY (CH)
- SILTY SAND (SM)

FIG.No.2.4 CROSS SECTIONAL VARIATION OF SUB SOIL PROFILE THROUGH BH-01 TO 03

GRAIN SIZE DISTRIBUTION CURVE

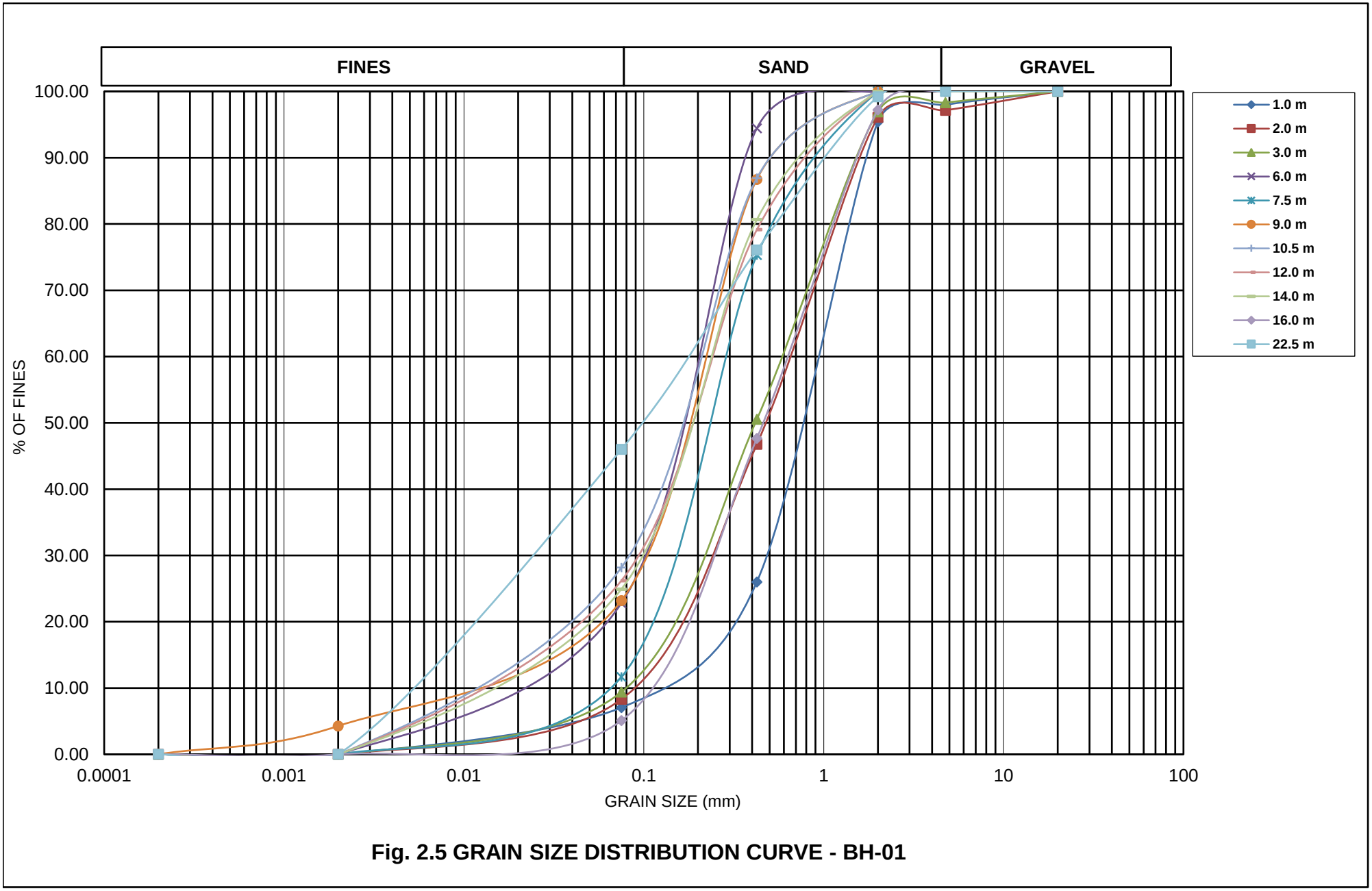


Fig. 2.5 GRAIN SIZE DISTRIBUTION CURVE - BH-01

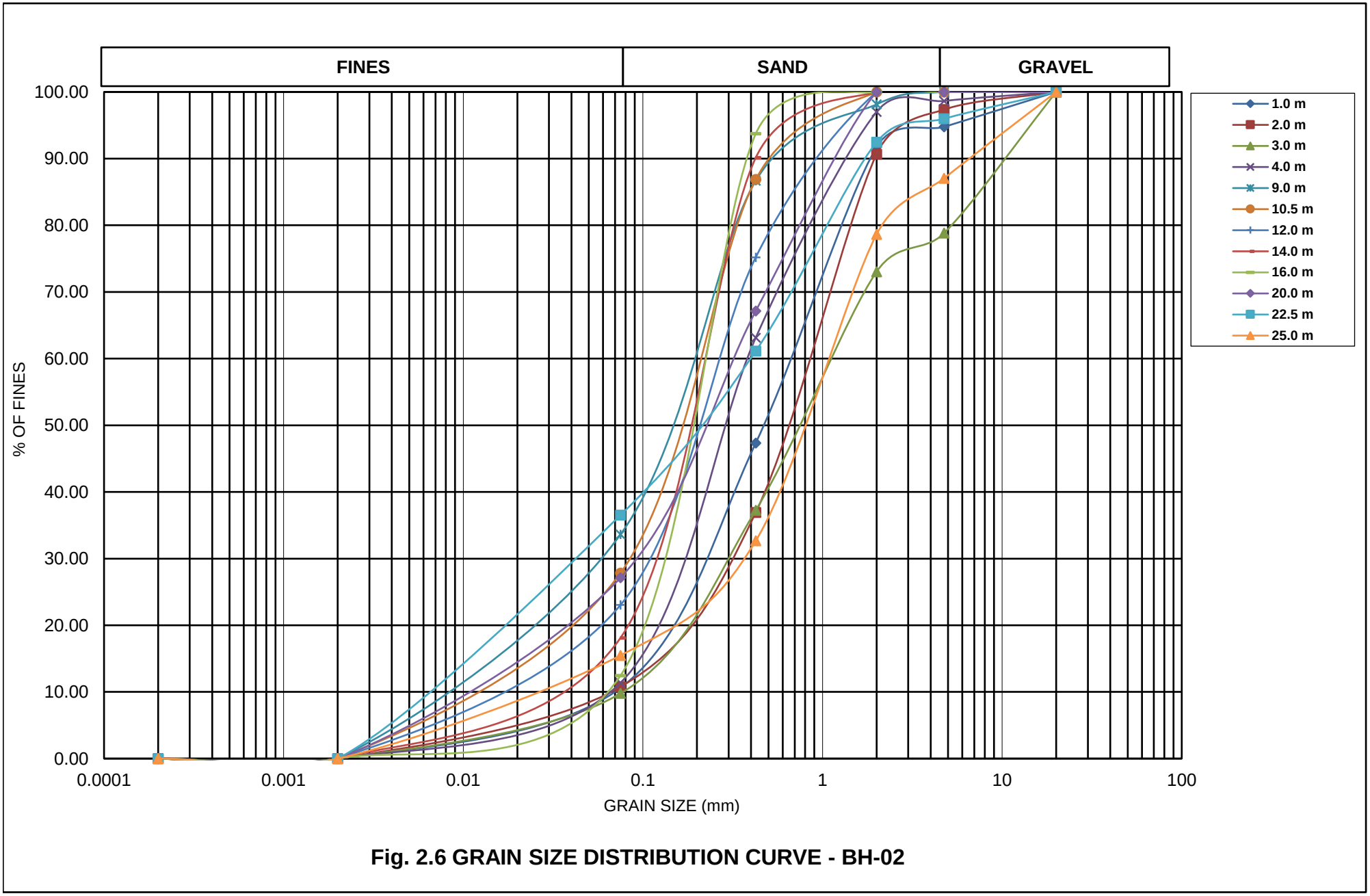


Fig. 2.6 GRAIN SIZE DISTRIBUTION CURVE - BH-02

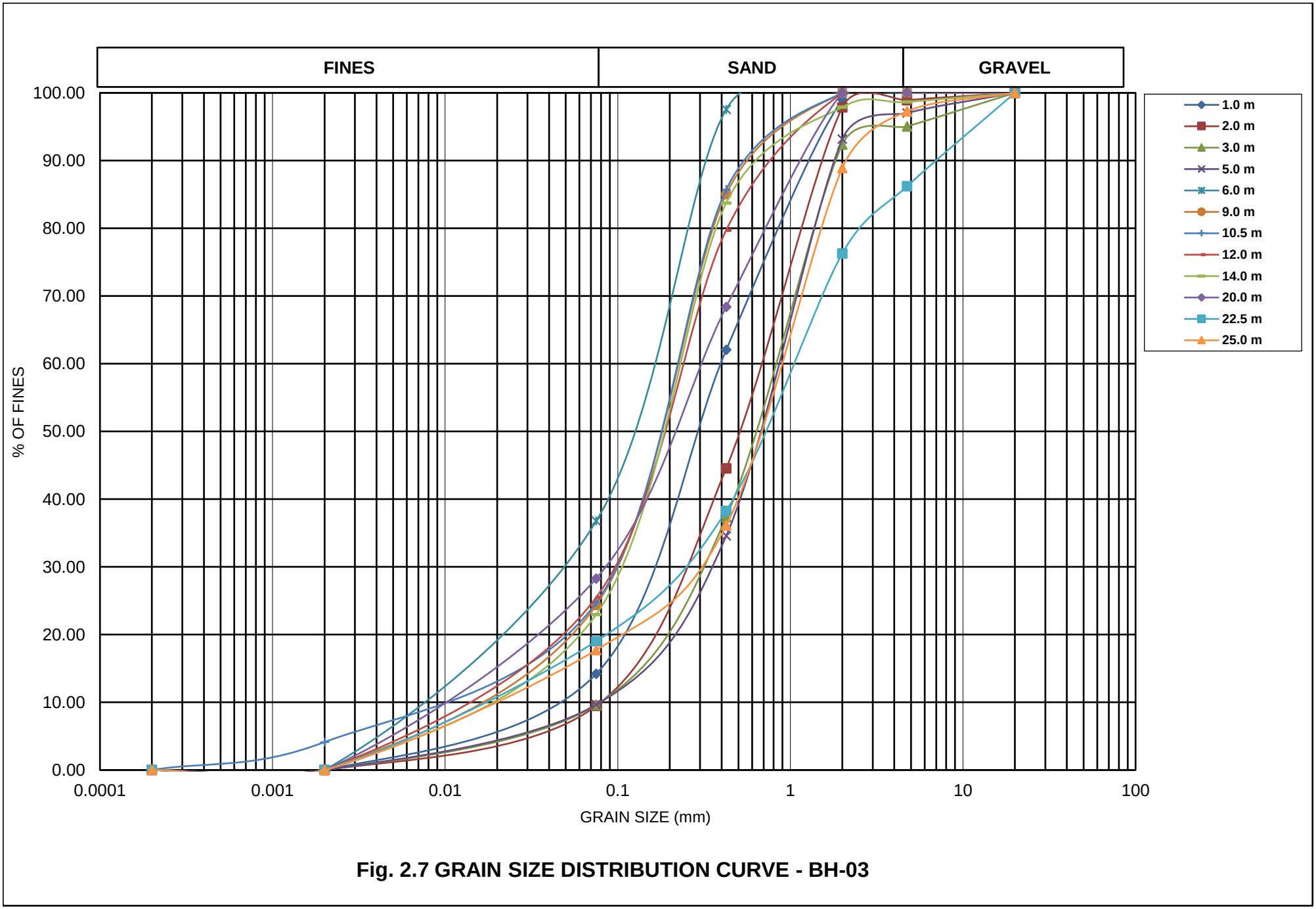


Fig. 2.7 GRAIN SIZE DISTRIBUTION CURVE - BH-03

HYDROMETER ANALYSIS CURVE

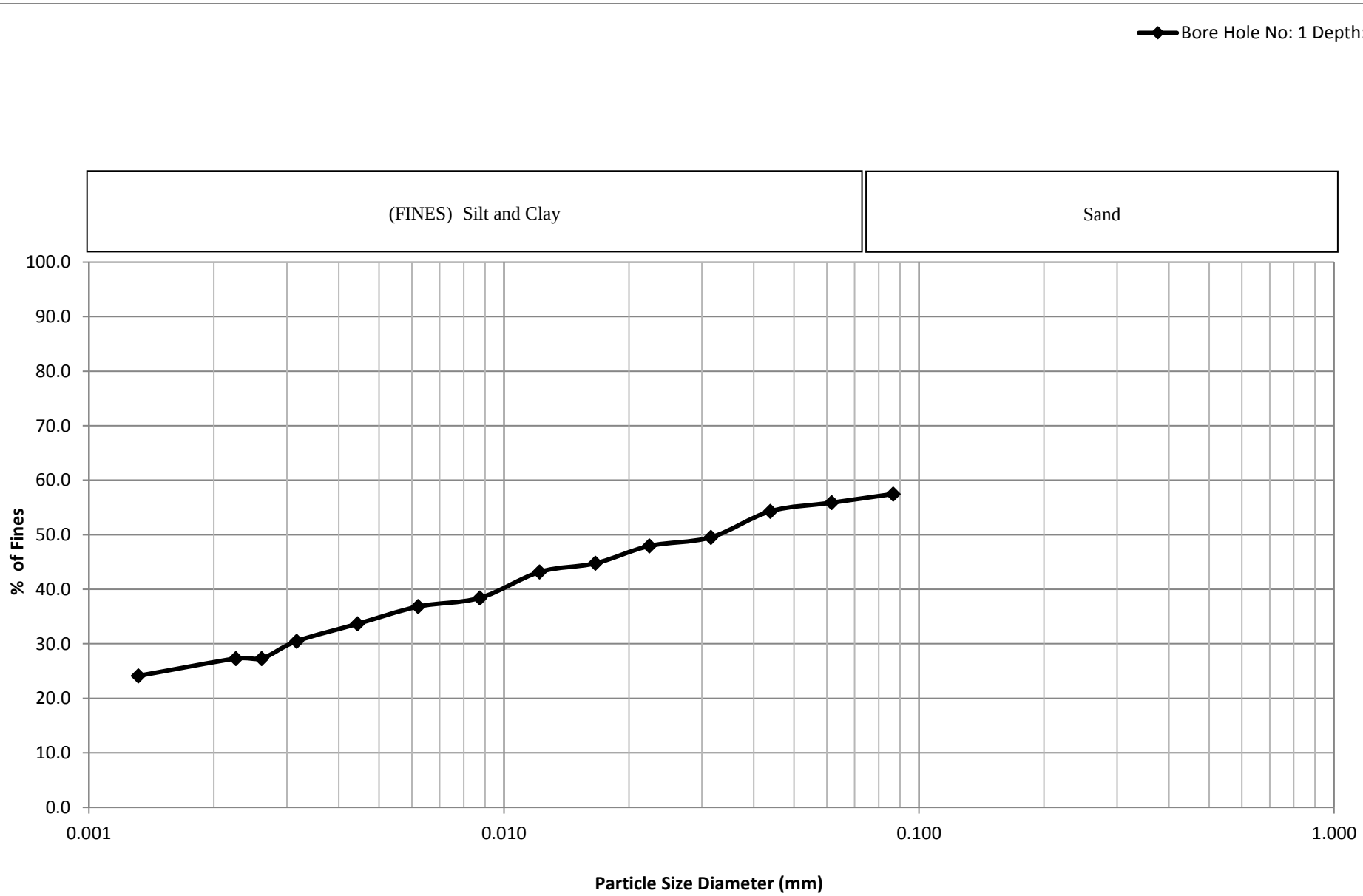


Fig 2.8 Hydrometer Analysis Master Curve

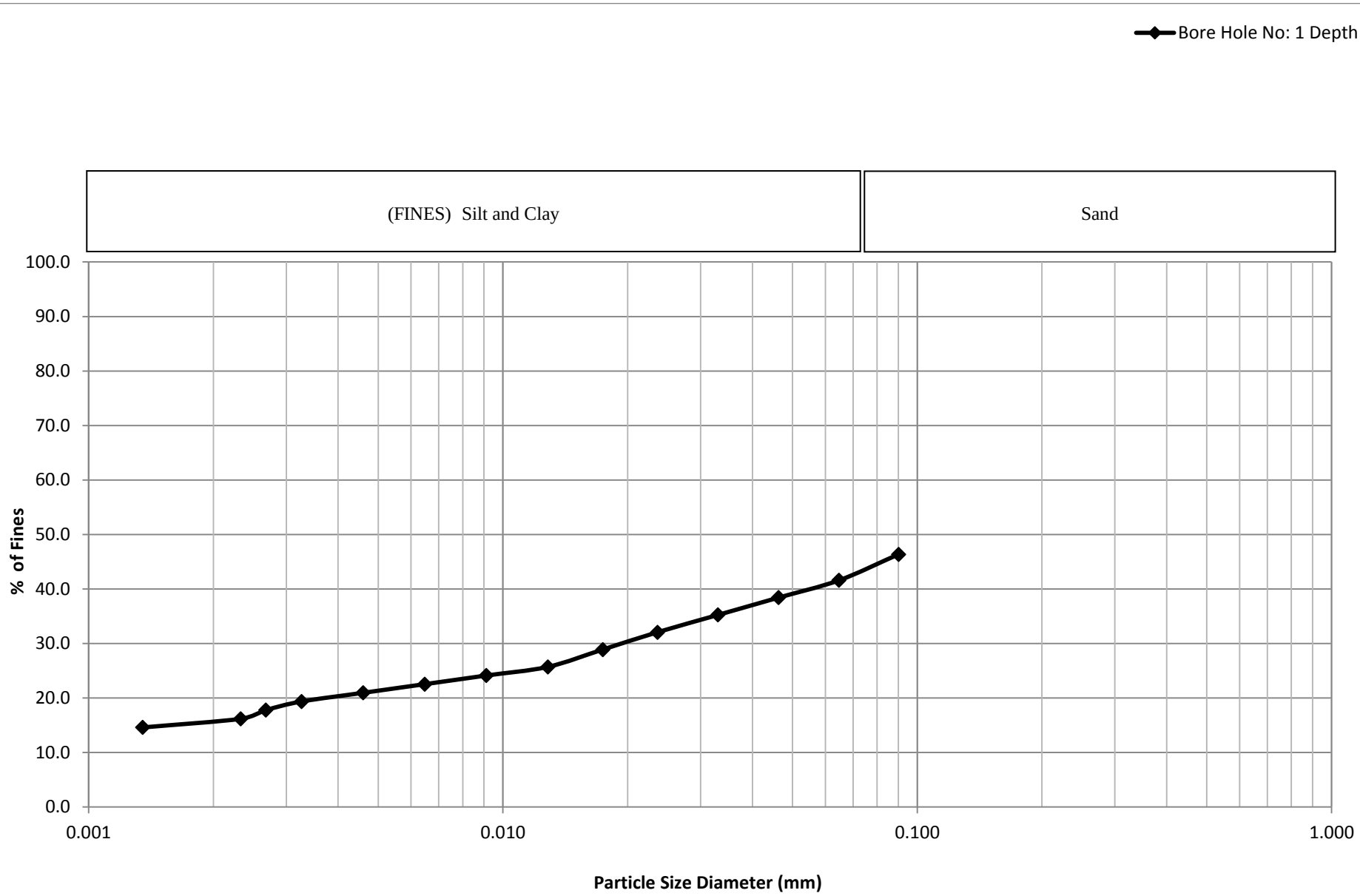


Fig 2.9 Hydrometer Analysis Master Curve

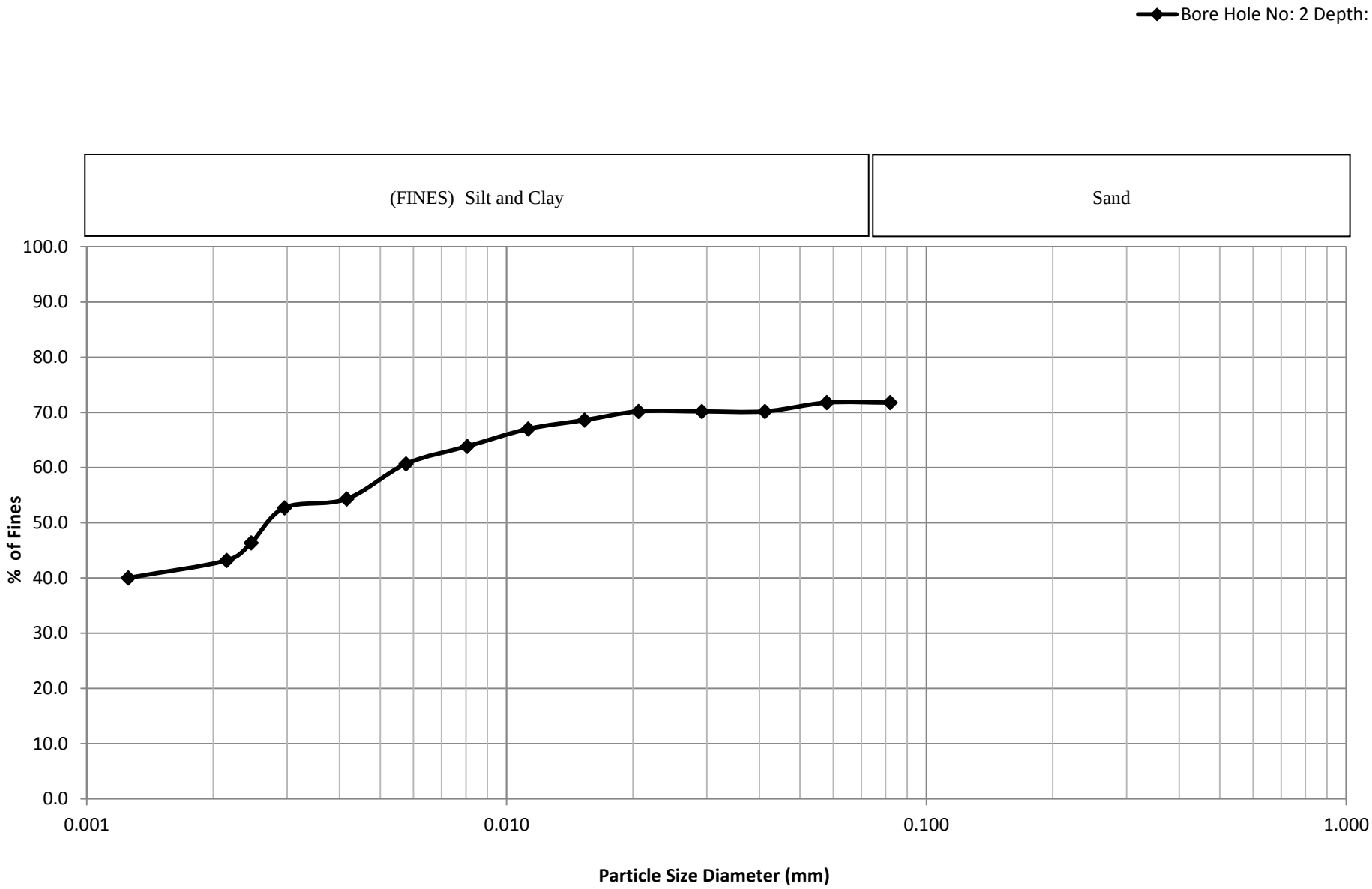


Fig 2.10 Hydrometer Analysis Master Curve

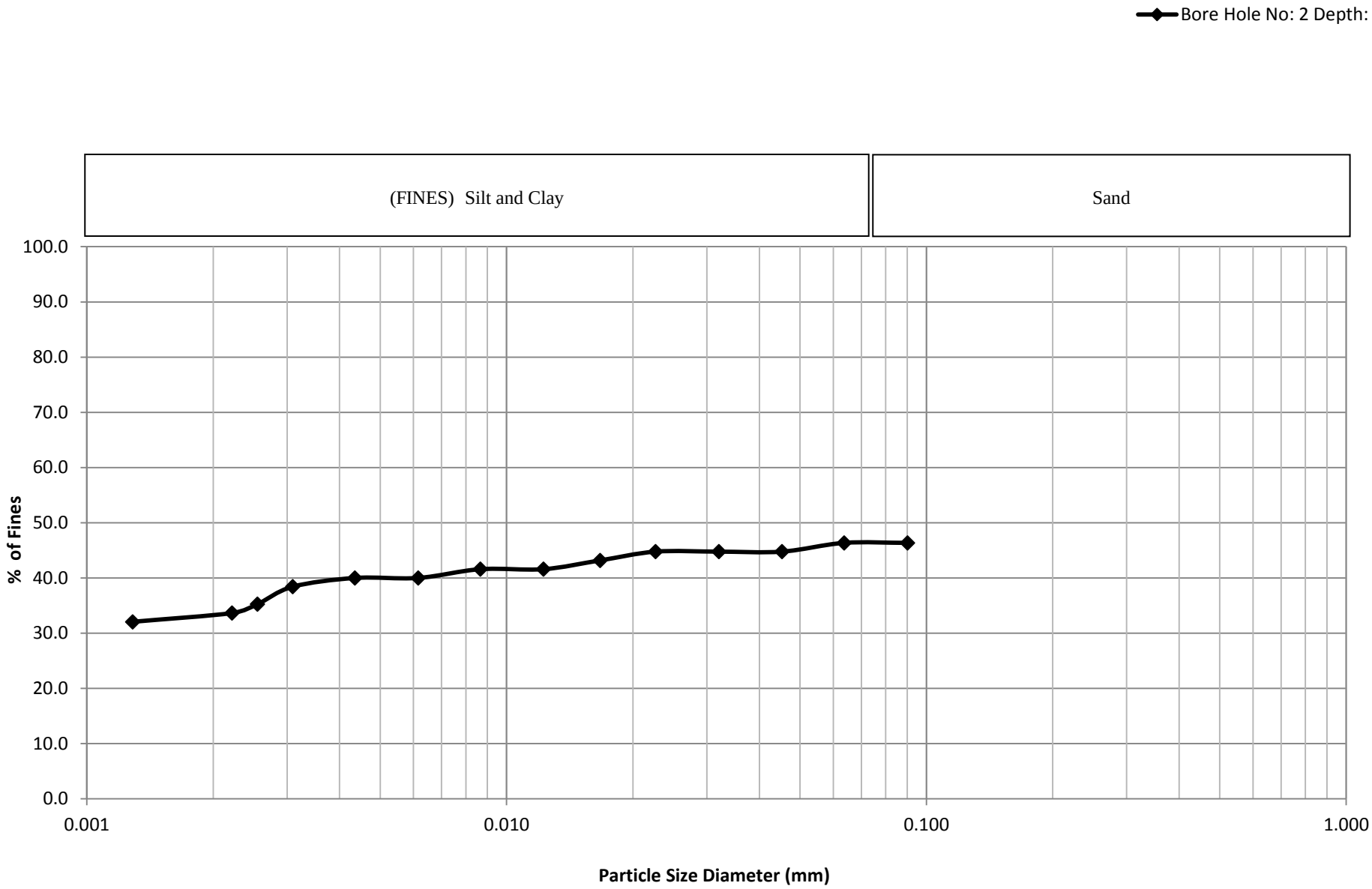


Fig 2.11 Hydrometer Analysis Master Curve

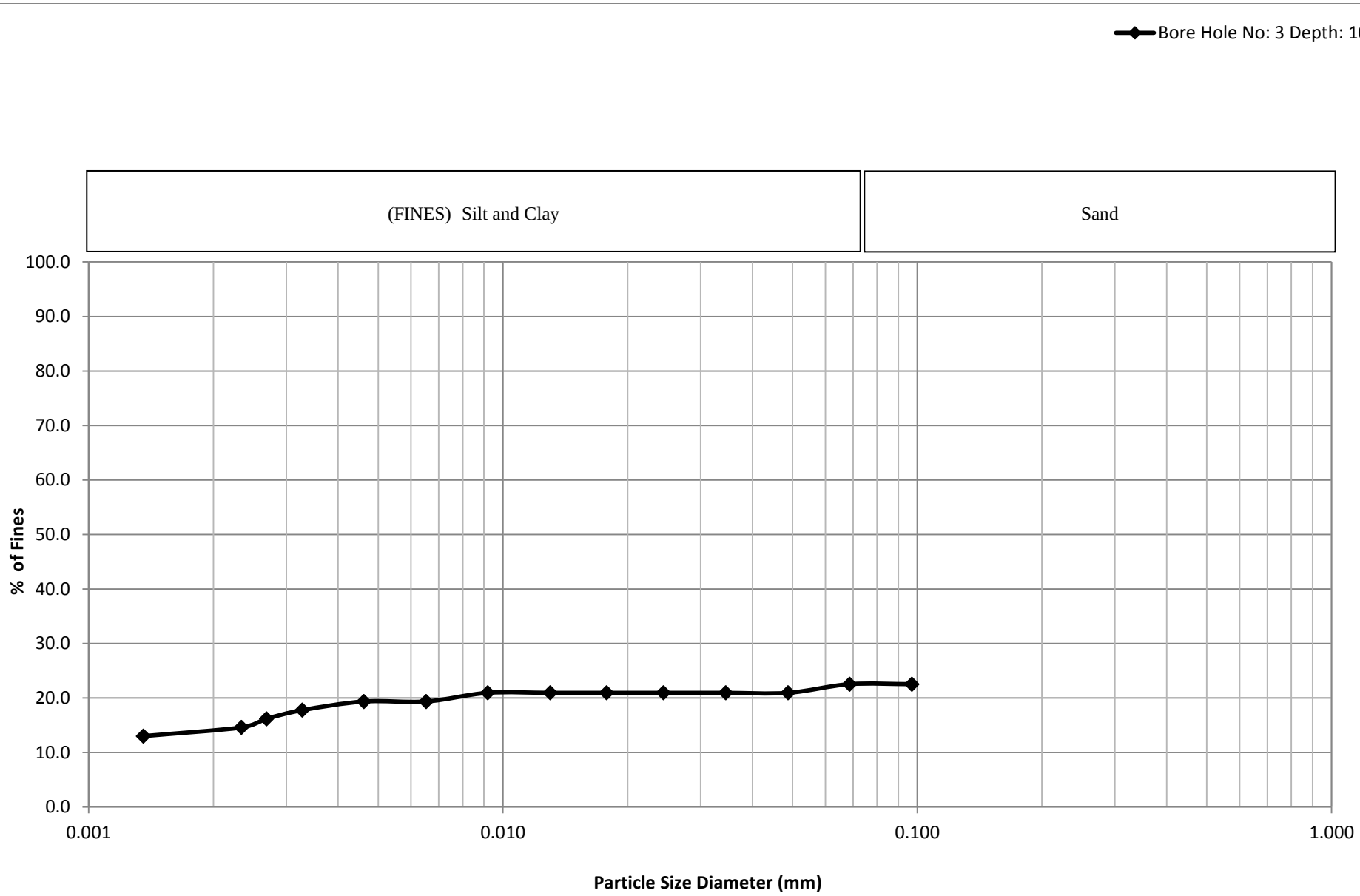


Fig 2.12 Hydrometer Analysis Master Curve

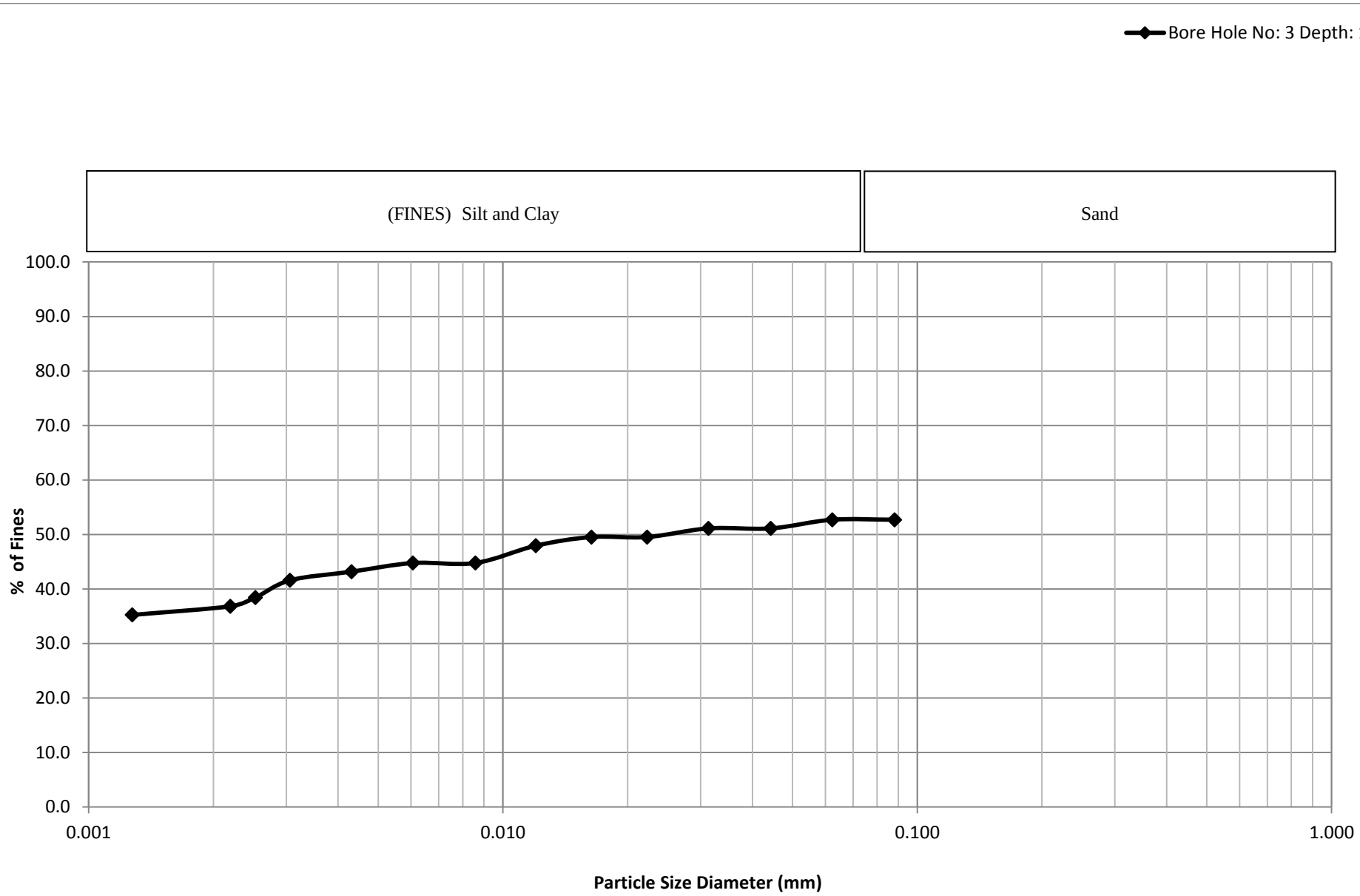


Fig 2.13 Hydrometer Analysis Master Curve

LABORATORY TEST RESULTS

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Phone No.: 044-24481485, 044-24480305

LABORATORY TEST REPORT

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

Name & Address of the Customer	:	**M/s RAMANIYAM REAL ESTATES (P) LTD**	**Customer Reference**	:	By Email
Sample Description	:	Soil Sample	**Period of Testing**	:	30/04/2022 to 06/05/2022
Source of Sample	:	Customer Supplied- Borehole No. BH-01	**Sample Identification Number**	:	SS/GMC/042022/463/BH01
Sample Condition	:	Satisfactory	**Test Report No.**	:	GT-2364/BH-01
Test Method	:	As per Bureau of Indian Standards	**Report Date**	:	25/05/2022
Sample Receipt Date	:	30/04/2022	**Test Report Pages**	:	One Page

Table-2.1 Laboratory Classification of Soil Samples from BH-01

Sample Depth (m)	SPT- "N" Value	Type of Sample	Fine Grained (FG)										SPECIFIC GRAVITY AS PER IS 2720 (P-III, SEC-1) - 1980, RA-2010	Coarse Grained (CG)													
			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)	Consistency Index (I_c=LL-NMC/I_p)	SHRINKAGE LIMIT (%) AS PER IS 2720 (P-VI) - 1972, RA-2011	FREE SWELL INDEX (%) AS PER IS 2720 (P-XL) - 1977, RA-2011	Consistancy	Position With Respect to A-Aline	IS:Notation		GRAIN SIZE ANALYSIS AS PER IS 2720 (P-IV) - 1985, RA-2015						D_{10} (mm)	D_{30}(mm)	D_{60} (mm)	Uniformity Co-Efficient $C_U=D_{60}/D_{10}$	Co-Efficient of Curvature $C_c=D_{30}^2/(D_{10}xD_{60})$	Relative Density	IS-Notation	
														Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)							Gravel	Sand
1.0	30	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	2.0	2.6	69.4	19.0	7.1		-	-	-	-	-	M.Dense	<50%	SP-SM
2.0	33	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	2.8	1.1	49.3	38.5	8.3		-	-	-	-	-	Dense	<50%	SP-SM
3.0	48	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	1.7	1.4	46.4	41.1	9.4		-	-	-	-	-	Dense	<50%	SP-SM
4.0	16	SS	17.5	47.7	18.4	29.3	1.0	12.4	3.6	V.Stiff	Above	CI	-	-	-	-	-	72.7	27.3	-	-	-	-	-	FG>50%	FG>50%	FG>50%
5.0	15	SS	19.3	46.5	18.5	28.0	1.0	13.0	12.5	Stiff	Above	CI	-	-	-	-	-	100.0		-	-	-	-	-	FG>50%	FG>50%	FG>50%
6.0	39	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	0.0	0.0	5.6	71.6	22.8		-	-	-	-	-	Dense	<50%	SM
7.5	48	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	0.0	0.0	24.7	63.6	11.7		-	-	-	-	-	Dense	<50%	SP-SM
9.0	3	SS	12.5	21.9	10.8	11.1	0.8	20.0	18.2	CG>50%	Above	-	-	0.0	0.0	13.3	60.3	22.2	4.3	-	-	-	-	-	V.Loose	<50%	SC
10.5	8	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	0.0	0.0	13.1	58.7	28.2		-	-	-	-	-	Loose	<50%	SM
12.0	18	SS	4.2	18.3	Non Plastic				0.0	CG>50%	Above	-	-	0.0	0.0	20.9	52.9	26.2		-	-	-	-	-	M.Dense	<50%	SC
14.0	23	SS	12.2	49.8	23.0	26.8	1.4	19.1	13.3	CG>50%	Above	-	-	0.0	0.0	19.3	55.7	24.9		-	-	-	-	-	M.Dense	<50%	SC
16.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	-	0.0	2.8	49.6	42.6	5.1		-	-	-	-	-	V.Dense	<50%	SP-SM
18.0	45	SS	18.4	80.6	36.0	44.6	1.4	10.8	100.0	Hard	Above	CH	-	-	-	-	-	100.0		-	-	-	-	-	FG>50%	FG>50%	FG>50%
20.0	>100	SS	17.5	63.5	29.0	34.5	1.3	11.8	65.5	Hard	Above	CH	-	-	-	-	-	100.0		-	-	-	-	-	FG>50%	FG>50%	FG>50%
22.5	71	SS	15.3	31.7	17.0	14.7	1.1	17.5	39.1	CG>50%	Above	-	-	0.0	0.8	23.1	30.1	46.0		-	-	-	-	-	V.Dense	<50%	SC
25.0	>100	SS	13.8	47.5	23.0	24.5	1.4	14.5	27.3	Hard	Above	CI	-	-	-	-	-	100.0		-	-	-	-	-	FG>50%	FG>50%	FG>50%
27.5	>100	SS	12.1	45.8	22.0	23.7	1.4	-	0.0	Hard	Above	CI	-	-	-	-	-	100.0		-	-	-	-	-	FG>50%	FG>50%	FG>50%

**** END OF REPORT****

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Authorised Signatory

A. VINOTH
(Technical Manager)

GEOMARINE
THE SPIRIT OF ENGINEERING
Phone No.: 044-24481485, 044-24480305

LABORATORY TEST REPORT

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

Name & Address of the Customer	:	**M/s RAMANIYAM REAL ESTATES (P) LTD**	**Customer Reference**	:	By Email
Sample Description	:	Soil Sample	**Period of Testing**	:	30/04/2022 to 06/05/2022
Source of Sample	:	Customer Supplied- Borehole No. BH-02	**Sample Identification Number**	:	SS/GMC/042022/463/BH02
Sample Condition	:	Satisfactory	**Test Report No.**	:	GT-2364/BH-02
Test Method	:	As per Bureau of Indian Standards	**Report Date**	:	25/05/2022
Sample Receipt Date	:	30/04/2022	**Test Report Pages**	:	One Page

Table-2.2 Laboratory Classification of Soil Samples from BH-02

Sample Depth (m)	SPT- "N" Value	Type of Sample	Fine Grained (FG)										Coarse Grained (CG)													
			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)	Consistency Index (Ic=LL-NMC/I_p)	SHRINKAGE LIMIT (%) AS PER IS 2720 (P-VI) - 1972, RA-2011	FREE SWELL INDEX (%) AS PER IS 2720 (P-XL) - 1977, RA-2011	Consistancy	Position With Respect to A-Aline	IS:Notation	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						D_{10} (mm)	D_{30}(mm)	D_{60} (mm)	Uniformity Co-Efficient $C_U=D_{60}/D_{10}$	Co-Efficient of Curvature $C_c=D_{30}^2/(D_{10}xD_{60})$	Relative Density	IS-Notation	
													Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)							Gravel	Sand
1.0	17	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	5.2	3.0	44.4	36.7	10.6		-	-	-	-	-	M.Dense	<50%	SP-SM
2.0	35	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	2.7	6.7	53.8	26.2	10.8		-	-	-	-	-	Dense	<50%	SP-SM
3.0	42	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	21.2	5.8	35.8	27.5	9.8		-	-	-	-	-	Dense	<50%	SP-SM
4.0	24	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	1.4	1.6	33.9	51.8	11.4		-	-	-	-	-	M.Dense	<50%	SP-SM
6.0	33	SS	13.4	49.0	24.5	24.5	1.5	13.5	0.0	Hard	Above	CI	-	-	-	-	-	100.0		-	-	-	-	-	FG>50%	FG>50%	FG>50%
7.5	7	SS	37.6	62.1	29.2	32.9	0.7	11.2	3.2	M.Stiff	Above	CH	-	-	-	-	-	56.8	43.2	-	-	-	-	-	FG>50%	FG>50%	FG>50%
9.0	8	SS	18.8	25.7	14.7	11.0	0.6	19.2	11.1	CG>50%	Above	-	-	0.0	1.9	11.5	53.1	33.6		-	-	-	-	-	Loose	<50%	SC
10.5	13	SS	16.9	25.0	14.6	10.4	0.8	19.5	10.0	CG>50%	Above	-	-	0.0	0.0	13.1	59.1	27.8		-	-	-	-	-	M.Dense	<50%	SC
12.0	46	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	0.0	0.0	24.8	52.2	23.0		-	-	-	-	-	Dense	<50%	SM
14.0	44	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	0.0	0.0	9.9	72.0	18.1		-	-	-	-	-	Dense	<50%	SM
16.0	69	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	0.0	0.0	6.3	81.3	12.4		-	-	-	-	-	V.Dense	<50%	SM
18.0	48	SS	24.5	82.0	32.9	49.1	1.2	10.4	34.5	Hard	Above	CH	-	-	-	-	-	66.4	33.6	-	-	-	-	-	FG>50%	FG>50%	FG>50%
20.0	78	SS	12.5	27.0	13.7	13.3	1.1	16.8	29.5	CG>50%	Above	-	-	0.0	0.0	32.9	40.0	27.1		-	-	-	-	-	V.Dense	<50%	SC
22.5	>100	SS	9.1	32.0	12.8	19.2	1.2	17.5	35.0	CG>50%	Above	-	-	4.0	3.5	31.3	24.6	36.5		-	-	-	-	-	V.Dense	<50%	SC
25.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	13.0	8.4	46.0	17.2	15.5		-	-	-	-	-	V.Dense	<50%	SM
27.5	>100	SS	11.9	40.8	24.2	16.6	1.7	14.5	12.5	Hard	Above	CI	-	-	-	-	-	100.0		-	-	-	-	-	FG>50%	FG>50%	FG>50%

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LABORATORY TEST REPORT

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

Name & Address of the Customer	:	**M/s RAMANIYAM REAL ESTATES (P) LTD**	**Customer Reference**	:	By Email
Sample Description	:	Soil Sample	**Period of Testing**	:	30/04/2022 to 06/05/2022
Source of Sample	:	Customer Supplied- Borehole No. BH-03	**Sample Identification Number**	:	SS/GMC/042022/463/BH03
Sample Condition	:	Satisfactory	**Test Report No.**	:	GT-2364/BH-03
Test Method	:	As per Bureau of Indian Standards	**Report Date**	:	25/05/2022
Sample Receipt Date	:	30/04/2022	**Test Report Pages**	:	One Page

Table-2.3 Laboratory Classification of Soil Samples from BH-03

Sample Depth (m)	SPT- "N" Value	Type of Sample	Fine Grained (FG)										SPECIFIC GRAVITY AS PER IS 2720 (P-III, SEC-1) - 1980, RA-2010	Coarse Grained (CG)													
			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)	Consistency Index (Ic=LL-NMC/I_p)	SHRINKAGE LIMIT (%) AS PER IS 2720 (P-VI) - 1972, RA-2011	FREE SWELL INDEX (%) AS PER IS 2720 (P-XL) - 1977, RA-2011	Consistancy	Position With Respect to A-Aline	IS:Notation		GRAIN SIZE ANALYSIS AS PER IS 2720 (P-IV) - 1985, RA-2015						D_{10} (mm)	D_{30}(mm)	D_{60} (mm)	Uniformity Co-Efficient $C_U=D_{60}/D_{10}$	Co-Efficient of Curvature $C_c=D_{30}^2/(D_{10}xD_{60})$	Relative Density	IS-Notation	
														Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)							Gravel	Sand
1.0	22	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	0.0	1.0	37.0	47.8	14.2		-	-	-	-	-	M.Dense	<50%	SM
2.0	25	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	1.1	1.1	53.3	35.1	9.5		-	-	-	-	-	M.Dense	<50%	SP-SM
3.0	40	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	5.0	2.7	55.1	27.7	9.6		-	-	-	-	-	Dense	<50%	SP-SM
4.0	38	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	3.0	3.9	58.6	24.9	9.6		-	-	-	-	-	Dense	<50%	SP-SM
5.0	23	SS	16.1	35.2	16.8	18.4	1.0	15.3	8.3	V.Stiff	Above	CI	-	-	-	-	-	100.0		-	-	-	-	-	FG>50%	FG>50%	FG>50%
6.0	30	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	0.0	0.0	2.5	60.8	36.8		-	-	-	-	-	M.Dense	<50%	SM
9.0	4	SS	10.7	25.9	14.0	11.9	1.3	18.0	14.3	CG>50%	Above	-	-	0.0	0.0	15.0	60.7	24.4		-	-	-	-	-	V.Loose	<50%	SC
10.5	23	SS	24.4	25.8	14.5	11.3	0.1	17.8	23.8	CG>50%	Above	-	-	0.0	0.0	14.3	57.9	23.7	4.1	-	-	-	-	-	M.Dense	<50%	SC
12.0	52	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	0.0	0.0	20.3	54.2	25.5		-	-	-	-	-	V.Dense	<50%	SM
14.0	40	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	1.4	0.8	14.1	60.8	23.0		-	-	-	-	-	Dense	<50%	SM
16.0	>100	SS	17.6	36.5	22.1	14.4	1.3	14.0	27.3	Hard	Above	CI	-	-	-	-	-	100.0		-	-	-	-	-	FG>50%	FG>50%	FG>50%
18.0	40	SS	21.0	73.0	33.2	39.8	1.3	10.8	60.9	Hard	Above	CH	-	-	-	-	-	63.2	36.8	-	-	-	-	-	FG>50%	FG>50%	FG>50%
20.0	44	SS	10.1	30.5	14.8	15.7	1.3	15.6	30.0	CG>50%	Above	-	-	0.0	0.0	31.6	40.1	28.3		-	-	-	-	-	Dense	<50%	SC
22.5	66	SS	11.5	28.2	14.0	14.2	1.2	19.0	44.4	CG>50%	Above	-	-	13.8	9.9	38.0	19.3	19.0		-	-	-	-	-	V.Dense	<50%	SC
25.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	2.7	8.4	52.8	18.4	17.7		-	-	-	-	-	V.Dense	<50%	SM
27.5	>100	SS	18.4	49.9	23.0	26.9	1.2	-	0.0	Hard	Above	CI	-	-	-	-	-	100.0		-	-	-	-	-	FG>50%	FG>50%	FG>50%
30.0	>100	SS	Fissile, Shale																								

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A. VINOTH
(Technical Manager)

Table-2.4 Results of Chemical Analysis									
		Water				Soil (2:1)			
SL No.	Bore HoleNo.	Depth of Sample (m)	pH	Chlorides (ppm)	Sulphates (ppm)	Depth of Sample (m)	pH	Chlorides (ppm)	Sulphates (ppm)
1.0	BH-01	2.40	7.03	225.6	23.3	2.0	7.08	58.6	20.3
2.0	BH-02	2.60	7.02	200.3	20.8	1.0	7.05	49.2	19.3
3.0	BH-03	2.60	6.94	254.1	18.2	2.0	7.06	65.2	27.1

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.

3.4 GEOLOGICAL ORDER OF THE STUDY AREA:

Geologically, the present site is located in a coastal region with sub surface consisting of sedimentary deposits. The top sedimentary deposit is under laid by upper Gondwana system, particularly lower stage of Sriperumpudur. The formation mechanism of the sediments is chiefly due to transportation of surface water and marine deposition.

The above geological characteristics are also observed in the direct borehole investigation, which confirms that the present site does not depict any surprising geological features that are different from that of the region.

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	4.00	4.00	Silty Sand	Brown	37	Dense	-	19.5	-	37.925
2.0	4.00	6.00	2.00	Silty Clay	Grey	16	-	Very Stiff	20	107	-
3.0	6.00	9.00	3.00	Silty Sand	Grey Brown	44	Dense	-	20	-	39.65
4.0	9.00	12.00	3.00	Clayey Silty Sand	Grey	5	Loose	-	14	-	20.374
5.0	12.00	16.00	4.00	Clayey Silty Sand	Grey, Grey Brown	21	Medium Dense	-	18.5	-	33.3
6.0	16.00	22.50	6.50	Shale	Grey, Yellow	60	-	Hard	22	400	-
7.0	22.50	25.00	2.50	Cemented Sand	Grey, Yellow Brown	71	Very Dense	-	21	-	42.5
8.0	25.00	27.60	2.60	Shale	Grey Green	>100	-	Hard	22	400	-

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/m³	Shear Parameters	
	Top BGL	Bottom BGL	Thickness							(C_u) kPa	(ϕ) Deg.
1.0	0.00	2.00	2.00	Silty Sand	Brown	17	Medium Dense	-	18	-	32.1
2.0	2.00	5.30	3.30	Silty Sand	Brown	34	Dense	-	19.5	-	37.1
3.0	5.30	7.50	2.20	Silty Clay	Grey,Black	33	-	Hard	21	220	-
4.0	7.50	9.00	1.50	Silty Clay	Grey	7	-	Medium Stiff	16	47	-
5.0	9.00	12.00	3.00	Clayey Silty Sand	Grey Brown	10	Loose	-	15	-	30
6.0	12.00	18.00	6.00	Silty Sand	Grey, Green Grey	53	Very Dense	-	20.5	-	41.45
7.0	18.00	20.00	2.00	Shale	Grey,Yellow Brown	48	-	Hard	21	320	-
8.0	20.00	27.50	7.50	Cemented Sand	Grey Yellow	>100	Very Dense	-	21	-	42.5
9.0	27.50	27.70	0.20	Shale	Grey,Green Grey	>100	-	Hard	22	400	-

REFERENCE BORE HOLE					BH-03	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	5.00	5.00	Silty Sand	Brown	31	Dense	-	19.5	-	36.275
2.0	5.00	6.00	1.00	Silty Clay	Brown	23	-	Very Stiff	20.5	153	-
3.0	6.00	7.50	1.50	Silty Sand	Grey	30	Medium Dense	-	19	-	36
4.0	7.50	9.00	1.50	Silty Clay	Grey,Black	-	-	-	-	-	-
5.0	9.00	10.50	1.50	Clayey Silty Sand	Grey, Grey Brown	4	Very Loose	-	13.5	-	20.221
6.0	10.50	12.00	1.50	Clayey Silty Sand	Grey Brown	23	Medium Dense	-	18.5	-	33.9
7.0	12.00	16.00	4.00	Silty Sand	Grey Brown	46	Dense	-	20	-	40.1
8.0	16.00	20.00	4.00	Shale	Grey Brown	60	-	Hard	22	400	-
9.0	20.00	25.00	5.00	Cemented Sand	Grey	50	Dense	-	20.5	-	41
10.0	25.00	27.50	2.50	Silty Sand	Grey Brown	>100	Very Dense	-	21	-	42.5
11.0	27.50	30.20	2.70	Shale	Grey, Grey Green	>100	-	Hard	22	400	-

FOUNDATION SYSTEM

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 one basement floors and ten upper floors, and is meant for residential building. For this kind of structure, the column loads could vary between 3,000 kN to 5,000 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 STRATIFICATION:

The stratigraphically succession in the project site consists of:

Layer-I	0.0m to 5.0m	Medium Dense to Dense, Sand
Layer-II	5.0m to 9.0m	Stiff to Medium Stiff, Clay & Medium Dense, Sand
Layer-III	9.0m to 12.0m	Very Loose to Loose, Clayey Sand/Sand with Binder
Layer-IV	12.0m to 16.0m	Dense to Very Dense, Sand
Layer-V	16.0m to 20.0m	Hard, Shale
Layer-VI	20.0m to 25.0m	Very Dense, Cemented Sand
Layer-VII	>25.0m	Hard, Shale (at Location Very Dense Cemented Sand up to 27.5m)

4.3 FOUNDATION SYSTEM:

4.3.1 PREAMBLE:

It is proposed to construct one basement floors, hence the overall depth of excavation up to the bottom of foundation is considered as 4.0m below the existing ground level.

4.3.2 FOUNDATION SYSTEM:

Taking into account of the superstructure configuration and sub soil conditions it is not possible to adopt any kind of open foundation system from both shear, settlement and liquefaction considerations of underlying very loose sand. Hence, it is advisable to adopt deep pile foundation system.

The piles can be installed by drilling with direct mud circulation technique **(Bored Cast Insitu Piles)** and the recommended safe load carrying capacity of bored cast insitu piles in compression, tension and lateral for different diameters is worked out as per IS 2911-Part-I-Section-2 and are presented in Table 4.1.

Typical computations are presented in Annexure-I

TABLE:- 4.1 RECOMMENDED SAFE LOAD CARRYING CAPACITIES OF BORED CAST-IN SITU PILES

Sl.No	Reference Bore hole No.	Length of Pile below E.G.L	Assumed Length of Cut-Off Below E.G.L	Length of Pile below Cut-off	Dia.of Pile in (mm)	SAFE LOAD CARRYING CAPACITY (kN)		
						Vertical Load Carrying Capacity	Pull Out Capacity	Lateral Load Carrying Capacity
1.0	BH-01 to BH-03	21.0	4.0	17.0	500	1050	500	55
2.0					600	1350	600	75
3.0					750	1900	750	90
4.0					800	2100	850	110
5.0					900	2500	950	130
6.0					1000	3000	1050	150

4.4 BASEMENT EXCAVATION:

For carrying out basement excavation contiguous pile with clear gap of 50mm is an option. Since the set back is close to the boundary no back anchoring is possible. For structural design cantilever lever system is a viable option.

The design soil profile presents the requisite design data for the estimation of lateral earth pressures and the same hold good for the analysis and design of contiguous piles.

To prevent escape of sand particles from the gap between the piles provide 4mm welded mesh and shotcrete the same.

4.5 GROUND WATER LOWERING:

For ground water lowering multiple well point system is suitable. For providing safe construction condition, lower ground water table up to 6.0m. The data for well point system is presented in Annexure-II

4.6 BASEMENT SLAB UPLIFT:

Basement floor experience uplift pressure during monsoon rains, raising ground water table at ground level. Hence, basement floor slab needs design check for uplift pressure.

RECOMMENDATIONS

CHAPTER-5

RECOMMENDATIONS

5.1 Recommendation for Pile foundation system:

- For the kind of proposed structure Bored Cast in situ piles are recommended as the suitable foundation system.
- The allowable safe load carrying capacities of different diameters of piles as given in Table-4.1 can be adopted as provisional design loads, as the load carrying capacity of piles is not only depends upon the sub soil properties, but also depends on the care and experience of installation piles.
- The theoretical load carrying estimates of piles shall be confirmed by conducting pile loads tests as per the guide lines laid down in IS: 2911-Part-IV.
- The boring shall be carried out using direct mud circulation prepared out of sodium bentonite.
- After reaching the borehole termination depth, the borehole shall be cleaned using mud circulation for a minimum period of 30min or till the return mud is relatively clear of soil particles.
- After ensuring the borehole is clean, the tremie pipe shall be lowered and concreting can be done.

5.1.1 Construction method statement of pile foundation:

- For the bored cast in situ piles, a guide casing of suitable length can be adopted.
- The mud used shall be made out of sodium bentonite with minimum frees swell index of more than 300% and liquid limit more than 100%. The silt content in bentonite shall not more than 5%.
- The mud was prepared using sodium bentonite with a density of 1.10 to 1.15 g/cc.

5.2 General Recommendations:

- The chloride content in ground water sample is lower than the permissible limit of 500mg/l as per IS 456 Table 1.0. Hence no special steel is required for the construction.
- Corresponding to the sulphate content in 2:1 Water-Soil extract and ground water use Table 4.0 of IS 456 Clause 2.0 for minimum cement content and maximum water cement ratio. In the present case, ordinary Portland cement is suitable for the construction.
- The present project site fall in seismic zone-III as per IS 1893-P-I. The liquefaction analysis of the sub soil formation is presented in Annexure-II

AUTHORISED SIGNATORY

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ANNEXURE-I

GEO MARINE
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ESTIMATION OF SAFE LOAD CARRYING CAPACITY OF BORED CAST-INSITU PILES

Type of Pile			Bored	**Diameter of Pile**			**Length of Pile below G.L. (m)**		21.00	**As Per IS:2911-(P-I,S-2)-2010**								
Reference Bore Hole			BH-01				500	**mm**	**Surcharge Pressure**		0	**kPa**						
Layer No.	**Layer Thk. (m)**			**Type of Strata**	**Ave. SPT**	**(γ) kN/m³**		**Shear Parameters**		**Effective Overburden Pressure (kPa)**			**Adhesion Factor (α)**	**Earth Pressure Coefficient (k)**	**Skin Friction (Q_f) kN**			
	Top. R.L.	**Bot. R.L.**	**Thickness**			**of Layer**	**Ave. upto Layer**	**(C_u) kPa**	**(ϕ) Deg.**	**At top of Layer**	**At Bot. of Layer**	**At Mid. of Layer**						
1.0	0.00	4.00	4.00	Cut-Off Level														
2.0	4.00	6.00	2.00	Clay	16	20.0	20.0	107	-	0.0	20.0	10.0	0.4	-	qf	2	137.8	
3.0	6.00	9.00	3.00	Sand	44	20.0	20.0	-	39.7	20.0	50.0	35.0	-	1.5	qf	3	203.5	
4.0	9.00	12.00	3.00	Sand	5	14.0	17.0	-	20.4	50.0	62.0	56.0	-	1.0	qf	4	98.0	
5.0	12.00	16.00	4.00	Sand	21	18.5	16.3	-	33.3	62.0	96.0	79.0	-	1.2	qf	5	380.5	
6.0	16.00	21.00	5.00	Shale	60	22.0	20.3	400	-	96.0	156.0	126.0	0.3	-	qf	6	816.8	

Summation of Positive Skin Resitance (kN) Q_f= 1636.65

Summation of Negative Skin Resistance (kN) -Qf= 0.00

Computation of End Bearing Resistance

		SPT	ϕ	C_u	N_q	N_c			
Bearing Stratum	Shale	60	-	600	-	9	Eff.Ht.of Overburden	8	m
							Effective Overburden Pressure	65.25	kN/m^2

End Bearing Resistance (kN) Q_p= 1060.29

Skin Resistance in Clay Layer is $\pi*d*T_l*C_u*\alpha$

Skin Resistance in Sand Layer is $\pi*d*T_l*q_l*K*Tan(\phi)$

End Bearing Resistance in Clay Layer is $\pi*d^2/4*C_u*N_c$

End Bearing Resistance in Sand Layer is $\pi*d^2/4*Q*N_q$

Ultimate Load Carrying Capacity (Q_{ult})	$Q_u=Q_f-Q_f+Q_p$ (kN)	2696.94
Safe Load Carrying Capacity (Q_{safe})	$Q_u/2.5$ (kN)	1078.78
Allowable Safe Load Carrying Capacity	$Q_{A\text{-}safe}$ (kN)	1078.78
Allowable Safe Pull out Capacity	$Q_{A\text{-}pull}$: Qf/3 (kN)	545.55

Where

Cu=Undrained Shear Strength of Clay

ϕ=Angle of Shearing Resistance

N_c=Bearing Capacity Factor = 9

K=Coef. Earth Pressure at Rest

q_l=Effecitve Overburden Pressure at middle of Layer

N_q=Bearing Capacity Factor, Ref. Fig.1 of IS: Code Referred above

d=Dia. Of Pile

α=Adhession Factor

T_l=Thickness of Layer

Q (i.e) Effecitve Overburden Pressure at pile tip=Effective height of overburden X (γ-10)

GEO MARINE
THE SPIRIT OF ENGINEERING

ESTIMATION OF SAFE LOAD CARRYING CAPACITY OF BORED CAST-INSITU PILES

Type of Pile	Bored	Diameter of Pile		Length of Pile below G.L. (m)	21.00	As Per IS:2911-(P-I,S-2)-2010	
Reference Bore Hole	BH-02		500 mm	Surcharge Pressure	0	kPa	

Layer No.	Layer Thk. (m) Top. R.L.	Bot. R.L.	Thickness	Type of Strata	Ave. SPT	(γ) kN/m³ of Layer	Ave. upto Layer	Shear Parameters (C_u) kPa	(ϕ) Deg.	Effective Overburden Pressure (kPa) At top of Layer	At Bot. of Layer	At Mid. of Layer	Adhesion Factor (α)	Earth Pressure Coefficient (k)	Skin Friction (Q_f) kN		
1.0	0.00	4.00	4.00	Cut-Off Level													
2.0	4.00	5.30	1.30	Sand	29	19.0	19.0	-	35.7	0.0	11.7	5.9	-	1.3	qf	2	11.1
3.0	5.30	7.50	2.20	Clay	33	21.0	20.0	220	-	11.7	35.9	23.8	0.3	-	qf	3	197.7
4.0	7.50	9.00	1.50	Clay	7	16.0	18.5	47	-	35.9	44.9	40.4	0.9	-	qf	4	99.7
5.0	9.00	12.00	3.00	Sand	11	15.5	15.8	-	30.3	44.9	61.4	53.2	-	1.0	qf	5	148.6
6.0	12.00	18.00	6.00	Sand	53	20.5	18.0	-	41.5	61.4	124.4	92.9	-	1.5	qf	6	1159.9
7.0	18.00	20.00	2.00	Shale	48	21.0	20.8	320	-	124.4	146.4	135.4	0.3	-	qf	7	261.4
8.0	20.00	21.00	1.00	Cemented Sand	50	20.5	20.8	-	36.0	146.4	156.9	151.7	-	1.5	qf	8	259.6

Summation of Positive Skin Resitance (kN) Q_f= 2137.87

Summation of Negative Skin Resistance (kN) -Qf= 0.00

Computation of End Bearing Resistance

		SPT	ϕ	C_u	N_q	N_c			
Bearing Stratum	Cemented Sand	50	36.00	-	57.50	-	Eff.Ht.of Overburden	8	m
							Effective Overburden Pressure	78.75	kN/m²

End Bearing Resistance (kN) Q_p= 889.09

Skin Resistance in Clay Layer is $\pi*d*T_l*C_u*\alpha$	Ultimate Load Carrying Capacity (Q_{ult})	**$Q_u=Q_f-Q_f+Q_p$ (kN)** 3026.96
Skin Resistance in Sand Layer is $\pi*d*T_l*q_l*K*Tan(\phi)$	Safe Load Carrying Capacity (Q_{safe})	**$Q_u/2.5$ (kN)** 1210.79
End Bearing Resistance in Clay Layer is $\pi*d^2/4*C_u*N_c$	Allowable Safe Load Carrying Capacity	**$Q_{A\text{-}safe}$ (kN)** 1210.79
End Bearing Resistance in Sand Layer is $\pi*d^2/4*Q*N_q$	Allowable Safe Pull out Capacity	**$Q_{A\text{-}pull}$: Qf/3 (kN)** 712.62

Where

Cu=Undrained Shear Strength of Clay
K=Coef. Earth Pressure at Rest
d=Dia. Of Pile
ϕ=Angle of Shearing Resistance
q_l=Effecitve Overburden Pressure at middle of Layer
α=Adhession Factor
N_c=Bearing Capacity Factor = 9
N_q=Bearing Capacity Factor, Ref. Fig.1 of IS: Code Referred above
T_l=Thickness of Layer

Q (i.e) Effecitve Overburden Pressure at pile tip=Effective height of overburden X (γ-10)

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ESTIMATION OF SAFE LOAD CARRYING CAPACITY OF BORED CAST-INSITU PILES

Type of Pile	Bored	Diameter of Pile		Length of Pile below G.L. (m)	21.00	As Per IS:2911-(P-I,S-2)-2010	
Reference Bore Hole	BH-03		500	mm	Surcharge Pressure	0	kPa

Layer No.	Layer Thk. (m) Top. R.L.	Bot. R.L.	Thickness	Type of Strata	Ave. SPT	(γ) kN/m³ of Layer	Ave. upto Layer	Shear Parameters (C_u) kPa	(ϕ) Deg.	Effective Overburden Pressure (kPa) At top of Layer	At Bot. of Layer	At Mid. of Layer	Adhesion Factor (α)	Earth Pressure Coefficient (k)	Skin Friction (Q_f) kN
1.0	0.00	4.00	4.00	Cut-Off Level											
2.0	4.00	5.00	1.00	Sand	38	19.5	19.5	-	38.2	0.0	9.5	4.8	-	1.4	qf 2 = 8.3
3.0	5.00	6.00	1.00	Clay	23	20.5	20.0	153	-	9.5	20.0	14.8	0.3	-	qf 3 = 72.1
4.0	6.00	7.50	1.50	Sand	30	19.0	19.8	-	36.0	20.0	33.5	26.8	-	1.3	qf 4 = 59.7
5.0	7.50	9.00	1.50	Clay	7	16.0	17.5	47	-	33.5	42.5	38.0	0.9	-	qf 5 = 99.7
6.0	9.00	10.50	1.50	Sand	4	13.5	14.8	-	20.2	42.5	47.8	45.1	-	1.0	qf 6 = 39.2
7.0	10.50	12.00	1.50	Sand	23	18.5	16.0	-	33.9	47.8	60.5	54.1	-	1.2	qf 7 = 102.6
8.0	12.00	16.00	4.00	Sand	46	20.0	19.3	-	40.1	60.5	100.5	80.5	-	1.5	qf 8 = 638.9
9.0	16.00	20.00	4.00	Shale	50	21.0	20.5	333	-	100.5	144.5	122.5	0.3	-	qf 9 = 544.0
10.0	20.00	21.00	1.00	Cemented Sand	44	20.0	20.5	-	36.0	144.5	154.5	149.5	-	1.5	qf 10 = 254.0

Summation of Positive Skin Resitance (kN) Q_f= 1818.43

Summation of Negative Skin Resistance (kN) -Qf= 0.00

Computation of End Bearing Resistance

		SPT	ϕ	C_u	N_q	N_c			
Bearing Stratum	Cemented Sand	50	36.00	-	57.50	-	Eff.Ht.of Overburden	8	m
							Effective Overburden Pressure	75.00	kN/m²

End Bearing Resistance (kN) Q_p= 846.75

Skin Resistance in Clay Layer is $\pi*d*T_l*C_u*\alpha$

Skin Resistance in Sand Layer is $\pi*d*T_l*q_l*K*Tan(\phi)$

End Bearing Resistance in Clay Layer is $\pi*d^2/4*C_u*N_c$

End Bearing Resistance in Sand Layer is $\pi*d^2/4*Q*N_q$

Where

Cu=Undrained Shear Strength of Clay

ϕ=Angle of Shearing Resistance

N_c=Bearing Capacity Factor = 9

K=Coef. Earth Pressure at Rest

q_l=Effecitve Overburden Pressure at middle of Layer

N_q=Bearing Capacity Factor, Ref. Fig.1 of IS: Code Referred above

Q (i.e) Effecitve Overburden Pressure at pile tip=Effective height of overburden X (γ-10)

d=Dia. Of Pile

α=Adhession Factor

T_l=Thickness of Layer

Ultimate Load Carrying Capacity (Q_{ult})	**$Q_u=Q_f-Q_f+Q_p$ (kN)** 2665.19
Safe Load Carrying Capacity (Q_{safe})	**$Q_u/2.5$ (kN)** 1066.08
Allowable Safe Load Carrying Capacity	**$Q_{A\text{-}safe}$ (kN)** 1066.08
Allowable Safe Pull out Capacity	**$Q_{A\text{-}pull}$: Qf/3 (kN)** 606.14

LATERAL LOAD CARRYING CAPACITY OF BORED CAST- SITU PILES

Reference Bore Hole : BH-01 to BH-03

1.0 Geometrical Data

Type of Pile Head Considered		Fixed	
Diameter of Pile (d)	:	0.50	m
Free standing Length of Pile (e)	:	0	m
Length of Pile below E.G.L (Le)	:	21.0	m
Cut-Off Level From E.G.L	:	4.0	
Length of Pile below Cut-Off Level (Le)	:	17.0	m
Grade of Concrete (M)	:	25	MN/m^2
Young's Modulus of Concrete (E)	:	25000000	kN/m^2
Momemnt of Inertia (I)	:	0.003068	m^4

2.0 Determination of Depth of Fixity

Type of Soil Strata	:	Sand	
Ground Water Condition	:	Submerged	
Design SPT "N" Value	:	20	
T=(EI/nh)1/5			
(n can be read as h in the above and below equation in case of Sand)			
nh=	:	2840	kN/m^3
In Case of Sand	:	-	kN/m^4
T=	:	1.93	m
L1/T	:	0.00	
Lf/T	:	2.20	
Depth of Fixity below Cut off (z_f)	:	4.25	m

3.0 Determincation of Lateral Load and Moment Carrying Capacity for 0.005 m Lateral Deflection:

Allowable Lateral Deflection (Y)	:	0.005	m
Lateral Load Carrying Capacity (H)= Y*12EI/(e+zf)^3	:	59.81	kN
Recommended Design Lateral Load carrying Capacity	:	**59**	**kN**
Fixed End Moment,M_F=H(e+z_f)/2		127	
Reduction Factor (L_1/T)	:	0.8	m
Actual Moment (Fixed End Moment/Reduction Factor),M_F		**102**	kN-m

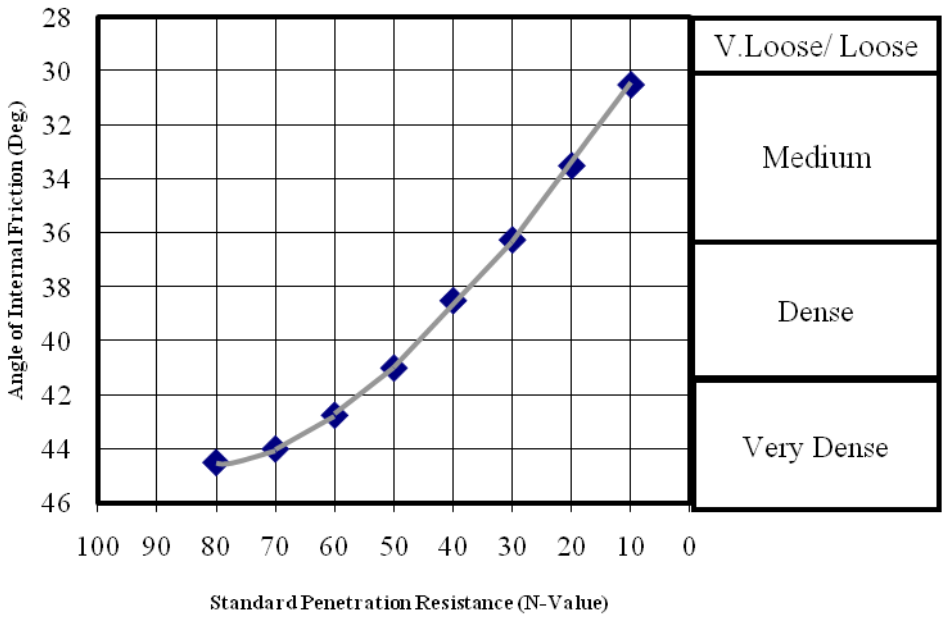


FIG. A1 Relation Ship between Angle of Internal Friction & N-value (Reproduced from IS:6403-1981)

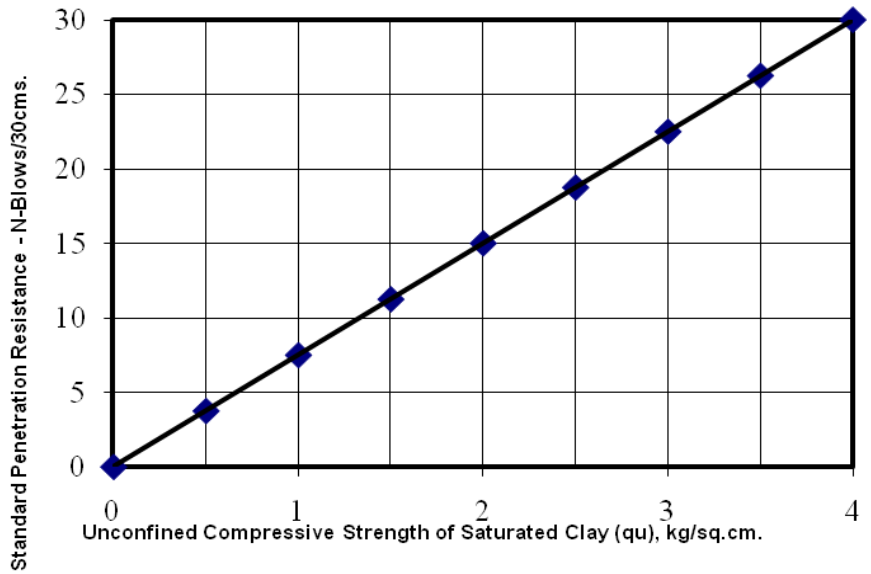


FIG. A2 : Relationship between UCC & SPT-Value (N) of Saturated Clay (AfterTerzhagi & Peck, 1948)

ANNEXURE-II

GEOMARINE
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ANNEXURE-II SIMPLIFIED PROCEDURE FOR EVALUATION OF LIQUEFACTION POTENTIAL AS PER IS 1893 (PART-1)- 2016 BASED ON SPT "N"

Zone Factor / Horizontal ground acceleration (Z or a_{max}/g): 0.16 | Location of Ground Water Table: 0.6 EGL | C_{HT} 1 | C_{SS} 1

Atmospheric Pressure: 100.00 kPa | Magnitude, Mw = 6.5 | C_{BD} 1 | C_{HW} 1 | C_{RL} 0.75

Borehole: BH-01

Depth (m)	"N" SPT Value	Type of Soil	γ (kN/m3)	Fines Content FC	σ_o (kPa)	σ_o' (kPa)	$\sigma_o/\sigma o'$	r_d	CSR $(0.65*(a_{max}/g)*(\sigma o/\sigma o')*r_d)$	C_{60}	$N_{60}=NC_{60}$	C_N	$(N_1)_{60}=C_N*NC_{60}$	α	β	$(N_1)_{60CS}=\alpha+\beta(N_1)_{60}$	$CRR_{7.5}$	CRR	Factor of Safety FOS=1 CRR/CSR	Possiblity of Liquifaction
1.00	30	Sand	19.00	7	19	9	2.07	0.99	0.21	0.75	23	1.70	38	0.13	1.01	38.7	0.07	0.10	0.48	Liquefiable
2.00	33	Sand	19.50	8	39	19	1.99	0.98	0.20	0.75	25	1.70	42	0.37	1.01	43.0	0.20	0.29	1.44	Non-Liquefiable
3.00	48	Sand	20.00	9	59	31	1.91	0.98	0.19	0.75	36	1.70	61	0.68	1.02	63.0	0.43	0.62	3.17	Non-Liquefiable
4.00	16	Clay	20.00	100	79	41	1.93	0.97	0.19	0.75	12	1.57	19	0.50	1.20	23.1	0.26	0.37	1.91	Non-Liquefiable
5.00	15	Clay	20.00	100	99	51	1.93	0.96	0.19	0.75	11	1.40	16	0.50	1.20	19.4	0.21	0.30	1.55	Non-Liquefiable
6.00	39	Sand	19.50	23	118	58	2.03	0.95	0.20	0.75	29	1.31	38	4.03	1.10	46.2	0.26	0.37	1.83	Non-Liquefiable
7.50	48	Sand	20.00	12	148	76	1.94	0.94	0.19	0.75	36	1.14	41	1.45	1.03	43.9	0.22	0.32	1.66	Non-Liquefiable
9.00	3	Sand	13.00	27	168	29	5.83	0.93	0.56	0.75	2	1.70	4	4.43	1.13	8.7	0.10	0.15	0.26	Liquefiable
10.50	8	Sand	14.50	28	189	49	3.84	0.89	0.36	0.75	6	1.43	9	4.58	1.14	14.3	0.15	0.22	0.62	Liquefiable
12.00	18	Sand	18.00	26	216	98	2.20	0.85	0.20	0.75	14	1.01	14	4.41	1.12	19.7	0.21	0.31	1.56	Non-Liquefiable
14.00	23	Sand	18.50	25	253	122	2.08	0.80	0.17	0.75	17	0.91	16	4.28	1.11	21.7	0.24	0.34	1.98	Non-Liquefiable
16.00	100	Sand	21.00	5	295	179	1.65	0.75	0.13	0.75	75	0.75	56	0.00	1.00	56.1	0.37	0.53	4.12	Non-Liquefiable

Borehole: BH-02

Depth (m)	"N" SPT Value	Type of Soil	γ (kN/m3)	Fines Content FC	σ_o (kPa)	σ_o' (kPa)	$\sigma_o/\sigma o'$	r_d	CSR $(0.65*(a_{max}/g)*(\sigma o/\sigma o')*r_d)$	C_{60}	$N_{60}=NC_{60}$	C_N	$(N_1)_{60}=C_N*NC_{60}$	α	β	$(N_1)_{60CS}=\alpha+\beta(N_1)_{60}$	$CRR_{7.5}$	CRR	Factor of Safety FOS=1 CRR/CSR	Possiblity of Liquifaction
1.00	17	Sand	18.00	11	18	8	2.20	0.99	0.23	0.75	13	1.70	22	1.07	1.02	23.3	0.26	0.38	1.66	Non-Liquefiable
2.00	35	Sand	19.50	11	38	19	1.93	0.98	0.20	0.75	26	1.70	45	1.14	1.03	46.9	0.27	0.38	1.93	Non-Liquefiable
3.00	42	Sand	20.00	10	58	31	1.88	0.98	0.19	0.75	32	1.70	54	0.80	1.02	55.5	0.36	0.52	2.71	Non-Liquefiable
4.00	24	Sand	18.50	11	76	35	2.19	0.97	0.22	0.75	18	1.70	31	1.35	1.03	32.7	1.04	1.49	6.78	Non-Liquefiable
6.00	33	Clay	21.00	100	117	67	1.74	0.95	0.17	0.75	25	1.22	30	0.50	1.20	36.7	-0.10	-0.14	-	Non-Liquefiable
7.50	7	Clay	16.00	100	141	46	3.04	0.94	0.30	0.75	5	1.47	8	0.50	1.20	9.7	0.11	0.16	-	Non-Liquefiable
9.00	8	Sand	14.50	34	163	42	3.86	0.93	0.37	0.75	6	1.54	9	4.91	1.18	15.9	0.17	0.24	0.65	Liquefiable
10.50	13	Sand	16.50	28	188	70	2.67	0.89	0.25	0.75	10	1.19	12	4.55	1.14	17.8	0.19	0.27	1.10	Non-Liquefiable
14.00	44	Sand	20.00	18	258	143	1.80	0.80	0.15	0.75	33	0.84	28	3.25	1.07	32.7	1.03	1.48	9.87	Non-Liquefiable
16.00	69	Sand	21.00	12	300	179	1.67	0.75	0.13	0.75	52	0.75	39	1.69	1.03	41.7	0.17	0.25	1.92	Non-Liquefiable

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ANNEXURE-II SIMPLIFIED PROCEDURE FOR EVALUATION OF LIQUEFACTION POTENTIAL AS PER IS 1893 (PART-1)- 2016 BASED ON SPT "N"

Zone Factor / Horizontal ground acceleration (Z or a_{max}/g): 0.16 Location of Ground Water Table: 0.6 EGL C_{HT} **1** C_{SS} **1**

Atmospheric Pressure: 100.00 kPa Magnitude, Mw = 6.5 C_{BD} **1** C_{HW} **1** C_{RL} **0.75**

Borehole: BH-03

Depth (m)	"N" SPT Value	Type of Soil	γ (kN/m3)	Fines Content FC	σ_o (kPa)	σ_o' (kPa)	$\sigma_o/\sigma o'$	r_d	CSR $(0.65*(a_{max}/g)*(\sigma o/\sigma o')*r_d)$	C_{60}	$N_{60}=NC_{60}$	C_N	$(N_1)_{60}=C_N*NC_{60}$	α	β	$(N_1)_{60CS}=\alpha+\beta(N_1)_{60}$	$CRR_{7.5}$	CRR	Factor of Safety FOS=1 CRR/CSR	Possiblity of Liquifaction
1.00	22	Sand	18.50	14	19	9	2.13	0.99	0.22	0.75	17	1.70	28	2.27	1.04	31.5	0.63	0.92	4.17	Non-Liquefiable
2.00	25	Sand	18.50	10	37	17	2.13	0.98	0.22	0.75	19	1.70	32	0.71	1.02	33.2	1.49	2.14	9.84	Non-Liquefiable
3.00	40	Sand	20.00	10	57	31	1.86	0.98	0.19	0.75	30	1.70	51	0.74	1.02	52.7	0.33	0.48	2.53	Non-Liquefiable
4.00	38	Sand	19.50	10	77	39	1.97	0.97	0.20	0.75	29	1.61	46	0.74	1.02	47.4	0.27	0.39	1.97	Non-Liquefiable
5.00	23	Clay	20.50	100	97	53	1.81	0.96	0.18	0.75	17	1.37	24	0.50	1.20	28.8	0.40	0.58	3.19	Non-Liquefiable
9.00	4	Sand	13.50	24	166	33	5.01	0.93	0.48	0.75	3	1.70	5	4.22	1.11	9.9	0.11	0.16	0.33	Liquefiable
10.50	23	Sand	18.50	28	194	91	2.13	0.89	0.20	0.75	17	1.05	18	4.55	1.14	25.1	0.29	0.42	2.14	Non-Liquefiable
12.00	52	Sand	20.50	26	225	128	1.75	0.85	0.16	0.75	39	0.88	34	4.34	1.12	42.9	0.20	0.29	1.85	Non-Liquefiable
14.00	40	Sand	20.00	23	265	143	1.86	0.80	0.15	0.75	30	0.84	25	4.06	1.10	31.7	0.66	0.96	6.20	Non-Liquefiable
16.00	100	Shale	22.00	100	309	195	1.58	0.75	0.12	0.75	75	0.72	54	0.50	1.20	64.9	0.44	0.64	5.21	Non-Liquefiable

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Phone No.: 044-24481485, 044-24480305

LABORATORY TEST REPORT

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

Name & Address of the Customer	:	**M/s RAMANIYAM REAL ESTATES (P) LTI**	**Customer Reference**	:	By Email
Sample Description	:	Soil Sample	**Period of Testing**	:	30/04/2022 to 06/05/2022
Source of Sample	:	Customer Supplied- Borehole No. BH-	**Sample Identification Number**	:	SS/GMC/042022/463/BH01
Sample Condition	:	Satisfactory	**Test Report No.**	:	GT-2364/BH-01
Test Method	:	As per Bureau of Indian Standards	**Report Date**	:	25/05/2022
Sample Receipt Date	:	30/04/2022	**Test Report Pages**	:	One Page

Table-2.1 Laboratory Classification of Soil Samples from BH-01

Sample Depth (m)	SPT- "N" Value	Type of Sample	Fine Grained (FG)								Coarse Grained (CG)													
			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)	Consistency Index (Ic=LL-NMC/I_p)	SHRINKAGE LIMIT (%) AS PER IS 2720 (P-VI) - 1972, RA-2011	FREE SWELL INDEX (%) AS PER IS 2720 (P-XL) - 1977, RA-2011	Consistancy	GRAIN SIZE ANALYSIS AS PER IS 2720 (P-IV) - 1985, RA-2015						D_{10} (mm)	D_{30}(mm)	D_{60} (mm)	Uniformity Co-Efficient $C_U=D_{60}/D_{10}$	Co-Efficient of Curvature $C_c=D_{30}^2/(D_{10}xD_{60})$	Coefficient of Permeability of (K) m/sec Hazen's Formula $(D_{10})^2/100$	Relative Density	IS-Notation	
											Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)								Gravel	Sand
1.0	30	SS	-	-	-	-	-	-	-	CG>50%	2.0	2.6	69.4	19.0	7.1		0.125	0.5	0.9	7.2	2.222	2E-04	M.Dense	<50%	SW-SM
2.0	33	SS	-	-	-	-	-	-	-	CG>50%	2.8	1.1	49.3	38.5	8.3		0.09	0.24	0.65	7.222	0.985	8E-05	Dense	<50%	SP-SM
3.0	48	SS	-	-	-	-	-	-	-	CG>50%	1.7	1.4	46.4	41.1	9.4		0.08	0.21	0.6	7.5	0.919	6E-05	Dense	<50%	SP-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

(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- GEOTECHNICAL LABORATORY
NO.11 2nd MAIN ROAD, KANNAPA NAGAR EXTN,
KOTTIVAKKAM. CHENNAI

Name & Address of the Customer	:	**M/s RAMANIYAM REAL ESTATES (P) LTD**	**Customer Reference**	:	By Email
Sample Description	:	Soil Sample	**Period of Testing**	:	30/04/2022 to 06/05/2022
Source of Sample	:	Customer Supplied- Borehole No. BH-	**Sample Identification Number**	:	SS/GMC/042022/463/BH02
Sample Condition	:	Satisfactory	**Test Report No.**	:	GT-2364/BH-02
Test Method	:	As per Bureau of Indian Standards	**Report Date**	:	25/05/2022
Sample Receipt Date	:	30/04/2022	**Test Report Pages**	:	One Page

Table-2.2 Laboratory Classification of Soil Samples from BH-02

Sample Depth (m)	SPT- "N" Value	Type of Sample	Fine Grained (FG)								Coarse Grained (CG)													
			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)	Consistency Index (Ic=LL-NMC/I_p)	SHRINKAGE LIMIT (%) AS PER IS 2720 (P-VI) - 1972, RA-2011	FREE SWELL INDEX (%) AS PER IS 2720 (P-XL) - 1977, RA-2011	Consistancy	GRAIN SIZE ANALYSIS AS PER IS 2720 (P-IV) - 1985, RA-2015						D_{10} (mm)	D_{30}(mm)	D_{60} (mm)	Uniformity Co-Efficient $C_U=D_{60}/D_{10}$	Co-Efficient of Curvature $C_c=D_{30}^2/(D_{10}xD_{60})$	Coefficient of Permeability of (K) m/sec Hazen's Formula $(D_{10})^2/100$	Relative Density	IS-Notation	
											Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)								Gravel	Sand
1.0	17	SS	-	-	-	-	-	-	-	CG>50%	5.2	3.0	44.4	36.7	10.6		0.07	0.22	0.7	10	0.988	5E-05	M.Dense	<50%	SP-SM
2.0	35	SS	-	-	-	-	-	-	-	CG>50%	2.7	6.7	53.8	26.2	10.8		0.065	0.3	0.85	13.08	1.629	4E-05	Dense	<50%	SW-SM
3.0	42	SS	-	-	-	-	-	-	-	CG>50%	21.2	5.8	35.8	27.5	9.8		0.075	0.3	1.1	14.67	1.091	6E-05	Dense	<50%	SW-SM
4.0	24	SS	-	-	-	-	-	-	-	CG>50%	1.4	1.6	33.9	51.8	11.4		0.065	0.18	0.39	6	1.278	4E-05	M.Dense	<50%	SW-SM

**** END OF REPORT****

Terms and Conditions

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(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- GEOTECHNICAL LABORATORY
NO.11 2nd MAIN ROAD, KANNAPA NAGAR EXTN,
KOTTIVAKKAM. CHENNAI

Name & Address of the Customer	:	**M/s RAMANIYAM REAL ESTATES (P) LTD**	**Customer Reference**	:	By Email
Sample Description	:	Soil Sample	**Period of Testing**	:	30/04/2022 to 06/05/2022
Source of Sample	:	Customer Supplied- Borehole No. BH-	**Sample Identification Number**	:	SS/GMC/042022/463/BH03
Sample Condition	:	Satisfactory	**Test Report No.**	:	GT-2364/BH-03
Test Method	:	As per Bureau of Indian Standards	**Report Date**	:	25/05/2022
Sample Receipt Date	:	30/04/2022	**Test Report Pages**	:	One Page

Table-2.3 Laboratory Classification of Soil Samples from BH-03

Sample Depth (m)	SPT- "N" Value	Type of Sample	Fine Grained (FG)								Coarse Grained (CG)														
			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)	Consistency Index (Ic=LL-NMC/I_p)	SHRINKAGE LIMIT (%) AS PER IS 2720 (P-VI) - 1972, RA-2011	FREE SWELL INDEX (%) AS PER IS 2720 (P-XL) - 1977, RA-2011	Consistancy	GRAIN SIZE ANALYSIS AS PER IS 2720 (P-IV) - 1985, RA-2015						D_{10} (mm)	D_{30}(mm)	D_{60} (mm)	Uniformity Co-Efficient $C_U=D_{60}/D_{10}$	Co-Efficient of Curvature $C_c=D_{30}^2/(D_{10}xD_{60})$	Coefficient of Permeability of (K) m/sec Hazen's Formula $(D_{10})^2/100$	Relative Density	IS-Notation	
											Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)								Gravel	Sand
1.0	22	SS	-	-	-	-	-	-	-	CG>50%	0.0	1.0	37.0	47.8	14.2		0.049	0.18	0.4	8.163	1.653	2.40E-05	M.Dense	<50%	SM
2.0	25	SS	-	-	-	-	-	-	-	CG>50%	1.1	1.1	53.3	35.1	9.5		0.075	0.25	0.7	9.333	1.19	5.63E-05	M.Dense	<50%	SW-SM
3.0	40	SS	-	-	-	-	-	-	-	CG>50%	5.0	2.7	55.1	27.7	9.6		0.075	0.32	0.82	10.93	1.665	5.63E-05	Dense	<50%	SW-SM
4.0	38	SS	-	-	-	-	-	-	-	CG>50%	3.0	3.9	58.6	24.9	9.6		0.075	0.35	0.85	11.33	1.922	5.63E-05	Dense	<50%	SW-SM
6.0	30	SS	-	-	-	-	-	-	-	CG>50%	0.0	0.0	2.5	60.8	36.8		0.008	0.05	0.18	22.5	1.736	6.40E-07	M.Dense	<50%	SM

**** END OF REPORT****

Terms and Conditions

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Authorised Signatory

A. VINOTH
(Technical Manager)

ANNEXURE-III

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SITE INVESTIGATION RECORD

BORE HOLE No.	BH-01
PAGE No.	01
DIA OF BORE HOLE	150mm ✓ / 100mm
BORE START DATE	18/04/22
BORE END DATE	20/04/2022
TOTAL DRILLING DAYS	3

PROJECT NAME	RAMANIYAM - ANNA NAGAR (12th main Road)				
LOCATION	Tiruvanmiyur Metro	MACHINE No.	SR-01	CHAINAGE (m)	
STRUCTURE	Silt + Base + 9	DRILLING METHOD	Rotary	CO-ORDINATES	N
JOB CODE		FLUSHING MEDIUM	Bentonite		E

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	SPT Details: Blows/cm. 15-30	SPT Details: Blows/cm. 30-45	SPT 'N' Value	Sample Details: Depth	Sample Details: No.	Sample Details: Type	Layer Data: Depth (m)	Geotechnical Description
1	18/04/22	15	09	SC			7	11	19	20	1.00	1	SS		M.dense, brown Sand
		15	10												
2		15	37	SC			12	13	20	33	2.00	2	SS		Dense, brown, Sand
		15	38												
3		15	53	SC			14	21	27	48	3.00	3	SS		Dense, brown, Sand.
		15	54												
4		14	19	SC			6	7	9	16	4.00	4	SS		V. Stiff, Dark Greyish brown, Sandy silty clay
		14	20												
5		14	45	SC			8	6	9	15	5.00	5	SS		—— Do ——
		14	48												
6	19/04/2022	10	34	SC			17	21	18	39	6.00	6	SS		→ Hard clay, Dark greyish Brown Sandy Silt & Clay
		10	38												
7		10	53	SC			16	24	24	48	7.50	7	SS		→ Dark, greyish Brown Sandy Silt.
		10	to 58												
8															
9		11	14	SC			1	1	2	3	9.00	8	SS		→ Soft, Dark greyish Brown Sandy Silt clay
		11	to 16												
0															

CS - Core Sample
SS - Split Spoon Sample
UDS-Undisturbed Sample
WS - Wash Sample

DS - Disturbed Sample
SC - Soil Cutter
TCB - Tungsten Carbide Bit
DB - Diamond Bit

SUPERVISOR NAME	H. SIVAKUMAR
SIGNATURE	H. Sivakumar
DATE	19/04/2022.
CLIENT IN-CHARGE	

PROJECT SITE DETAILS	
GROUND LEVEL (m)	
WATER TABLE (m)	
CASING DEPTH (m)	

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SITE INVESTIGATION RECORD

BORE HOLE No.	01
PAGE No.	02
DIA OF BORE HOLE	150mm / 100mm
BORE START DATE	18/04/2022
BORE END DATE	20/04/2022
TOTAL DRILLING DAYS	3

PROJECT NAME	RAMANIYAM - ANNA NAGAR (12th Main Road)				
LOCATION	Tiruvanmiyam metro	MACHINE No.	SR-01	CHAINAGE (m)	-
STRUCTURE	Silt + Base + 9	DRILLING METHOD	Rotary	CO-ORDINATES	N
JOB CODE		FLUSHING MEDIUM	Bentonite		E

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	SPT Details: Blows/cm. 15-30	SPT Details: Blows/cm. 30-45	SPT 'N' Value	Sample Details: Depth	Sample Details: No.	Sample Details: Type	Layer Data: Depth (m)	Layer Data: Geotechnical Description
1	19/04/2022	11	32	SC			3	3	5	8	10.50	9	SS	→	Stiff, Greyish Brown, Sandy Silt Clay
		11	34												
2		11	49	SC			5	7	11	18	12.00	10	SS	→	Very Stiff greyish pale green Sandy Silt Clay
		11	51												
3		12	30	SC			8	9	14	23	14.00	11	SS	→	—— Same as above ——
		to 12	33												
4		2	05	SC			8cm / 50B	HR	HR	N/100	16.00	12	WS	→	SPT Failed or Sample Slipped.
		2	16												
5		2	55	SC			15	21	24	45	18.00	13	SS	→	Hard, Reddish pale yellowish grey, Shale & Clay
		3	30												
6		4	12	SC			16	13cm / 50B	HR	N/100	20.00	14	SS	→	Hard, greyish pale yellow Sandy Silt clay & Shale
		to 4	34												
7	20/04/2022	9	50	SC			24	30	41	71	22.50	15	SS	→	Very dense - greyish pale yellow - Clay & Sandy Silt.
		to 10	26												
8		11	50	SC			8cm / 50B	HR	HR	N/100	25.00	16	SS	→	Very dense or Hard, greyish pale green, Shale.
		12	13												
9		2	03	SC			10cm / 50B	HR	HR	N/100	27.50	17	SS	→	Very dense or Hard greyish pale green, Hard clay or Shale mixed gravels.
		2	21												
0															Bore hole Terminated at 27.50 mts depth.

CS - Core Sample	DS - Disturbed Sample	SUPERVISOR NAME	Lt. SHANKAR	PROJECT SITE DETAILS	
SS - Split Spoon Sample	SC - Soil Cutter	SIGNATURE		GROUND LEVEL (m)	
UDS-Undisturbed Sample	TCB - Tungsten Carbide Bit	DATE	20/04/2022	WATER TABLE (m)	
WS - Wash Sample	DB - Diamond Bit	CLIENT IN-CHARGE		CASING DEPTH (m)	

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SITE INVESTIGATION RECORD

BORE HOLE No.	02
PAGE No.	01
DIA OF BORE HOLE	150mm ✓ / 100mm
BORE START DATE	21-04-2022
BORE END DATE	23-04-2022
TOTAL DRILLING DAYS	03

PROJECT NAME: RAMANIYAM - ANNA NAGAR (12th Main Road)
LOCATION: Thiruvanmiyur | MACHINE No.: SP-01 | CHAINAGE (m):
STRUCTURE: SI + BH. | DRILLING METHOD: Rotary | CO-ORDINATES: N, E
JOB CODE: | FLUSHING MEDIUM: Bentonite

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	SPT Details: Blows/cm. 15-30	SPT Details: Blows/cm. 30-45	SPT 'N' Value	Sample Details: Depth	Sample Details: No.	Sample Details: Type	Layer Data: Depth (m)	Geotechnical Description
1	21-03-2022	15	30	SC			7	8	9	17	1.00		SS		M. dense, Brownish, Sand
		15	33												
2		15	59	SC			12	18	17	35	2.00		SS		dense, Brownish Sand
		16	02												
3		16	32	SC			18	20	22	42	3.00		SS		dense, Brownish Sandy gravels
		16	35												
4		10	12	SC			11	11	13	24	4.00		SS		M. dense, Brownish, Sand
		10	14												
5	22-03-2022	10	27	SC			10	15	18	33	5.00		SS		dense, Brownish Grayish sandy clay.
		10	29												
		10	45	SC	-	-	-	UDS	-	-	5.30		UDS		— UDS SAMPLE —
		10	48												
6		11	05	SC			6	14	19	33	6.00		SS		Hard, Grayish, Clay with gravels.
		11	08												
7															
		11	37	SC			3	4	3	7	7.50		SS		M. Stiff, Blackish, Clay
8		11	40												
9		12	00	SC			2	2	6	8	9.00		SS		Stiff, Grayish, Blackish Silty clay.
		12	04												
0		12	15	SC			5	6	7	13	10.50		SS		Stiff, Grayish, Blackish Silty Clay.
		12	17												

CS - Core Sample	DS - Disturbed Sample	SUPERVISOR NAME	M. Dhanasekaran.	PROJECT SITE DETAILS	
SS - Split Spoon Sample	SC - Soil Cutter	SIGNATURE		GROUND LEVEL (m)	
UDS-Undisturbed Sample	TCB - Tungsten Carbide Bit	DATE	29-04-2022	WATER TABLE (m)	2.60M.
WS - Wash Sample	DB - Diamond Bit	CLIENT IN-CHARGE		CASING DEPTH (m)	

GEOMARINE
THE SPIRIT OF ENGINEERING

SITE INVESTIGATION RECORD

BORE HOLE No.	02		
PAGE No.	02		
DIA OF BORE HOLE	150mm ✓	100mm	
BORE START DATE	21-04-2022		
BORE END DATE	23-04-2022		
TOTAL DRILLING DAYS	03		

PROJECT NAME	RAMANIVAM - ANNA NAGAR (12th Main Road)				
LOCATION	Thiruvanmangalam	MACHINE No.	SR-01	CHAINAGE (m)	
STRUCTURE	Silt + Bldg	DRILLING METHOD	Rotary	CO-ORDINATES	N
JOB CODE		FLUSHING MEDIUM	Bentonite		E

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	SPT Details: Blows/cm. 15-30	SPT Details: Blows/cm. 30-45	SPT 'N' Value	Sample Details: Depth	Sample Details: No.	Sample Details: Type	Layer Data: Depth (m)	Geotechnical Description
1	22-04-2022	12	44	SC			16	20	26	46	12.00	10	SS		Hard, Grayish, Sandy Silty clay.
		12	47												
2															
3		14	26	SC			11	21	23	44	14.00	11	SS		Dense, Grayish, Silt
		14	33												
4															
5		15	03	SC			30	39	30	69	16.00	12	SS		V. dense, Grayish, Silt
		15	10												
6															
7		15	39	SC			11	16	32	48	18.00	13	SS		V. Hard, Brownish, Yellowish Shale.
		16	23												
8															
9	23-04-2022	10	15	SC			35	49	29	78	20.00	14	SS		V. dense, Grayish, Yellowish Silty Sand
		11	90												
0															

CS - Core Sample	DS - Disturbed Sample	SUPERVISOR NAME	N. Dhanasankar	PROJECT SITE DETAILS	
SS - Split Spoon Sample	SC - Soil Cutter	SIGNATURE		GROUND LEVEL (m)	
UDS-Undisturbed Sample	TCB - Tungsten Carbide Bit	DATE	23-04-2022	WATER TABLE (m)	2.6m
WS - Wash Sample	DB - Diamond Bit	CLIENT IN-CHARGE		CASING DEPTH (m)	

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SITE INVESTIGATION RECORD

BORE HOLE No.	02
PAGE No.	03
DIA OF BORE HOLE	150mm ✓ / 100mm
BORE START DATE	21-04-2022
BORE END DATE	23-04-2022
TOTAL DRILLING DAYS	03

PROJECT NAME	ROMANIYAM - ANNA NAGAR (12th Main Road)				
LOCATION	Thiruvanmiyur Metro	MACHINE No.	SR-01	CHAINAGE (m)	
STRUCTURE	Silt + FB + 9	DRILLING METHOD	Rotary	CO-ORDINATES	N
JOB CODE		FLUSHING MEDIUM	Bentonite		E

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	SPT Details: Blows/cm. 15-30	SPT Details: Blows/cm. 30-45	SPT 'N' Value	Sample Details: Depth	Sample Details: No.	Sample Details: Type	Layer Data: Depth (m)	Geotechnical Description
1		11	47	SC			33	38	50B / 4cm →	>100	22.50	15	SS		V. dense. Grayish. Yellowish Silty Sand
2		12	05												
3															
4		12	36	SC			40	52B / 14cm	HR	>100	25.00	16	SS		V. dense, Brownish, Silty sand gravels.
5		12	47												
6															
7		14	30	SC			55B / 13cm	HR		>100	27.50	17	SS		V. Hard. Grayish. Silty Shale.
8		15	10												
9															
0															

Bore Hole Terminated At (27.50) Mts Depth

CS - Core Sample	DS - Disturbed Sample	SUPERVISOR NAME	N. Dhanasekaran	PROJECT SITE DETAILS	
SS - Split Spoon Sample	SC - Soil Cutter	SIGNATURE		GROUND LEVEL (m)	
UDS-Undisturbed Sample	TCB - Tungsten Carbide Bit	DATE	23-04-2022	WATER TABLE (m)	2.60m
WS - Wash Sample	DB - Diamond Bit	CLIENT IN-CHARGE		CASING DEPTH (m)	

GEOMARINE
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SITE INVESTIGATION RECORD

BORE HOLE No.	03
PAGE No.	01
DIA OF BORE HOLE	150mm ✓ / 100mm
BORE START DATE	25-04-2022
BORE END DATE	27-04-2022
TOTAL DRILLING DAYS	03

PROJECT NAME	RAMANIYAM - ANNA NAGAR (12th Main Road)				
LOCATION	Thirumangalam	MACHINE No.	SP-01	CHAINAGE (m)	
STRUCTURE	Slit + BT 9	DRILLING METHOD	Rotary	CO-ORDINATES	N
JOB CODE		FLUSHING MEDIUM	Bentonite		E

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	SPT Details: Blows/cm. 15-30	SPT Details: Blows/cm. 30-45	SPT 'N' Value	Sample Details: Depth	Sample Details: No.	Sample Details: Type	Layer Data: Depth (m)	Geotechnical Description
1	25-04-2022	14	30												
		14	32	SC			9	8	14	22	1.00	1	SS		M. dence., Brownish, Sand
2		14	42												
		14	44	SC			9	10	15	25	2.00	2	SS		M. dence. Brownish, Sand.
3		14	54	SC			21	18	22	40	3.00	3	SS		dence, Brownish, Sand.
		14	56												
4		15	07	SC			10	16	22	38	4.00	4	SS		dence, Brownish, Sand.
		15	08												
		15	28												
5		15	30	SC			6	8	15	23	5.00	5	SS		M. dence. Brownish, Silty clay (MI-A)
6		15	40												
		15	42	SC			7	10	20	30	6.00	6	SS		——— do ———
7		15	56												
		15	59	SC			—	-	-	24	7.50	7	UDS		- - UDS SAMPLE - -
8															
9		16	26				2	2	2	4					
		16	28	SC							9.00	8	SS		Soft clay, Grayish, Silty clay.
10		16	43												
		16	44	SC			6	10	13	23	10.00	9			M. dence., Grayish. clay, Silt.

CS - Core Sample	DS - Disturbed Sample	SUPERVISOR NAME	N. Dhana Sankar	PROJECT SITE DETAILS	
SS - Split Spoon Sample	SC - Soil Cutter	SIGNATURE		GROUND LEVEL (m)	
UDS-Undisturbed Sample	TCB - Tungsten Carbide Bit	DATE	25-04-2022	WATER TABLE (m)	2.60m
WS - Wash Sample	DB - Diamond Bit	CLIENT IN-CHARGE		CASING DEPTH (m)	

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SITE INVESTIGATION RECORD

BORE HOLE No.	03
PAGE No.	02
DIA OF BORE HOLE	150mm ✓ / 100mm
BORE START DATE	25-04-2022
BORE END DATE	
TOTAL DRILLING DAYS	

PROJECT NAME	PAMANIYAM – ANNA NAGAR (D^th MAIN ROAD)				
LOCATION	Thiruvanmiyur	MACHINE No.	SR-01	CHAINAGE (m)	
STRUCTURE	Silt Bed	DRILLING METHOD	Rotary	CO-ORDINATES	N
JOB CODE		FLUSHING MEDIUM	Bentonite		E

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	SPT Details: Blows/cm. 15-30	SPT Details: Blows/cm. 30-45	SPT 'N' Value	Sample Details: Depth	Sample Details: No.	Sample Details: Type	Layer Data: Depth (m)	Geotechnical Description
1	26-04-2022	09	15												
		09	23	SC			15	27	25	52	12.00	10	SS		V. dense Grayish, Silt
2															
3		09	40	SC			8	15	25	40	14.00	11	SS		dense, Grayish, Silt
		09	52												
4															
5		10	27	SC			14	30	50/8cm	>100	16.00	12	SS		V. dense, Greenish. Silt
		10	35												
6															
7		10	51	SC			11	18	22	40	18.00	13	SS		V. Hard, Brownish, Grayish Shale.
		11	30												
8															
9		14	22	SC			17	19	25	44	20.00	14	SS		dense, Grayish, Yellowish, Silty Sand.
		15	03												
0															

CS - Core Sample	DS - Disturbed Sample	SUPERVISOR NAME	M. Dhana Sankar	PROJECT SITE DETAILS	
SS - Split Spoon Sample	SC - Soil Cutter	SIGNATURE		GROUND LEVEL (m)	
UDS-Undisturbed Sample	TCB - Tungsten Carbide Bit	DATE	26-04-2022	WATER TABLE (m)	9.60m.
WS - Wash Sample	DB - Diamond Bit	CLIENT IN-CHARGE		CASING DEPTH (m)	

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SITE INVESTIGATION RECORD

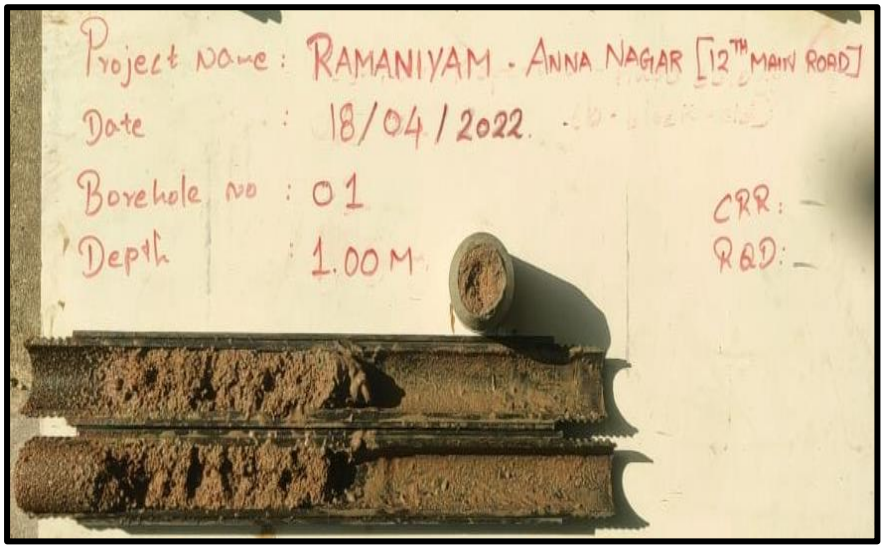
BORE HOLE No.	BH 3
PAGE No.	03
DIA OF BORE HOLE	150mm ✓ / 100mm
BORE START DATE	25-04-22
BORE END DATE	27-04-2022
TOTAL DRILLING DAYS	03

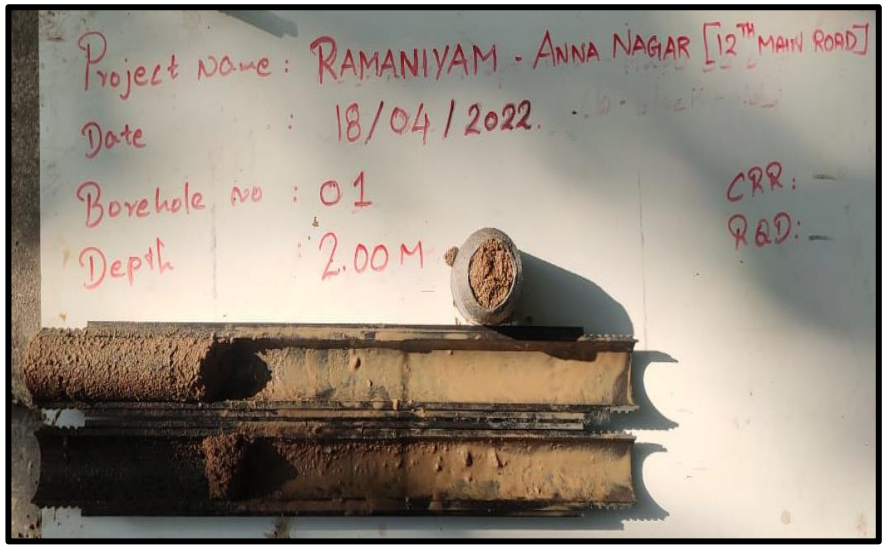
PROJECT NAME: RAMAPURAM - ANNA NAGAR (12th Main Road)
LOCATION: Thirumangalam
STRUCTURE: Silt + Bldg
JOB CODE:
MACHINE No.: SD-01
DRILLING METHOD: Rotary
FLUSHING MEDIUM: Bentonite
CHAINAGE (m):
CO-ORDINATES: N / E

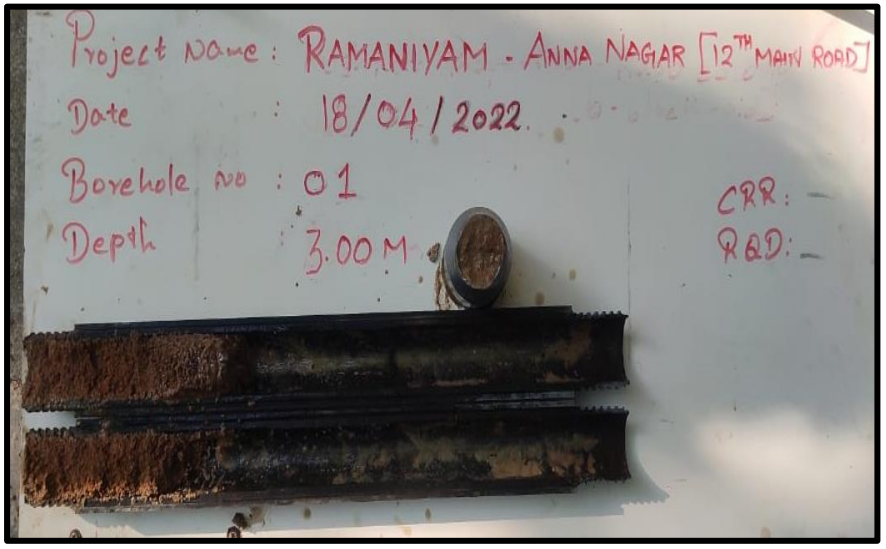
Depth below E.G.L (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	SPT Details: Blows/cm. 15-30	SPT Details: Blows/cm. 30-45	SPT 'N' Value	Sample Details: Depth	Sample Details: No.	Sample Details: Type	Layer Data: Depth (m)	Geotechnical Description
1	26-04-2022	15	46	SC			31	36	30	66	22.50	15	SS		Vidence, Brownish, Silty Sand with gravels.
		16	01												
2															
3															
4		16	32	SC			44	50B/5cm	HR	>100	25.00	16	SS		Vidence, Brownish, Sand gravels.
		16	40												
5															
6		17	10	SC			30	50B/2cm	HR	>100	27.50	17	SS		V. Hard, Grayish Shale.
		17	22												
7	27-04-2022	10	05												
		10	15												
8															
9		11	15	SC			50B/13cm	HR		>100	30.00	18	SS		V. Hard, Grayish Shale.
		11	36												
0															Bore Hole Terminated At (30.00Mts) depth.

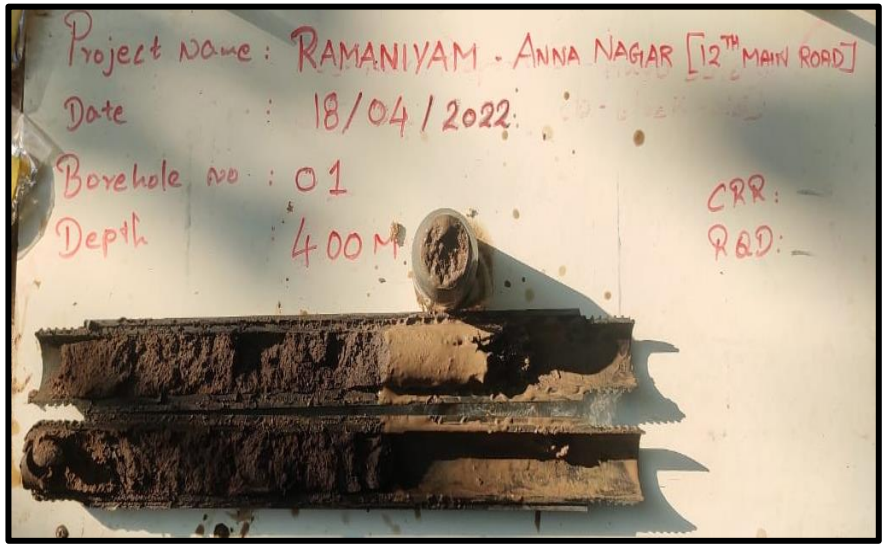
CS - Core Sample	DS - Disturbed Sample	SUPERVISOR NAME	N. Dhana Sankar	PROJECT SITE DETAILS	
SS - Split Spoon Sample	SC - Soil Cutter	SIGNATURE		GROUND LEVEL (m)	
UDS-Undisturbed Sample	TCB - Tungsten Carbide Bit	DATE	27-04-2022	WATER TABLE (m)	2.60M.
WS - Wash Sample	DB - Diamond Bit	CLIENT IN-CHARGE		CASING DEPTH (m)	

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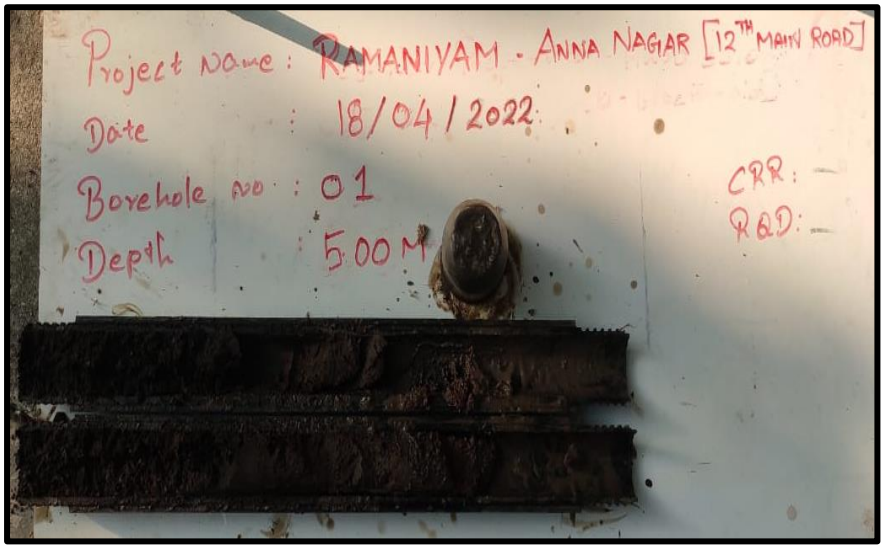








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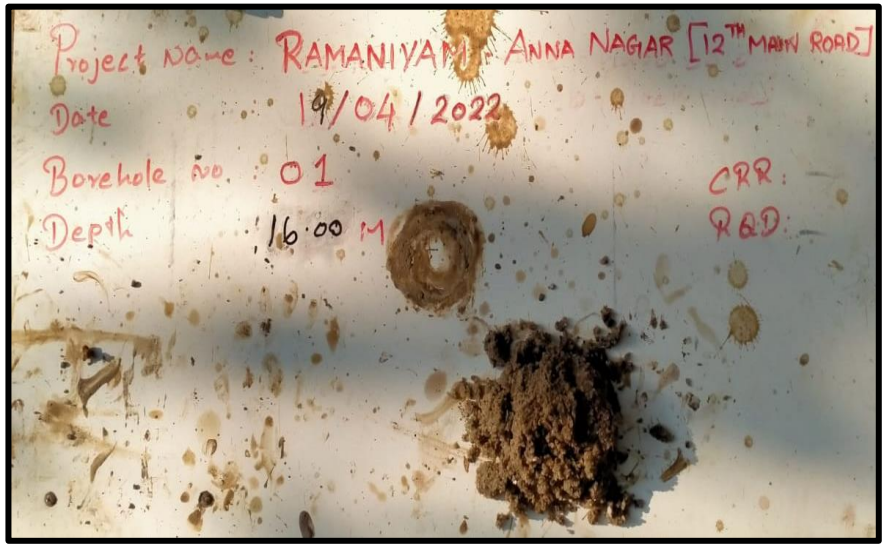


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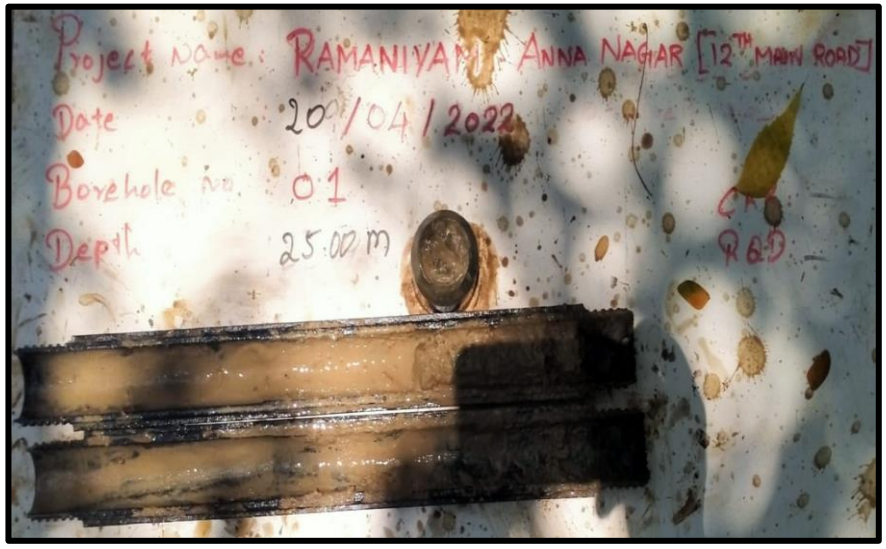


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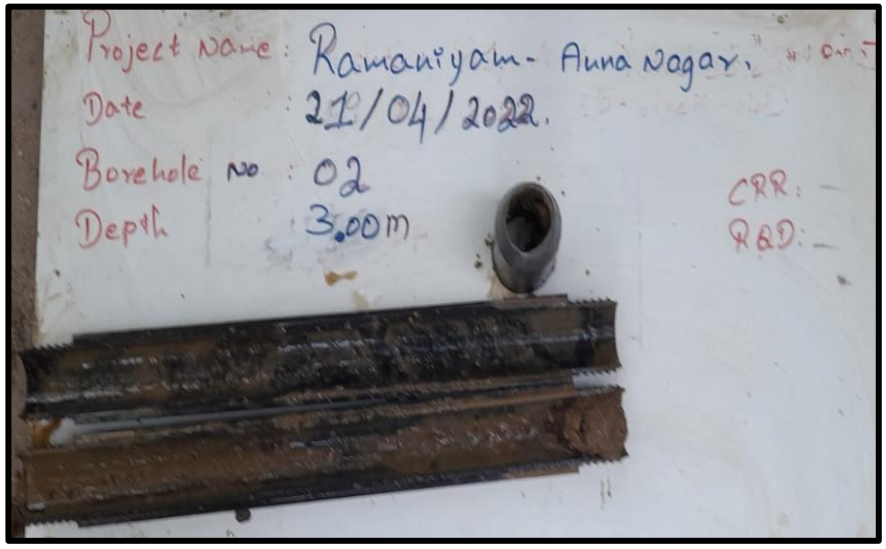


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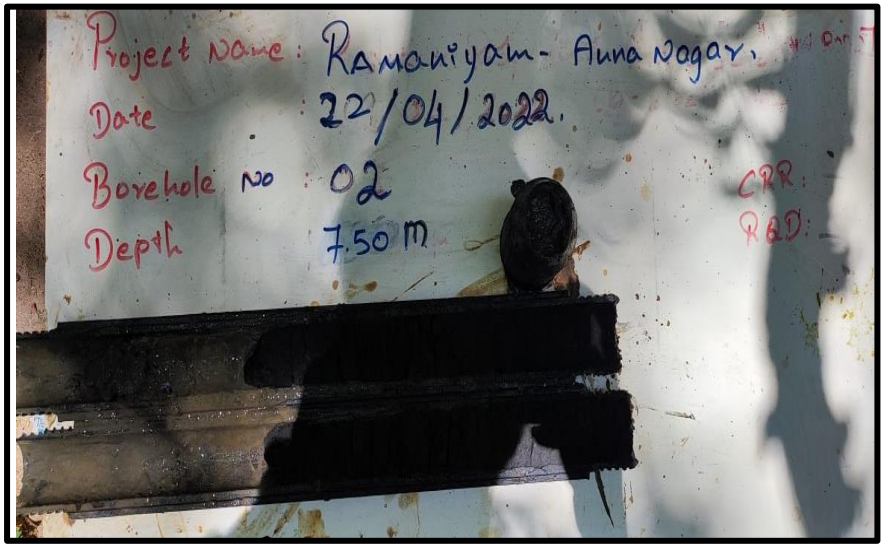


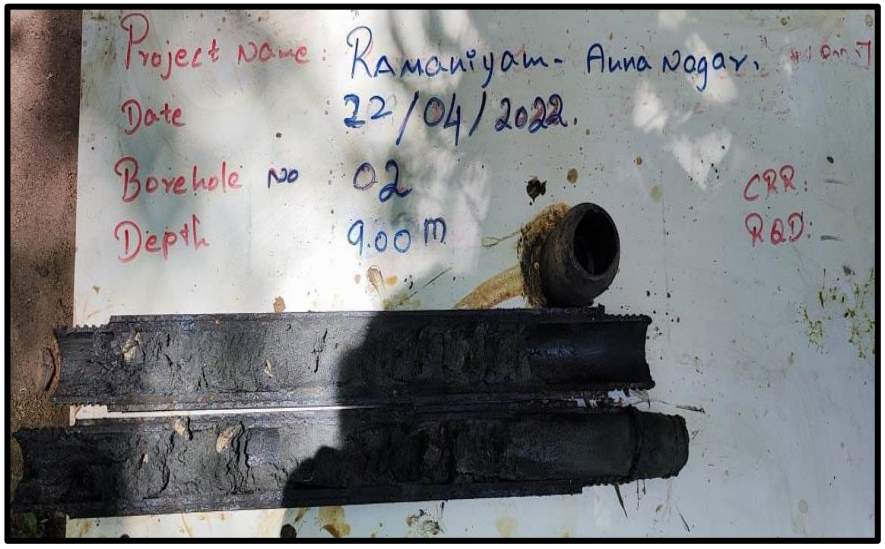


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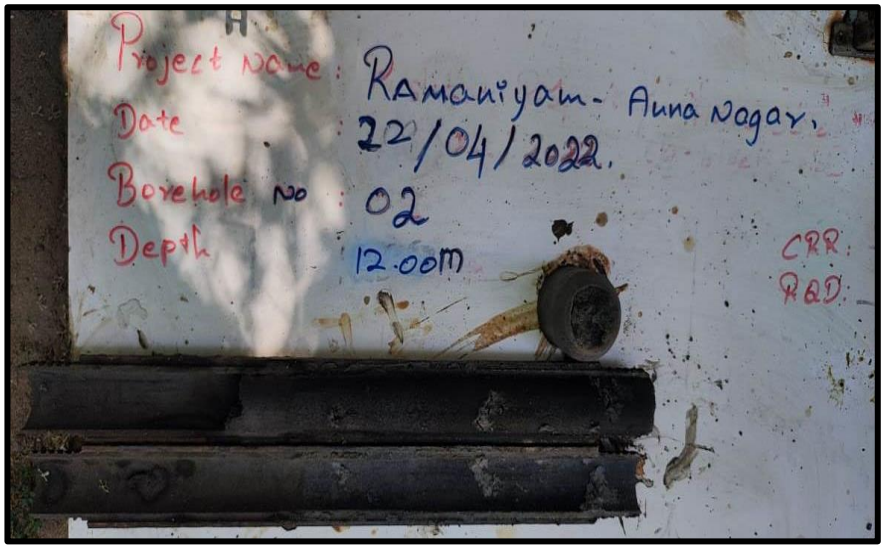






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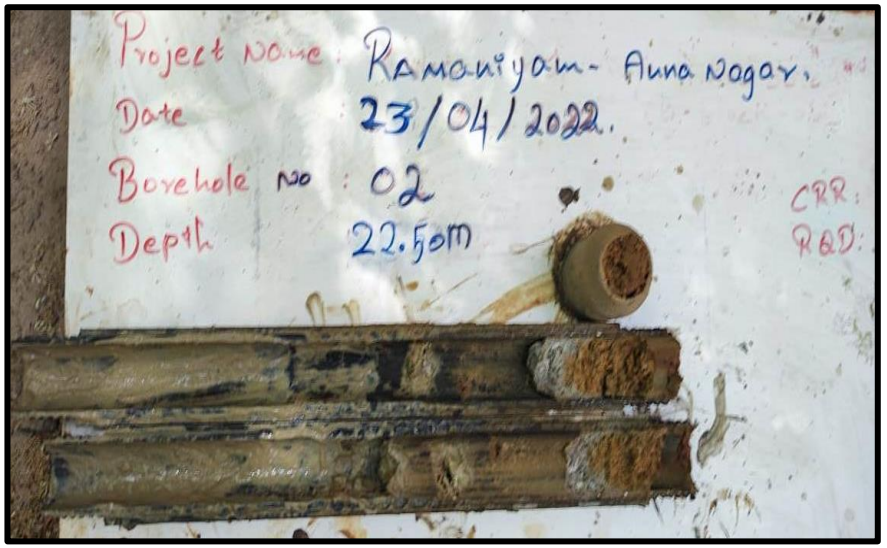


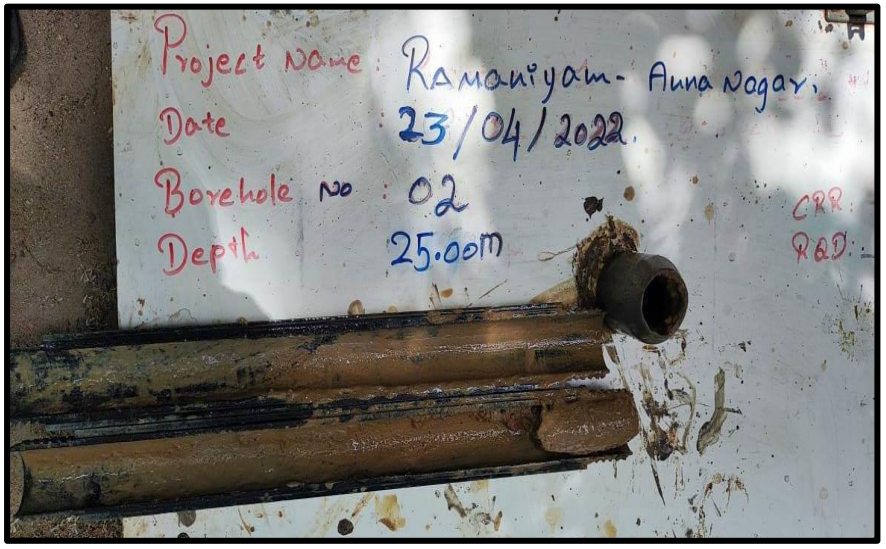




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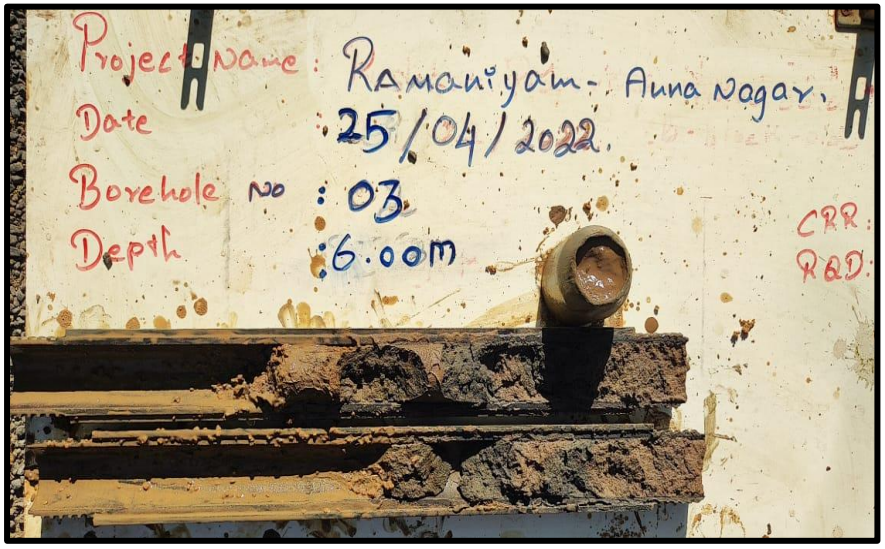




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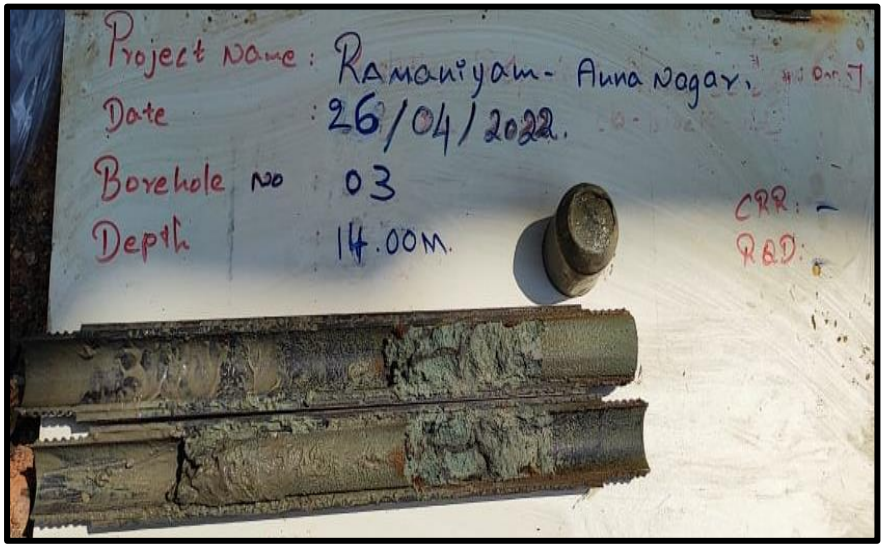




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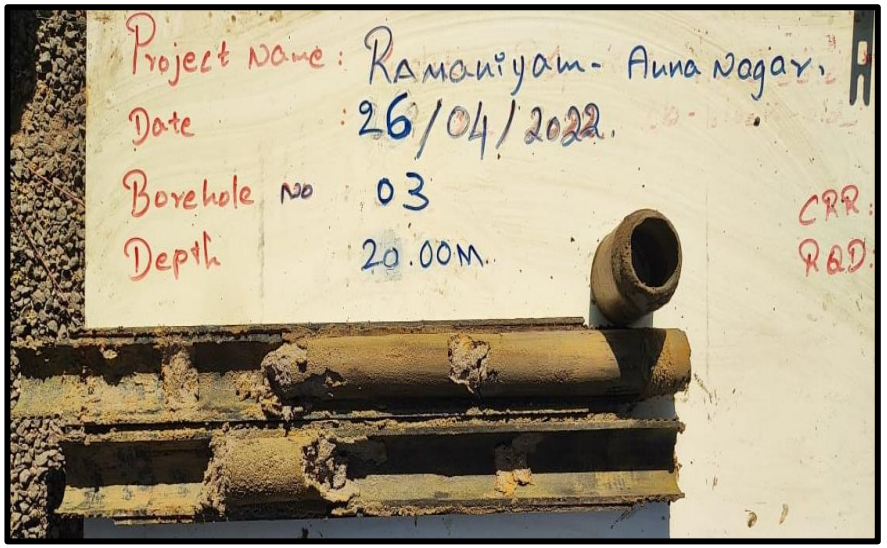






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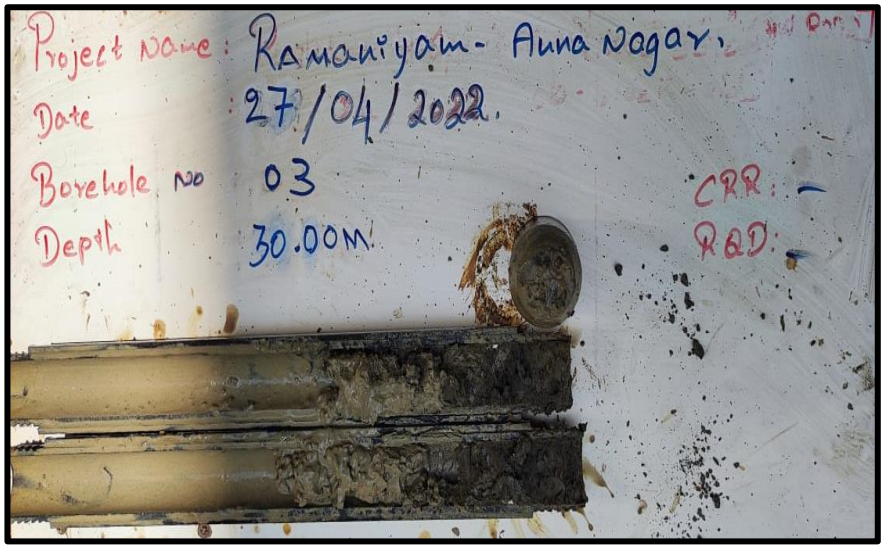




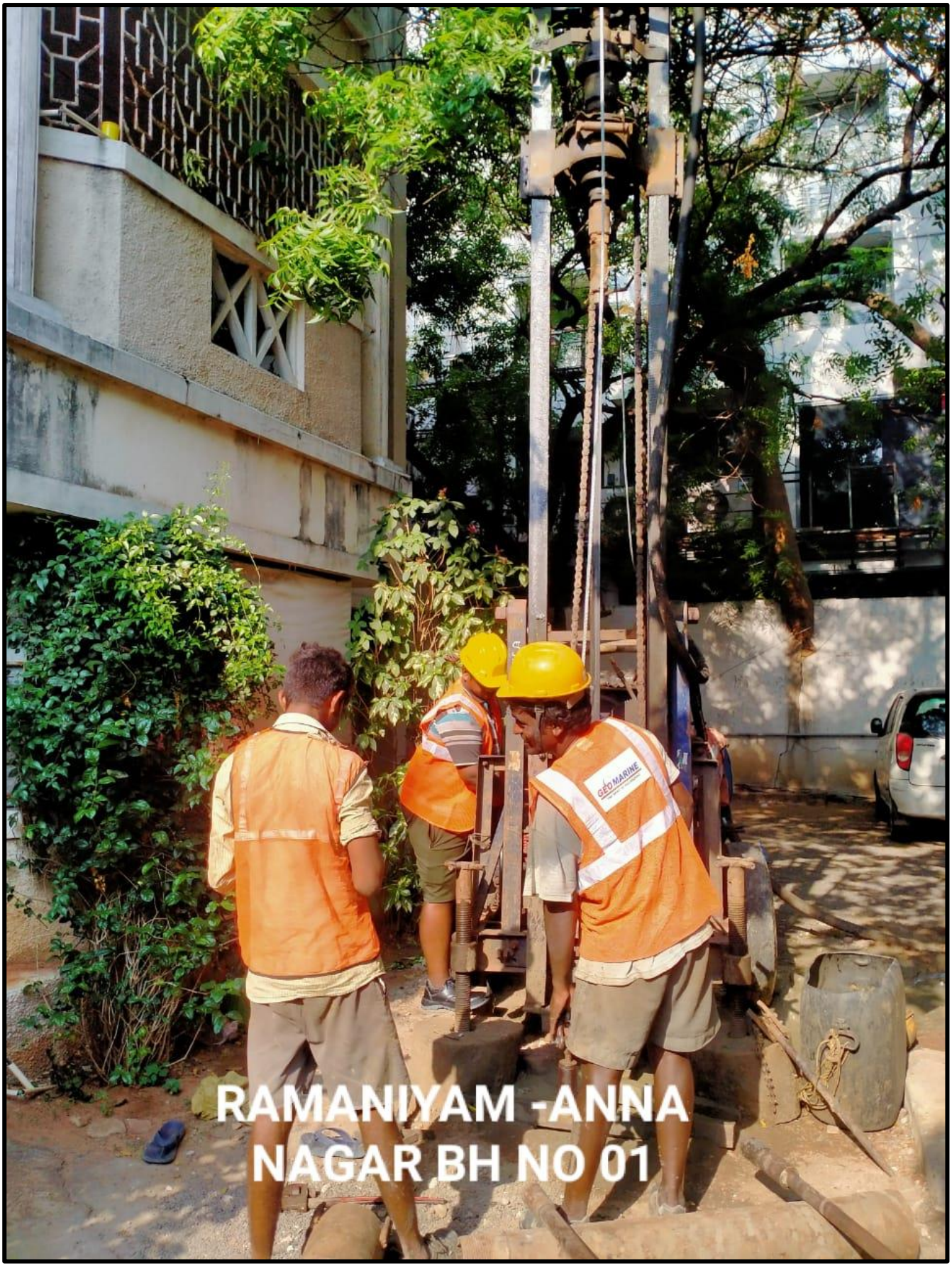


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