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PROJECT

GEOTECHNICAL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING (STILT + 5 FLOORS) AT WEST END STREET, GOPALAPURAM, CHENNAI

CLIENT

M/s SOUTH INDIA SHELTER PRIVATE LIMITED,
NO.14, GULMOHAR AVENUE,
VELACHERY MAIN ROAD, GUINDY,
CHENNAI – 600 032.

TITLE

GEOTECHNICAL INVESTIGATION REPORT

REPORT NO.: GT- 2378

DATE	REVISON	DESCRIPTION		AUTHORISED SIGNATORY
03/06/2022	-	SUBMISSION OF PRELIMINARY REPORT FOR DESIGN OF FOUNDATION	SIGN	
05/07/2022	0.0	SUBMISSION OF GEOTECHNICAL INVESTIGATION REPORT	DATE	03/06/2022
			DESIGNATION	MANAGING DIRECTOR
			NAME	**DR. C.V.PRASAD**

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REPORT TEXT

CHAPTER-1

INTRODUCTION

1.0 PROJECT INFORMATION MATRIX:

NATURE OF PROJECT	**: PROPOSED RESIDENTIAL BUILDING**
STRUCTURE	**: STILT + 5 FLOORS**
PROJECT OWNER	**: M/s SOUTH INDIA SHELTERS PRIVATE LIMITED**
PROJECT LOCATION	**: GOPALAPURAM, CHENNAI**
JOB CODE	**: GT-2378**

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
  - In rock core recovery is checked at every 1.5m depth interval
- 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

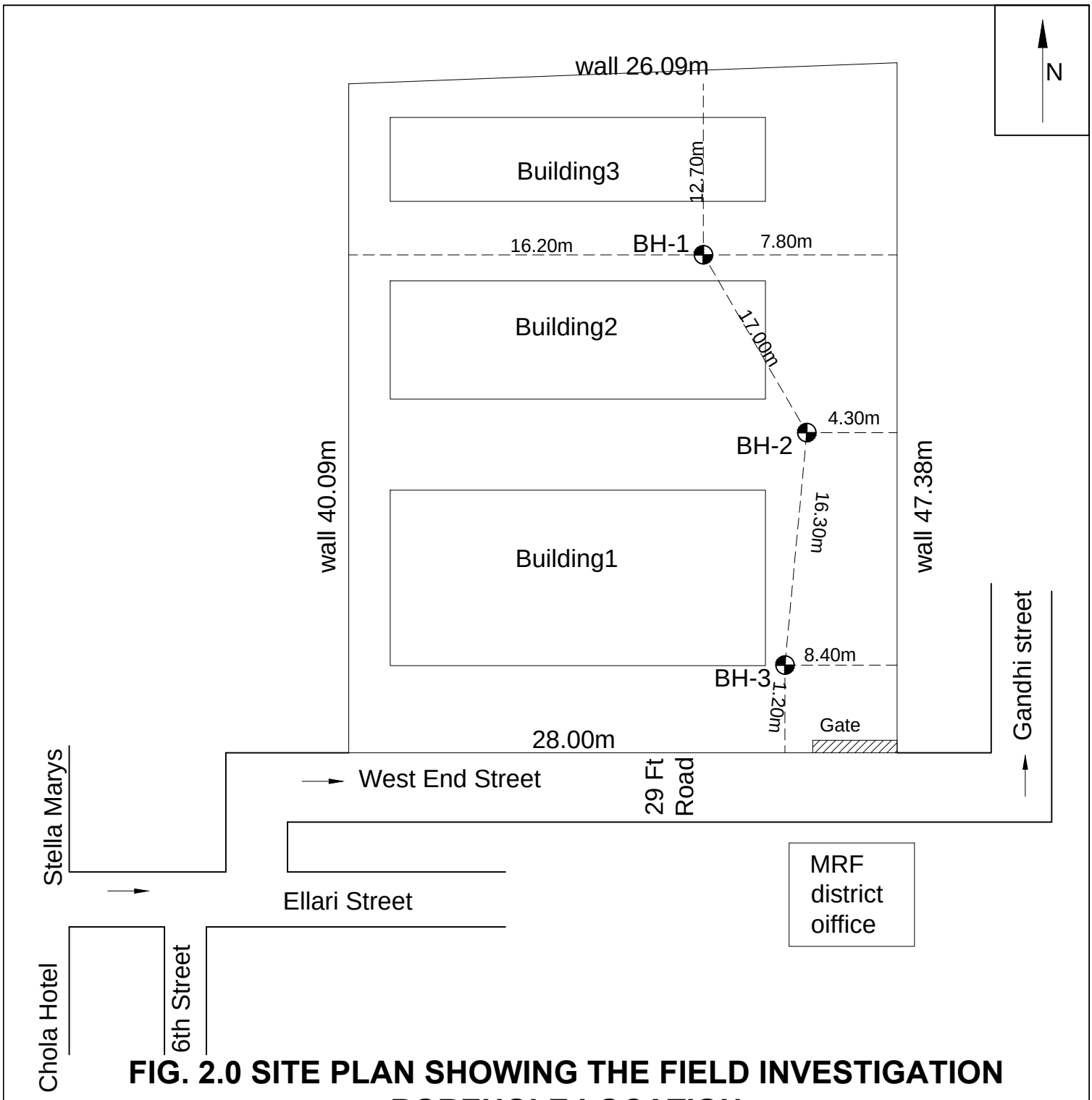


FIG. 2.0 SITE PLAN SHOWING THE FIELD INVESTIGATION BOREHOLE LOCATION

SOIL PROFILES

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SITE INVESTIGATION RECORD

BORE HOLE No.	BH-01		
SHEET	1	OF	2
DIA OF BORE HOLE	150mm ✓		
	NX		

PROJECT NAME	PROPOSED CONSTRUCTION OF A RESIDENTIAL BUILDING					BORE START DATE	16/05/2022
LOCATION	Gopalapuram, Chennai	MACHINE No.	-	CHAINAGE (m)	-		
STRUCTURE	Stilt + 5 Upper Floors	DRILLING METHOD	Rotary	CO-ORDINATES	N -	BORE END DATE	17/05/2022
JOB CODE	GT-2378	FLUSHING MEDIUM	Bentonite		E -	TOTAL DRILL DAYS	2

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
		10	20															
			To	SC	-	-												
		10	21															
1							4	6	7	13	1.00	1	SS	-1.0				
		10	38								1.45 ↓							
			To	SC	-	-												
		10	39															
2							4	6	9	15	2.00	2	SS	-2.0				Brown,Moist,Stiff,**Silty CLAY (CI) With Sand Mix** Lean Clay of Medium Plasticity
		10	55								2.45 ↓							
			To	SC	-	-												
		10	57															
3							-	-	-	-	3.00	3	UDS	-3.0				
		11	20															
			To	SC	-	-												
		11	22															
4							2	3	4	7	4.00	4	SS	-4.0		L1	4.0	
		11	37								4.45 ↓							Grey to Black,Moist,Medium Stiff, **Sandy Silty CLAY (CI)** Sandy Silty Clay of Medium Plasticity
			To	SC	-	-												
		11	38															
5	16/05/2022						2	2	2	4	5.00	5	SS	-5.0		L2	5.0	
		11	55								5.45 ↓							
			To	SC	-	-												
		11	56															
6							1	1	1	2	6.00	6	SS	-6.0				
		12	35								6.45 ↓							
			To	SC	-	-												
		12	37															Grey to Black,Moist,Very Soft & Soft, **Silty CLAY (CI)** Lean Clay of Medium Plasticity
7							-	-	-	-	7.50	7	UDS	-7.5				
		14	10															
8			To	SC	-	-												
		14	11															
9							6	8	8	16	9.00	8	SS	-9.0		L3	9.0	
		14	50								9.45 ↓							Grey,Moist,Poorly Graded,Fine & Medium Grains Sand,Medium Dense, **Silty SAND (SM)**
			To	SC	-	-												
10		14	51															

CS - Core Sample	DS - Disturbed Sample	LOGGED	K. Selvam	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	16/05/2022	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	A.VINOTH	WATER TABLE (m) 2.20	
WS - Wash Sample	DB - Diamond Bit	DATE	31/05/2022	CASING DEPTH (m) 0.00	

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SITE INVESTIGATION RECORD

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

PROJECT NAME	PROPOSED CONSTRUCTION OF A RESIDENTIAL BUILDING					BORE START DATE	16/05/2022
LOCATION	Gopalapuram, Chennai	MACHINE No.	-	CHAINAGE (m)	-		
STRUCTURE	Stilt + 5 Upper Floors	DRILLING METHOD	Rotary	CO-ORDINATES	N -	BORE END DATE	17/05/2022
JOB CODE	GT-2378	FLUSHING MEDIUM	Bentonite		E -	TOTAL DRILL DAYS	2

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)	Layer Data: Legend	No	Depth	Geotechnical Description
11	16/05/2022	15	45	SC	-	-	5	5	6	11	10.50	-	*SS	-10.5				Grey,Moist,Poorly Graded,Fine & Medium Grains Sand,Medium Dense, **Silty SAND (SM)**
		To									10.95							
		15	47															
12							2	2	4	6	12.00	9	SS	-12.0		L4	12.0	
											12.45							
13		16	10	SC	-	-												Grey to Black,Moist,Medium Stiff, **Silty CLAY (CI)** Lean Clay of Medium Plasticity
		To																
		16	12															
14							7	12	13	25	14.00	10	SS	-14.0		L5	14.0	
											14.45							
15		16	45	SC	-	-												Grey Green,Moist,Poorly Graded,Fine & Medium Grains,Medium Dense, **Clayey Silty SAND (SC)**
		To																
		16	47															
16							11	27	10cm Penet for 55Blows	>100	16.00	11	SS	-16.0		L6	16.0	
											16.40							
17		09	05	SC	-	-												
		To																
		09	20															
18	17/05/2022						15cm Penet for 55Blows			>100	18.00	12	SS	-18.0				Offwhite Grey & Brown Grey,Moist, Poorly Graded,Fine & Medium Grains Sand,Very Dense,**Clayey Silty SAND (SC) & Silty SAND (SM)/ Partially Weathered Rock**
											18.15							
19		11	10	SC	-	-												
		To																
		11	24															
20							5cm Penet for 50Blows			>100	20.00	13	SS	-20.0		L7	20.0	
											20.05				+ + +	L8	20.1	Very Dense,**Completely Weathered Rock W5 Grade of Rock**

CS - Core Sample	DS - Disturbed Sample	LOGGED	K. Selvam	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	17/05/2022	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	A.VINOTH	WATER TABLE (m) 2.20	
WS - Wash Sample	DB - Diamond Bit	DATE	31/05/2022	CASING DEPTH (m) 0.00	

Borehole terminated at 20 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	2
DIA OF BORE HOLE	150mm ✓		
	NX		

PROJECT NAME	PROPOSED CONSTRUCTION OF A RESIDENTIAL BUILDING					BORE START DATE	18/05/2022
LOCATION	Gopalapuram, Chennai	MACHINE No.	-	CHAINAGE (m)	-		
STRUCTURE	Stilt + 5 Upper Floors	DRILLING METHOD	Rotary	CO-ORDINATES	N -	BORE END DATE	19/05/2022
JOB CODE	GT-2378	FLUSHING MEDIUM	Bentonite		E -	TOTAL DRILL DAYS	2

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	18/05/2022	11	20	SC	-	-												
		To																
		11	22				7	11	10	21	1.00	1	SS	-1.0				Brown,Moist,Very Stiff,**Sandy Silty CLAY (CL)** Sandy Silty Clay of Low Plasticity
		11	35								1.45							
		To		SC	-	-												
2		11	37				3	5	7	12	2.00	2	SS	-2.0		L1	2.0	
		11	50								2.45							
		To		SC	-	-												
3		11	52				3	4	6	10	3.00	3	SS	-3.0				Brown,Moist,Stiff,**Silty CLAY (CI)** With Sand Mix Lean Clay of Medium Plasticity
		12	07								3.45							
		To		SC	-	-												
4		12	09				-	-	-	-	4.00	4	UDS	-4.0		L2	4.0	
		12	30															
		To		SC	-	-												
5		12	31				1	1	2	3	5.00	5	SS	-5.0				Grey to Black,Moist,Very Soft,**Silty CLAY (CH)** Clay of High Plasticity
		16	01								5.45							
		To		SC	-	-												
6		16	02				1	1	2	3	6.00	6	SS	-6.0		L3	6.0	
		16	27								6.45							
		To		SC	-	-												
7		16	28															Grey,Moist,Poorly Graded,Fine & Medium Grains Sand,Very Loose, **Clayey Silty SAND (SC)**
							4	8	10	18	7.50	7	SS	-7.5		L4	7.5	
											7.95							
8		16	50															
		To		SC	-	-												
		16	51															
9							5	7	8	15	9.00	8	SS	-9.0				Grey,Moist,Poorly Graded,Fine & Medium Grains Sand,Medium Dense, **Silty SAND (SM)**
	19/05/2022										9.45							
		08	55															
		To		SC	-	-												
10		08	56															

CS - Core Sample	DS - Disturbed Sample	LOGGED	K. Selvam	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	19/05/2022	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	A. Vinoth	WATER TABLE (m) 2.50	
WS - Wash Sample	DB - Diamond Bit	DATE	31/05/2022	CASING DEPTH (m) 0.00	

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SITE INVESTIGATION RECORD

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

PROJECT NAME	PROPOSED CONSTRUCTION OF A RESIDENTIAL BUILDING					BORE START DATE	18/05/2022
LOCATION	Gopalapuram, Chennai	MACHINE No.	-	CHAINAGE (m)	-		
STRUCTURE	Stilt + 5 Upper Floors	DRILLING METHOD	Rotary	CO-ORDINATES	N -	BORE END DATE	19/05/2022
JOB CODE	GT-2378	FLUSHING MEDIUM	Bentonite		E -	TOTAL DRILL DAYS	2

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)	Layer Data: Legend	No	Depth	Geotechnical Description
							2	2	2	**4**	10.50	9	SS	-10.5		L5	10.5	Grey,Moist,Poorly Graded,Fine & Medium Grains Sand,Medium Dense, **Silty SAND (SM)**
11		09 To 09	20 21	SC	-	-					10.95							Grey,Moist,Poorly Graded,Fine & Medium Grains Sand,Very Loose, **Clayey Silty SAND (SC)**
12							1	3	8	**11**	12.00	10	SS	-12.0		L6	12.0	
											12.45							
13		09 To 09	40 42	SC	-	-												
14							7	6	11	**17**	14.00	11	SS	-14.0				Grey Green,Brown Grey,Moist,Poorly Graded,Fine & Medium Grains,Medium Dense, **Clayey Silty SAND (SC)**
											14.45							
15	19/05/2022	10 To 10	05 07	SC	-	-												
16							33	10cm Penet for 55blows		**>100**	16.00	12	SS	-16.0		L7	16.0	
											16.25							
17		11 To 11	12 24	SC	-	-												Brown Grey,Moist,Poorly Graded,Fine & Medium Grains Sand,Very Dense, **Clayey Silty SAND (SC)**
18								5cm Penet for 35Blows		**>100**	18.00	13	SS	-18.0		L8	18.0	
											18.05				+ + +			
19		12 To 12	15 34	SC	-	-									+ + +			Brown Grey,Moist,Fine to Coarse Grain Sand With Gravels Size Particles,Very Dense,**Completely Weathered Rock - Grade W5 Rock Formation** Disintegrated Hypersthene Granite Rock
20								SPT Hammer Rebound		**>100**	20.00	14	SS	-20.0	+ + +	L9	20.0	

CS - Core Sample	DS - Disturbed Sample	LOGGED	K. Selvam	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	19/05/2022	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	A. Vinoth	WATER TABLE (m) 2.50	
WS - Wash Sample	DB - Diamond Bit	DATE	31/05/2022	CASING DEPTH (m) 0.00	

Borehole terminated at 20 m depth below E.G.L

FIG.2.2 Sub Soil Profile at BH-02 Location

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SITE INVESTIGATION RECORD

BORE HOLE No.	BH-03
SHEET	1 OF 3

PROJECT NAME	PROPOSED CONSTRUCTION OF A RESIDENTIAL BUILDING					DIA OF BORE HOLE	150mm ✓ / NX
LOCATION	Gopalapuram, Chennai	MACHINE No.	-	CHAINAGE (m)	-	BORE START DATE	20/05/2022
STRUCTURE	Stilt + 5 Upper Floors	DRILLING METHOD	Rotary	CO-ORDINATES	N -	BORE END DATE	20/05/2022
JOB CODE	GT-2378	FLUSHING MEDIUM	Bentonite		E -	TOTAL DRILL DAYS	1

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min.	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	15-30	30-45	SPT 'N' Value	Sample Details: Depth	No.	Type	RL (m)	Layer Data: Legend	No	Depth	Geotechnical Description
1	20/05/2022	09	10	SC	-	-												
		To																
		09	12				4	7	9	16	1.00 ↓ 1.45	1	SS	-1.0				Brown,Moist,Very Stiff,**Sandy Silty CLAY (Cl)** Sandy Silty Clay of Medium Plasticity
		09	25	SC	-	-												
		To																
2		09	27				5	15	23	38	2.00 ↓ 2.45	2	SS	-2.0		L1	2.0	
		09	40															Brown Grey,Moist,Hard,**Sandy Silty CLAY (CL)** Sandy Silty Clay of Low Plasticity
		To		SC	-	-												
3		09	41				9	12	13	25	3.00 ↓ 3.45	3	SS	-3.0		L2	3.0	
		10	05															
		To		SC	-	-												
4		10	06				6	6	8	14	4.00 ↓ 4.45	4	SS	-4.0				Grey Brown,Moist,Fine & Medium Grains Sand,Medium Dense, **Silty SAND (SM)**
		10	30															
		To		SC	-	-												
5		10	31				1	1	1	2	5.00 ↓ 5.45	5	SS	-5.0		L3	5.0	
		10	52															
		To		SC	-	-												
6		10	53				1	0	1	1	6.00 ↓ 6.45	6	SS	-6.0		L4	6.0	Grey to Black,Moist,Very Soft,**Silty CLAY (CH)** Clays of High Plasticity
		11	20															
		To		SC	-	-												
7		11	21															Grey,Moist,Poorly Graded,Fine & Medium Grains,Very Loose,**Clayey Silty SAND (SC)**
							4	6	10	16	7.50 ↓ 7.95	7	SS	-7.5		L5	7.5	
8		12	00															
		To		SC	-	-												
		12	01															
9							7	8	9	17	9.00 ↓ 9.45	8	SS	-9.0				Grey,Moist,Poorly Graded,Fine & Medium Grains,Medium Dense,**Silty SAND (SM)**
		12	24															
		To		SC	-	-												
10		12	25															

CS - Core Sample	DS - Disturbed Sample	LOGGED	K. Selvam	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	20/05/2022	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	A. Vinoth	WATER TABLE (m) 2.50	
WS - Wash Sample	DB - Diamond Bit	DATE	31/05/2022	CASING DEPTH (m) 0.00	

GEOMARINE
THE SPIRIT OF ENGINEERING

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	Gopalapuram, Chennai	MACHINE No.	-	CHAINAGE (m)	-	BORE START DATE	20/05/2022
STRUCTURE	Stilt + 5 Upper Floors	DRILLING METHOD	Rotary	CO-ORDINATES	N -	BORE END DATE	20/05/2022
JOB CODE	GT-2378	FLUSHING MEDIUM	Bentonite		E -	TOTAL DRILL DAYS	1

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min.	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	15-30	30-45	SPT 'N' Value	Sample Details: Depth	No.	Type	RL (m)	Layer Data: Legend	No	Depth	Geotechnical Description
							2	2	2	**4**	10.50	9	SS	-10.5		L6	10.5	Grey,Moist,Poorly Graded,Fine & Medium Grains,Medium Dense,**Silty SAND (SM)**
11		12	42								10.95							
		To		SC	-	-												Grey,Moist,Poorly Graded,Fine & Medium Grains,Very Loose,**Clayey Silty SAND (SC)**
		12	43															
12							2	3	3	**6**	12.00	10	SS	-12.0		L7	12.0	
											12.45							
		14	00															
13		**To**		SC	-	-												Grey to Black,Moist,Medium Stiff,**Silty CLAY (CI)** Clay of Medium Plasticity
		14	02															
14							5	8	8	**16**	14.00	11	SS	-14.0		L8	14.0	
											14.45							
		14	35															
15	**20/05/2022**	**To**		SC	-	-												Grey Green,Moist,Poorly Graded,Fine & Medium Grains Sand,Medium Dense, **Silty SAND (SM) With Binder**
		14	50															
16							4cm Penet for 50Blows			**>100**	16.00	12	SS	-16.0		L9	16.0	
											16.04							
		15	20															
17		**To**		DB	0	0												Brown Grey,Moist,Fine to Coarse Grain Sand With Gravels Size Particles,Very Dense,**Completely Weathered Rock - Grade W5 Rock Formation** Disintegrated Hypersthene Granitic Rock
		15	33															
18							-	-	-	**-**	18.00	-	WS	-18.0				
		16	05															
19		**To**		DB	0	0												
		16	20															
20							-	-	-	**-**	20.00	-	WS	-20.0		L10	20.0	

CS - Core Sample	DS - Disturbed Sample	LOGGED	K. Selvam	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	20/05/2022	GROUND LEVEL (m)	0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	A. Vinoth	WATER TABLE (m)	2.50	
WS - Wash Sample	DB - Diamond Bit	DATE	31/05/2022	CASING DEPTH (m)	0.00	

GEOMARINE
THE SPIRIT OF ENGINEERING

SITE INVESTIGATION RECORD

BORE HOLE No.	BH-03		
SHEET	2	OF	3
DIA OF BORE HOLE	150mm ✓		
	NX		

PROJECT NAME	PROPOSED CONSTRUCTION OF A RESIDENTIAL BUILDING					BORE START DATE	20/05/2022
LOCATION	Gopalapuram, Chennai	MACHINE No.	-	CHAINAGE (m)	-		
STRUCTURE	Stilt + 5 Upper Floors	DRILLING METHOD	Rotary	CO-ORDINATES	N -	BORE END DATE	20/05/2022
JOB CODE	GT-2378	FLUSHING MEDIUM	Bentonite		E -	TOTAL DRILL DAYS	1

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min.	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	15-30	30-45	SPT 'N' Value	Sample Details: Depth	No.	Type	RL (m)	Layer Data: Legend	No	Depth	Geotechnical Description
21	20/05/2022	16 To 17	45 34	DB	37	14	-	-	-	-	21.50	13	CS	-21.5	+ +	L11	21.5	Grey,Brown Grey,Medium & Coarse Grain Structure,Highly Fractured & Disintegrated at Times,**Moderately Weathered Rock - Grade W3 Rock Formation** Hypersthene Granitic Rock
22																		
23																		
24																		
25																		
26																		
27																		
28																		
29																		
30																		

CS - Core Sample	DS - Disturbed Sample	LOGGED	K. Selvam	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	20/05/2022	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	A. Vinoth	WATER TABLE (m) 2.50	
WS - Wash Sample	DB - Diamond Bit	DATE	31/05/2022	CASING DEPTH (m) 0.00	

Borehole terminated at 21.5 m depth below E.G.L

FIG.2.3 Sub Soil Profile at BH-03 Location

CROSS SECTION PROFILE

GRAIN SIZE DISTRIBUTION CURVE

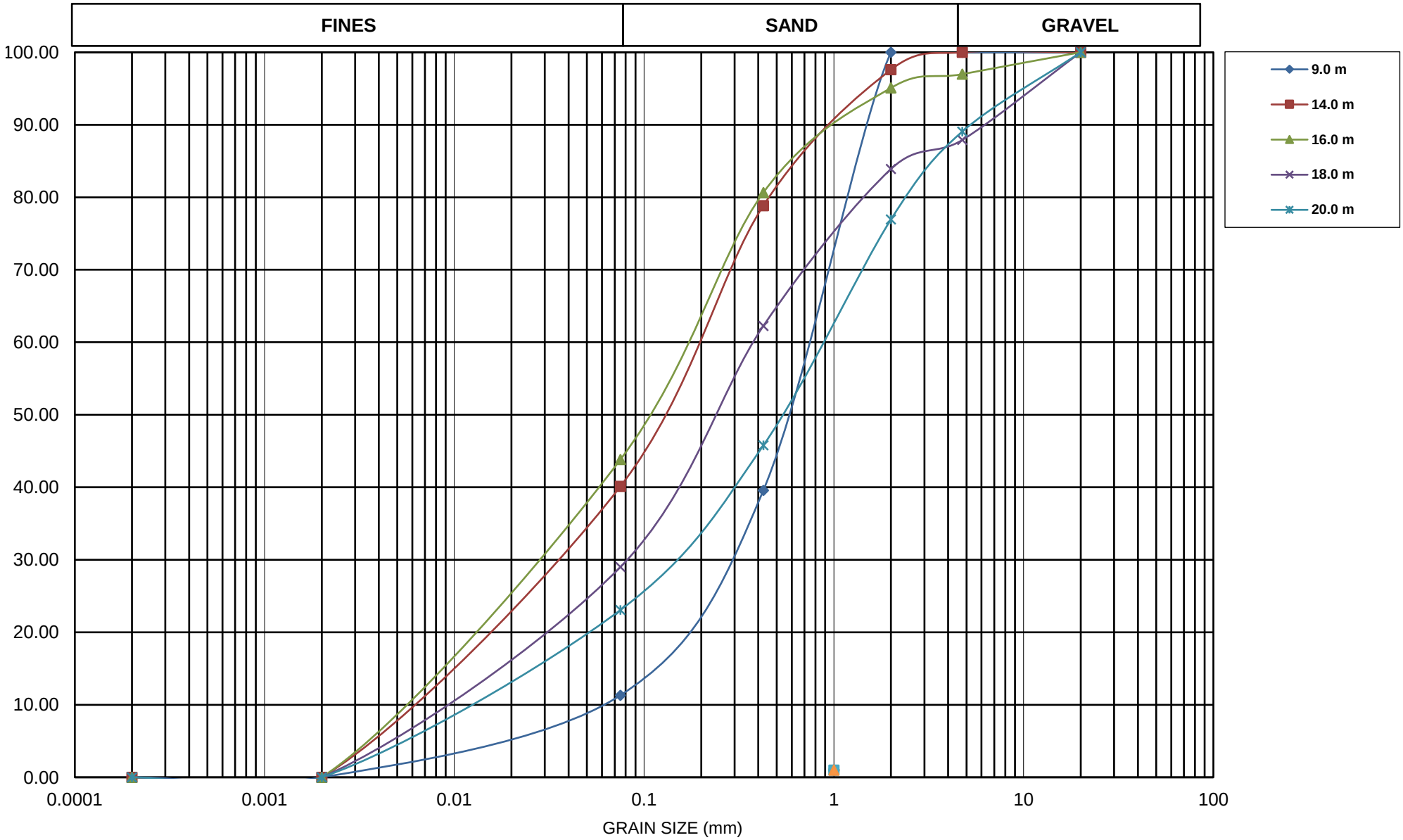


Fig. 2.5 GRAIN SIZE DISTRIBUTION CURVE - BH-01

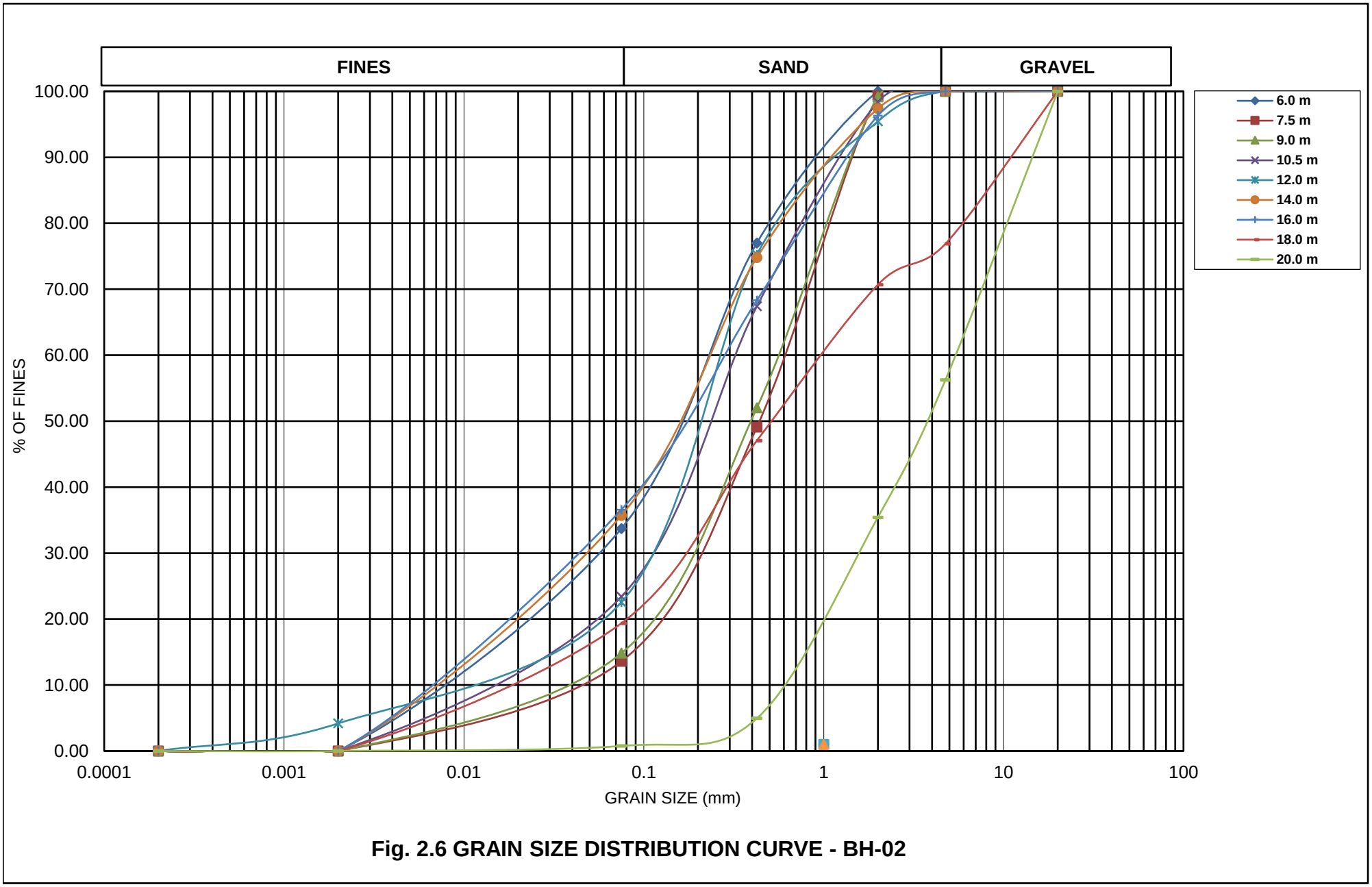


Fig. 2.6 GRAIN SIZE DISTRIBUTION CURVE - BH-02

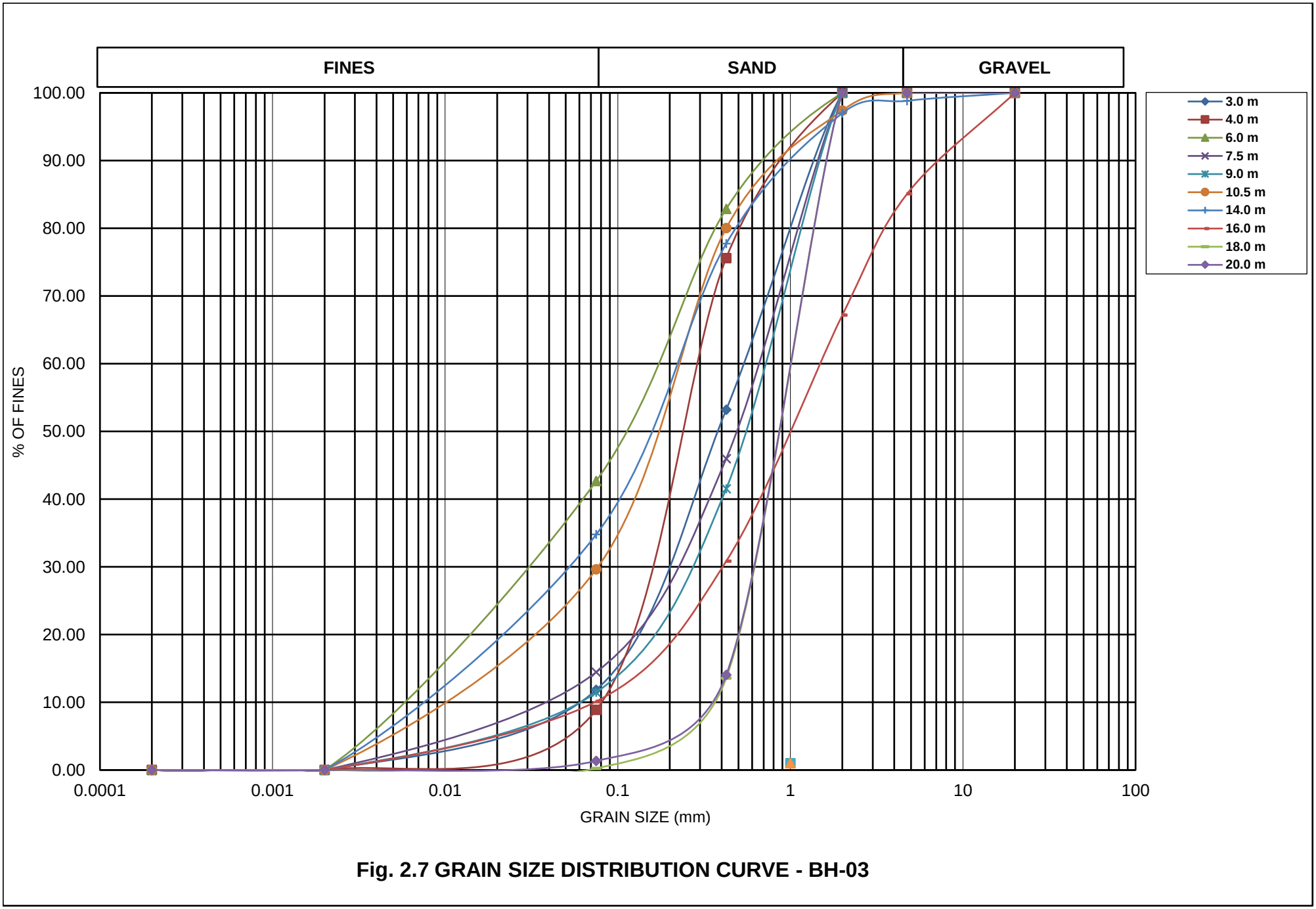


Fig. 2.7 GRAIN SIZE DISTRIBUTION CURVE - BH-03

HYDROMETER ANALYSIS CURVE

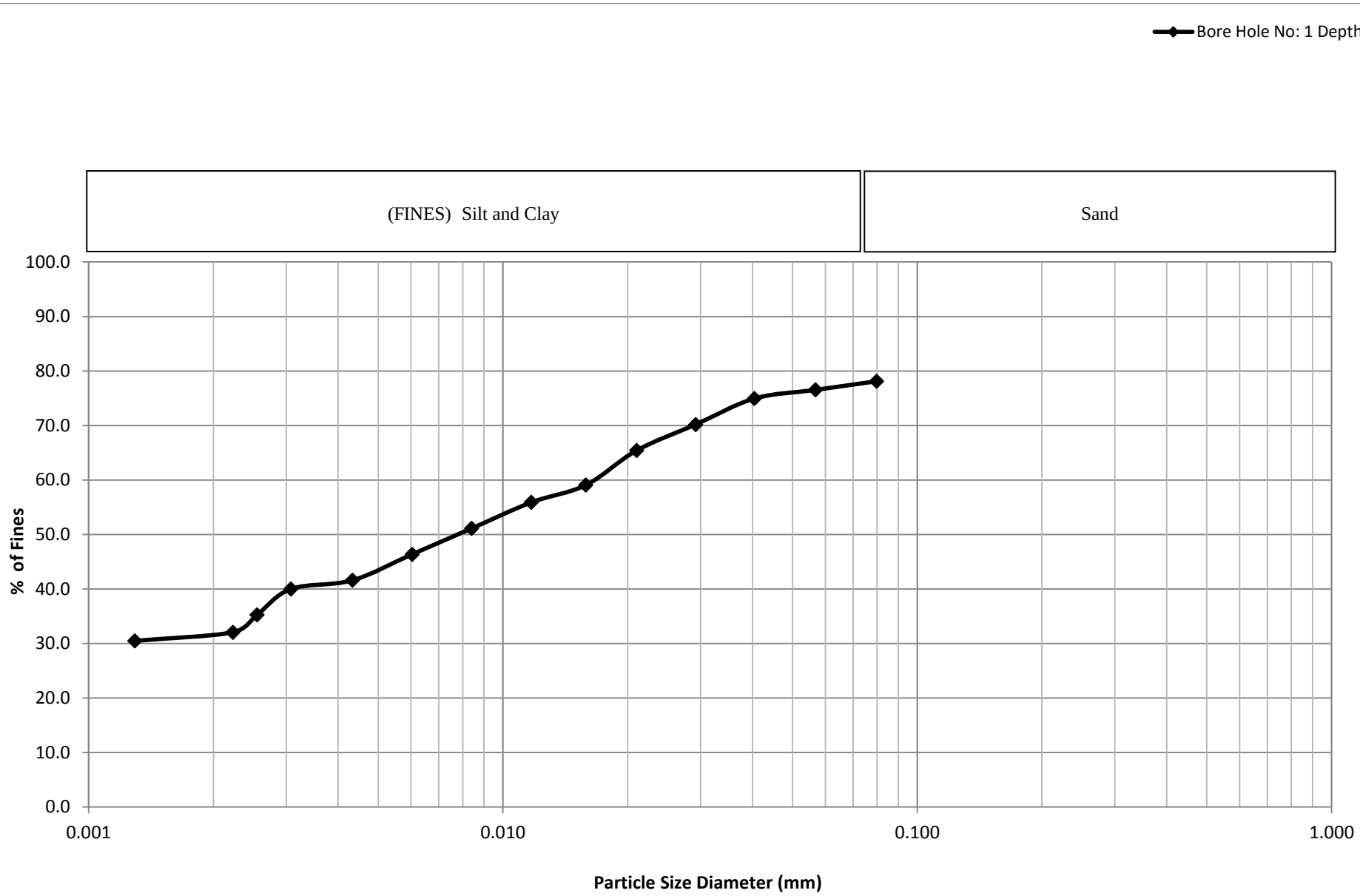


Fig 2.8 Hydrometer Analysis Master Curve

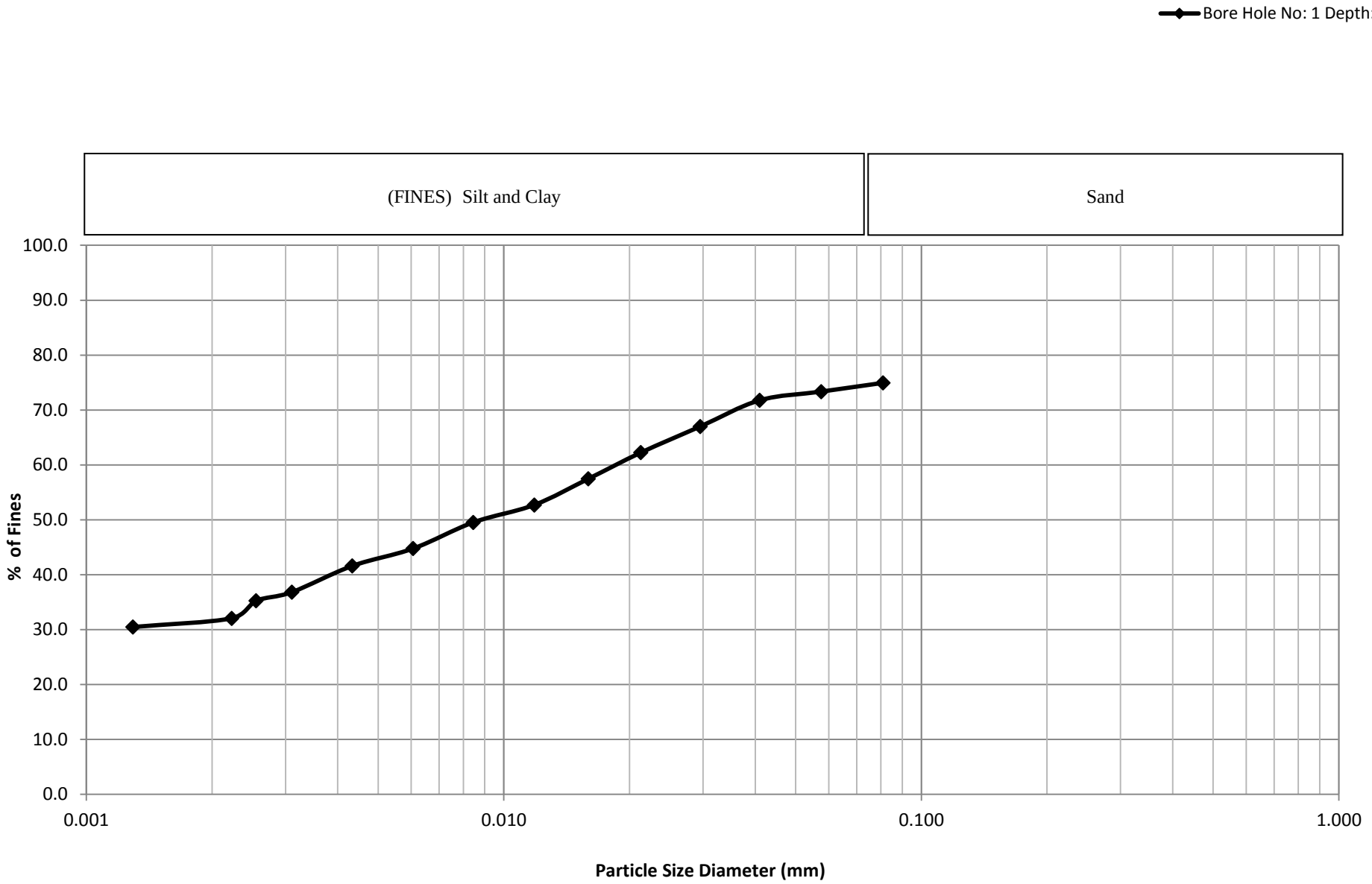


Fig 2.9 Hydrometer Analysis Master Curve

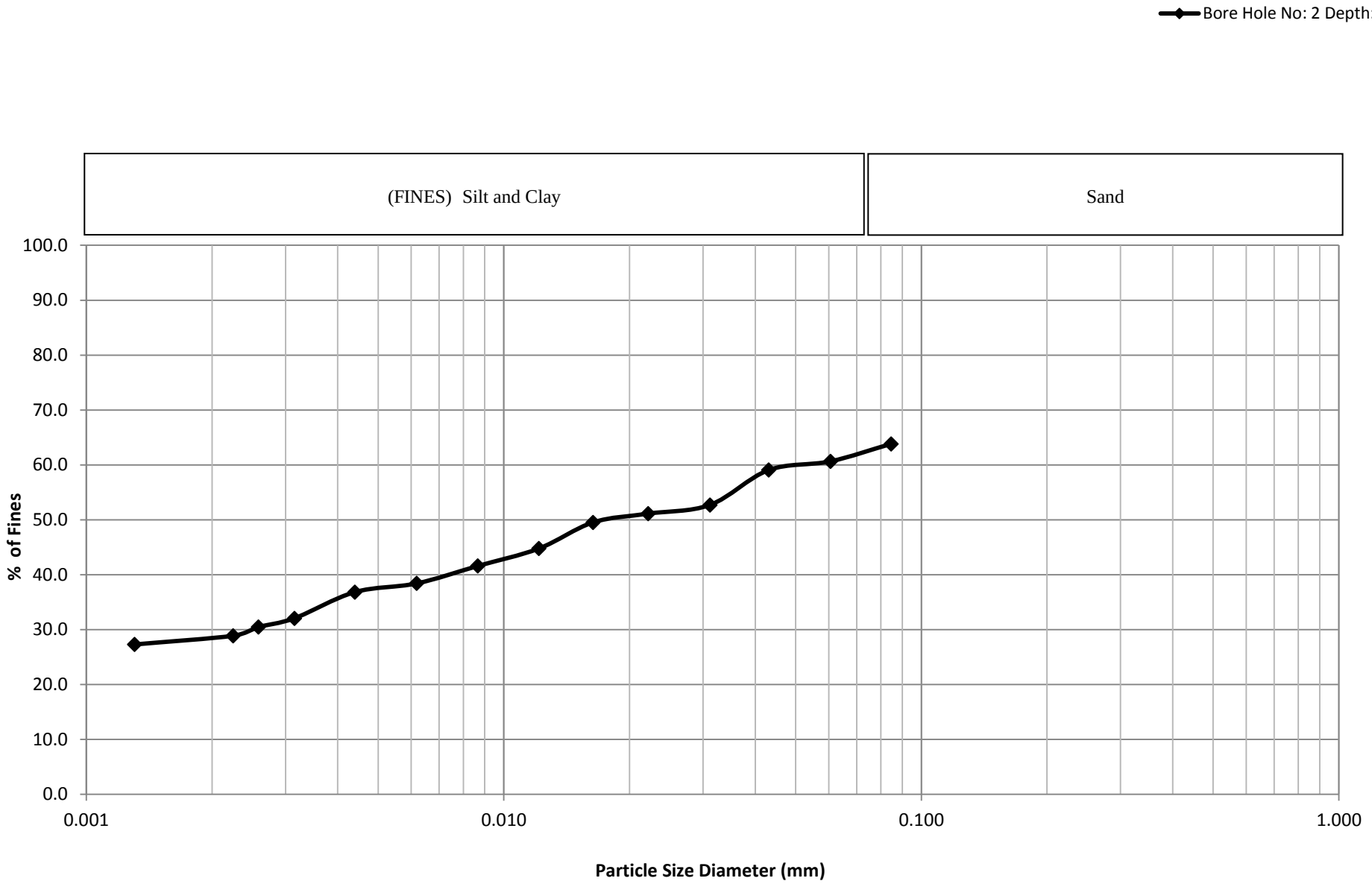


Fig 2.10 Hydrometer Analysis Master Curve

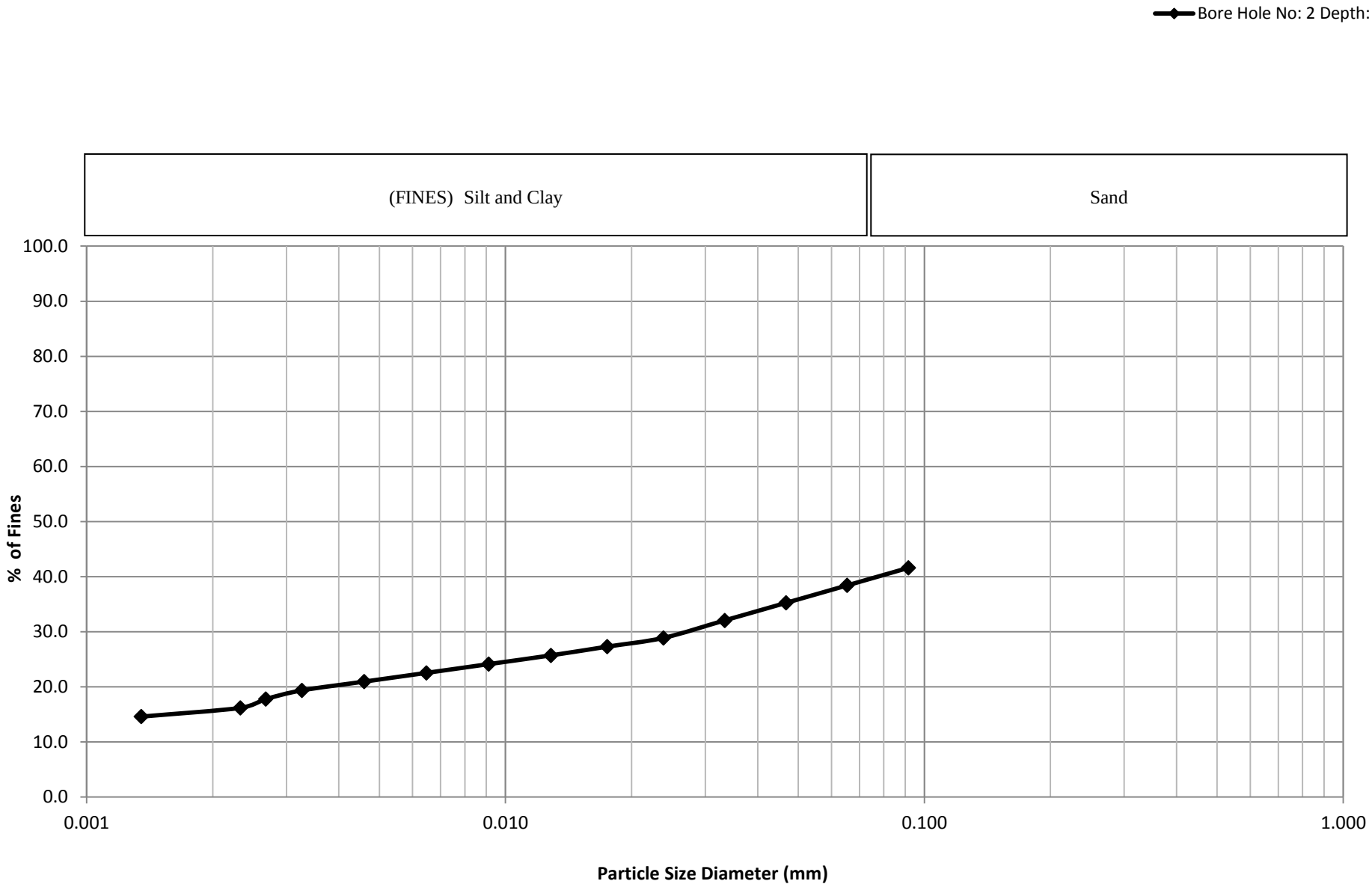


Fig 2.11 Hydrometer Analysis Master Curve

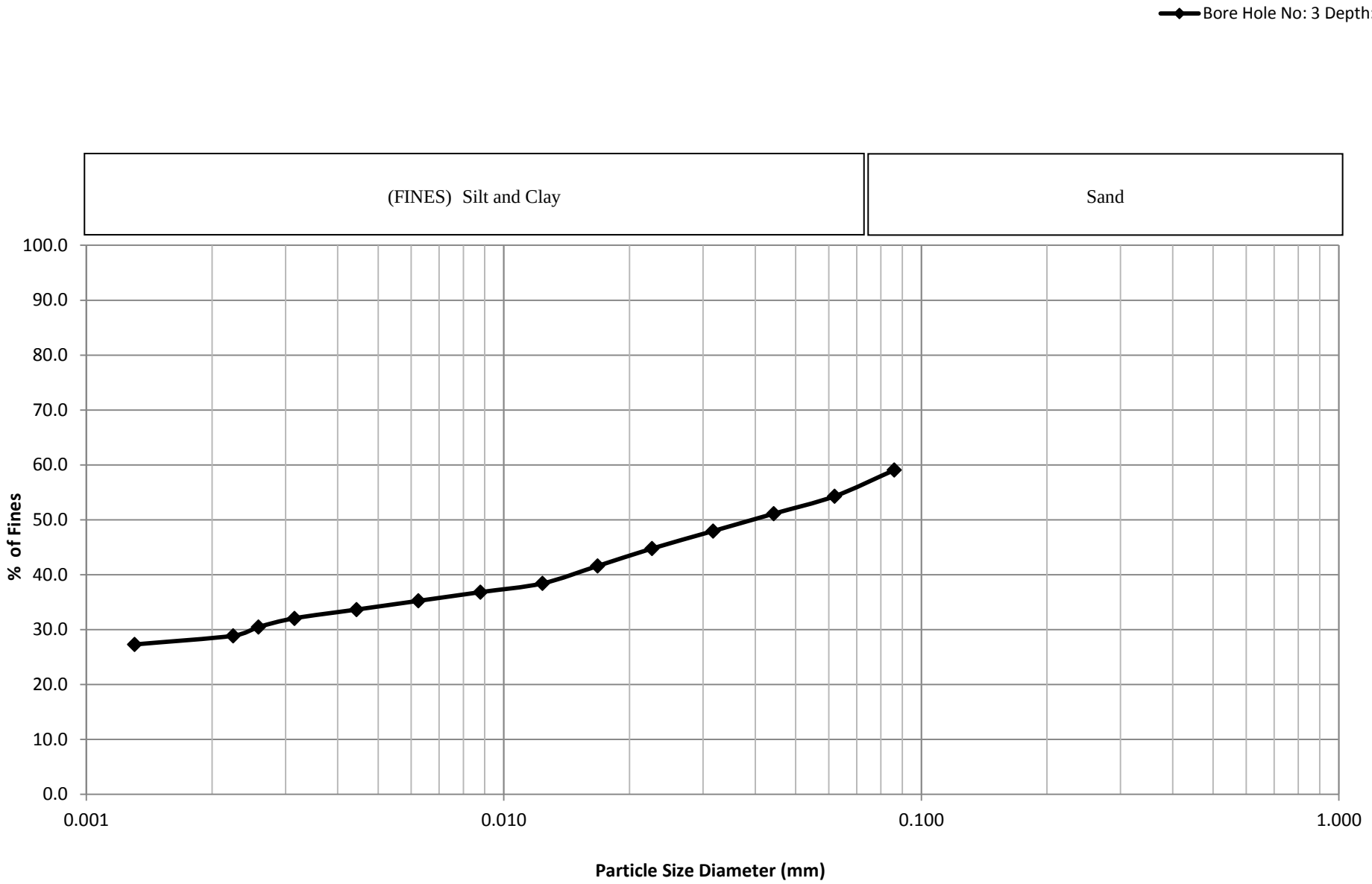


Fig 2.12 Hydrometer Analysis Master Curve

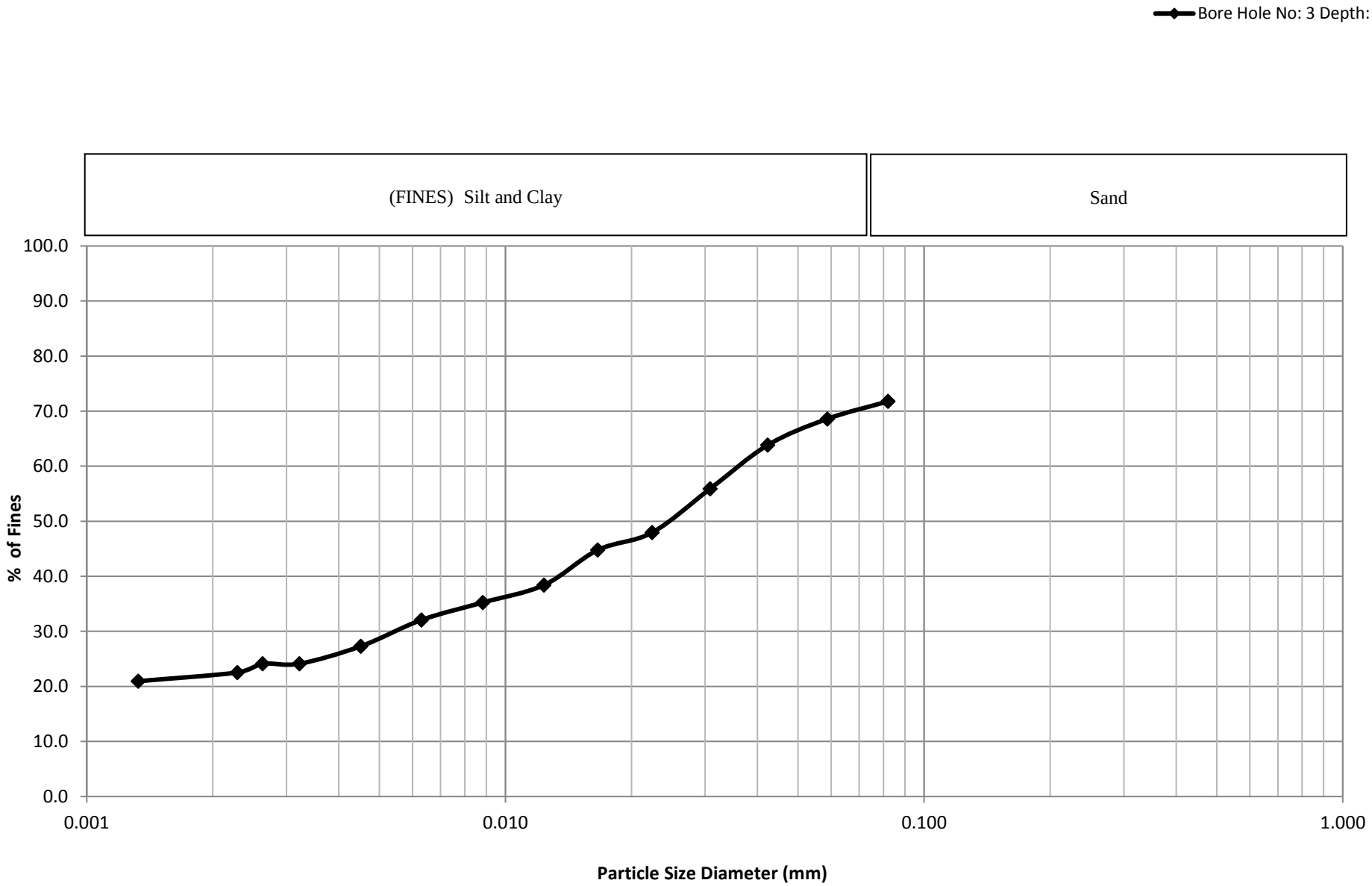


Fig 2.13 Hydrometer Analysis Master Curve

LABORATORY TEST RESULTS

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 SOUTH INDIA SHELTER PRIVATE LIMITED**	**Customer Reference**	:	By Email
Sample Description	:	Soil Sample	**Period of Testing**	:	02/06/2022 to 09/06/2022
Source of Sample	:	Customer Supplied- Borehole No. BH-01	**Sample Identification Number**	:	SS/GMC/052022/477/BH01
Sample Condition	:	Satisfactory	**Test Report No.**	:	GT-2378/BH-01
Test Method	:	As per Bureau of Indian Standards	**Report Date**	:	10/06/2022
Sample Receipt Date	:	01/06/2022	**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	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	13	SS	17.9	47.8	15.9	31.8	0.9	14.0	18.2	Stiff	Above	CI	-	0.0	0.0	2.9	46.4	50.6		-	-	-	-	-	FG>50%	FG>50%	FG>50%
2.0	15	SS	23.1	45.8	22.1	23.8	1.0	14.2	23.1	Stiff	Above	CI	-	0.0	0.0	0.9	10.7	60.2	28.3	-	-	-	-	-	FG>50%	FG>50%	FG>50%
4.0	7	SS	25.9	37.9	19.1	18.8	0.6	14.5	36.4	M.Stiff	Above	CI	-	0.0	0.0	11.2	30.6	58.2		-	-	-	-	-	FG>50%	FG>50%	FG>50%
5.0	4	SS	33.9	46.1	19.8	26.3	0.5	14.2	63.6	Soft	Above	CI	-	0.0	0.0	18.9	26.9	54.2		-	-	-	-	-	FG>50%	FG>50%	FG>50%
6.0	2	SS	45.1	50.0	23.2	26.8	0.2	13.9	33.3	Very Soft	Above	CI	-	0.0	0.0	8.9	11.0	54.4	25.7	-	-	-	-	-	FG>50%	FG>50%	FG>50%
9.0	16	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	0.0	0.0	60.4	28.3	11.3		-	-	-	-	-	M.Dense	<50%	SP-SM
10.5	11	SS	Sample Failed																								
12.0	6	SS	30.7	49.1	23.0	26.1	0.7	13.7	38.5	M.Stiff	Above	CI	-	0.0	1.5	14.8	21.4	62.3		-	-	-	-	-	FG>50%	FG>50%	FG>50%
14.0	25	SS	14.2	30.7	17.8	12.9	1.3	17.5	60.0	CG>50%	Above	-	-	0.0	2.4	18.8	38.7	40.1		-	-	-	-	-	M.Dense	<50%	SC
16.0	>100	SS	14.7	Clay Binder						CG>50%	-	-	-	3.0	1.9	14.4	36.8	43.8		-	-	-	-	-	V.Dense	<50%	SM
18.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	12.1	4.0	21.7	33.3	29.0		-	-	-	-	-	V.Dense	<50%	SM
20.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	10.9	12.1	31.2	22.7	23.1		-	-	-	-	-	V.Dense	<50%	SM

**** END OF REPORT****

Terms and Conditions

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

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

(3) Any correction in this reports invalidates the reports

Authorised Signatory

A. VINOTH
(Technical Manager)

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 SOUTH INDIA SHELTER PRIVATE LIMITED**	**Customer Reference**	:	By Email
Sample Description	:	Soil Sample	**Period of Testing**	:	02/06/2022 to 09/06/2022
Source of Sample	:	Customer Supplied- Borehole No. BH-02	**Sample Identification Number**	:	SS/GMC/052022/477/BH02
Sample Condition	:	Satisfactory	**Test Report No.**	:	GT-2378/BH-02
Test Method	:	As per Bureau of Indian Standards	**Report Date**	:	10/06/2022
Sample Receipt Date	:	01/06/2022	**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	21	SS	10.6	33.5	16.7	16.9	1.4	16.8	16.7	V.Stiff	Above	CL	-	0.0	1.6	8.6	28.5	61.2		-	-	-	-	-	FG>50%	FG>50%	FG>50%
2.0	12	SS	26.4	49.9	25.2	24.7	1.0	14.7	40.9	Stiff	Above	CI	-	0.0	0.0	1.0	8.3	90.7		-	-	-	-	-	FG>50%	FG>50%	FG>50%
3.0	10	SS	22.5	39.6	19.0	20.5	0.8	14.8	31.8	Stiff	Above	CI	-	0.0	0.0	1.1	8.5	90.4		-	-	-	-	-	FG>50%	FG>50%	FG>50%
5.0	3	SS	45.3	52.7	24.3	28.4	0.3	14.3	36.4	Soft	Above	CH	-	-	-	-	-	71.1	28.9	-	-	-	-	-	FG>50%	FG>50%	FG>50%
6.0	3	SS	21.1	25.2	15.8	9.4	0.4	17.9	30.0	CG>50%	Above	-	-	0.0	0.0	23.0	43.3	33.7		-	-	-	-	-	V.Loose	<50%	SC
7.5	18	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	0.0	0.7	50.2	35.5	13.6		-	-	-	-	-	M.Dense	<50%	SM
9.0	15	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	0.0	0.9	47.1	37.2	14.8		-	-	-	-	-	M.Dense	<50%	SM
10.5	4	SS	19.8	24.3	14.6	9.7	0.5	19.0	13.6	CG>50%	Above	-	-	0.0	1.6	31.0	44.0	23.4		-	-	-	-	-	V.Loose	<50%	SC
12.0	11	SS	19.4	29.7	16.2	13.6	0.8	18.5	30.0	CG>50%	Above	-	-	0.0	4.6	20.2	49.5	21.6	4.2	-	-	-	-	-	M.Dense	<50%	SC
14.0	17	SS	16.2	37.5	18.5	19.0	1.1	17.0	39.9	CG>50%	Above	-	-	0.0	2.6	22.6	39.1	35.7		-	-	-	-	-	M.Dense	<50%	SC
16.0	>100	SS	15.4	41.2	20.4	20.8	1.2	16.8	100.0	CG>50%	Above	-	-	0.0	3.7	28.0	31.7	36.6		-	-	-	-	-	V.Dense	<50%	SC
18.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	23.1	6.2	23.6	27.7	19.4		-	-	-	-	-	V.Dense	<50%	SM
20.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	-	43.8	20.8	30.5	4.2	0.8		-	-	-	-	-	V.Dense	<50%	SP

**** 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 SOUTH INDIA SHELTER PRIVATE LIMITED**	**Customer Reference**	:	By Email
Sample Description	:	Soil Sample	**Period of Testing**	:	02/06/2022 to 09/06/2022
Source of Sample	:	Customer Supplied- Borehole No. BH-03	**Sample Identification Number**	:	SS/GMC/052022/477/BH03
Sample Condition	:	Satisfactory	**Test Report No.**	:	GT-2013/BH-03
Test Method	:	As per Bureau of Indian Standards	**Report Date**	:	10/06/2022
Sample Receipt Date	:	01/06/2022	**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	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	16	SS	12.7	47.0	21.5	25.5	1.3	13.8	23.1	V.Stiff	Above	CI	-	0.0	0.0	3.7	12.9	83.4		-	-	-	-	-	FG>50%	FG>50%	FG>50%
2.0	38	SS	14.6	26.2	14.8	11.4	1.0	16.0	20.0	Hard	Above	CL	-	0.0	0.0	5.2	37.2	41.0	16.6	-	-	-	-	-	FG>50%	FG>50%	FG>50%
3.0	25	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	0.0	0.0	46.8	41.4	11.8		-	-	-	-	-	M.Dense	<50%	SP-SM
4.0	14	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	0.0	0.0	24.4	66.7	8.9		-	-	-	-	-	M.Dense	<50%	SP-SM
5.0	2	SS	54.4	54.8	27.0	27.7	0.0	12.3	30.8	Very Soft	Above	CH	-	-	-	-	-	100.0		-	-	-	-	-	FG>50%	FG>50%	FG>50%
6.0	1	SS	26.5	27.9	15.2	12.7	0.1	17.0	17.5	CG>50%	Above	-	-	0.0	0.0	17.1	40.2	42.7		-	-	-	-	-	V.Loose	<50%	SC
7.5	16	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	0.0	0.0	54.0	31.5	14.5		-	-	-	-	-	M.Dense	<50%	SM
9.0	17	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	0.0	0.0	58.5	30.1	11.5		-	-	-	-	-	M.Dense	<50%	SP-SM
10.5	4	SS	28.3	21.9	Non Plastic				22.2	CG>50%	Below	-	-	0.0	2.6	17.4	50.4	29.6		-	-	-	-	-	V.Loose	<50%	SM
12.0	6	SS	28.2	46.0	19.6	26.4	0.7	14.6	50.0	M.Stiff	Above	CI	-	-	-	-	-	77.5	22.5	-	-	-	-	-	FG>50%	FG>50%	FG>50%
14.0	16	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	1.2	1.8	19.3	43.0	34.8		-	-	-	-	-	M.Dense	<50%	SM
16.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	-	14.9	17.9	36.3	20.7	10.1		-	-	-	-	-	V.Dense	<50%	SP-SM
18.0	-	WS	-	-	-	-	-	-	-	CG>50%	-	-	-	0.0	0.0	86.4	13.3	0.2		-	-	-	-	-	V.Dense	<50%	SP
20.0	-	WS	-	-	-	-	-	-	-	CG>50%	-	-	-	0.0	0.0	86.0	12.7	1.3		-	-	-	-	-	V.Dense	<50%	SP

**** END OF REPORT****

Terms and Conditions

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

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

(3) Any correction in this reports invalidates the reports

Authorised Signatory

A. VINOTH
(Technical Manager)

Table-2.4 Results of Chemical Analysis									
SL No.	Bore HoleNo.	Water				Soil (2:1)			
		Depth of Sample (m)	pH	Chlorides (ppm)	Sulphates (ppm)	Depth of Sample (m)	pH	Chlorides (ppm)	Sulphates (ppm)
1.0	BH-01	2.20	7.15	199.7	208.0	1.0	7.07	95.3	45.2
2.0	BH-02	2.50	7.14	390.2	459.0	2.0	7.03	113.4	49.3
3.0	BH-03	2.50	7.10	154.3	211.0	1.0	7.16	89.4	42.2

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:

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

Deposits of Recent Age

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

Archaean Basement Rock (Charnockite Rock / Hypersthene Granite)

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

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

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

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

REFERENCE BORE HOLE					BH-01	Ref R.L. of G.L. (m):			0.00		
Layer No.	Layer Thk. (m)			Type of Strata	Colour	Ave. Design SPT	Relative Density	Consistency	(γ) kN/m^3	Shear Parameters	
	Top BGL	Bottom BGL	Thickness							(C_u) kPa	(ϕ) Deg.
1.0	0.00	4.00	4.00	Silty Clay	Brown	14	-	Stiff	19.5	93	-
2.0	4.00	5.00	1.00	Sandy Silty Clay	Grey	7	-	Medium Stiff	16	47	-
3.0	5.00	9.00	4.00	Silty Clay	Grey	3	-	Soft	14	20	-
4.0	9.00	12.00	3.00	Silty Sand	Grey	14	Medium Dense	-	17	-	31.2
5.0	12.00	14.00	2.00	Silty Clay	Grey	6	-	Medium Stiff	15.5	40	-
6.0	14.00	16.00	2.00	Clayey Silty Sand	Grey Green	25	Medium Dense	-	18.5	-	34.5
7.0	16.00	20.00	4.00	Clayey Silty Sand	Off-white Grey	>100	Very Dense	-	21	-	42.5
8.0	20.00	20.10	0.10	Completely Weathered Rock	Grey Brown	>100	Very Dense	-	21	-	42.5

REFERENCE BORE HOLE					BH-02	Ref R.L. of G.L. (m):			0.00		
Layer No.	Layer Thk. (m)			Type of Strata	Colour	Ave. Design SPT	Relative Density	Consistency	(γ) kN/m^3	Shear Parameters	
	Top BGL	Bottom BGL	Thickness							(C_u) kPa	(ϕ) Deg.
1.0	0.00	2.00	2.00	Sandy Silty Clay	Brown	21	-	Very Stiff	20.5	140	-
2.0	2.00	4.00	2.00	Silty Clay	Brown	11	-	Stiff	18	73	-
3.0	4.00	6.00	2.00	Silty Clay	Grey to Black	3	-	Soft	14	20	-
4.0	6.00	7.50	1.50	Clayey Silty Sand	Grey	3	Very Loose	-	13	-	20.07
5.0	7.50	10.50	3.00	Silty Sand	Grey	17	Medium Dense	-	18	-	32.1
6.0	10.50	12.00	1.50	Clayey Silty Sand	Grey	4	Very Loose	-	13.5	-	20.22
7.0	12.00	16.00	4.00	Clayey Silty Sand	Grey Green	14	Medium Dense	-	17	-	31.2
8.0	16.00	18.00	2.00	Clayey Silty Sand	Brown Grey	>100	Very Dense	-	21	-	42.5
9.0	18.00	20.00	2.00	Completely Weathered Rock	Brown Grey	>100	Very Dense	-	21	-	42.5

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	2.00	2.00	Sandy Silty Clay	Brown	16	-	Very Stiff	20	107	-
2.0	2.00	3.00	1.00	Sandy Silty Clay	Brown Grey	38	-	Hard	21	253	-
3.0	3.00	5.00	2.00	Silty Sand	Grey Brown	20	Medium Dense	-	18	-	33
4.0	5.00	6.00	1.00	Silty Clay	Grey to Black	2	-	Very Soft	14	13	-
5.0	6.00	7.50	1.50	Clayey Silty Sand	Grey	1	Very Loose	-	12	-	19.76
6.0	7.50	10.50	3.00	Silty Sand	Grey	17	Medium Dense	-	18	-	32.1
7.0	10.50	12.00	1.50	Clayey Silty Sand	Grey	4	Very Loose	-	13.5	-	20.22
8.0	12.00	14.00	2.00	Silty Clay	Grey to Black	6	-	Medium Stiff	15.5	40	-
9.0	14.00	16.00	2.00	Clayey Silty Sand	Grey	16	Medium Dense	-	18	-	31.8
10.0	16.00	20.00	4.00	Completely Weathered Rock	Brow Grey	>100	Very Dense	-	21	-	42.5
11.0	20.00	21.50	1.50	Moderately Weathered Rock	Grey,Brown Grey	CRR-37%, RQD-14%					

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 stilt and five upper floors, and is meant for residential occupancy. For this kind of structure, the column loads could vary between 1,750 kN to 2,500kN.

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 following presents the geological succession of the investigation location:

0.0m to 6.0m/7.5m	Silty Clay (Very Stiff to Stiff & Soft)
6.0m/7.5m to 16.0m	Sand & Clay intermittently (Medium Dense to Loose & Medium Stiff)
16.0m to 18.0m/20.0m	Very Dense, Clayey Silty
18.0m/20.0m to 21.5m	Very Dense, Completely Weathered Rock/ Moderately Weathered Rock (Granitic Rock)

4.3 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	18.0	1.0	17.00	500	1500	400	55
2.0					550	1800	450	60
3.0					600	2200	500	65
4.0					650	2500	600	70

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.
- ***Installation of working piles follow only after completion of initial pile load test.***
- 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

GEOMARINE
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)	18.0	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) 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	0.0	1.0	1.0	Cut-Off Level													
2.0	1.0	4.0	3.0	Clay	14	19.5	19.5	93	-	0.0	28.5	14.3	0.5	-	qf	2	206.0
3.0	4.0	5.0	1.0	Clay	7	16.0	17.8	47	-	28.5	34.5	31.5	0.9	-	qf	3	66.4
4.0	5.0	9.0	4.0	Clay	3	14.0	15.0	20	-	34.5	50.5	42.5	1.0	-	qf	4	125.7
5.0	9.0	12.0	3.0	Sand	14	17.0	15.5	-	31.2	50.5	71.5	61.0	-	1.1	qf	5	184.7
6.0	12.0	14.0	2.0	Clay	6	15.5	16.3	40	-	71.5	82.5	77.0	1.0	-	qf	6	125.7
7.0	14.0	16.0	2.0	Sand	25	18.5	17.0	-	34.5	82.5	99.5	91.0	-	1.2	qf	7	241.3
8.0	16.0	18.0	2.0	Sand	50	20.5	19.5	-	41.0	99.5	120.5	110.0	-	1.5	qf	8	450.6

Summation of Positive Skin Resitance (kN) Q_f= 1400.28

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

Computation of End Bearing Resistance

		SPT	ϕ	C_u	N_q	N_c			
Bearing Stratum	Weathered Rock	50	41.00	-	157.31	-	Eff.Ht.of Overburden	8	m
							Effective Overburden Pressure	78.75	kN/m²

End Bearing Resistance (kN) Q_p= 2432.38

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

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

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)**	3832.66
Safe Load Carrying Capacity (Q_{safe})	**$Q_u/2.5$ (kN)**	1533.06
Allowable Safe Load Carrying Capacity	**$Q_{A\text{-}safe}$ (kN)**	1533.06
Allowable Safe Pull out Capacity	**$Q_{A\text{-}pull}$: Qf/3 (kN)**	466.76

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_i=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_i=Thickness of Layer

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

GEOMARINE
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)	18.0	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	0.0	1.0	1.0	Cut-Off Level											
2.0	1.0	4.0	3.0	Clay	14	19.5	19.5	93	-	0.0	28.5	14.3	0.5	-	qf 2 206.0
3.0	4.0	6.0	2.0	Clay	3	14.0	16.8	20	-	28.5	36.5	32.5	1.0	-	qf 3 62.8
4.0	6.0	7.5	1.5	Sand	3	13.0	13.5	-	20.1	36.5	41.0	38.8	-	1.0	qf 4 33.4
5.0	7.5	10.5	3.0	Sand	17	18.0	15.5	-	32.1	41.0	65.0	53.0	-	1.1	qf 5 173.3
6.0	10.5	12.0	1.5	Sand	4	13.5	15.8	-	20.2	65.0	70.3	67.6	-	1.0	qf 6 58.7
7.0	12.0	16.0	4.0	Sand	14	17.0	15.3	-	31.2	70.3	98.3	84.3	-	1.1	qf 7 340.1
8.0	16.0	18.0	2.0	Sand	50	20.5	18.8	-	41.0	98.3	119.3	108.8	-	1.5	qf 8 445.5

Summation of Positive Skin Resitance (kN) Q_f= 1319.74

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

Computation of End Bearing Resistance

		SPT	ϕ	C_u	N_q	N_c			
Bearing Stratum	Weathered Rock	50	41.00	-	157.31	-	Eff.Ht.of Overburden	8	m
							Effective Overburden Pressure	78.75	kN/m²

End Bearing Resistance (kN) Q_p= 2432.38

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

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

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)**	3752.12
Safe Load Carrying Capacity (Q_{safe})	**$Q_u/2.5$ (kN)**	1500.85
Allowable Safe Load Carrying Capacity	**$Q_{A\text{-}safe}$ (kN)**	1500.85
Allowable Safe Pull out Capacity	**$Q_{A\text{-}pull}$: Qf/3 (kN)**	439.91

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_i=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_i=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)	18.0	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	0.0	1.0	1.0	Cut-Off Level													
2.0	1.0	3.0	2.0	Clay	38	21.0	21.0	253	-	0.0	22.0	11.0	0.3	-	qf	2	206.7
3.0	3.0	5.0	2.0	Sand	20	18.0	19.5	-	33.0	22.0	38.0	30.0	-	1.2	qf	3	70.5
4.0	5.0	6.0	1.0	Clay	2	14.0	16.0	13	-	38.0	42.0	40.0	1.0	-	qf	4	20.4
5.0	6.0	7.5	1.5	Sand	1	12.0	13.0	-	19.8	42.0	45.0	43.5	-	1.0	qf	5	36.8
6.0	7.5	10.5	3.0	Sand	17	18.0	15.0	-	32.1	45.0	69.0	57.0	-	1.1	qf	6	186.4
7.0	10.5	12.0	1.5	Sand	4	13.5	15.8	-	20.2	69.0	74.3	71.6	-	1.0	qf	7	62.2
8.0	12.0	14.0	2.0	Clay	6	15.5	14.5	40	-	74.3	85.3	79.8	1.0	-	qf	8	125.7
9.0	14.0	16.0	2.0	Sand	16	18.0	16.8	-	31.8	85.3	101.3	93.3	-	1.1	qf	9	198.2
10.0	16.0	18.0	2.0	Weathered Rock	50	20.5	19.3	-	41.0	101.3	122.3	111.8	-	1.5	qf	10	457.8

Summation of Positive Skin Resitance (kN) Q_f= 1364.61

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

Computation of End Bearing Resistance

		SPT	ϕ	C_u	N_q	N_c			
Bearing Stratum	Weathered Rock	50	41.00	-	157.31	-	Eff.Ht.of Overburden	8	m
							Effective Overburden Pressure	78.75	kN/m^2

End Bearing Resistance (kN) Q_p= 2432.38

Skin Resistance in Clay Layer is $\pi*d*T_i*C_u*\alpha$	Ultimate Load Carrying Capacity (Q_{ult})	**$Q_u=Q_f-Q_f+Q_p$ (kN)** 3796.99
Skin Resistance in Sand Layer is $\pi*d*T_i*q_i*K*Tan(\phi)$	Safe Load Carrying Capacity (Q_{safe})	**$Q_u/2.5$ (kN)** 1518.80
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)** 1518.80
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)** 454.87

Where

Cu=Undrained Shear Strength of Clay; K=Coef. Earth Pressure at Rest; d=Dia. Of Pile

ϕ=Angle of Shearing Resistance; q_i=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_i=Thickness of Layer

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

LATERAL LOAD CARRYING CAPACITY OF BORED CAST- SITU PILES

Reference Bore Hole : BH-01

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)	:	20.0	m
Cut-Off Level From E.G.L	:	1.0	
Length of Pile below Cut-Off Level (Le)	:	19.0	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	:	Clay	
Ground Water Condition	:	Submerged	
Design SPT "N" Value	:	10	
K=((k1/1.5)*(0.3/B))			
(n can be read as h in the above and below equation in case of Sand)			
K1=	:	24750	kN/m^3
K=	:	9900	kN/m^4
R=	:	1.98	m
L1/R	:	0.00	
Lf/R	:	2.20	
Depth of Fixity below Cut off (z_f)	:	4.36	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	:	55.34	kN
Recommended Design Lateral Load carrying Capacity	:	**55**	**kN**
Fixed End Moment,M_F=H(e+z_f)/2		121	
Reduction Factor (L_1/T)	:	0.8	m
Actual Moment (Fixed End Moment/Reduction Factor),M_F		**97**	kN-m

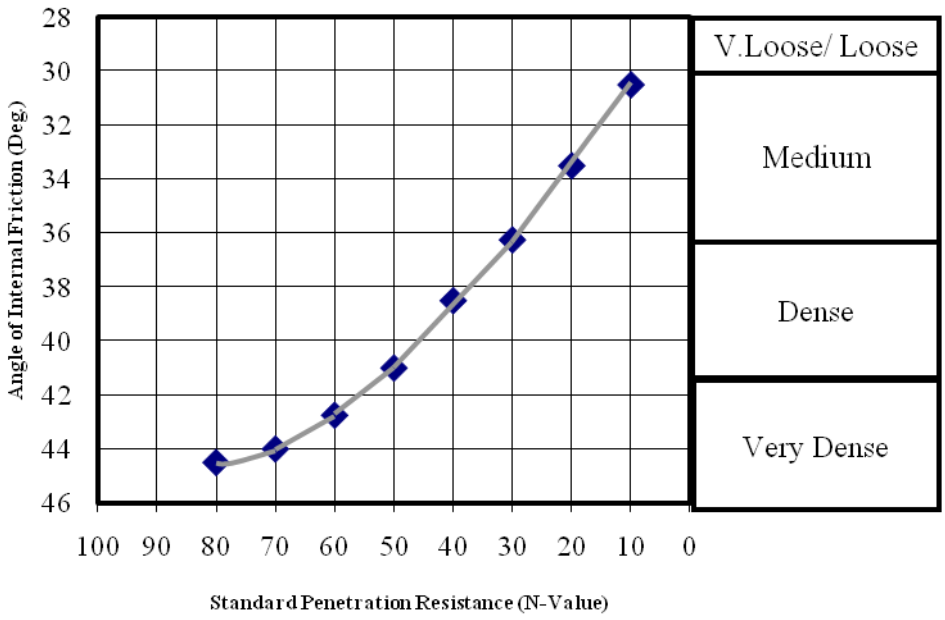


FIG. A1 Relation Ship between Angle of Internal Friction & N-value (Reproduced from IS:6403-1981)

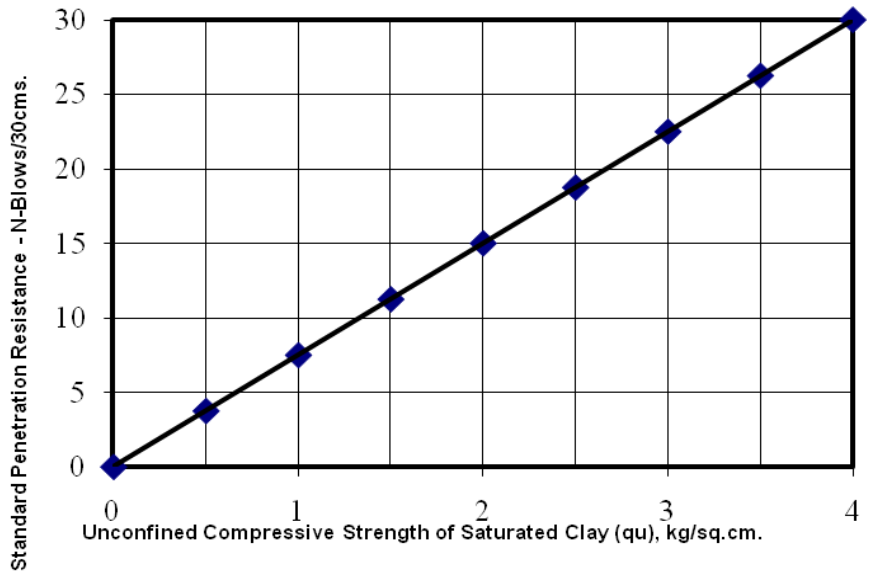


FIG. A2 : Relationship between UCC & SPT-Value (N) of Saturated Clay (AfterTerzhagi & Peck, 1948)

ANNEXURE-II

GEOMARINE
THE SPIRIT OF ENGINEERING

SITE INVESTIGATION RECORD

BORE HOLE No.	01		
PAGE No.	01		
DIA OF BORE HOLE	150mm	✓	
	100mm		
BORE START DATE	16-05-22		
BORE END DATE	17-05-22		
TOTAL DRILLING DAYS			

PROJECT NAME	SIS - GOPALAPURAM						
LOCATION		MACHINE No.	CR-03	CHAINAGE (m)			
STRUCTURE	B+STILT+5	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	16-05-22	10	20												
		10	21	SC			4	6	7	13	1.00	1	SS		Stiff, Brownish Silty clay.
2		10	38												
		10	39	SC			4	6	9	15	2.00	2	SS		Stiff Brownish Silty clay
3		10	55												
		10	57	SC			-	-	-	-	3.00	3	UDS		~~~ UDS Sample ~~~
4		11	20												
		11	22	SC			2	3	4	7	4.00	4	SS		Loose, Greyish-Black clayey Silt.
5		11	37												
		11	38	SC			2	2	2	4	5.00	5	SS		Loose - Soft, Dark Greyish-Black Sandy clay.
6		11	55												
		11	56	SC			1	1	1	2	6.00	6	SS		V. Soft, dark Greyish - Black Sandy Silty clay.
7		12	35												
		12	37	SC			-	-	-	-	7.50	7	UDS		~~~ UDS Sample ~~~
8		14	10												
9		14	11	SC			6	8	8	16	9.00	8	SS		Medium dense dark Greyish Sand.
10		14	50												
		14	51	SC			4	4	6	11	10.50	9	SS(N)		Sample failed. (Medium dense sand).

CS - Core Sample	DS - Disturbed Sample	SUPERVISOR NAME	K. SELVAM	PROJECT SITE DETAILS	
SS - Split Spoon Sample	SC - Soil Cutter	SIGNATURE		GROUND LEVEL (m)	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	DATE	16-05-22	WATER TABLE (m)	
WS - Wash Sample	DB - Diamond Bit	CLIENT IN-CHARGE		CASING DEPTH (m)	

GEOMARINE
THE SPIRIT OF ENGINEERING

SITE INVESTIGATION RECORD

BORE HOLE No. 01
PAGE No. 02

PROJECT NAME: SIS - Gopalapuram
DIA OF BORE HOLE: 150mm ✓ / 100mm
LOCATION:
MACHINE No.: CR-03
CHAINAGE (m):
BORE START DATE: 16-05-22
STRUCTURE: B+STILT+5
DRILLING METHOD: Rotary
CO-ORDINATES: N / E
BORE END DATE: 17-05-22
JOB CODE:
FLUSHING MEDIUM: Bentonite
TOTAL DRILLING DAYS:

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	SPT Details: Blows/cm. 15-30	SPT Details: Blows/cm. 30-45	SPT 'N' Value	Sample Details: Depth	Sample No.	Sample Type	Layer Data: Depth (m)	Geotechnical Description
1	17-05-22	15	45												
2		15	47	SC			2	2	4	6	12.00	10	SS		Medium Stiff, dark greyish Black Sandy clay.
3		16	10												
4		16	12	SC			7	12	13	25	14.00	11	SS		Medium dense, greyish-greenish fine grains clayey Silt.
5		16	45												
6		16	47	SC			11	27	10cm / 55blw SPT H.R	N>100	16.00	12	SS		Very dense, White-greyish fine grains clayey Silt with lime Pebbles to Boulders.
7		09	05												
8		09	20	SC			15cm / 55blw	SPT H.R		N>100	18.00	13	SS		Very dense, Brownish-greyish Silty Sand with Pebbles.
9		11	10												
10		11	24	SC			5cm / 50blw	H.R		N>100	20.00	14	SS		Very dense Brownish Residual Soil with Pebbles.

Bore Hole Terminated depth 20.00 mts

CS - Core Sample	DS - Disturbed Sample	SUPERVISOR NAME	K. SELVAM
SS - Split Spoon Sample	SC - Soil Cutter	SIGNATURE	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	DATE	17-05-22
WS - Wash Sample	DB - Diamond Bit	CLIENT IN-CHARGE	

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

GEOMARINE
THE SPIRIT OF ENGINEERING

SITE INVESTIGATION RECORD

BORE HOLE No.	02
PAGE No.	01
DIA OF BORE HOLE	150mm ✓ / 100mm
BORE START DATE	18-05-22
BORE END DATE	19-05-22
TOTAL DRILLING DAYS	

PROJECT NAME	SIS - GopaLapuram						
LOCATION		MACHINE No.	CR-03	CHAINAGE (m)		CO-ORDINATES	N
STRUCTURE	BRIDGE	DRILLING METHOD	Rotary				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	18-05-22	11	20												V. Stiff
		11	22	SC			7	11	10	21	1.00	1	SS		Brownish, Sandy Silty clay.
		11	35												
2		11	37	SC			3	4	7	12	2.00	2	SS		Stiff Brownish clay.
		11	50												
3		11	52	SC			3	4	6	10	3.00	3	SS		Stiff Brownish Silty clay.
		12	07												
4		12	09	SC			–	–	–	–	4.00	4	UDS		~~~ UDS Sample ~~~
		12	30												
5		12	31	SC			1	1	2	3	5.00	5	SS		Soft, dark Greyish - Black Silty clay.
		16	01												
6		16	02	SC			1	1	2	3	6.00	6	SS		Loose, dark Greyish clayey Sand.
		16	27												
7		16	28	SC			4	8	10	18	7.50	7	SS		Medium Dense dark Greyish Sand
		16	50												
8		16	51	SC			5	7	8	15	9.00	8	SS		Medium dense, dark Greyish Sand.
	19-05-22	08	55												
9		08	56	SC			2	2	2	4	10.50	9	SS		Loose dark Greyish - Black clayey Sand.

CS - Core Sample	DS - Disturbed Sample	SUPERVISOR NAME	K. SELVAM	PROJECT SITE DETAILS	
SS - Split Spoon Sample	SC - Soil Cutter	SIGNATURE		GROUND LEVEL (m)	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	DATE	18-05-22	WATER TABLE (m)	2.50 mts
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 18/05/22
BORE END DATE 19/05/22
TOTAL DRILLING DAYS

PROJECT NAME: SIS - GOPALAPURAM
LOCATION:
STRUCTURE: B+STILT+5
JOB CODE:
MACHINE No.: CR-03
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		09	20												
2		09	21	SC			1	3	8	11	12.00	10	SS		Medium dense, dark Greyish Black clayey Silty Sand
3		09	40												
4		09	42	SC			7	6	11	17	14.00	11	SS		Medium dense, Greenish fine grains clayey Sandy Silt.
5		10	05												
6		10	07	SC			33 (10cm 55blks)	SPT H.R		N>100	16.00	12	SS		Very dense, Brownish-Greyish, compact clayey Silty Sand with Pebbles to Boulders.
7		11	12												
8		11	24	SC			5cm / 35blks	SPT Hammer Rebounded		N>100	18.00	13	SS		Very dense, Brownish-Greyish Residual Soil with Pebbles.
9		12	15												
10		12	34	SC			SPT H.R			N>100	20.00	14	SS		Weak, Brownish-Greyish Completely Weathered Rock

Bore Hole Terminated Depth 20.00 mts

CS - Core Sample	DS - Disturbed Sample	SUPERVISOR NAME	K. SELVAM	PROJECT SITE DETAILS	
SS - Split Spoon Sample	SC - Soil Cutter	SIGNATURE		GROUND LEVEL (m)	
UDS-Undisturbed Sample	TCB - Tungsten Carbide Bit	DATE	19/05/22	WATER TABLE (m)	
WS - Wash Sample	DB - Diamond Bit	CLIENT IN-CHARGE		CASING DEPTH (m)	

GEOMARINE
THE SPIRIT OF ENGINEERING

SITE INVESTIGATION RECORD

BORE HOLE No. 03
PAGE No. 01

PROJECT NAME: SIS - GOPALAPURAM
DIA OF BORE HOLE: 150mm ✓ / 100mm
LOCATION: West End Streat-
MACHINE No.: CR-03
CHAINAGE (m):
BORE START DATE: 20-05-22
STRUCTURE: B+ Stilt+5
DRILLING METHOD: Rotary
CO-ORDINATES: N / E
BORE END DATE: 20-05-22
JOB CODE:
FLUSHING MEDIUM: Bentonite
TOTAL DRILLING DAYS:

Depth below E.G.L (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	15-30	30-45	SPT 'N' Value	Sample Details: Depth	No.	Type	Layer Data: Depth (m)	Geotechnical Description
1	20-05-22	09	10												
		09	12	SC			4	7	9	16	1.00	1	SS		Very Stiff, Brownish Sandy Silty clay.
2		09	25												
		09	27	SC			5	15	23	38	2.00	2	SS		Dense, Brownish clayey Sand
3		09	40												
		09	41	SC			9	12	13	25	3.00	3	SS		Medium dense, Greyish Brownish Sand.
4		10	05												
		10	06	SC			6	6	8	14	4.00	4	SS		Medium dense, Brownish-Greyish Silty Sand.
5		10	30												
		10	31	SC			1	1	1	2	5.00	5	SS		Very Soft dark Greyish-Black Silty clay.
6		10	52												
		10	53	SC			1	0	1	1	6.00	6	SS		V.soft - Loose, Black clayey Sand
7		11	20												
		11	21	SC			4	6	10	16	7.50	7	SS		Medium dense, dark Greyish Sand
8															
		12	00												
9		12	01	SC			7	8	9	17	9.00	8	SS		Medium dense, dark Greyish Sand.
10		12	24												
		12	25	SC			2	2	2	4	10.50	9	SS		Loose Greyish Sand Mix clay.

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: K. SELVAM
SIGNATURE:
DATE: 20/05/22
CLIENT IN-CHARGE:

PROJECT SITE DETAILS
GROUND LEVEL (m):
WATER TABLE (m): 2.50 mb
CASING DEPTH (m):

GEOMARINE
THE SPIRIT OF ENGINEERING

SITE INVESTIGATION RECORD

BORE HOLE No. 03
PAGE No. 02

PROJECT NAME: SIS - GOPALAPURAM
DIA OF BORE HOLE: 150mm ✓ / 100mm
LOCATION: West End Street | MACHINE No.: CR-03 | CHAINAGE (m):
STRUCTURE: STILT+5 | DRILLING METHOD: Rotary | CO-ORDINATES: N, E
JOB CODE: | FLUSHING MEDIUM: Bentonite
BORE START DATE: 20-05-22
BORE END DATE: 20-05-22
TOTAL DRILLING DAYS:

Depth below E.G.L (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	15-30	30-45	SPT 'N' Value	Sample Details: Depth	No.	Type	Layer Data: Depth (m)	Geotechnical Description
1		12	42												
2		12	43	SC			2	3	3	6	12.00	10	SS		Medium Stiff, dark greyish-Black Silty clay.
3		14	00												
4		14	02	SC			5	6	8	16	14.00	11	SS		Medium dense, greyish-greenish fine grains clayey Silt.
5		14	35												
6		14	50	SC			4cm SOLS	SPT	G.R	N/A	16.00	12	SS		Very dense, Brownish Residual Soil with Pebbles. (C.W.Rock).
7		15	20												
		15	33	DB	0%	0%					18.00	13	WS		Weak, greyish-Brownish Completely Weathered Rock.
8		16	05												
		16	20	DB	0%	0%					20.00	14	WS		Completely Weathered Rock.
9		16	45												
		17	34	DB	37%	14%					21.50	15	CS		Strong, greyish-Brownish Moderately Weathered Rock.
0															Bore Hole Terminated depth 21.50 m

CS - Core Sample | DS - Disturbed Sample
SS - Split Spoon Sample | SC - Soil Cutter
UDS-Undisturbed Sample | TCB - Tungsten Carbide Bit
WS - Wash Sample | DB - Diamond Bit

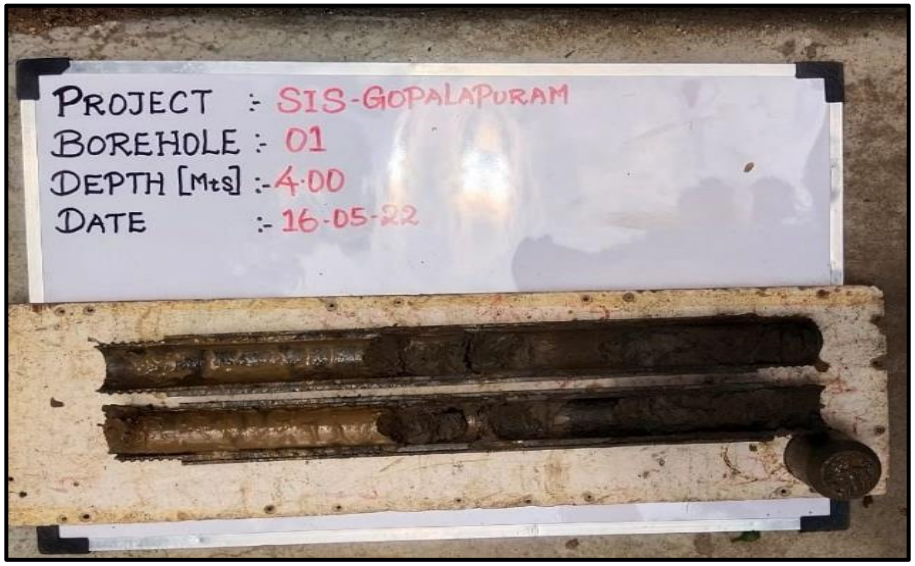
SUPERVISOR NAME: K. SELVAM
SIGNATURE: K. Selvam
DATE: 20-05-22.
CLIENT IN-CHARGE:

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

GEO MARINE
THE SPIRIT OF ENGINEERING

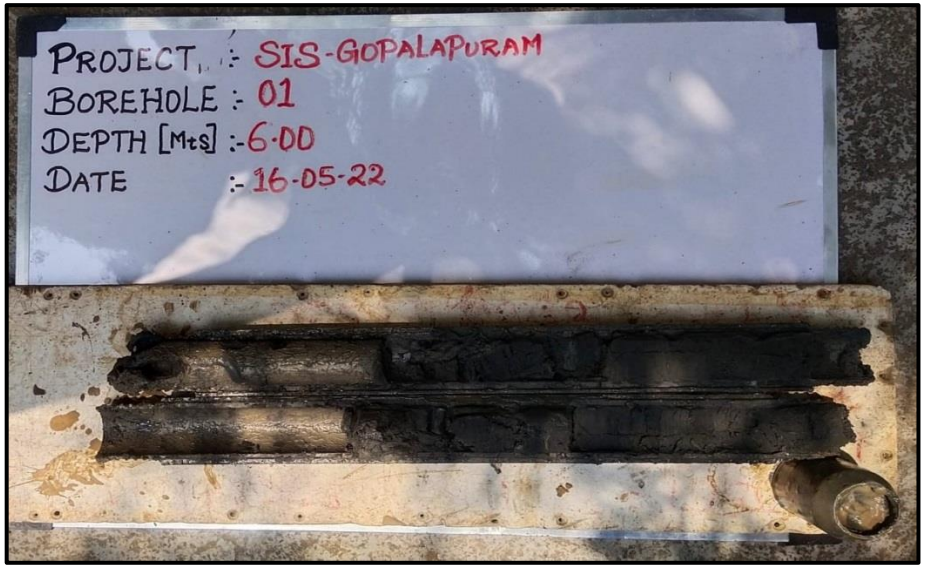




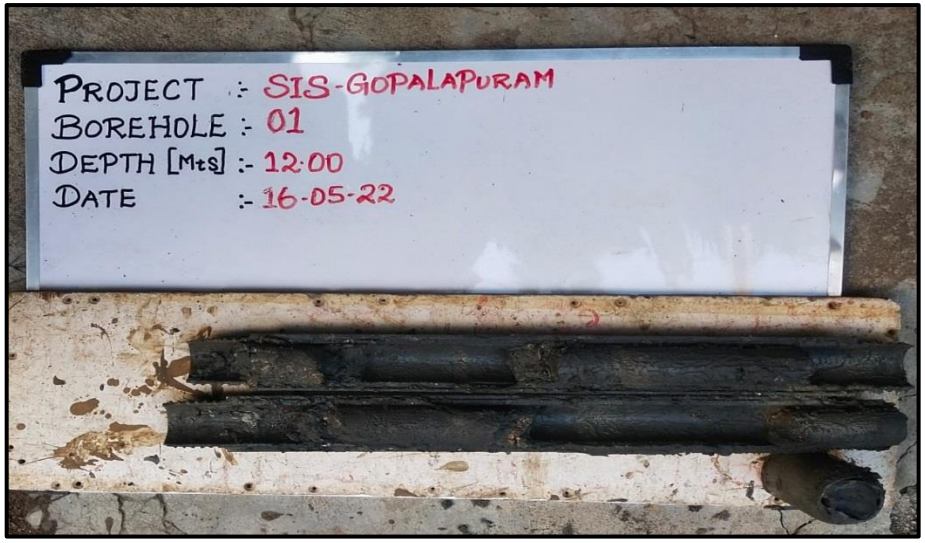


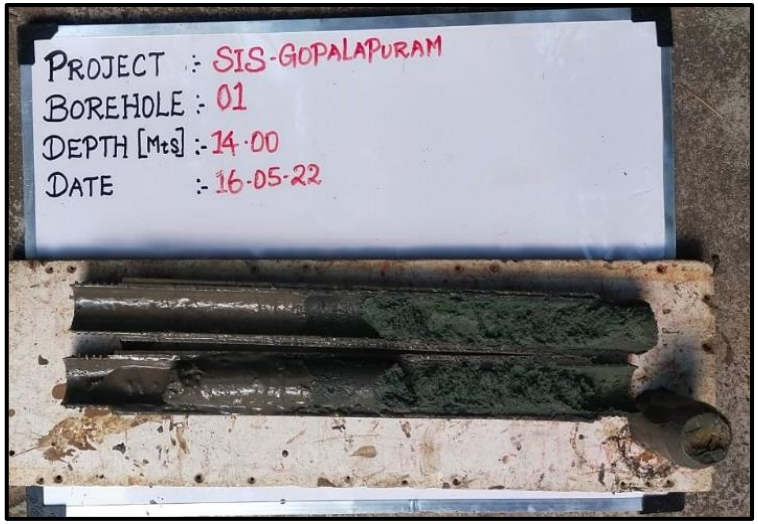


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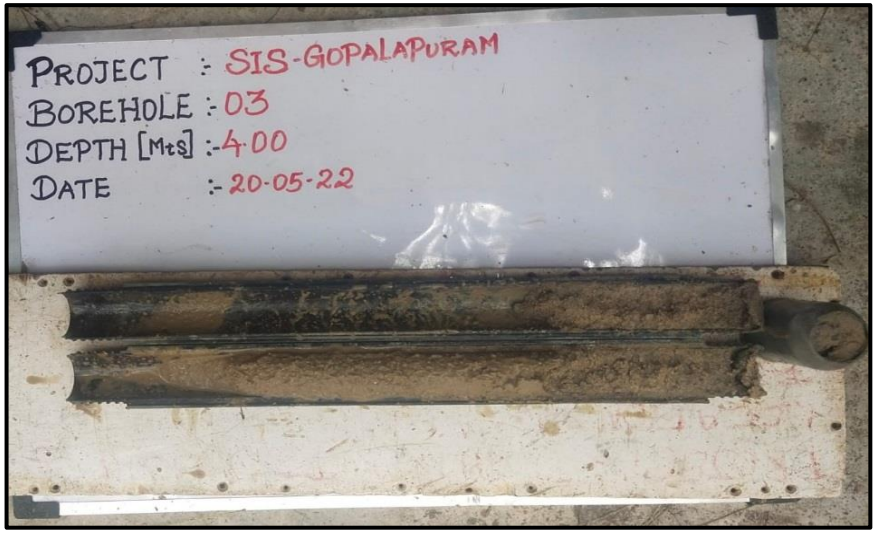




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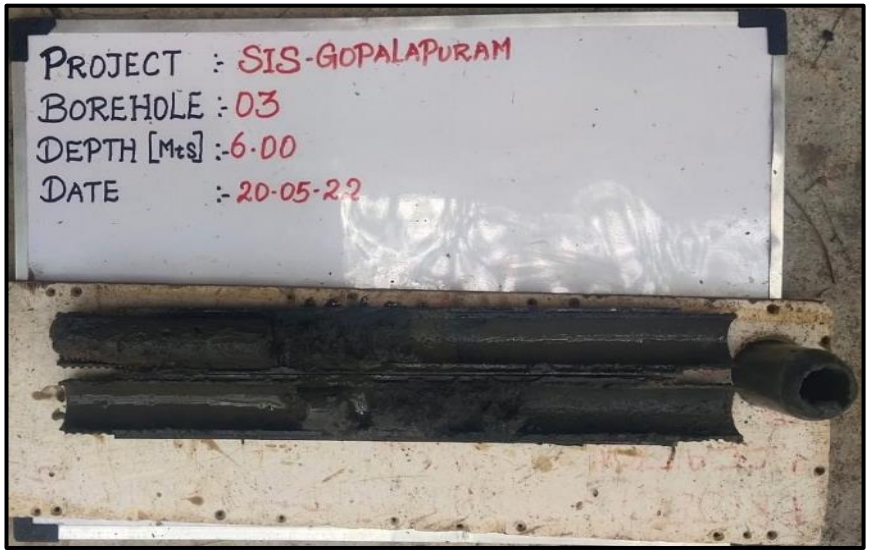


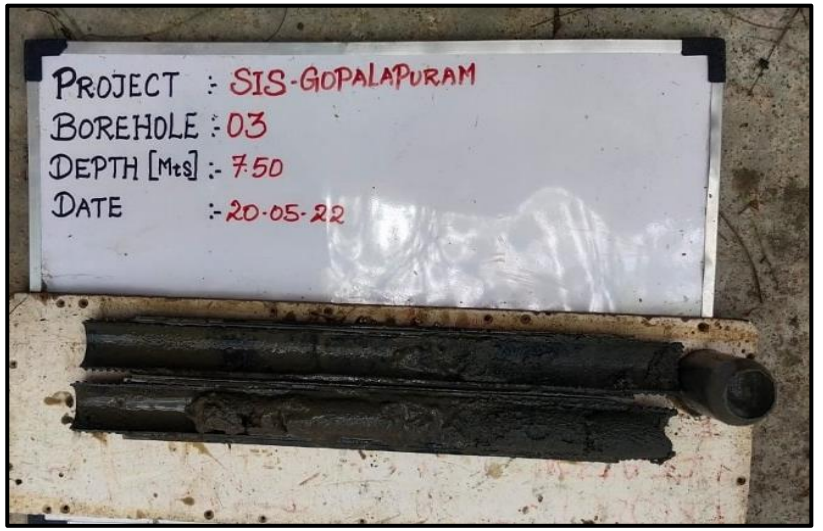


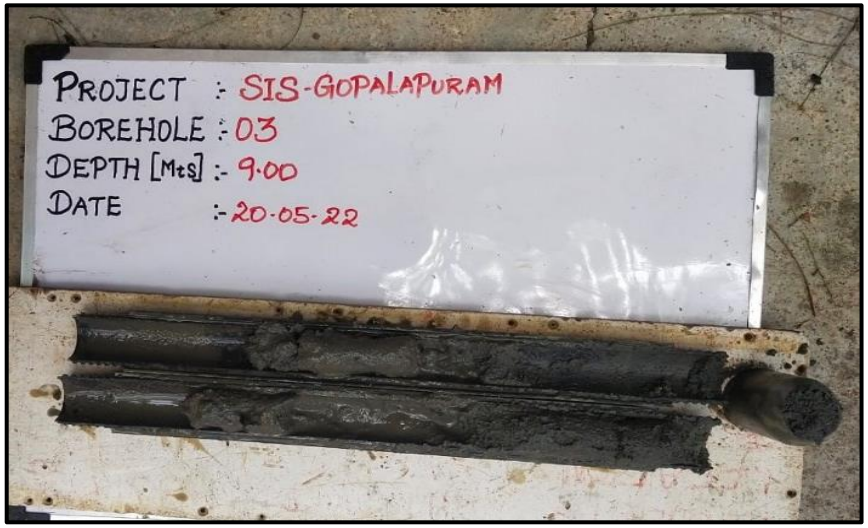


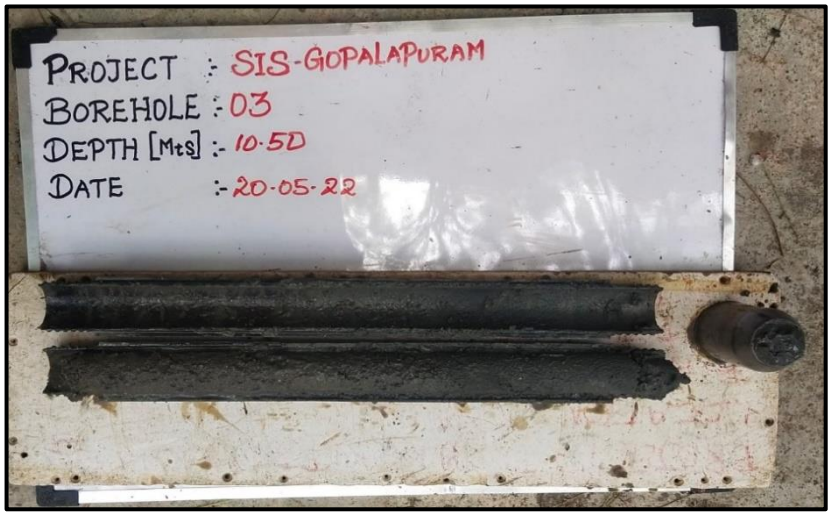


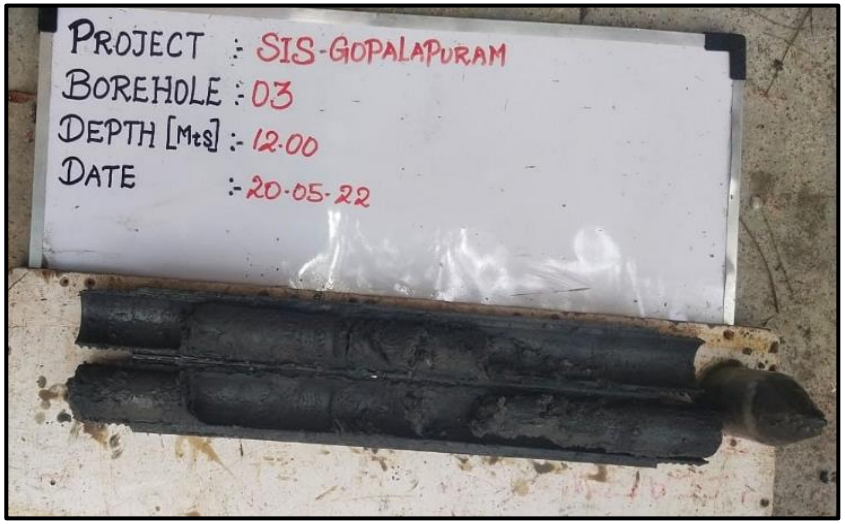
GEO MARINE
THE SPIRIT OF ENGINEERING

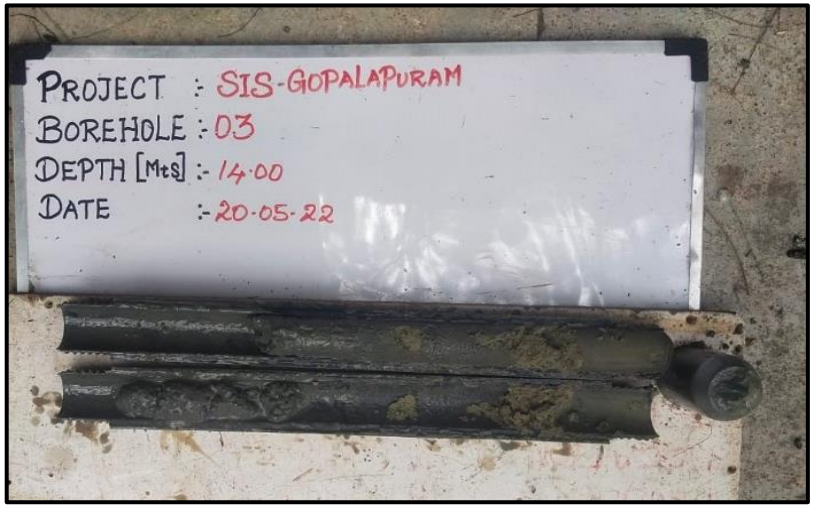


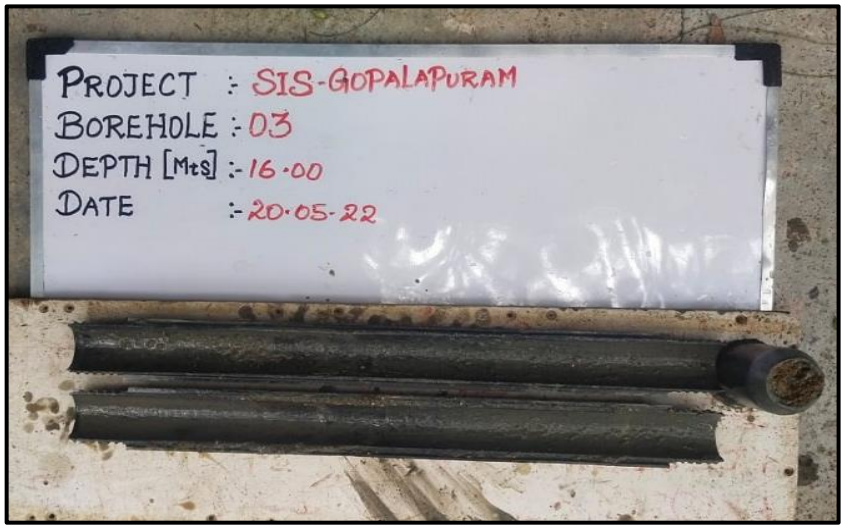







PROJECT :- SIS-GOPALAPURAM
BOREHOLE :- 03
DEPTH [Mts] :- 12.00
DATE :- 20-05-22


PROJECT :- SIS-GOPALAPURAM
BOREHOLE :- 03
DEPTH [Mts] :- 14.00
DATE :- 20-05-22


PROJECT :- SIS-GOPALAPURAM
BOREHOLE :- 03
DEPTH [Mts] :- 16.00
DATE :- 20-05-22




GEO MARINE





our services doesn't just end there

Buying & Selling Services

Property Buying Assistance, Property Selling Support, Market Price Analysis, Owner Outreach and Negotiation.

Legal & Documentation Services

Certified EC, Patta, legal opinions, property verification, due diligence, litigation solutions, and legal heir certificates.

Property Development & Approvals

Building plan approvals, construction, layout and sub-division approvals, zone conversion, and occupancy certification.

NRI & Investment Services

Escrow Services, Rentals, Litigation Solutions, Property Valuation and Property Management

Compliance & Special Services

Demolition, Vaasthu checks, regularization of unauthorized buildings, and office space solutions.



empowering your real estate decisions with smart tools

Property Valuation & Cost Estimation

Guideline Value, Apartment Composite Value, Stamp Duty & Registration Fees Calculator, Building Value Calculator, Capital Gains Calculator, Area Unit Converter, Length Unit Converter

Ownership, Compliance & Legal Verification

Encumbrance Certificate (EC) Search, Find Your SRO, Temple Property Check, WAQF Property Check, View Patta/Chitta, View FMB, Patta Analyzer, EC Analyzer

Zoning & Land Use Analysis

Land Use Zone Finder, CRZ Zone Check, Aquifer Zone Check, CBA Check, EWS Check, Road Width Check, Proposed Road Widening Check, FSI Calculator

Property Documentation & Workflow Tools

Forms & Templates, Document Generator, Document Translation, Dictionary

Vastu & Property Management Tools

Home Vastu Shastra, Plot Vastu Shastra, Property Management

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