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PROJECT

PROPOSED CONSTRUCTION OF RESIDENTIAL APARMENTS (2B+STILT+12 UPPER FLOORS) AN EXTENT OF 11 GROUNDS AND 1764 SQ. FT. SITUATED IN RE SURVEY NO. 143/1, EGMORE VILLAGE, TOGETHER WITH A DUPLEX (TWIN) HOUSE ADMEASURING 7045 SQ. FT. BEARING DOOR NO. 1 AND 3 (OLD DOOR NO. 1 AND 2) AND A RESIDENTIAL HOUSE ADMEASURING 3127.36 SQ. FT. BEARING DOOR NO. 3/1 (OLD DOOR NO. 2-A), TAYLORS ROAD, CHENNAI – 600 010

CLIENT

A.R.FOUNDATIONS PVT. LTD.,
NO-148, DR.RADHAKRISHNAN SALAI,
MYLAPORE,
CHENNAI - 600 004.

TITLE

GEOTECHNICAL INVESTIGATION REPORT

PROJECT NO: GEC-JC-GT-5049/2023-2024

DATE: 16/09/2023



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REPORT TEXT



INTRODUCTION

CHAPTER 1

1.0 Project Information Matrix

Nature of project	: Proposed Residential Apartments (2B+Stilt+12 Upper Floors)
Project Client	: M/s A.R.FOUNDATIONS PVT. LTD.,
Project Location	: Taylors Road, Kilpauk, Chennai.
Job Code	: JC-GT-5049

1.1 Scope Of Work

1.1.1 Field Work

- ❖ Conducting two soil investigation bore holes of 150 mm up to 22.0m depth or up to the refusal strata with SPT>100
- ❖ Conducting Standard Penetration Test (SPT) within the borehole at every 1.0m depth interval up to 5.0m and thereafter at every 1.5m depth interval up to 20.0m depth and after that at every 2.0m depth interval up to termination depth.
- ❖ Collection of soil samples 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
- ❖ 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
- ❖ Geology &Sub-Surface Stratification
- ❖ Foundation System
- ❖ Recommendation
- ❖ Annexure



INVESTIGATION METHODOLOGY & TEST RESULTS

2.0 Preamble:

Two 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.

2.1.4 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.



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 2.2. The graphical representation of grain size distribution curve for the representative samples in each bore is presented in Fig. 2.3 to 2.4.

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 2.2. The graphical representation of hydrometer analyses curve for the representative samples in each bore is presented in Fig.2.5 to 2.8.

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 - 2.3.

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. .

SOIL PROFILE

SITE INVESTIGATION RECORD

BORE HOLE No. _____

BH-01

SHEET

1	OF	3
---	----	---

LOCATION		Kilpauk, Chennai		MACHINE No.		CR-01		CHAINAGE (m)		-		BORE START DATE		08/09/2023					
STRUCTURE		2B+Silt+12 Floors		DRILLING METHOD		Rotary		CO-ORDINATES		N		-		BORE END DATE		09/09/2023			
JOB CODE		JC-GT-5049		FLUSHING MEDIUM		Bentonite		CO-ORDINATES		E		-		TOTAL DRILL DAYS		1			
Depth below E.G.L. (m)	Drilling progress per metre			Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details				Layer Data					
	Date	Time			Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description	
		Hr.	Min.				0-15	15-30	30-45										
08/09/2023		12	52	SC	-	-	3	5	5	10	1.00	1	SS	-1.0		L1	0.5	Filled Up Soil (Brownish, Sand)	
		To	12																56
	1		13	01	SC	-	-	4	7	11	18	1.45	2	SS	-2.0		L2	2.0	Greyish Brown, Moist, Stiff, Sandy Silty CLAY (CL) Clays of Low Plasticity
		To	13	03															
	2		14	12	SC	-	-	9	12	14	26	2.45	3	SS	-3.0		L3	3.0	Brownish, Moist, Very Stiff, Sandy Silty CLAY (CL) Clays of Low Plasticity
		To	14	14															
	3		14	23	SC	-	-	6	9	13	22	3.45	4	SS	-4.0		L4	5.0	Brownish/Greyish Brown, Moist, Medium Dense, Poorly Graded, Silty SAND (SM/SP-SM) Sand-Silt mixtures
		To	14	26															
	4		14	38	SC	-	-	1	1	2	3	4.45	5	SS	-5.0		L5	6.5	Brownish, Moist, Very Loose, Poorly Graded, Silty SAND (SP-SM) Sand-Silt mixtures with Clay Binder
		To	14	40															
5		14	52	SC	-	-	2	6	7	13	5.45	6	SS	-6.5		L5	6.5	Pale Greyish, Moist, Medium Dense, Poorly Graded, Silty SAND (SM) Sand-Silt mixtures	
	To	14	59																
6		15	18	SC	-	-	5	7	10	17	6.95	7	SS	-8.0		L5	6.5		
	To	15	25																
8		15	49	SC	-	-	6	8	5	13	8.45	8	SS	-9.5		L5	6.5		
	To	15	55																
9		15	55	SC	-	-	6	8	5	13	9.50	8	SS	-9.5		L5	6.5		
	To	15	55																
10		15	55	SC	-	-	6	8	5	13	9.95	8	SS	-9.5		L5	6.5		
	To	15	55																
		15	55	SC	-	-	6	8	5	13	9.95	8	SS	-9.5		L5	6.5		
	To	15	55																
		15	55	SC	-	-	6	8	5	13	9.95	8	SS	-9.5		L5	6.5		
	To	15	55																
		15	55	SC	-	-	6	8	5	13	9.95	8	SS	-9.5		L5	6.5		
	To	15	55																
		15	55	SC	-	-	6	8	5	13	9.95	8	SS	-9.5		L5	6.5		
	To	15	55																
		15	55	SC	-	-	6	8	5	13	9.95	8	SS	-9.5		L5	6.5		
	To	15	55																
		15	55	SC	-	-	6	8	5	13	9.95	8	SS	-9.5		L5	6.5		
	To	15	55																
		15	55	SC	-	-	6	8	5	13	9.95	8	SS	-9.5		L5	6.5		
	To	15	55																
		15	55	SC	-	-	6	8	5	13	9.95	8	SS	-9.5		L5	6.5		
	To	15	55																
		15	55	SC	-	-	6	8	5	13	9.95	8	SS	-9.5		L5	6.5		
	To	15	55																
		15	55	SC	-	-	6	8	5	13	9.95	8	SS	-9.5		L5	6.5		
	To	15	55																
		15	55	SC	-	-	6	8	5	13	9.95	8	SS	-9.5		L5	6.5		
	To	15	55																

CS - Core Sample		DS - Disturbed Sample		LOGGED		CLINTON EMMANUEL		PROJECT SITE DETAILS		REMARKS	
SS - Split Spoon Sample		SC - Soil Cutter		DATE		08/09/2023		GROUND LEVEL (m)		0.00	
UDS- Undisturbed Sample		TCB - Tungsten Carbide Bit		CHECKED		Jaleel Yasin		WATER TABLE (m)		5.00	
WS - Wash Sample		DB - Diamond Bit		DATE		16/09/2023		CASING DEPTH (m)		0.00	

SITE INVESTIGATION RECORD							BORE HOLE No.		BH-01										
							SHEET	1	OF	3									
PROJECT NAME PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENTS AT KILPAUK, CHENNAI							DIA OF BORE HOLE	150mm	☒										
LOCATION Kilpauk, Chennai		MACHINE No.	CR-01		CHAINAGE (m)	-	BORE START DATE	08/09/2023											
STRUCTURE 2B+Stilt+12 Floors		DRILLING METHOD	Rotary		CO-ORDINATES	N	-	BORE END DATE	09/09/2023										
JOB CODE	JC-GT-5049 <th>FLUSHING MEDIUM</th> <td colspan="2">Bentonite</td> <td>E</td> <td>-</td> <th>TOTAL DRILL DAYS</th> <td>1</td>	FLUSHING MEDIUM	Bentonite			E	-	TOTAL DRILL DAYS	1										
Depth below E.G.L. (m)	Drilling progress per metre		Core Details		SPT Details		Sample Details		Layer Data										
	Date	Time	Type of Drill Bit (SC / TCB / DB)	Total Core Recovery %	R.Q.D %	Blows/cm.	SPT N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description				
	Hr.	Min.				0-15	15-30	30-45											
08/09/2023	12	52	To	SC	-	-	3	5	5	10	1.00	↓	1	SS	-1.0		L1	0.5	Filled Up Soil (Brownish, Sand)
	12	56	To																
	13	01	To	SC	-	-	4	7	11	18	2.00	↓	2	SS	-2.0		L2	2.0	Greyish Brown, Moist, Stiff, Sandy Silty CLAY (CL) Clays of Low Plasticity
	13	03	To																
	14	12	To	SC	-	-	9	12	14	26	3.00	↓	3	SS	-3.0		L3	3.0	Brownish, Moist, Very Stiff, Sandy Silty CLAY (CL) Clays of Low Plasticity
	14	14	To																
	14	23	To	SC	-	-	6	9	13	22	4.00	↓	4	SS	-4.0		L4	5.0	Brownish/Greyish Brown, Moist, Medium Dense, Poorly Graded, Silty SAND (SM/SP-SM) Sand-Silt mixtures
	14	26	To																
	14	38	To	SC	-	-	1	1	2	3	5.00	↓	5	SS	-5.0		L5	6.5	Brownish, Moist, Very Loose, Poorly Graded, Silty SAND (SP-SM) Sand-Silt mixtures with Clay Binder
	14	40	To																
	14	52	To	SC	-	-	2	6	7	13	6.50	↓	6	SS	-6.5				Pale Greyish, Moist, Medium Dense, Poorly Graded, Silty SAND (SM) Sand-Silt mixtures
	14	59	To																
	15	18	To	SC	-	-	5	7	10	17	8.00	↓	7	SS	-8.0				
	15	25	To																
	15	49	To	SC	-	-	6	8	5	13	9.50	↓	8	SS	-9.5				
	15	55	To																
10																			
CS - Core Sample			DS - Disturbed Sample			LOGGED		CLINTON EMMANUEL		PROJECT SITE DETAILS			REMARKS						
SS - Split Spoon Sample			SC - Soil Cutter			DATE		08/09/2023		GROUND LEVEL (m)		0.00							
UDS- Undisturbed Sample			TCB - Tungsten Carbide Bit			CHECKED		Jaleel Yasin		WATER TABLE (m)		5.00							
WS - Wash Sample			DB - Diamond Bit			DATE		16/09/2023		CASING DEPTH (m)		0.00							

GEC		SITE INVESTIGATION RECORD								BORE HOLE No.		BH-01						
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENTS AT KILPAUK, CHENNAI								SHEET		2 OF 3						
LOCATION		Kilpauk, Chennai	MACHINE No.		CR-01		CHAINAGE (m)				DIA OF BORE HOLE		150mm NX					
STRUCTURE		2B+Stilt+12 Floors	DRILLING METHOD		Rotary		CO-ORDINATES		N	-	BORE START DATE		08/09/2023					
JOB CODE		JC-GT-5049	FLUSHING MEDIUM		Bentonite				E	-	BORE END DATE		09/09/2023					
											TOTAL DRILL DAYS		1					
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details				Layer Data					
	Date	Time		Total Core Recovery %	R.O.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description	
	Hr.	Min.				0-15	15-30	30-45										
11	08/09/2023	17 30 To 17 37	SC	-	-	7	8	9	17	11.00	9	SS	-11.0					Pale Greyish/Yellowish Brown/Greyish Brown, Moist, Medium Dense, Poorly Graded, Silty SAND(SP-SM) Sand-Silt mixtures
12		07 10 To 07 18	SC	-	-	6	12	16	28	12.50	10	SS	-12.5					
13		07 42 To 07 48	SC	-	-	5	6	10	16	14.00	11	SS	-14.0					
14		08 31 To 08 34	SC	-	-	4	4	6	10	15.50	12	SS	-15.5	L6	15.5			
15	09/09/2023	10 01 To 10 12	SC	-	-	7	13	18	31	17.00	13	SS	-17.0	L7	17.0			Yellowish Brown, Moist, Loose, Poorly Graded, Silty SAND (SM) Sand-Silt mixtures
16		10 42 To 10 49	SC	-	-	11	11	16	27	18.50	14	SS	-18.5					Yellowish Brown, Moist, Dense, Poorly Graded, Silty SAND (SM) Sand-Silt mixtures
17		11 18 To 11 29	SC	-	-	5cm Penet. For 50Blows			>100	20.00	15	SS	-20.0	L8	19.7			Brownish, Moist, Very Hard, COMPACTED CLAY (SHALE)
18									20.05					L9	20.2			
CS - Core Sample		DS - Disturbed Sample		LOGGED		CLINTON EMMANUEL		PROJECT SITE DETAILS				REMARKS						
SS - Split Spoon Sample		SC - Soil Cutter		DATE		09/09/2023		GROUND LEVEL (m)				0.00						
UDS- Undisturbed Sample		TCB - Tungsten Carbide Bit		CHECKED		Jaleel Yasin		WATER TABLE (m)				5.00						
WS - Wash Sample		DB - Diamond Bit		DATE		16/09/2023		CASING DEPTH (m)				0.00						

		SITE INVESTIGATION RECORD						BORE HOLE No. BH-01										
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENTS AT KILPAUK, CHENNAI						SHEET 3 OF 3										
LOCATION		Kilpauk, Chennai		MACHINE No.		CR-01		CHAINAGE (m)										
STRUCTURE		2B+Stilt+12 Floors		DRILLING METHOD		Rotary		CO-ORDINATES										
JOB CODE		JC-GT-5049		FLUSHING MEDIUM		Bentonite		TOTAL DRILL DAYS										
								1										
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details			Layer Data						
	Date	Time		Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description	
		Hr.				Min.	0-15	15-30										30-45
21	09/09/2023	12	11	DB	30	-												Brownish, SHALE ROCK
22		13	20															
23																		
24																		
25																		
26																		
27																		
28																		
29																		
30																		

CS - Core Sample	DS - Disturbed Sample	LOGGED	CLINTON EMMANUEL	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	09/09/2023	GROUND LEVEL (m)	0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	Jaleel Yasin	WATER TABLE (m)	5.00	
WS - Wash Sample	DB - Diamond Bit	DATE	16/09/2023	CASING DEPTH (m)	0.00	

Borehole terminated at 22 m depth below E.G.L

FIG.2.1 Sub Soil Profile at BH-01 Location

GEC		SITE INVESTIGATION RECORD										BORE HOLE No.		BH-02				
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENTS AT KILPAUK, CHENNAI										SHEET		1 OF 3				
LOCATION		Kilpauk, Chennai		MACHINE No.		CR-01		CHAINAGE (m)		-		DIA OF BORE HOLE		150mm ☒				
STRUCTURE		2B+Stilt+12 Floors		DRILLING METHOD		Rotary		CO-ORDINATES		N -		BORE START DATE		09/09/2023				
JOB CODE		JC-GT-5049		FLUSHING MEDIUM		Bentonite		CO-ORDINATES		E -		BORE END DATE		10/09/2023				
												TOTAL DRILL DAYS		1				
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details				Sample Details				Layer Data				
	Date	Time		Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description	
						0-15	15-30	30-45										
	09/09/2023	16:44 To 16:45	SC	-	-													Filled Up Soil (Brownish, Sand)
		16:55 To 16:58	SC	-	-	1	1	2	3	1.00	1	SS	-1.0		L1	0.5		Brownish, Moist, Soft, Sandy Silty CLAY (CH) Clays of High Plasticity
		15:11 To 15:20	SC	-	-	3	5	6	11	1.45	2	SS	-2.0		L2	2.0		Brownish, Moist, Stiff, Sandy Silty CLAY (CL) Clays of Low Plasticity
		15:32 To 15:46	SC	-	-	7	8	8	16	2.00	3	SS	-3.0		L3	3.0		
		07:05 To 07:06	SC	-	-	4	6	4	10	2.45	4	SS	-4.0					Greyish, Moist, Stiff, Silty CLAY (CI) Clays of Low Plasticity
		07:16 To 07:17	SC	-	-	1	2	3	5	3.00	5	SS	-5.0		L4	5.0		
		07:27 To 07:28	SC	-	-	3	4	6	10	3.45	6	SS	-6.5					Pale Greyish Brown, Moist, Very Loose to Loose, Poorly Graded, Silty SAND (SM) Sand-Silt mixtures
		07:38 To 07:39	SC	-	-	4	8	5	13	4.00	7	SS	-8.0		L5	8.0		
						5	7	4	11	4.45	8	SS	-9.5					Light Greyish/Brownish, Moist, Medium Dense, Poorly Graded, Silty SAND (SP-SM/SM) Sand-Silt mixtures
										4.95								

CS - Core Sample	DS - Disturbed Sample	LOGGED	N.PANDIARAJAN	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	09/09/2023	GROUND LEVEL (m)	0.00	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	Jaleel Yasin	WATER TABLE (m)	5.00	
WS - Wash Sample	DB - Diamond Bit	DATE	16/09/2023	CASING DEPTH (m)	0.00	

GEC		SITE INVESTIGATION RECORD										BORE HOLE No.		BH-02			
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENTS AT KILPAUK, CHENNAI										SHEET		2 OF 3			
LOCATION		Kilpauk, Chennai		MACHINE No.		CR-01		CHAINAGE (m)		-		DIA OF BORE HOLE		150mm NX			
STRUCTURE		2B+Stilt+12 Floors		DRILLING METHOD		Rotary		CO-ORDINATES		N - E -		BORE START DATE		09/09/2023			
JOB CODE		JC-GT-5049		FLUSHING MEDIUM		Bentonite		CO-ORDINATES		N - E -		BORE END DATE		10/09/2023			
TOTAL DRILL DAYS		1															
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details				Layer Data				
	Date	Time		Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description
						0-15	15-30	30-45									
11	09/09/2023	06 To 07	SC	-	-	8	9	10	19	11.00	9	SS	-11.0				Pale Greyish/Light Greyish/Brownish, Moist, Medium Dense, Poorly Graded, Silty SAND (SP-SM/SM) Sand-Silt mixtures
12	09/09/2023	20 To 21	SC	-	-	7	13	15	28	12.50	10	SS	-12.5				
13	09/09/2023	35 To 36	SC	-	-	6	10	10	20	14.00	11	SS	-14.0				
14	09/09/2023	50 To 51	SC	-	-	4	5	6	11	15.50	12	SS	-15.5				
15	09/09/2023	05 To 06	SC	-	-	9	16	17	33	17.00	13	SS	-17.0	L6	17.0		
16	10/09/2023	20 To 21	SC	-	-	10	13	14	27	18.50	14	SS	-18.5	L7	18.5		Greyish Brown, Moist, Dense, Poorly Graded, Silty SAND (SM) Sand-Silt mixtures
17	10/09/2023	35 To 36	SC	-	-					18.95							Greyish Brown, Moist, Medium Dense, Poorly Graded, Silty SAND (SM) Sand-Silt mixtures
18	10/09/2023									20.00	15	SS	-20.0	L8	19.7		Brownish, Moist, Very Hard, COMPACTED CLAY (SHALE)
19										20.04							
20																	

CS - Core Sample	DS - Disturbed Sample	LOGGED	N.PANDIARAJAN	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	04/07/2023	GROUND LEVEL (m)	0.00	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	Jaleel Yasin	WATER TABLE (m)	5.00	
WS - Wash Sample	DB - Diamond Bit	DATE	16/09/2023	CASING DEPTH (m)	0.00	

		SITE INVESTIGATION RECORD										BORE HOLE No. BH-02						
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENTS AT KILPAUK, CHENNAI										SHEET						
LOCATION		Kilpauk, Chennai		MACHINE No.		CR-01		CHAINAGE (m)		-		DIA OF BORE HOLE						
STRUCTURE		2B+Stilt+12 Floors		DRILLING METHOD		Rotary		CO-ORDINATES		N -		150mm						
JOB CODE		JC-GT-5049		FLUSHING MEDIUM		Bentonite		E -		BORE START DATE		09/09/2023						
										BORE END DATE		10/09/2023						
										TOTAL DRILL DAYS		1						
Depth below E.G.L. (m)	Drilling progress per metre			Type of Drill Bit (SC / TCB / DB)	Core Details		SPT Details			Sample Details				Layer Data				
	Date	Time			Total Core Recovery %	R.Q.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description
		Hr.	Min.				0-15	15-30	30-45									
		SPT Hammer Rebounded																
21	10/09/2023	10	56	SC	-	-												Brownish, Moist, Very Hard COMPACTED CLAY (SHALE-Fragments)
		11	30															
		11	56															
		12	30	DB	15	-												Brownish, SHALE ROCK
22																		
23																		
24																		
25																		
26																		
27																		
28																		
29																		
30																		

CS - Core Sample	DS - Disturbed Sample	LOGGED	N.PANDIARAJAN	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	10/09/2023	GROUND LEVEL (m)	0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	Jaleel Yasin	WATER TABLE (m)	5.00	
WS - Wash Sample	DB - Diamond Bit	DATE	16/09/2023	CASING DEPTH (m)	0.00	

Borehole terminated at 22 m depth below E.G.L

FIG.2.2 Sub Soil Profile at BH-02 Location

Grain Size Distribution Curves

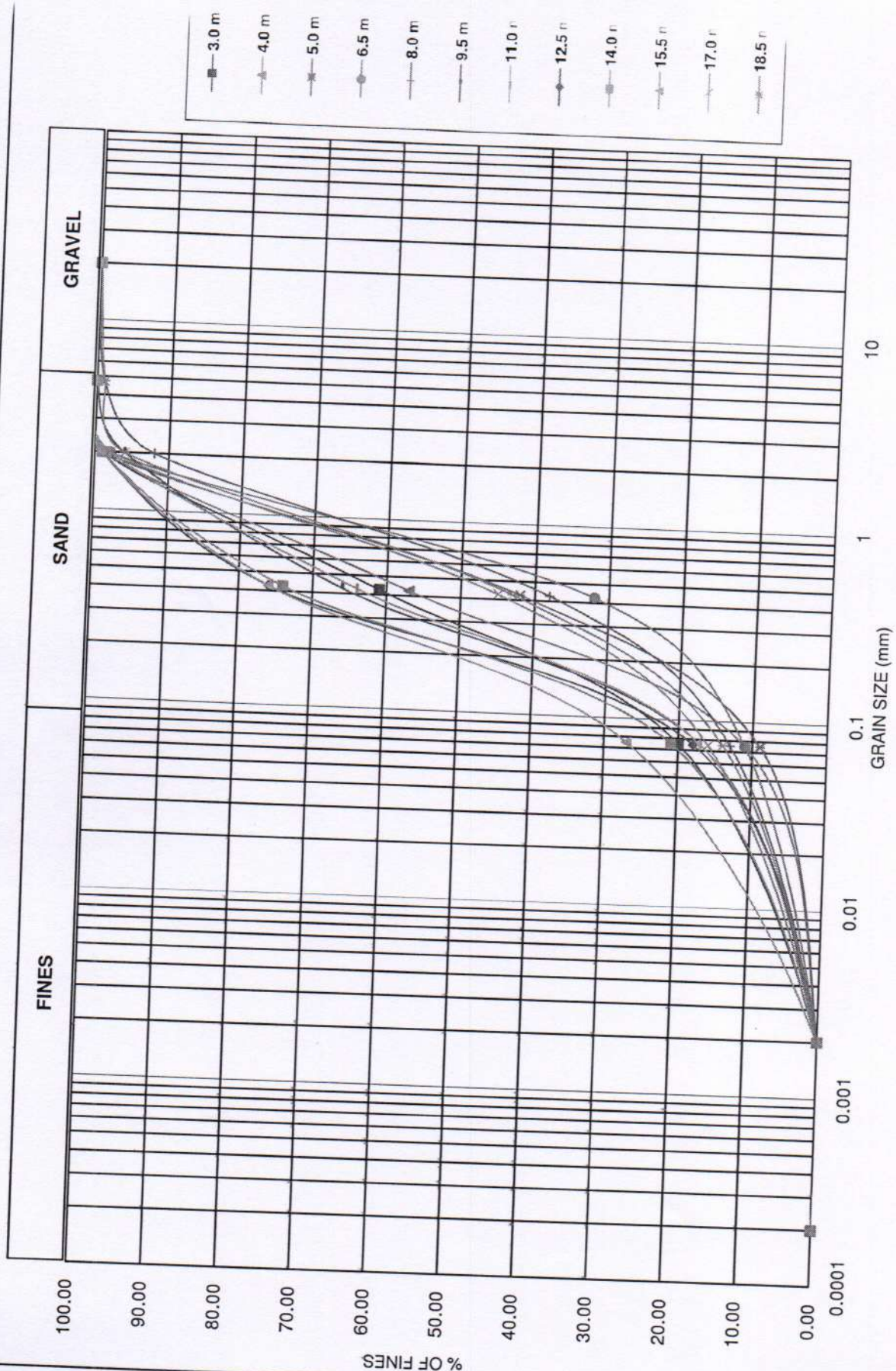


Fig. 2.3 GRAIN SIZE DISTRIBUTION CURVE - BH-01

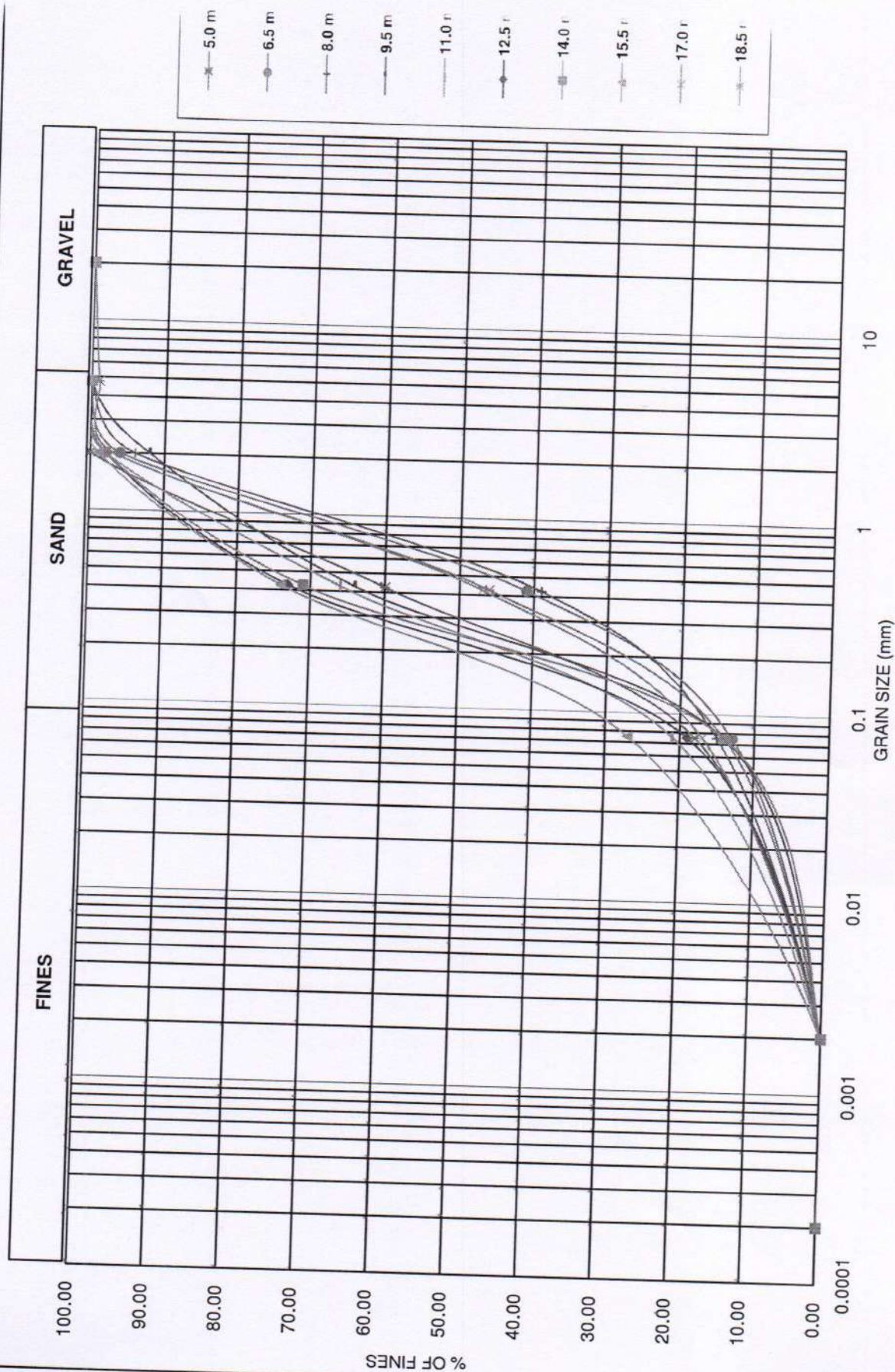


Fig. 2.4 GRAIN SIZE DISTRIBUTION CURVE - BH-02

HYDROMETER ANALYSIS CURVE

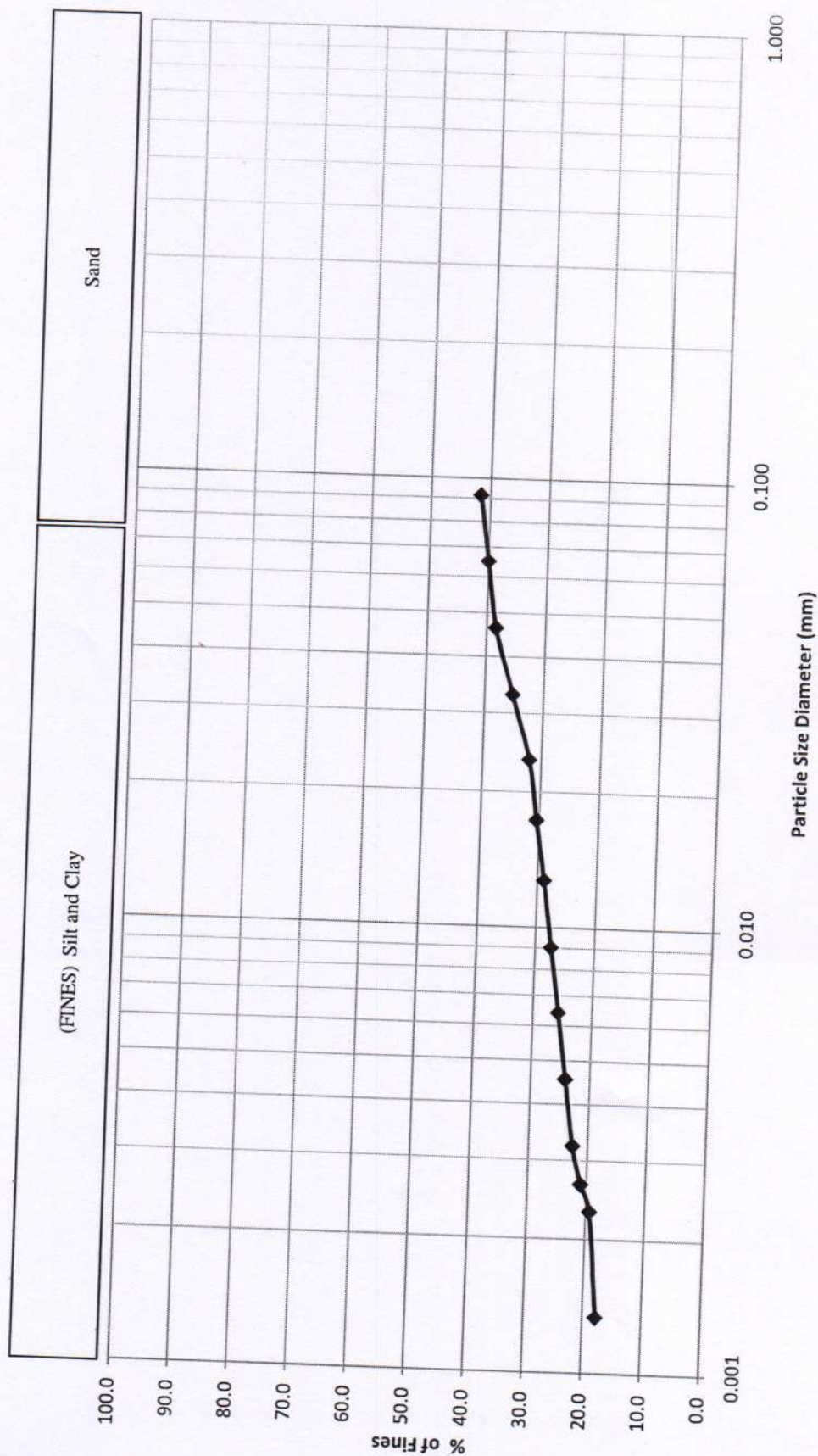


Fig 2.5 Hydrometer Analysis Master Curve

 Bore Hole No: 01 Depth (m)

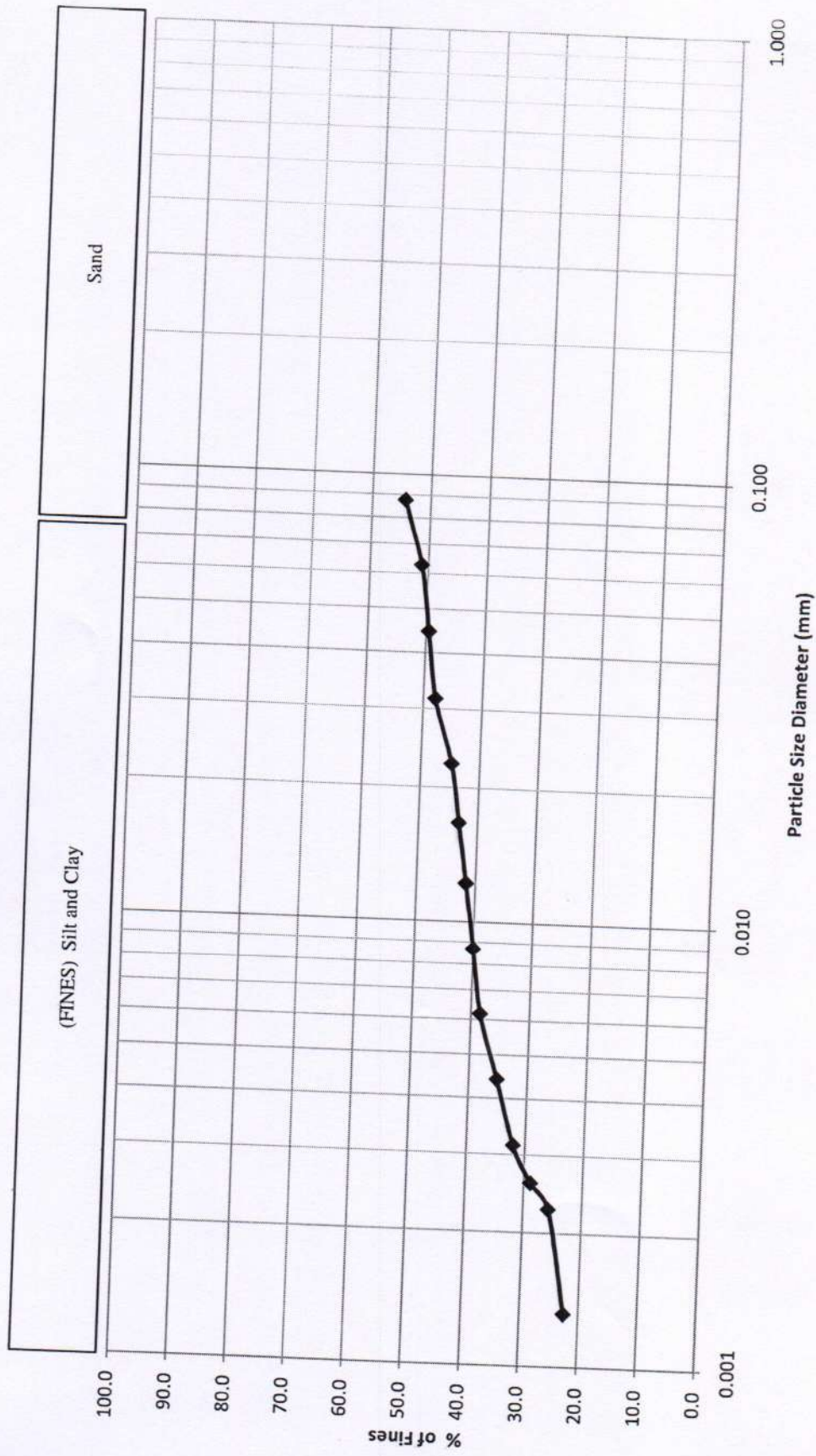


Fig 2.6 Hydrometer Analysis Master Curve

—●— Bore Hole No: 02 Dept

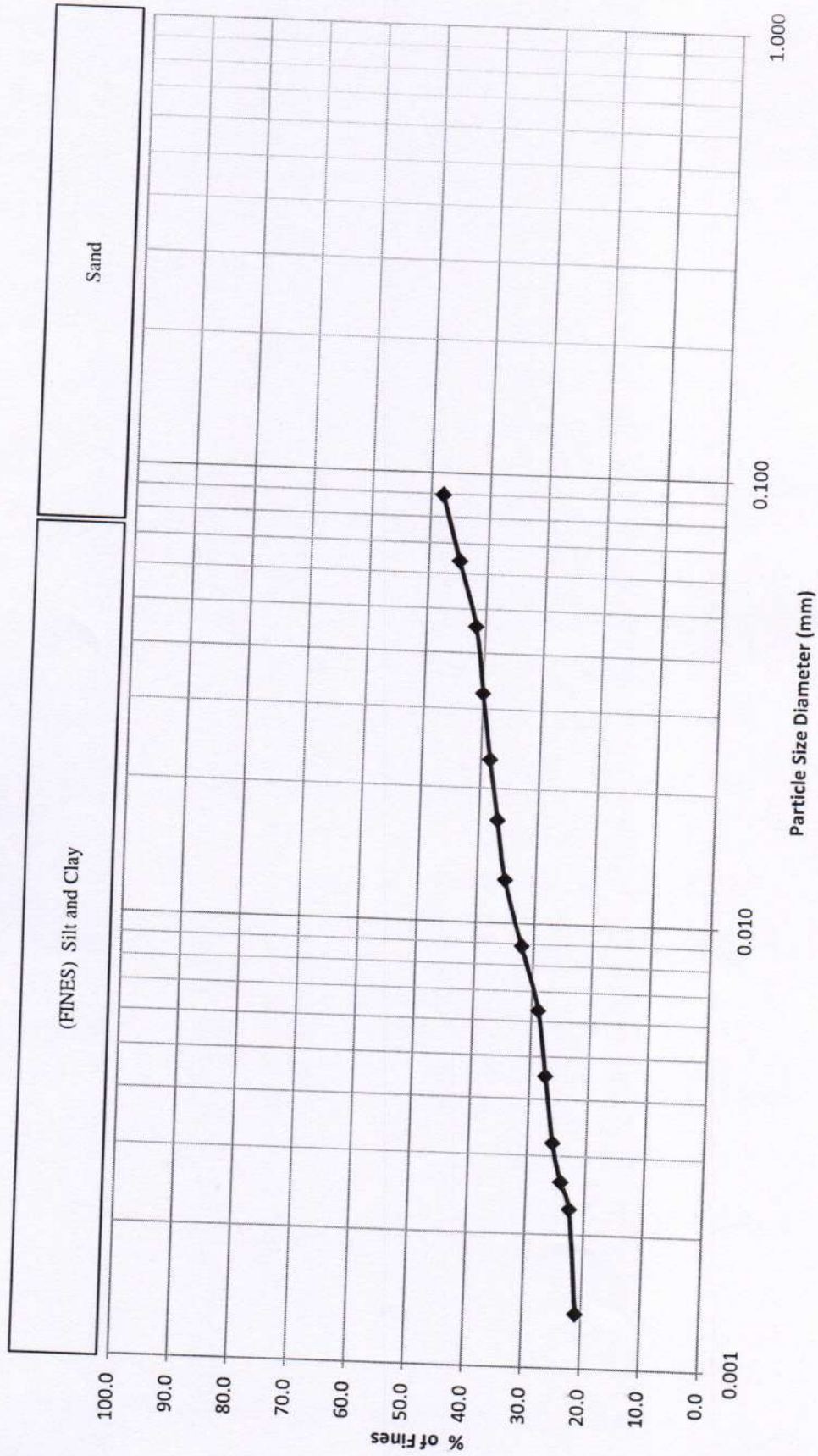


Fig 2.7 Hydrometer Analysis Master Curve

—●— Bore Hole No: 02 Depth

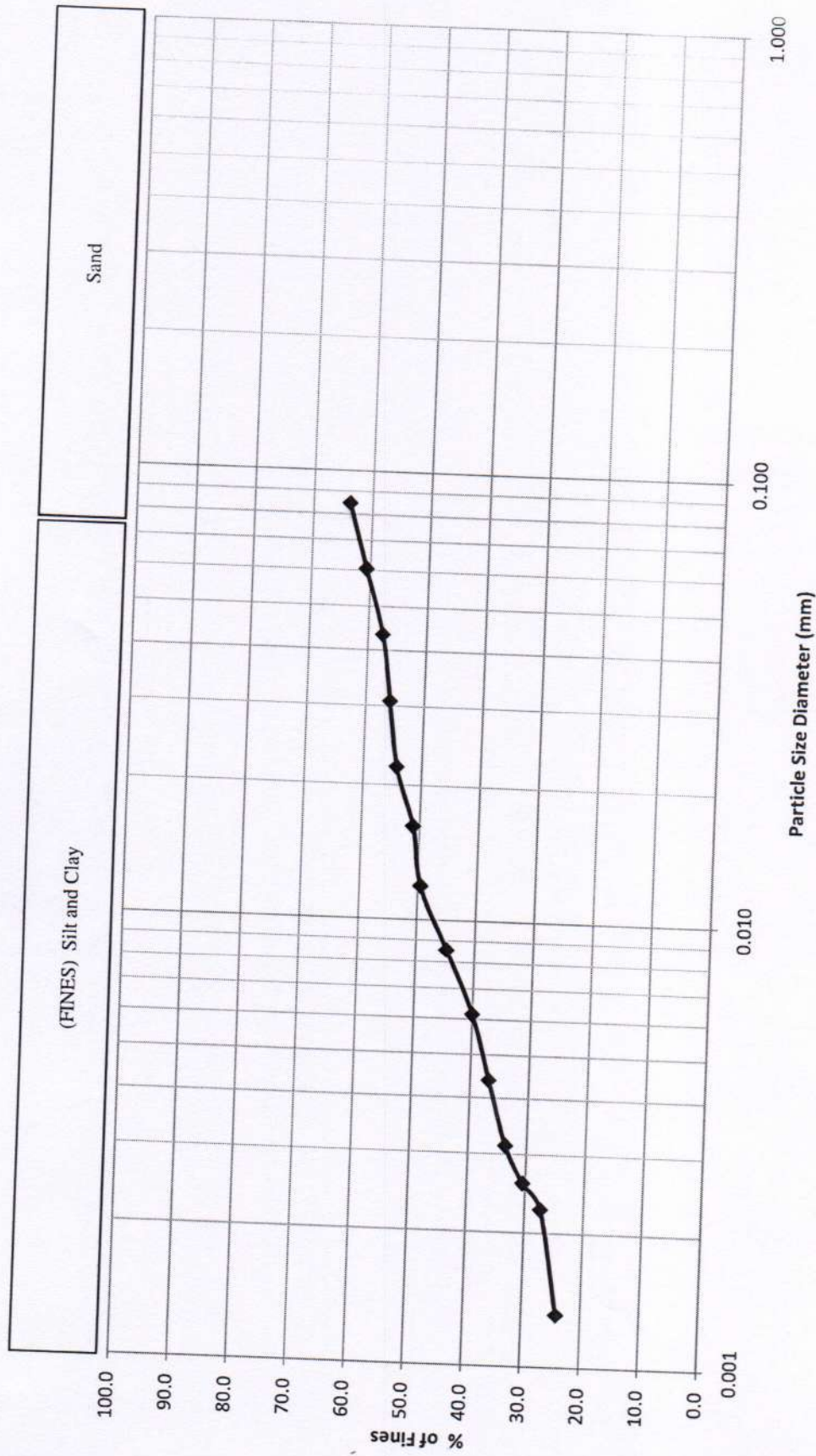


Fig 2.8 Hydrometer Analysis Master Curve

LABORATORY TEST RESULTS

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

Table-2.1 Laboratory Classification of Soil Samples from BH-01																											
Sub Soil Classification																											
Fine Grained (FG)														Coarse Grained (CG)													
Depth of Sample below E.G.L. (m)	SPT-Value	Type of Sample	NMC(%)	LL (%)	PL (%)	Ip	Ic	SL (%)	FS (%)	Consistency	Position With Respect to A-Aline	IS:Notation	Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)	D ₁₀ (mm)	D ₃₀ (mm)	D ₆₀ (mm)	C _u =D ₆₀ /D ₁₀	C _c =D ₃₀ ² /(D ₁₀ x D ₆₀)	Relative Density	IS-Notation		
																									Gravel	Sand	
1.0	10	SS	18	33	15	18	0.83	17	38	Stiff	Above	CL	0	0	5	38	42	15	-	-	-	-	-	FG>50%	FG>50%	FG>50%	
2.0	18	SS	15	34	16	18	1.06	16	42	V.Stiff	Above	CL	0	0	3	31	48	18	-	-	-	-	-	FG>50%	FG>50%	FG>50%	
3.0	26	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	1	38	41	20	0	-	-	-	-	-	<50%	<50%	SM	
4.0	22	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	1	42	46	11	0	-	-	-	-	-	M.Dense	M.Dense	SP-SM	
5.0	3	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	1	57	33	9	0	-	-	-	-	-	V.Loose	<50%	SP-SM	
6.5	13	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	2	66	21	11	0	-	-	-	-	-	M.Dense	<50%	SP-SM	
8.0	17	SS	-	-	-	-	-	-	-	CG>50%	-	-	1	7	54	25	13	0	-	-	-	-	-	M.Dense	<50%	SM	
9.5	13	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	4	30	49	17	0	-	-	-	-	-	M.Dense	<50%	SM	
11.0	17	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	2	34	47	17	0	-	-	-	-	-	M.Dense	<50%	SM	
12.5	28	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	1	23	58	18	0	-	-	-	-	-	M.Dense	<50%	SM	
14.0	16	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	1	25	53	21	0	-	-	-	-	-	M.Dense	<50%	SM	
15.5	10	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	1	23	49	27	0	-	-	-	-	-	Loose	<50%	SM	
17.0	31	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	2	53	29	16	0	-	-	-	-	-	Dense	<50%	SM	
18.5	27	SS	-	-	-	-	-	-	-	CG>50%	-	-	1	3	53	29	14	0	-	-	-	-	-	M.Dense	<50%	SM	
20.0	>100	SS	15	51	23	28	1.286	14	48	Hard	Above	CH	-	-	-	-	78	22	-	-	-	-	-	FG>50%	FG>50%	FG>50%	
FG = Fine Grained CG = Coarse Grained NMC= Nature Moisture Content LL = Liquid Limit														FS = Differential Free Well Index C _u = Uniformity Coefficient C _c = Coefficient of Curvature IP=LL-PL													
														LAB IN-CHARGE					M.PRAVEEN								
														REVIEWED BY					JALEEL YASIN								

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

Table-2.2 Laboratory Classification of Soil Samples from BH-02																													
Sub Soil Classification																													
Fine Grained (FG)															Coarse Grained (CG)														
Depth of Sample below E.G.L. (m)	SPT-Value	Type of Sample	NMC(%)	LL (%)	PL (%)	Ip	Ic	SL (%)	FS (%)	Consistency	Position With Respect to A-Aline	IS:Notation	Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)	D ₁₀ (mm)	D ₃₀ (mm)	D ₆₀ (mm)	C _u =D ₆₀ /D ₁₀	C _c =D ₃₀ ² /(D ₁₀ x D ₆₀)	Relative Density	IS-Notation				
																									Gravel	Sand			
1.0	3	SS	25	32	16	16	0.44	17	32	Soft	Above	CL	0	0	4	36	44	16	-	-	-	-	-	-	FG>50%	FG>50%	FG>50%		
2.0	11	SS	19	35	17	18	0.89	16	48	Stiff	Above	CL	0	0	5	33	45	17	-	-	-	-	-	-	FG>50%	FG>50%	FG>50%		
3.0	16	SS	18	37	19	18	1.06	14	54	V.Stiff	Above	CI	0	0	2	30	48	20	-	-	-	-	-	-	FG>50%	FG>50%	FG>50%		
4.0	10	SS	22	39	19	20	0.85	15	47	Stiff	Above	CI	0	0	3	28	47	22	-	-	-	-	-	-	FG>50%	FG>50%	FG>50%		
5.0	5	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	0	40	42	18	0	-	-	-	-	-	-	Loose	<50%	SM	SM	
6.5	10	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	4	55	28	13	0	-	-	-	-	-	-	Loose	<50%	SM	SM	
8.0	13	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	6	55	24	15	0	-	-	-	-	-	-	M.Dense	<50%	SM	SM	
9.5	11	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	8	28	50	14	0	-	-	-	-	-	-	M.Dense	<50%	SM	SM	
11.0	19	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	2	32	45	21	0	-	-	-	-	-	-	M.Dense	<50%	SM	SM	
12.5	28	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	2	25	54	19	0	-	-	-	-	-	-	M.Dense	<50%	SM	SM	
14.0	20	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	2	27	57	14	0	-	-	-	-	-	-	M.Dense	<50%	SM	SM	
15.5	11	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	1	25	47	27	0	-	-	-	-	-	-	M.Dense	<50%	SM	SM	
17.0	33	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	3	50	30	17	0	-	-	-	-	-	-	Dense	<50%	SM	SM	
18.5	27	SS	-	-	-	-	-	-	-	CG>50%	-	-	1	2	51	32	14	0	-	-	-	-	-	-	M.Dense	<50%	SM	SM	
20.0	>100	SS	16	42	22	20	1.3	14	52	Hard	Above	CI	-	-	-	-	77	23	-	-	-	-	-	-	FG>50%	FG>50%	FG>50%	FG>50%	
FG = Fine Grained CG = Coarse Grained NMC= Nature Moisture Content LL = Liquid Limit															FS = Differential Free Well Index C _u = Uniformity Coefficient C _c = Coefficient of Curvature IP=LL-PL														
															LAB IN-CHARGE					M.PRAVEEN									
															REVIEWED BY					JALEEL YASIN									



Table-2.3 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	BH-01	5.00	7.37	338	423	2.0	7.35	383	412
2	BH-02	5.00	7.37	335	415	2.0	7.35	369	438



GEOLOGY & SUB-SURFACE STRATIFICATION

3.0 Preamble:

Geotechnical investigation carried out at a specific site provides location specific sub surface characteristics based on which the design of sub structures/foundations is generally carried out. However, the macro-level understanding of the sub surface is also needed for a comprehensive understanding of the sub structure/foundation response to naturally super imposed loads like earthquake forces etc., The macro level understanding of the sub surface is better provided through the knowledge of the Geology of the region. Since, it is beyond the scope of the present study to carry out geological investigation to establish the geology of the study region; published data are presented below along with the sub surface stratification observed through the direct borehole investigation carried out at the specified locations.

3.1 Geology of Study Area (based on the published data)

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 (Shale Formation). 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 bore hole investigation, which confirms that the present site does not depict any surprising geological features that are different from that of the region.

3.2 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. R.L.	Bot. R.L.	Thickness							(C _u) kPa	(φ) Deg.
1	0.00	0.50	0.50	Filled Up Soil	-	-	-	-	-	-	-
2	0.50	2.00	1.50	Sandy Silty Clay	Brownish	10	-	Stiff	17.5	67	-
3	2.00	3.00	1.00	Sandy Silty Clay	Brownish	18	-	Very Stiff	20	120	-
4	3.00	5.00	2.00	Silty Sand	Brownish	24	Medium Dense	-	18.5	-	34.2
5	5.00	6.50	1.50	Silty Sand	Brownish	3	Very Loose	-	13	-	20.07
6	6.50	15.50	9.00	Silty Sand	Pale Greyish	17	Medium Dense	-	18	-	32.1
7	15.50	17.00	1.50	Silty Sand	Yellowish Brown	10	Loose	-	15	-	30
8	17.00	19.70	2.70	Silty Sand	Yellowish Brown	31	Dense	-	19.5	-	36.28
9	19.70	20.00	0.30	Compacted Clay	Brownish	>100	-	Hard	21	400	-
10	20.00	22.00	2.00	Shale Rock	Brownish Grey	CRR= 30%, RQD = 0%					



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. R.L.	Bot. R.L.	Thickness							(C _u) kPa	(φ) Deg.
1	0.00	0.50	0.50	Filled Up Soil	-	-	-	-	-	-	-
2	0.50	2.00	1.50	Sandy Silty Clay	Brownish	3	-	Soft	14	20	-
3	2.00	3.00	1.00	Sandy Silty Clay	Brownish	11	-	Stiff	18	73	-
4	3.00	5.00	2.00	Silty Clay	Brownish	13	-	Stiff	19	87	-
5	5.00	8.00	3.00	Silty Sand	Pale Greyish Brown	8	Loose	-	14.5	-	29.6
6	8.00	17.00	9.00	Silty Sand	Pale Greyish	17	Medium Dense	-	18	-	32.1
7	17.00	18.50	1.50	Silty Sand	Greyish Brown	33	Dense	-	19.5	-	36.83
8	18.50	19.70	1.20	Silty Sand	Greyish Brown	27	Medium Dense	-	19	-	35.1
9	19.70	20.00	0.30	Compacted Clay	Brownish	>100	-	Hard	21	400	-
10	20.00	22.00	2.00	Shale Rock	Brownish Grey	CRR= 15%, RQD = 0%					

FOUNDATION SYSTEM



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 two basements plus stilt plus twelve upper floors, and is meant for residential use. For this kind of structure, the column loads could vary between 3000kN to 5000kN. 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 Foundation System

For the kind of proposed structure and the sub soil conditions, it is not possible to adopt any kind of open foundation system from both shear and settlement considerations. Hence, it is advisable to adopt deep pile foundation system. The piles can be installed by drilling with direct mud circulation technique (**Bored Cast In-situ Piles**) and the recommended safe load carrying capacity of bored cast in-situ 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.



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	BH-02	22.0	6.0	16.00	500	750	400	39
2					550	850	425	45
3					600	950	450	50
4					650	1100	500	57
5					750	1300	600	70
6					800	1450	625	80
7					900	1750	700	95

RECOMMENDATIONS



RECOMMENDATIONS

5.0 Recommendation for Deep pile foundation system:

- ❖ If deep pile foundation system adopt, **Bored Cast in situ piles** are recommended as the suitable foundation system.
- ❖ The allowable safe load carrying capacities as per IS 2911-Part-I-Section-2 (2010) for different diameters of piles are given in Table-4.1 can be adopted as provisional design loads.
- ❖ As the load carrying capacity of piles 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 concrete can be done.

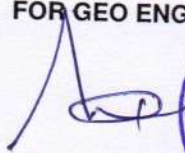
5.1 Construction method statement of pile foundation:

- ❖ For the bored cast in situ piles, a guide casing of 2.0m length can be adopted
- ❖ The mud used shall be made out of sodium bentonite with minimum free 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 Recommendation:

Since, chlorides and sulphates are well within the permissible limits, no special steel or cement is required for the construction of footings

FOR GEO ENGINEERING CONSULTANTS, CHENNAI


AUTHORIZED SIGNATORY



ANNEXURE

ESTIMATION OF SAFE LOAD CARRYING CAPACITY OF BORED CAST-IN-SITU PILES

Type of Pile			Bored		Diameter of Pile			Length of Pile below E.G.L.(m)			As Per IS:2911-(P-I,S-2)-2010					
Reference Bore Hole			BH-02					600			Surcharge Pressure					
Layer No.	Layer Thk. (m)		Type of Strata	Ave. SPT	(γ) kN/m ³		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	Ave. upto Layer		of Layer	(C _u) kPa				(φ) Deg.	At top of Layer	At Bot. of Layer	At Mid. of Layer
Cut-Off Level																
1	0	6	6	8	14.5	14.5	-	29.6	0.0	9.0	4.5	-	1.0	qf	2	9.6
2	6	8	2.0	17	18.0	16.3	-	32.1	9.0	81.0	45.0	-	1.1	qf	5	529.8
5	8	17	9.0	33	19.5	18.8	-	36.8	81.0	95.3	88.1	-	1.3	qf	6	251.1
6	17	18.5	1.5	27	19.0	19.3	-	35.1	95.3	106.1	100.7	-	1.3	qf	7	201.3
7	18.5	19.7	1.2	60	22.0	20.5	400	-	106.1	133.7	119.9	0.3	qf	8	450.9	
8	19.7	22	2.3													

Summation of Positive Skin Resistance (kN) Q_f= 1442.70
Summation of Negative Skin Resistance (kN) -Q_f= 0.00

Computation of End Bearing Resistance

Bearing Stratum	SPT	φ	C _u	N _q	N _c	Eff.Ht.of Overburden	9	m
Clay	60	-	400	-	9	Effective Overburden Pressure	70.65	kN/m ²
End Bearing Resistance (kN) Q _p =							1017.88	

Ultimate Load Carrying Capacity (Q_{ult}) Q_u=Q_f+Q_p (kN) 2460.58
Safe Load Carrying Capacity (Q_{safe}) Q_u/2.5 (kN) 984.23
Allowable Safe Load Carrying Capacity Q_{A-safe} (kN) 950.00
Allowable Safe Pull out Capacity Q_{A-pull}: Q_f/3 (kN) 480.90

Skin Resistance in Clay Layer is $\pi \cdot d \cdot T_1 \cdot C_{u1} \cdot \alpha$
Skin Resistance in Sand Layer is $\pi \cdot d \cdot T_1 \cdot q_1 \cdot K \cdot \tan(\phi)$
End Bearing Resistance in Clay Layer is $\pi \cdot d^2/4 \cdot C_{u1} \cdot N_c$
End Bearing Resistance in Sand Layer is $\pi \cdot d^2/4 \cdot Q \cdot N_q$
Where
C_u=Undrained Shear Strength of Clay
φ=Angle of Shearing Resistance
N_c=Bearing Capacity Factor = 9
Q (Le) Effective Overburden Pressure at pile tip=Effective height of overburden X (γ-10)

Note: The End being is Shale modeled as Clay with restricted to SPT-value of 60 corresponding Cu Value Taken as 400 kPa.
K=Coef. Earth Pressure at Rest
q₁=Effective Overburden Pressure at middle of Layer
N_c=Bearing Capacity Factor, Ref. Fig. 1 of IS: Code Referred above
T₁=Thickness of Layer
d=Dia. Of Pile
α=Adhesion Factor



LATERAL LOAD CARRYING CAPACITY OF BORED CAST-PILE

Reference Bore Hole : BH-02

1.0 Geometrical Data

Type of Pile Head Considered	Fixed
Diameter of Pile (d)	: 0.60 m
Free standing Length of Pile (e)	: 0 m
Length of Pile below E.G.L (Le)	: 22.0 m
Cut-Off Level From E.G.L	: 6.0
Length of Pile below Cut-Off Level (Le)	: 16.0 m
Grade of Concrete (M)	: 25 MN/m ²
Young's Modulus of Concrete (E)	: 25000000 kN/m ²
Moment of Inertia (I)	: 0.006362 m ⁴

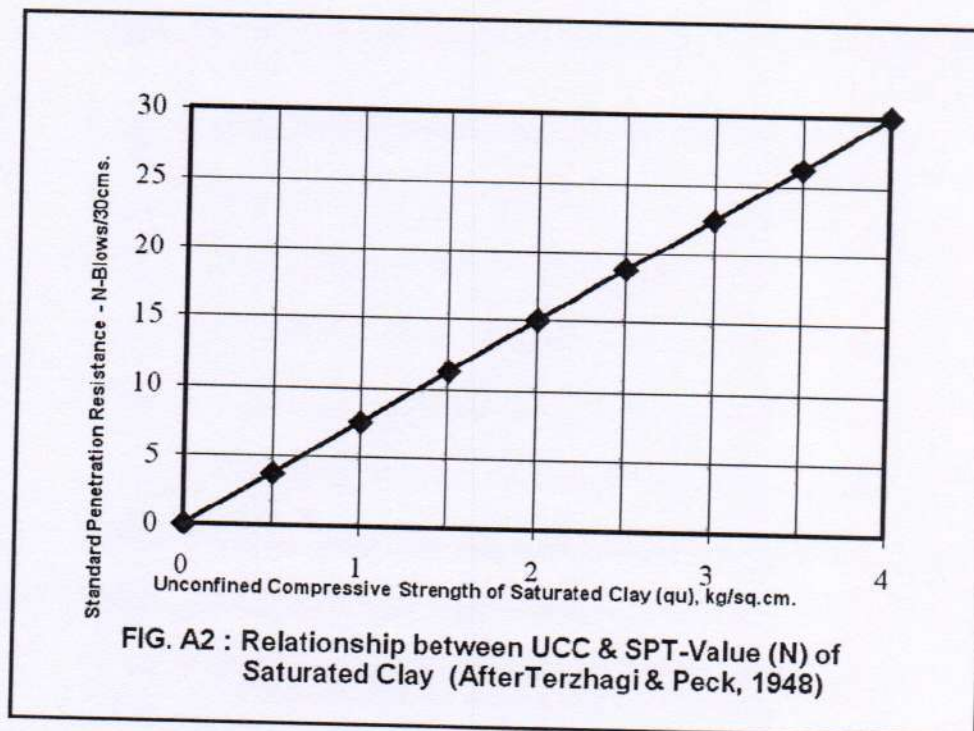
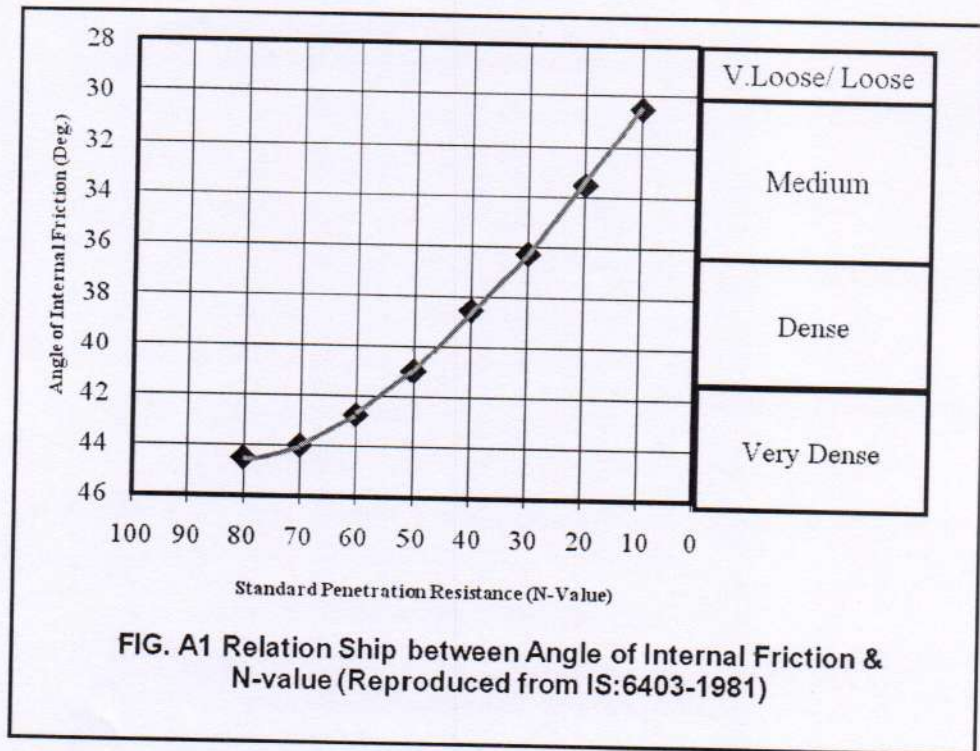
2.0 Determination of Depth of Fixity

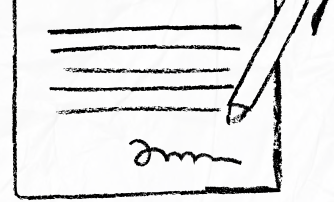
Type of Soil Strata	: Sand
Ground Water Condition	: Submerged
Average Design SPT "N" Value	: 10
$T = (EI/nh)^{1/5}$	
(n can be read as η in the above and below equation in case of Sand)	
nh=	: 1400 kN/m ³
In Case of Sand	: - kN/m ²
T=	: 2.58
L1/T	: 0.00
Lf/T	: 2.20
Depth of Fixity below Cut off (z_f)	: 5.67 m

3.0 Determination 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) = $Y \cdot 12EI / (e + z_f)^3$	: 52.38 kN
Recommended Design Lateral Load carrying Capacity	: 52 kN
Fixed End Moment, $M_F = H(e + z_f)/2$	: 148
Reduction Factor (L_1/T)	: 0.83 m
Actual Moment (Fixed End Moment/Reduction Factor), M_F	: 123 kN-m





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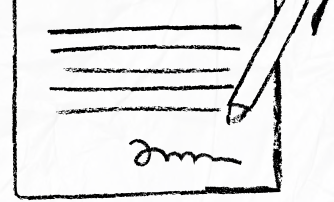
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