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PROJECT NAME

PROPOSED CONSTRUCTION OF PHASE – I NON HIGH RISE GROUP DEVELOPMENT CONSISTS OF 2 BLOCKS, WITH COMBINED BASEMENT, BLOCK A : GROUND + 5 UPPER FLOORS, (143 D/U), BLOCK B : GROUND FLOOR (PART) + 5 UPPER FLOORS, (64 D/U) CLUB HOUSE (PART) GROUND FLOOR (PART) + 4 UPPER FLOORS, AND SWIMMING POOL ON THE GROUND FLOOR TOTALLY 207 D/U COMPRISED IN S.NO. 150/1A2B OF KANNAMPALAYAM VILLAGE, SULUR TALUK, COIMBATORE

CLIENT NAME

CASA GRANDE COIMBATORE LLP,

COIMBATORE.

PROJECT ADDRESS

S.NO. 150/1A2B OF KANNAMPALAYAM VILLAGE,

SULUR TALUK, COIMBATORE.

TITLE

GEOTECHNICAL INVESTIGATION REPORT

PROJECT NO: GEC-JC-GT-4108/2022-2023

DATE: 13/01/2023

GEO ENGINEERING CONSULTANTS
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REPORT TEXT

CHAPTER-1

INTRODUCTION

1.0 Project Information Matrix

Nature of project : Proposed Residential Building (1B+Ground+5Floors)& Villas (G+1 Floors)
Project Owner : **M/s Casa Grande Coimbatore LLP,**
Project Location : Kannampalayam, Coimbatore, Tamil Nadu.
Job Code : GEC-JC-GT-4108

1.1 Scope of Work

1.1.1 Field Work

- Conducting seven soil investigation bore holes of 150 mm & NX diameter up to 6.0m 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 termination depth.
- Collection of Soil Samples and undisturbed samples from the clayey strata with SPT-value less than 15.
- Collection of water samples if groundwater table met within the investigation depth

.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

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CHAPTER-2

INVESTIGATION METHODOLOGY & TEST RESULTS

2.0 Preamble:

Seven 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.

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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-2.1to 2.7. The graphical representation of grain size distribution curve for the representative samples in each bore is presented in Fig. 2.8 to 2.14.

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 2.7. The graphical representation of hydrometer analyses curve for the representative samples in each bore is presented in Fig.2.15.

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 - 2.8.

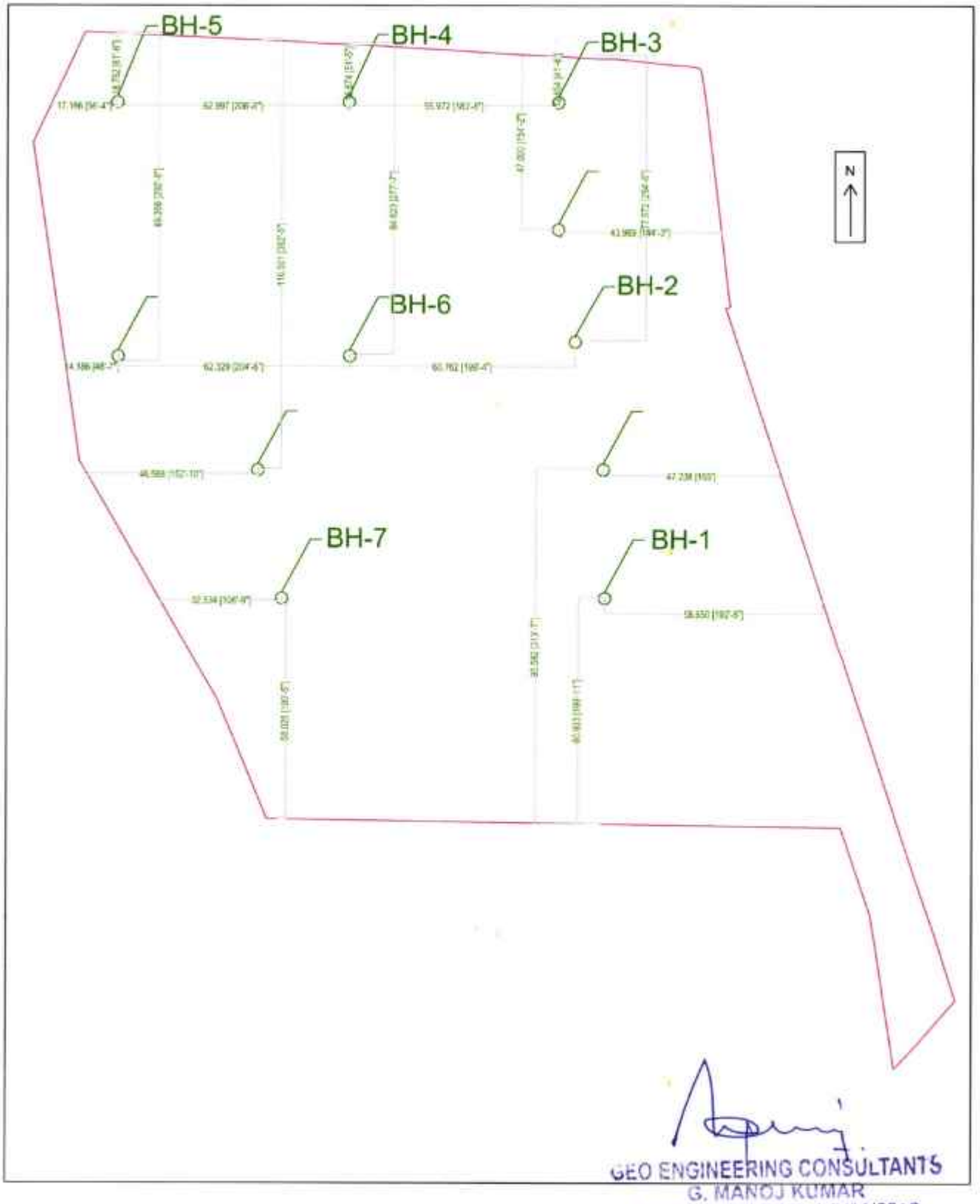
2.3 Summary:

The seven 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 2.7.

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SITE PLAN

SOIL TEST BORE HOLE LOCATIONS



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SOIL PROFILE

SITE INVESTIGATION RECORD

BORE HOLE No.	BH-01						
SHEET	1	OF	1				
PROJECT NAME	PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING AND VILLAS			DIA OF BORE HOLE	150mm ✓		
					100mm		
LOCATION	Kannampalayam, Coimbatore	MACHINE No.	CR-01	CHAINAGE (m)	-	BORE START DATE	26/12/2022
STRUCTURE	1B+G+5 Floors /G+1 Villas	DRILLING METHOD	Rotary	CO-ORDINATES	N	BORE END DATE	27/12/2022
JOB CODE	GEC-JC-GT-4108	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
0		12	50													L1	0.5	Brown,Moist, Poorly Graded, **Clayish SAND (SC),** Sand-Clay Mixture
		To		SC	-	-												
		12	54															
1		13	15				11cm Penet. For 50 Blows			>100	1.00 / 1.11	1	SS	-1.0				
		To		SC	-	-												
		13	20															
2	26/12/2022	13	35				SPT Hammer Rebounded			>100	2.00	2	WS	-2.0				Greyish Brown, Moist, Very Dense **Completely Weathered Rock,** Descent from Charnockite Rock
		To		SC	-	-												
		13	40				SPT Hammer Rebounded			>100	2.50	3	WS	-2.5				
3		13	47															
		To		DB	0	0												
		16	11				-	-	-	-	4.00	4	CS	-4.0		L2	4.0	
4		16	40															
		To		DB	10	-												
		17	40				-	-	-	-	5.00	5	CS	-5.0				Greyish Brown, **Highly Weathered Rock,** Descent from Granite Rock
5	27/12/2022	11	00															
		To		DB	11	-												
		11	55				-	-	-	-	6.00	6	CS	-6.0		L3	6.0	
6																		
7																		
8																		
9																		
10																		

CS - Core Sample	DS - Disturbed Sample	LOGGED	Vinod Pradap	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	27/12/2022	GROUND LEVEL (m)	0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	Jaleel Yasin	WATER TABLE (m)	Nil	
WS - Wash Sample	DB - Diamond Bit	DATE	13/01/2023	CASING DEPTH (m)	0.00	

Borehole terminated at 6 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	1				
PROJECT NAME	PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDINGAND VILLAS			DIA OF BORE HOLE	150mm ✓	100mm	
LOCATION	Kannampalayam, Coimbatore	MACHINE No.	CR-01	CHAINAGE (m)	-	BORE START DATE	27/12/2022
STRUCTURE	1B+G+5 Floors /G+1 Villas	DRILLING METHOD	Rotary	CO-ORDINATES	N	BORE END DATE	27/12/2022
JOB CODE	GEC-JC-GT-4108	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	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
0	27/12/2022	15	07	SC	-	-										L1	0.5	Brown,Moist, Poorly Graded, **Clayish SAND (SC)**, Sand-Clay Mixture
		To 15	12				7	9	10	**19**	1.00	1	SS	-1.0				
1		15	33								1.45							Greyish Brown, Moist, Medium Dense, Poorly Graded, **Residual Soil** Descent from Charnockite Rock
		To 15	40	SC	-	-												
2							14cm Penet. For 50 Blows			**>100**	2.00	2	SS	-2.0		L2	2.0	
		16	12								2.14							Brownish, Moist, Very Dense **Completely Weathered Rock,** Descent from Charnockite Rock
		To 16	31	SC	-	-												
3							SPT Hammer Rebounded			**>100**	3.00	3	WS	-3.0		L3	3.0	
		16	40															
		To 17	20	DB	12	-												
4							-	-	-	-	4.00	4	CS	-4.0				Greyish Brown, **Moderately Weathered Rock,** Descent from Granite Rock
		17	30															
		To 18	21	DB	13	-												
5							-	-	-	-	5.00	5	CS	-5.0		L4	5.0	
6																		
7																		
8																		
9																		
10																		

CS - Core Sample	DS - Disturbed Sample	LOGGED	Vinod Pradap	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	27/12/2022	GROUND LEVEL (m)	0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	Jaleel Yasin	WATER TABLE (m)	Nil	
WS - Wash Sample	DB - Diamond Bit	DATE	13/01/2023	CASING DEPTH (m)	0.00	

Borehole terminated at 5 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	1
PROJECT NAME	PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING AND VILLAS	DIA OF BORE HOLE	150mm ✓ / 100mm
LOCATION	Kannampalayam, Coimbatore	MACHINE No.	CR-01
CHAINAGE (m)	-	BORE START DATE	28/12/2022
STRUCTURE	1B+G+S Floors/G+1 Villas	DRILLING METHOD	Rotary
CO-ORDINATES	N	BORE END DATE	28/12/2022
JOB CODE	GEC-JC-GT-4108	FLUSHING MEDIUM	Bentonite
CO-ORDINATES	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	SPT Details: Blows/cm. 15-30	SPT Details: Blows/cm. 30-45	SPT 'N' Value	Sample Details: Depth	Sample Details: No.	Sample Details: Type	Sample Details: RL (m)	Layer Data: Legend	Layer Data: No	Layer Data: Depth	Layer Data: Geotechnical Description
0	28/12/2022	06	10	SC	-	-										L1	0.5	Brown,Moist, Poorly Graded, **Clayish SAND (SC),** Sand-Clay Mixture
		To																
		06	15				SPT Hammer Rebounded			>100	1.00	1	WS	-1.0				
1																		Greyish, Moist, Very Dense **Completely Weathered Rock**, Descent from Charnockite Rock
																L2	1.5	
2		06	30	DB	9	-												
		To																
		07	15				-	-	-	-	2.50	2	CS	-2.5				Brown, **Highly Weathered Rock,** Descent from Granite Rock
3																		
		07	20															
		To		DB	11	-												
4		08	30				-	-	-	-	4.00	3	CS	-4.0		L3	4.0	
		08	40															Greyish Brown, **Moderately Weathered Rock,** Descent from Granite Rock
		To		DB	14	-												
5		09	50				-	-	-	-	5.00	4	CS	-5.0		L4	5.0	
6																		
7																		
8																		
9																		
10																		

CS - Core Sample	DS - Disturbed Sample	LOGGED	Vinod Pradap	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	28/12/2022	GROUND LEVEL (m)	0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	Jaleel Yasin	WATER TABLE (m)	Nil	
WS - Wash Sample	DB - Diamond Bit	DATE	13/01/2023	CASING DEPTH (m)	0.00	

Borehole terminated at 5 m depth below E.G.L

FIG.2.3 Sub Soil Profile at BH-03 Location

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SITE INVESTIGATION RECORD

BORE HOLE No.	BH-04		
SHEET	1	OF	1
PROJECT NAME	PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING AND VILLAS	DIA OF BORE HOLE	150mm ✓ / 100mm
LOCATION	Kannampalayam, Coimbatore	MACHINE No.	CR-01
CHAINAGE (m)	-	BORE START DATE	28/12/2022
STRUCTURE	1B+G+5 Floors/G+1 Villas	DRILLING METHOD	Rotary
CO-ORDINATES	N	BORE END DATE	28/12/2022
JOB CODE	GEC-JC-GT-4108	FLUSHING MEDIUM	Bentonite
CO-ORDINATES	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	SPT Details: Blows/cm. 15-30	SPT Details: Blows/cm. 30-45	SPT 'N' Value	Sample Details: Depth	Sample Details: No.	Sample Details: Type	Sample Details: RL (m)	Layer Data: Legend	Layer Data: No	Layer Data: Depth	Layer Data: Geotechnical Description
0		11	43													L1	0.5	Brown,Moist, Poorly Graded, **Clayish SAND (SC)**, Sand-Clay Mixture
		To		SC	-	-												
1		11	46				18	29	14cm Penet. For 50 Blows	>100	1.00	1	SS	-1.0				
		12	10								1.44							Brown, Moist, Very Dense **Completely Weathered Rock**, Descent from Charnockite Rock
		To		SC	-	-												
2		12	14				4cm Penet. For 50 Blows			>100	2.00	2	SS	-2.0				
		12	38								2.04							
		To		SC	-	-												
3	28/12/2022	12	43				SPT Hammer Rebounded			>100	3.00	3	WS	-3.0		L2	3.0	
		13	00															
		To		DB	12	-												
4		13	59				-	-	-	-	4.50	4	CS	-4.5				Greyish Brown, **Moderately Weathered Rock**, Descent from Granite Rock
		14	10															
		To		DB	15	-												
5		15	40				-	-	-	-	6.00	5	CS	-6.0		L3	6.0	
6																		
7																		
8																		
9																		
10																		

CS - Core Sample	DS - Disturbed Sample	LOGGED	Vinod Pradap	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	28/12/2022	GROUND LEVEL (m)	0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	Jaleel Yasin	WATER TABLE (m)	Nil	
WS - Wash Sample	DB - Diamond Bit	DATE	13/01/2023	CASING DEPTH (m)	0.00	

Borehole terminated at 6 m depth below E.G.L

FIG.2.4 Sub Soil Profile at BH-04 Location

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SITE INVESTIGATION RECORD

BORE HOLE No.	BH-05						
SHEET	1	OF	1				
PROJECT NAME	PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING AND VILLAS			DIA OF BORE HOLE	150mm	✓	
					100mm		
LOCATION	Kannampalayam, Coimbatore	MACHINE No.	CR-01	CHAINAGE (m)	-	BORE START DATE	28/12/2022
STRUCTURE	1B+G+5 Floors/G+1 Villas	DRILLING METHOD	Rotary	CO-ORDINATES	N	BORE END DATE	28/12/2022
JOB CODE	GEC-JC-GT-4108	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	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
0		16	30													L1	0.5	Brown,Moist, Poorly Graded, **Clayish SAND (SC),** Sand-Clay Mixture
		To		SC	-	-												
1		16	33				7	12	12	24	1.00	1	SS	-1.0				Brown, Moist,Very Stiff, **Sandy Silty CLAY (CH),** Silty Clay of High Plasticity
		16	40								1.45					L2	1.5	
		To		SC	-	-												
2		16	44				SPT Hammer Rebounded			>100	2.00	2	WS	-2.0		L3	2.5	Brown, Moist, Very Dense **Completely Weathered Rock,** Descent from Charnockite Rock
	28/12/2022																	
3		16	57															
		To		DB	13	-	-	-	-	-	3.50	3	CS	-3.5				Greyish Brown, **Moderately Weathered Rock,** Descent from Granite Rock
4		17	44															
		17	56															
		To		DB	15	-												
5		18	49				-	-	-	-	5.00	4	CS	-5.0		L4	5.0	
6																		
7																		
8																		
9																		
10																		

CS - Core Sample	DS - Disturbed Sample	LOGGED	Vinod Pradap	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	28/12/2022	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	Jaleel Yasin	WATER TABLE (m) Nil	
WS - Wash Sample	DB - Diamond Bit	DATE	13/01/2023	CASING DEPTH (m) 0.00	

Borehole terminated at 5 m depth below E.G.L

FIG.2.5 Sub Soil Profile at BH-05 Location

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G. MANOJ KUMAR
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CMDA No: GTE/19/03/012
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Chennai - 600 042

SITE INVESTIGATION RECORD

BORE HOLE No.	BH-06		
SHEET	1	OF	1
PROJECT NAME	PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING AND VILLAS	DIA OF BORE HOLE	150mm ✓ / 100mm
LOCATION	Kannampalayam, Coimbatore	MACHINE No.	CR-01
CHAINAGE (m)	-	BORE START DATE	29/12/2022
STRUCTURE	1B+G+S Floors/G+1 Villas	DRILLING METHOD	Rotary
CO-ORDINATES	N	BORE END DATE	29/12/2022
JOB CODE	GEC-JC-GT-4108	FLUSHING MEDIUM	Bentonite
CO-ORDINATES	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
0		09	00 To 09 06	SC	-	-										L1	0.5	Brown,Moist, Poorly Graded, **Clayish SAND (SC)**, Sand-Clay Mixture
1		09	15 To 09 20	SC	-	-	6cm Penet. For 50 Blows			>100	1.00 / 1.06	1	SS	-1.0				
2		09	36 To 09 43	SC	-	-	2cm Penet. For 50 Blows			>100	2.00 / 2.02	2	WS	-2.0				Brownish, Moist, Very Dense **Completely Weathered Rock**, Descent from Charnockite Rock
3		10	00 To 10 03	SC	-	-	SPT Hammer Rebounded			>100	3.00	3	WS	-3.0				
4		10	15 To 10 25	SC	-	-	SPT Hammer Rebounded			>100	4.00	4	WS	-4.0				
5		11	00 To 11 59	DB	11	-	SPT Hammer Rebounded			>100	4.50	5	WS	-4.5		L2	4.5	
6		12	15 To 13 02	DB	15	-	-	-	-	-	6.00	6	CS	-6.0				Greyish Brown, **Moderately Weathered Rock**, Descent from Granite Rock
7							-	-	-	-	7.00	7	CS	-7.0		L3	7.0	
8																		
9																		
10																		

CS - Core Sample	DS - Disturbed Sample	LOGGED	Vinod Pradap	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	29/12/2022	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	Jaleel Yasin	WATER TABLE (m) Nil	
WS - Wash Sample	DB - Diamond Bit	DATE	13/01/2023	CASING DEPTH (m) 0.00	

Borehole terminated at 7 m depth below E.G.L

FIG.2.6 Sub Soil Profile at BH-06 Location

DDTC - No: GTE-T-xxx/01/2019
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Chennai - 600 042

SITE INVESTIGATION RECORD

BORE HOLE No.	BH-07		
SHEET	1	OF	1
PROJECT NAME	PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING AND VILLAS	DIA OF BORE HOLE	150mm ✓ / 100mm
LOCATION	Kannampalayam, Coimbatore	MACHINE No.	CR-01
CHAINAGE (m)	-	BORE START DATE	29/12/2022
STRUCTURE	1B+G+5 Floors/G+1 Villas	DRILLING METHOD	Rotary
CO-ORDINATES	N	BORE END DATE	29/12/2022
JOB CODE	GEC-JC-GT-4108	FLUSHING MEDIUM	Bentonite
CO-ORDINATES	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
0	29/12/2022	15	28	SC	-	-										L1	0.5	Brown,Moist, Poorly Graded, **Clayish SAND (SC)**, Sand-Clay Mixture
		To																
		15	29				38	14cm Penet.for 50Blows		>100	1.00	1	SS	-1.0				
1											1.29							
		15	43															Brown, Moist, Very Dense, Poorly Graded. **Residual Soil** Descent from Charnockite Rock
		To		SC	-	-												
		15	45															
2							14cm Penet. For 50 Blows			>100	2.00	2	SS	-2.0		L2	2.0	
											2.14							
		16	10															Brownish, Moist, Very Dense **Completely Weathered Rock,** Descent from Charnockite Rock
		To		SC	-	-												
		16	20													L3	3.0	
3							SPT Hammer Rebounded			>100	3.00	3	WS	-3.0				
		16	30															Brownish, **Highly Weathered Rock,** Descent from Charnockite Rock
4		To		DB	9	-												
		17	20				-	-	-	-	4.50	4	CS	-4.5		L4	4.5	
5																		Greyish Brown, **Moderately Weathered Rock,** Descent from Granite Rock
		17	30															
		To		DB	13	-												
		18	29													L5	6.0	
6							-	-	-	-	6.00	5	CS	-6.0				
7																		
8																		
9																		
10																		

CS - Core Sample	DS - Disturbed Sample	LOGGED	Vinod Pradap	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	29/12/2022	GROUND LEVEL (m)	0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	Jaleel Yasin	WATER TABLE (m)	Nil	
WS - Wash Sample	DB - Diamond Bit	DATE	13/01/2023	CASING DEPTH (m)	0.00	

Borehole terminated at 6 m depth below E.G.L

FIG.2.7 Sub Soil Profile at BH-07 Location

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Chennai - 600 042

Grain Size Distribution Curves

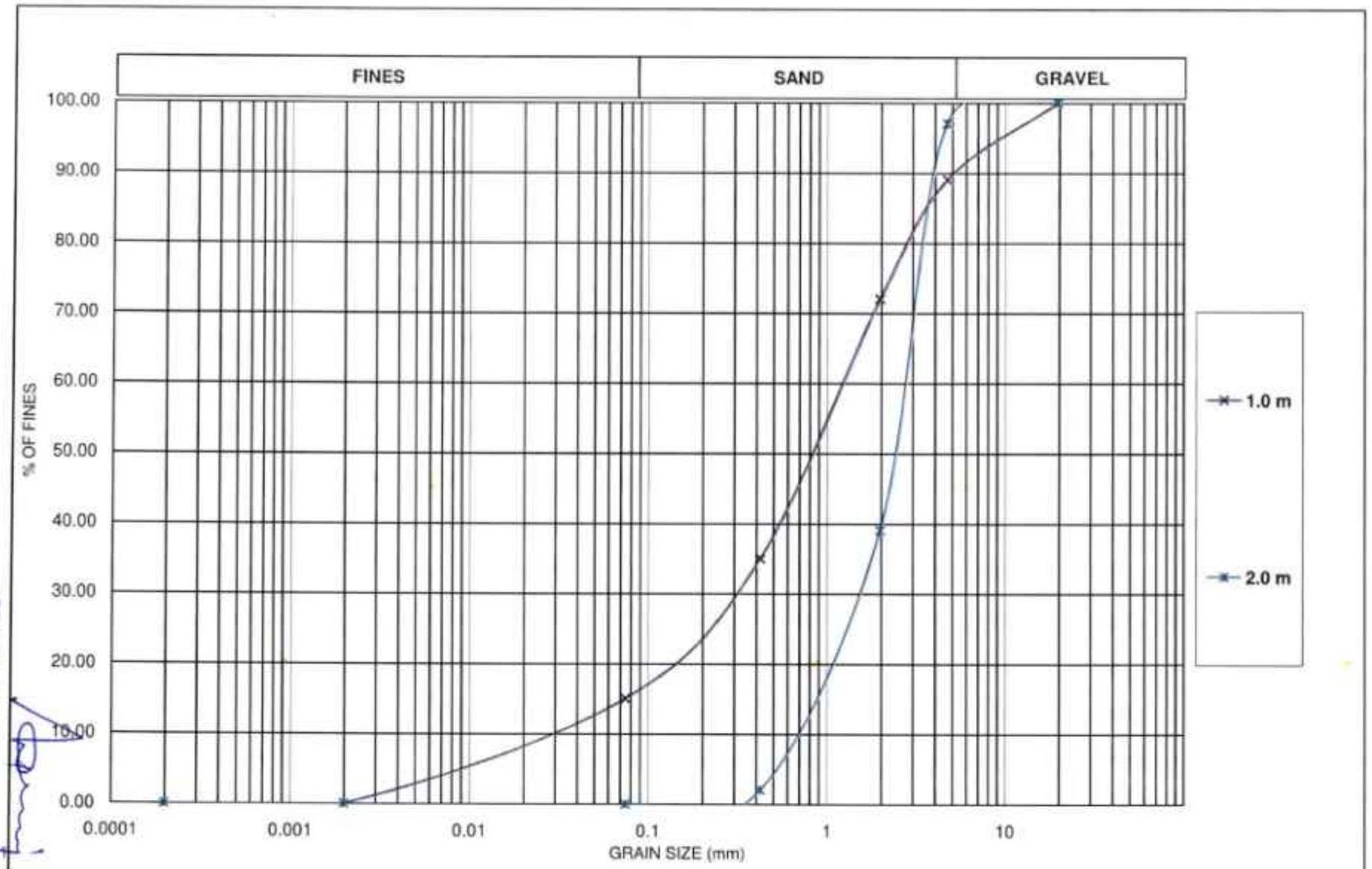


Fig. 2.8 GRAIN SIZE DISTRIBUTION CURVE - BH-01

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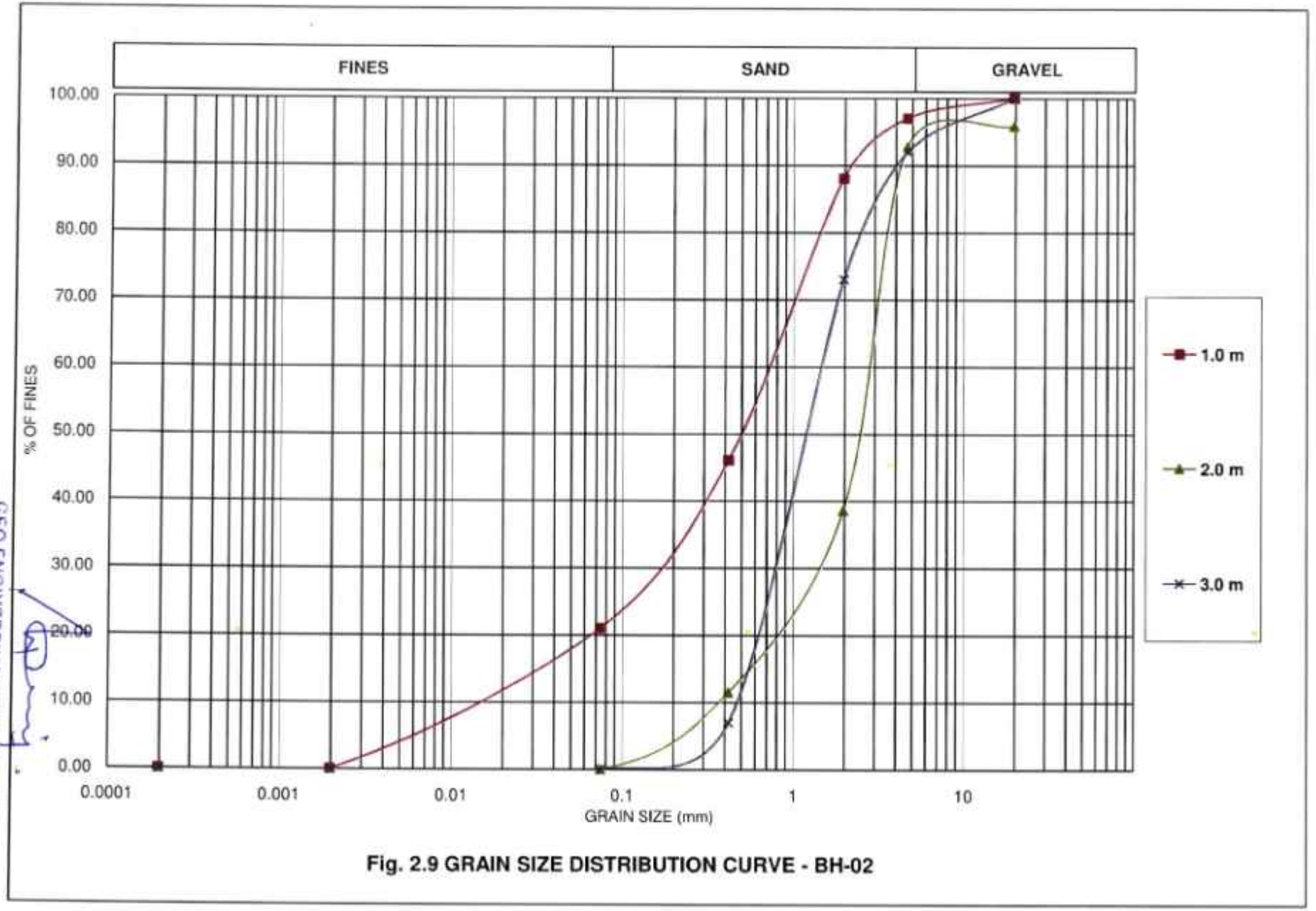


Fig. 2.9 GRAIN SIZE DISTRIBUTION CURVE - BH-02

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CMDA No. GTE/19/03/012
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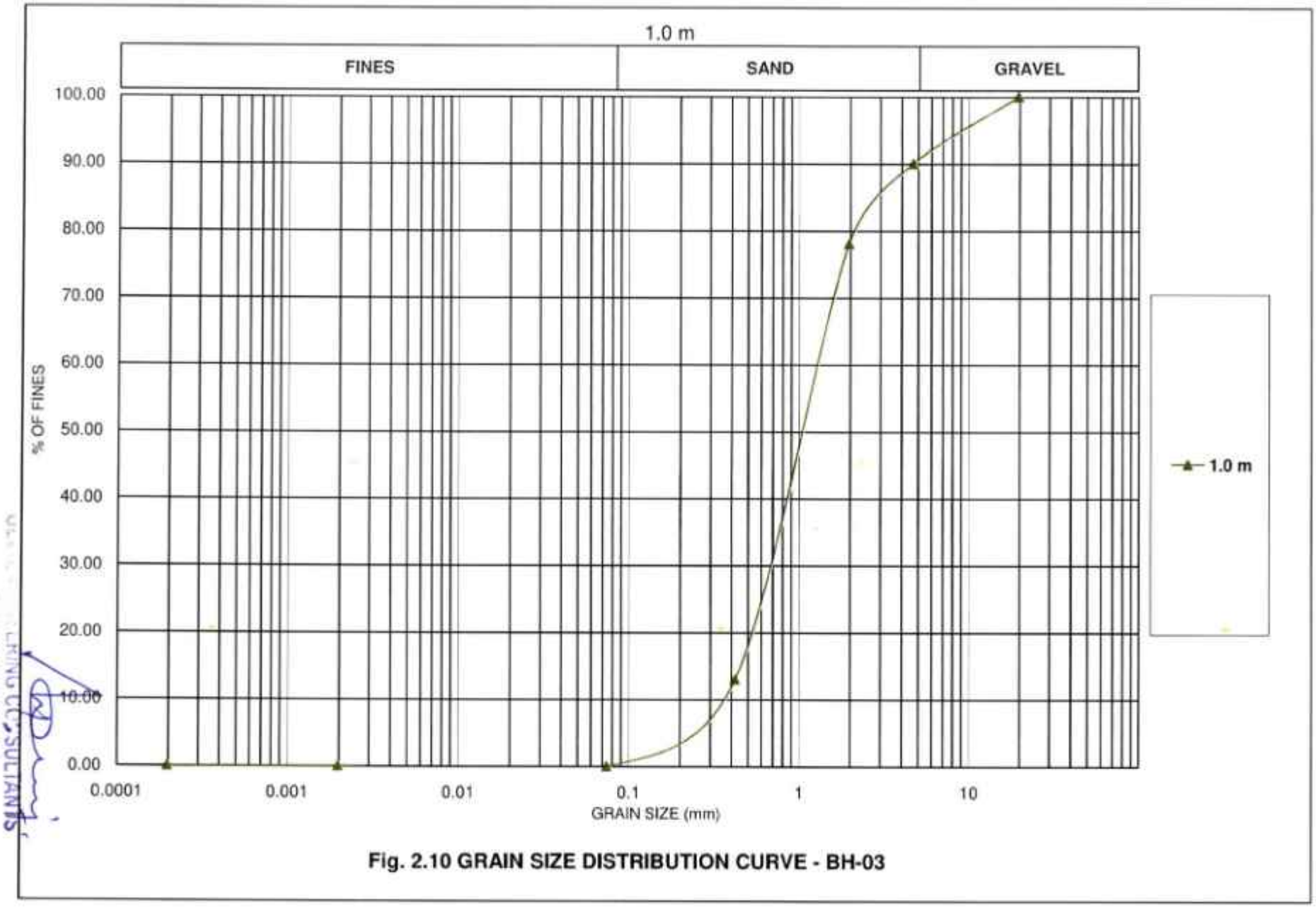


Fig. 2.10 GRAIN SIZE DISTRIBUTION CURVE - BH-03

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CMDA No. GTE/18/03/012
Dr. Seethapathy Nagar, Velachery
Chennai - 600 042

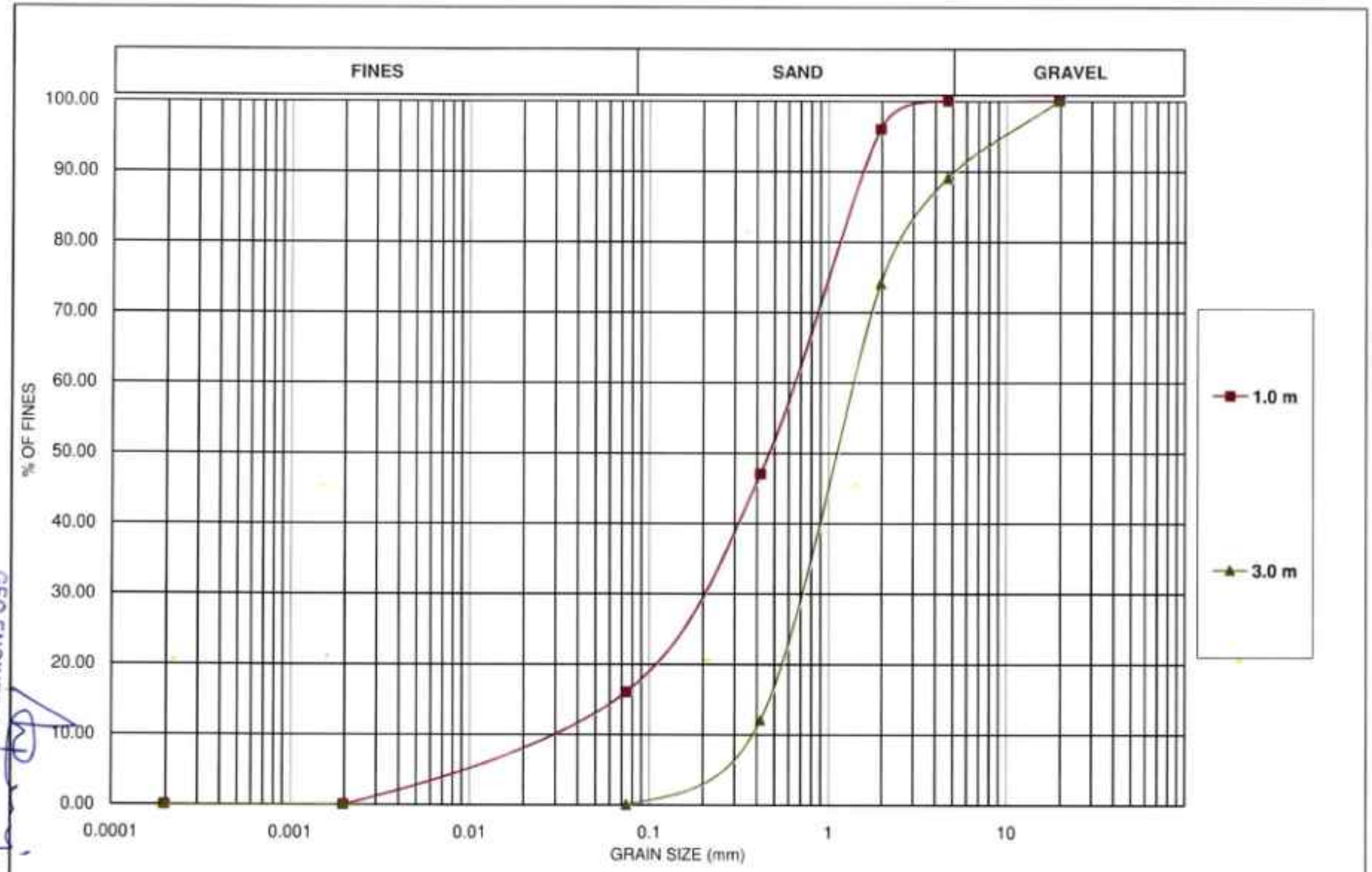


Fig. 2.11 GRAIN SIZE DISTRIBUTION CURVE - BH-04

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CMDA No: GTE/19/03/012
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Chennai - 600 042

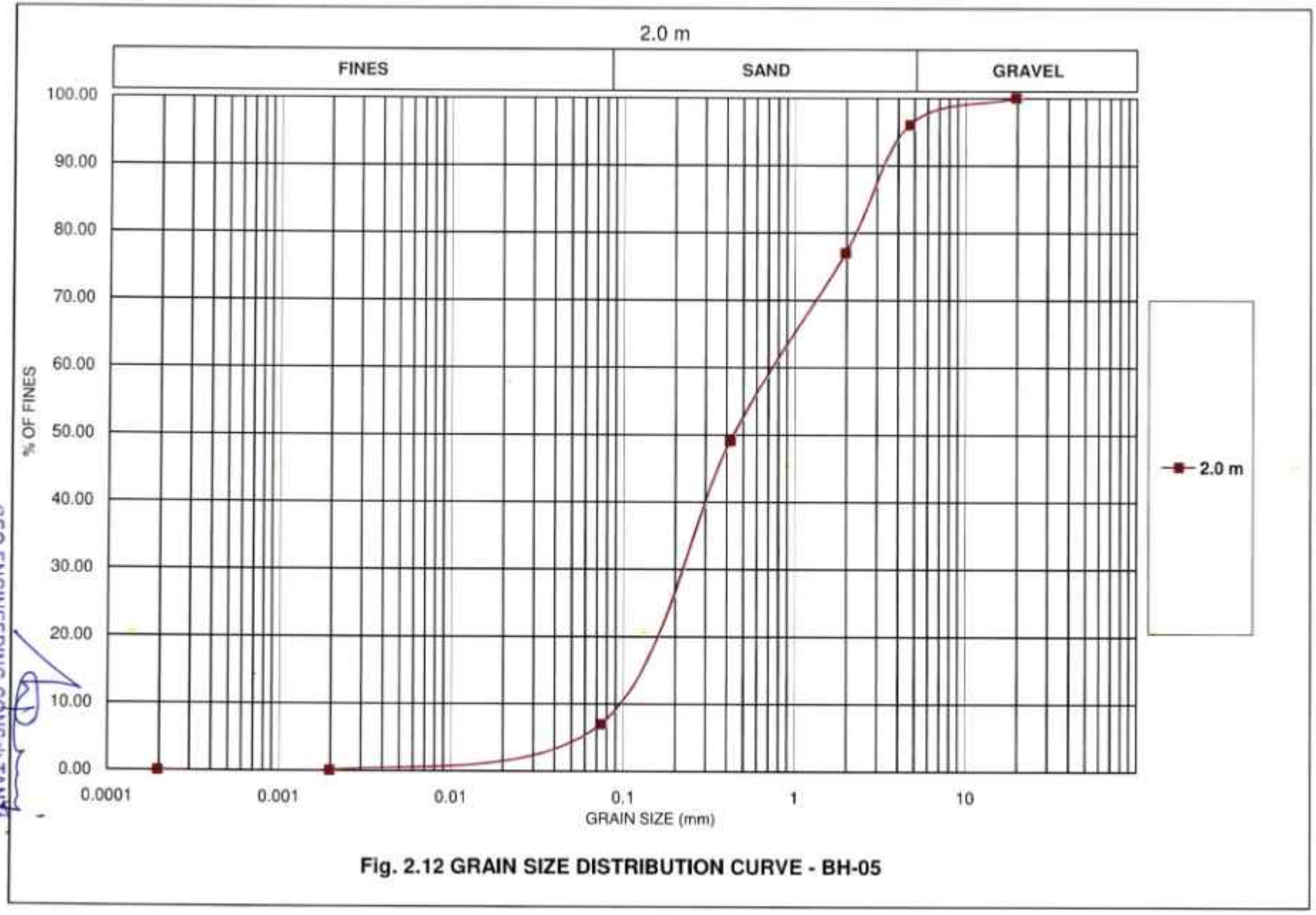


Fig. 2.12 GRAIN SIZE DISTRIBUTION CURVE - BH-05

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CMDA No: GTE/19/03/012
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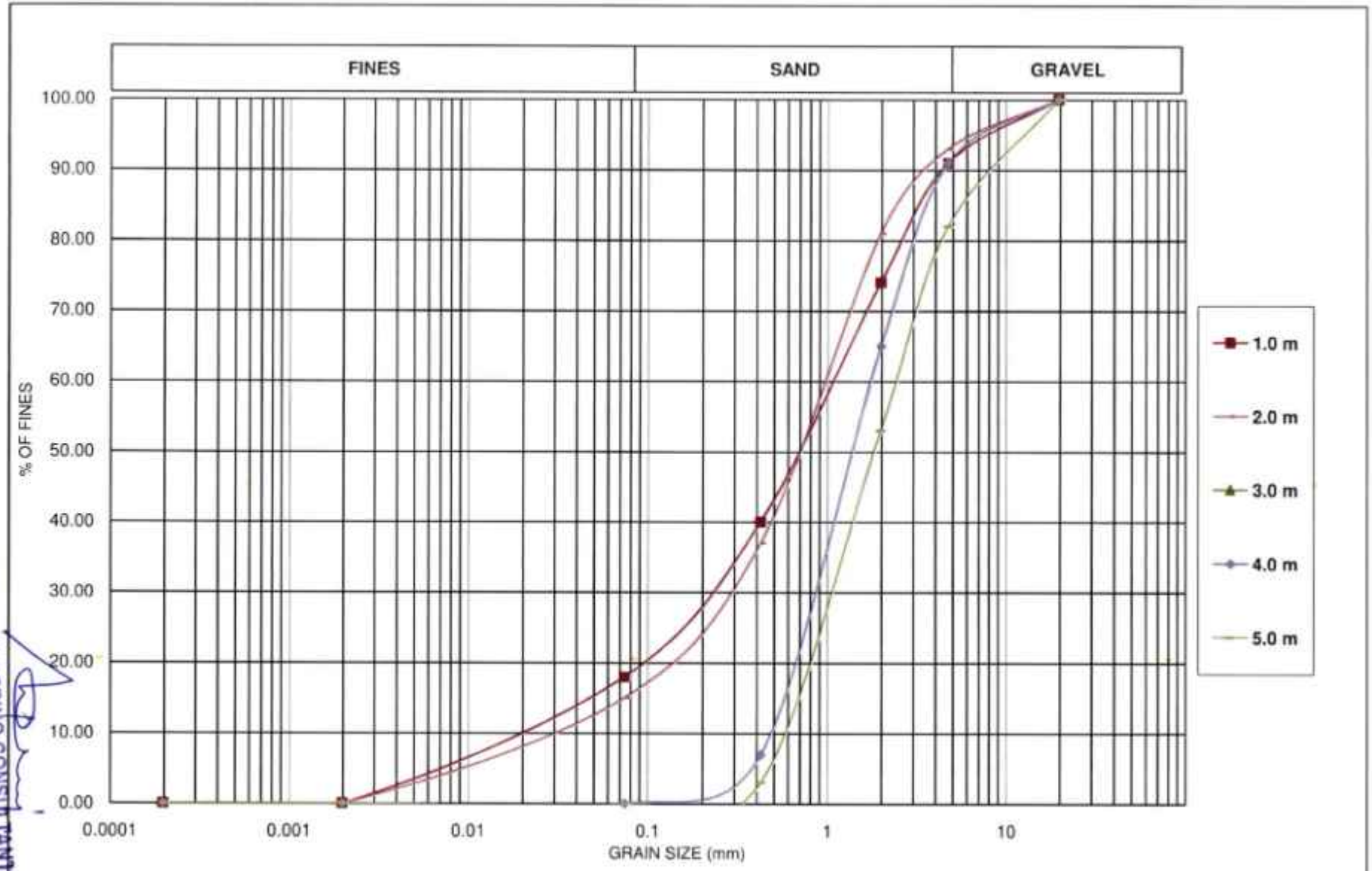


Fig. 2.13 GRAIN SIZE DISTRIBUTION CURVE - BH-06

GEO ENGINEERING CONSULTANTS
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Chennai - 600 042

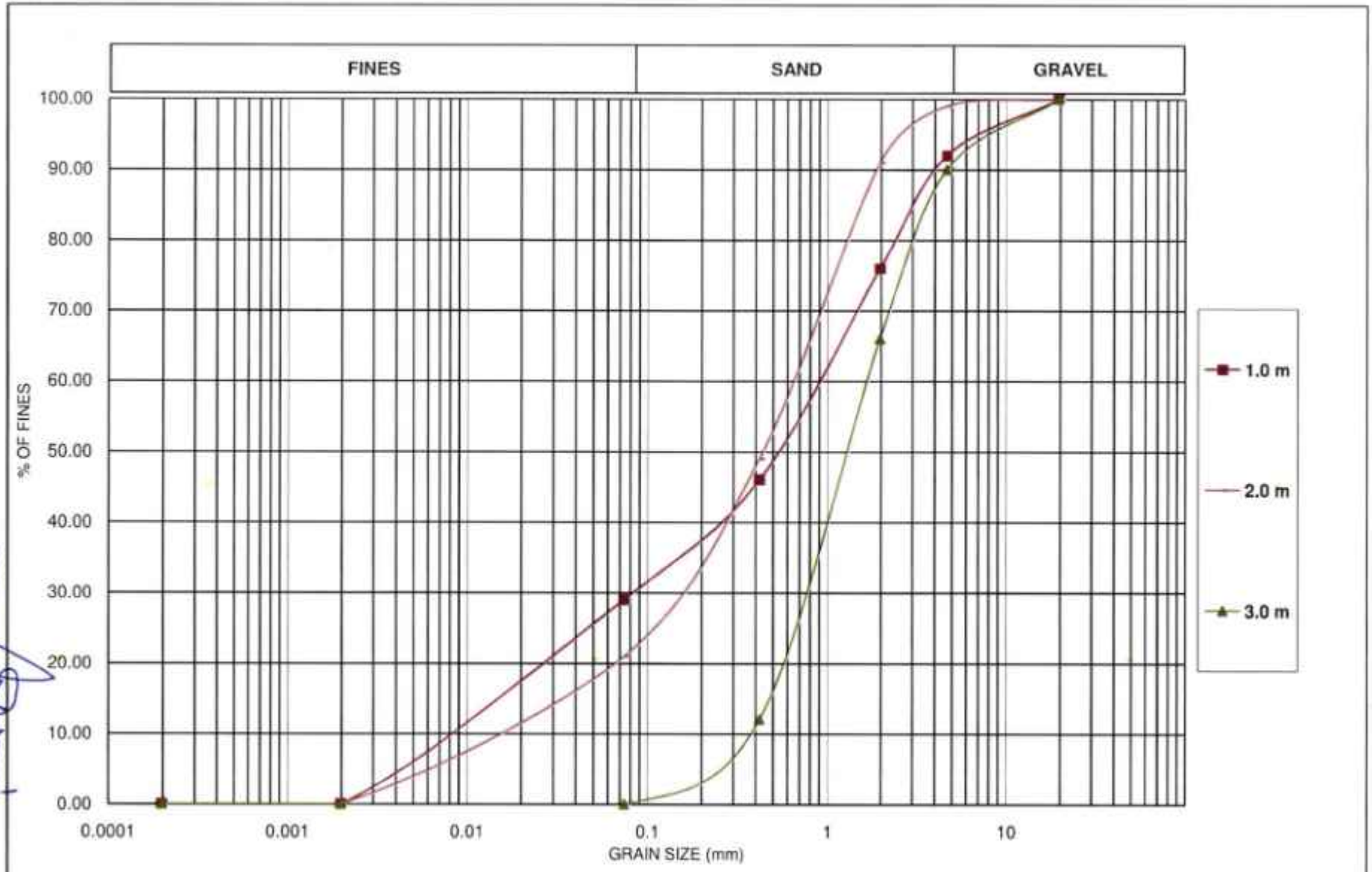


Fig. 2.14 GRAIN SIZE DISTRIBUTION CURVE - BH-07

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HYDROMETER ANALYSIS CURVE

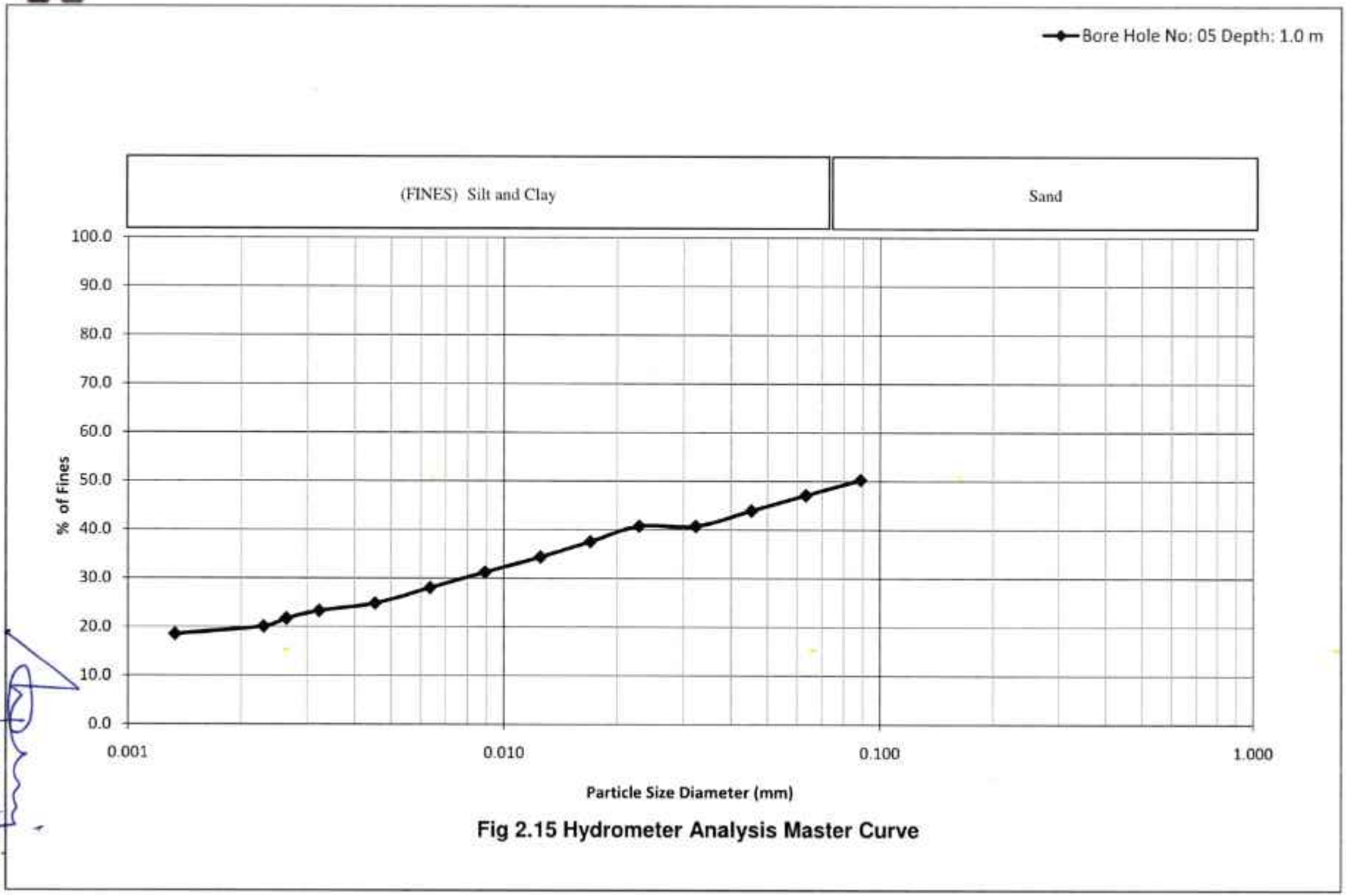


Fig 2.15 Hydrometer Analysis Master Curve

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CMDA No: GTE/19/03/012
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Chennai - 600 042

LABORATORY TEST RESULTS

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

Depth of Sample below E.G.L. (m)	SPT-Value	Type of Sample	Sub Soil Classification																								
			Fine Grained (FG)										Coarse Grained (CG)												IS-Notation		
			NMC(%)	LL (%)	PL (%)	I_P	Ic	SL (%)	FS (%)	Consistancy	Position With Respect to A-Aline	IS:Notation	Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)	D_{10} (mm)	D_{30}(mm)	D_{60} (mm)	$C_U=D_{60}/D_{10}$	$C_c=D_{30}^2/(D_{10}xD_{60})$	Relative Density	Gravel	Sand
1.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	11	17	37	20	15	0	-	-	-	-	-	V.Dense	<50%	SM
2.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	3	58	37	2	0	0	-	-	-	-	-	V.Dense	<50%	SP

FG = Fine Grained
CG = Coarse Grained
NMC= Nature Moisture Content
LL = Liquid Limit
PL = Plastic Limit
Ip = Plasticity Index
Ic = (LL-NMC)/Ip
SL = Shrinkage Limit
FS = Differential Frees Well Index
C_U = Uniformity Coefficient
C_C = Coefficient of Curvature
IP=LL-PL

LAB IN-CHARGE	M.PRAVEEN
REVIEWED BY	JALEEL YASIN

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

Depth of Sample below E.G.L. (m)	SPT-Value	Type of Sample	Sub Soil Classification																							
			Fine Grained (FG)										Coarse Grained (CG)												IS-Notation	
			NMC(%)	LL (%)	PL (%)	I_p	Ic	SL (%)	FS (%)	Consistancy	Position With Respect to A-Aline	IS:Notation	Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)	D_{10} (mm)	D_{30}(mm)	D_{60} (mm)	$C_U=D_{60}/D_{10}$	$C_c=D_{30}^2/(D_{10}xD_{60})$	Relative Density	Gravel	Sand
1.0	19	SS	-	-	-	-	-	-	-	CG>50%	-	-	3	9	42	25	21	0	-	-	-	-	-	M.Dense	<50%	SM
2.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	4	7	52	26	11	0	-	-	-	-	-	V.Dense	<50%	SP-SM
3.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	8	19	66	7	0	0	-	-	-	-	-	V.Dense	<50%	SP

FG = Fine Grained
CG = Coarse Grained
NMC= Nature Moisture Content
LL = Liquid Limit
PL = Plastic Limit
Ip = Plasticity Index
Ic = (LL-NMC)/Ip
SL = Shrinkage Limit
FS = Differential Frees Well Index
C_U = Uniformity Coefficient
C_C = Coefficient of Curvature
IP=LL-PL

LAB IN-CHARGE	M.PRAVEEN
REVIEWED BY	JALEEL YASIN

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

Depth of Sample below E.G.L. (m)	SPT-Value	Type of Sample	Sub Soil Classification																								
			Fine Grained (FG)										Coarse Grained (CG)												IS-Notation		
			NMC(%)	LL (%)	PL (%)	I_p	Ic	SL (%)	FS (%)	Consistancy	Position With Respect to A-Aline	IS:Notation	Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)	D_{10} (mm)	D_{30}(mm)	D_{60} (mm)	$C_U=D_{60}/D_{10}$	$C_c=D_{30}^2/(D_{10}xD_{60})$	Relative Density	Gravel	Sand
1.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	10	12	65	13	0	0	-	-	-	-	-	V.Dense	<50%	SP

FG = Fine Grained
CG = Coarse Grained
NMC= Nature Moisture Content
LL = Liquid Limit
PL = Plastic Limit
Ip = Plasticity Index
Ic = (LL-NMC)/Ip
SL = Shrinkage Limit
FS = Differential Frees Well Index
C_U = Uniformity Coefficient
C_C = Coefficient of Curvature
IP=LL-PL

LAB IN-CHARGE	M.PRAVEEN
REVIEWED BY	JALEEL YASIN

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Table-2.4 Laboratory Classification of Soil Samples from BH-04

Depth of Sample below E.G.L. (m)	SPT-Value	Type of Sample	Sub Soil Classification																								
			Fine Grained (FG)										Coarse Grained (CG)												IS-Notation		
			NMC(%)	LL (%)	PL (%)	I_p	I_c	SL (%)	FS (%)	Consistancy	Position With Respect to A-Aline	IS:Notation	Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)	D_{10} (mm)	D_{30}(mm)	D_{60} (mm)	$C_U=D_{60}/D_{10}$	$C_c=D_{30}^2/(D_{10}xD_{60})$	Relative Density	Gravel	Sand
1.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	4	49	31	16	0	-	-	-	-	-	V.Dense	<50%	SM
2.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	1	5	49	32	13	0	-	-	-	-	-	V.Dense	<50%	SM
3.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	11	15	62	12	0	0	-	-	-	-	-	V.Dense	<50%	SP

FG = Fine Grained
CG = Coarse Grained
NMC= Nature Moisture Content
LL = Liquid Limit
PL = Plastic Limit
Ip = Plasticity Index
Ic = (LL-NMC)/Ip
SL = Shrinkage Limit
FS = Differential Frees Well Index
C_U = Uniformity Coefficient
C_C = Coefficient of Curvature
IP=LL-PL

LAB IN-CHARGE	M.PRAVEEN
REVIEWED BY	JALEEL YASIN

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Table-2.5 Laboratory Classification of Soil Samples from BH-05

Depth of Sample below E.G.L. (m)	SPT-Value	Type of Sample	Sub Soil Classification																								
			Fine Grained (FG)										Coarse Grained (CG)												IS-Notation		
			NMC(%)	LL (%)	PL (%)	I_P	Ic	SL (%)	FS (%)	Consistancy	Position With Respect to A-Aline	IS:Notation	Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)	D_{10} (mm)	D_{30}(mm)	D_{60} (mm)	$C_U=D_{60}/D_{10}$	$C_c=D_{30}^2/(D_{10}xD_{60})$	Relative Density	Gravel	Sand
1.0	24	SS	18	57	25	32	1.22	12	85	V.Stiff	Above	CH	0	3	26	18	35	18	-	-	-	-	-	FG>50%	FG>50%	FG>50%
2.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	4	19	28	42	7	0	-	-	-	-	-	V.Dense	<50%	SP-SM

FG = Fine Grained
CG = Coarse Grained
NMC= Nature Moisture Content
LL = Liquid Limit
PL = Plastic Limit
Ip = Plasticity Index
Ic = (LL-NMC)/Ip
SL = Shrinkage Limit
FS = Differential Frees Well Index
C_U = Uniformity Coefficient
C_C = Coefficient of Curvature
IP=LL-PL

LAB IN-CHARGE	M.PRAVEEN
REVIEWED BY	JALEEL YASIN

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Table-2.6 Laboratory Classification of Soil Samples from BH-06

Depth of Sample below E.G.L. (m)	SPT-Value	Type of Sample	Sub Soil Classification																								
			Fine Grained (FG)										Coarse Grained (CG)												IS-Notation		
			NMC(%)	LL (%)	PL (%)	I_P	Ic	SL (%)	FS (%)	Consistancy	Position With Respect to A-Aline	IS:Notation	Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)	D_{10} (mm)	D_{30}(mm)	D_{60} (mm)	$C_U=D_{60}/D_{10}$	$C_c=D_{30}^2/(D_{10}xD_{60})$	Relative Density	Gravel	Sand
1.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	9	17	34	22	18	0	-	-	-	-	-	V.Dense	<50%	SM
2.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	7	12	44	22	15	0	-	-	-	-	-	V.Dense	<50%	SM
3.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	7	41	48	4	0	0	-	-	-	-	-	V.Dense	<50%	SP
4.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	9	26	58	7	0	0	-	-	-	-	-	V.Dense	<50%	SP
5.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	18	29	50	3	0	0	-	-	-	-	-	V.Dense	<50%	SP

FG = Fine Grained
CG = Coarse Grained
NMC= Nature Moisture Content
LL = Liquid Limit
PL = Plastic Limit
Ip = Plasticity Index
Ic = (LL-NMC)/Ip
SL = Shrinkage Limit
FS = Differential Frees Well Index
C_U = Uniformity Coefficient
C_C = Coefficient of Curvature
IP=LL-PL

LAB IN-CHARGE	M.PRAVEEN
REVIEWED BY	JALEEL YASIN

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CMDA No: GTE/19/03/012
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Dr. Seethapathy Nagar, Velachery
Chennai - 600 042

Table-2.7 Laboratory Classification of Soil Samples from BH-07

Depth of Sample below E.G.L. (m)	SPT-Value	Type of Sample	Sub Soil Classification																								
			Fine Grained (FG)										Coarse Grained (CG)												IS-Notation		
			NMC(%)	LL (%)	PL (%)	I_p	I_c	SL (%)	FS (%)	Consistancy	Position With Respect to A-Aline	IS:Notation	Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)	D_{10} (mm)	D_{30}(mm)	D_{60} (mm)	$C_U=D_{60}/D_{10}$	$C_c=D_{30}^2/(D_{10}xD_{60})$	Relative Density	Gravel	Sand
1.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	8	16	30	17	29	0	-	-	-	-	-	V.Dense	<50%	SM
2.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	1	8	42	28	21	0	-	-	-	-	-	V.Dense	<50%	SM
3.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	10	24	54	12	0	0	-	-	-	-	-	V.Dense	<50%	SP

FG = Fine Grained
CG = Coarse Grained
NMC= Nature Moisture Content
LL = Liquid Limit
PL = Plastic Limit
Ip = Plasticity Index
Ic = (LL-NMC)/Ip
SL = Shrinkage Limit
FS = Differential Frees Well Index
C_U = Uniformity Coefficient
C_C = Coefficient of Curvature
IP=LL-PL

LAB IN-CHARGE	M.PRAVEEN
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Table-2.8 Results of Chemical Analysis					
		Soil (2:1)			
SL No.	Bore HoleNo.	Depth of Sample (m)	pH	Chlorides (mg/l)	Sulphates (mg/l)
1	BH-01	1.0	7.35	228	318
2	BH-02	2.0	7.34	224	326
3	BH-05	1.0	7.34	221	315
4	BH-07	1.0	7.35	232	318

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CHAPTER-3

GEOLOGY & SUB-SURFACE STRATIFICATION

3.0 Preamble:

Geotechnical investigation carried out at a specific site provides location specific sub surface 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 the Region (based on the published data)

3.1.1 Formation Characteristics:

The present location falls under coimbatore district, which can be geologically classified as Sedimentary rock formation and hard rock formation (Charnockite of Meta igneous origin) of Archaean Rock Group, overlain by recent deposits.The entire area is mostly covered by recent alluvium on the site. The rocks present in this site are of sedimentary formation Limestone undergone weathering to variable extent. The thickness of alluvium deposit is around 2 to 3 meter underlain by varying degree of weathering.

The present location falls under coimbatore District, geologically it is classified as recent alluvium deposits consisting of Sandy Silty Clay and silty sand/Clayey Silty Sand, which is underlying by basement rock.

Recent alluvium deposit

Sedimentary formation (Limestone Rock)

3.2 DESIGN SUB SOIL PROFILE:(from 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:

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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	Clayey Silty Sand	Brownish	-	-	-	-	-	-
2	0.50	4.00	3.50	Completely Weathered Rock	Greyish Brown	>100	Very Dense	-	21	-	42.5
3	4.00	6.00	2.00	Highly Weathered Rock	Greyish Brown	CRR-10 % & 11%, 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	Clayey Silty Sand	Brownish	-	-	-	-	-	-
2	0.50	2.00	1.50	Residual Soil	Greyish Brown	19	Medium Dense	-	18	-	32.7
3	2.00	3.00	1.00	Completely Weathered Rock	Brownish	>100	Very Dense	-	21	-	42.5
4	3.00	5.00	2.00	Moderately Weathered Rock	Greyish Brown	CRR-12 % & 13%, RQD-0%					

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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/m³	Shear Parameters	
	Top. R.L.	Bot. R.L.	Thickness							(C_u) kPa	(ϕ) Deg.
1	0.00	0.50	0.50	Clayey Silty Sand	Brownish	-	-	-	-	-	-
2	0.50	1.50	1.00	Completely Weathered Rock	Greyish	>100	Very Dense	-	21	-	42.5
3	1.50	4.00	2.50	Highly Weathered Rock	Brownish	CRR-9 % & 11%, RQD-0%					
4	4.00	5.00	1.00	Moderately Weathered Rock	Greyish Brown	CRR-14 %, RQD-0%					

REFERENCE BORE HOLE-BH:					04	Ref R.L. of G.L. (m):			0.00		
Layer No.	Layer Thk. (m)			Type of Strata	Colour	Ave. Design SPT	Relative Density	Consistency	(γ) kN/m³	Shear Parameters	
	Top. R.L.	Bot. R.L.	Thickness							(C_u) kPa	(ϕ) Deg.
1	0.00	0.50	0.50	Clayey Silty Sand	Brownish	-	-	-	-	-	-
2	0.50	3.00	2.50	Completely Weathered Rock	Brownish	>100	Very Dense	-	21	-	42.5
3	3.00	6.00	3.00	Highly Weathered Rock	Greyish Brown	CRR-12 % & 15%, RQD-0%					

REFERENCE BORE HOLE-BH:					05	Ref R.L. of G.L. (m):			0.00		
Layer No.	Layer Thk. (m)			Type of Strata	Colour	Ave. Design SPT	Relative Density	Consistency	(γ) kN/m³	Shear Parameters	
	Top. R.L.	Bot. R.L.	Thickness							(C_u) kPa	(ϕ) Deg.
1	0.00	0.50	0.50	Clayey Silty Sand	Brownish	-	-	-	-	-	-
2	0.50	1.50	1.00	Sandy Silty Clay	Brown	24	-	Very Stiff	20.5	160	-
3	1.50	2.50	1.00	Completely Weathered Rock	Brown	>100	Very Dense	-	21	-	42.5
4	2.50	5.00	2.50	Moderately Weathered Rock	Greyish Brown	CRR-13 % & 15%, RQD-0%					

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REFERENCE BORE HOLE-BH:					06	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	Clayey Silty Sand	Brownish	-	-	-	-	-	-
2	0.50	4.50	4.00	Completely Weathered Rock	Brownish	>100	Very Dense	-	21	-	42.5
3	4.50	7.00	2.50	Moderately Weathered Rock	Greyish Brown	CRR-11 % & 15%, RQD-0%					

REFERENCE BORE HOLE-BH:					07	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	Clayey Silty Sand	Brownish	-	-	-	-	-	-
2	0.50	2.00	1.50	Residual Soil	Greyish Brown	>100	Very Dense	-	21	-	42.5
3	2.00	3.00	1.00	Completely Weathered Rock	Brownish	>100	Very Dense	-	21	-	42.5
4	3.00	4.50	1.50	Highly Weathered Rock	Greyish Brown	CRR-9 % , RQD-0%					
5	4.50	6.00	1.50	Moderately Weathered Rock	Greyish Brown	CRR-13 %, RQD-0%					

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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 1B+Ground+5 upper floors, and is meant for residential use. For this kind of structure, the column loads could vary between 2000 kN to 4000 kN. The above mentioned loads have no bearing on the design of either sub or super structures and are mentioned just to provide an insight to choose an appropriate foundation system with respect

4.2 Foundation System

4.2.1 Villas (Ground+1 Upper Floors)

For the kind of proposed structure and sub soil conditions, shallow foundation system can be adopted. The Isolated column footings can be located at a depth of 1.20m below the existing ground level. The footings can be designed for an allowable safe bearing pressure of 200kPa. All footings shall rest on 100mm thick M10 Grade levelling coarse bed.

Typical computations are presented in the annexure

4.2.2 Residential Building–1B+Ground+5 Upper Floors

In order to construct one basement floors an excavation of about 2.00m excluding the foundation depth is needed (as informed by the client incharge during the time of reporting). Hence, for the kind of proposed structure and the sub soil stratification, open foundation system (Isolated footing/R.C.C Raft) can be adopted..

The foundation system shall be Isolated Footing or R.C.C Raft and it can be located at a depth of 1.00m (assumed thickness of raft or embedment thickness) below basement floor, hence the overall depth of foundation excavation shall be 3.0m below the existing ground level.

The R.C.C Raft or Isolated Footing can be designed for an allowable safe bearing pressure of 800kPa. Since the sub soil stratum below the founding level is rock formation with varying grade of weathering only immediate elastic settlement will takes place.

Typical bearing capacity computation is presented in the Annexure

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RECOMMENDATIONS

CHAPTER-5

RECOMMENDATIONS

5.0 Recommendation for Villas (Ground+1 Upper Floor)

- For the kind of proposed structure and the sub soil conditions, open foundation system shall be adopted.
- The Isolated column footings shall be located at a depth of 1.20m below existing ground level.
- The footings shall be designed for a recommended allowable safe bearing pressure is 200kPa.
- All footings shall rest on 100mm thick M10 Grade levelling coarse bed.
- The excavated soil shall be used for foundation trenches.

5.1 Recommendation for Residential Building – 1B+Ground+5 Upper Floors

- For the kind of sub soil conditions, the foundation system as described in Chapter-4, Section 4.2.2 can be adopted
- In the present case, the depth of excavation including the foundation embedment is about 3.0m below the existing ground level.
- For the kind of proposed structure and the sub soil stratification Isolated footing/R.C.C Raft can be adopted.
- The R.C.C. Raft or Isolated footing can be designed for an allowable safe bearing pressure of 800kPa.
- In the present case, the basement floor slab shall be designed for the uplift pressure corresponding to ground water level at the existing ground level.
- The strata beyond the founding depth is rock formation the settlement will be of immediate elastic in nature.

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

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ANNEXURE

TYPICAL BEARING CAPACITY COMPUTATIONS FOR SHALLOW FOUNDATIONS

1.0 COMPUTATION OF BEARING CAPACITY AS PER IS:6403

Ref.BH-02

1.1 Geometrical Data :

Shape of the Foundation	Square
Depth of Foundation Below E.G.L"Df" (m)	1.20
Soil Replacement Thickness of CNS Layer (m)	0.00
Total Depth of Foundation (m)	1.20
Breadth of Footing "B" (m)	1.00
Length of Footing "L" (m)	1.00
B/L	1.00
Inclination of Vertical Load with the Vertical (a)	0.00

1.2 Soil Data :

Type of Effective Bearing Strata :	Sand	
Average Design SPT-value of the Bearing Strata	24.00	
Type of Shear Failure:	General	
Angle of Shearing Resistance	34.20	phi

1.3 Design Parameters:

Bulk Density of Soil above the foundation depth (γ_{bulk})	18.50	kN/m^3
Water Table Correction Factor (w')	0.50	
Effective Overburden pressure at foundation level (q)	10.20	kPa

Bearing Capacity Factors:

N_c = N/A

N_q = 30.92

N_g = 43.93

Shape Factors:

S_c = -

S_q = 1.20

S_g = 0.80

Depth Factors :

D_c = -

D_q = 1.02

D_g = 1.02

Inclination Factor:

I_c = 1.00

I_q = 1.00

I_g = 1.00

1.4 Ultimate Bearing Capacity (Qu) :

Qu=q'(Nq-1)'Sq'Dq'Iq + 0.5'B'g'Ng'Sg'Dg'Ig'w' 540.81 kPa

(g should be read as gama)

1.5 Safe Bearing Capacity (Qsafe) :

Factor of Safety (F.S.) :	2.50	
Qsafe :	216.33	kPa
Say Q_{safe}	**200**	**kPa**

2 Computation of Settlement for Maximum Pressure and Size of Footing: (as per IS:8009-Part-I-Ref. Eq.11) (Elastic Analysis)

The immediate elastic settlement (S_i)= $qB(1-m^2)'I/E_s$

q= bearing pressure	200.00	kPa
Poission's Ratio (μ)	0.30	

Modulus of Elasticity (E_s)(Ref. Joseph E Bowels,1996,page316,Table5.6, Japanese design standards)

Modulus of Elasticity (E_{si})	62400.00	kPa
Size of footing considered for maximum settlement(m)	1.00	
Influence factor	1.00	
Rigidity Factor	1.00	
Elastic Settlement (DH_i)	2.92	mm
	50	mm

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TYPICAL BEARING CAPACITY COMPUTATIONS FOR SHALLOW FOUNDATIONS

1.0 COMPUTATION OF BEARING CAPACITY AS PER IS:6403

	Reference Borehole No.	BH-06
1.1 Geometrical Data		
	Shape of the Foundation	Sqaure
	Depth of Basement floor Height Below R.L (m)	2.00
	Assumed Thickness of Foundation or Depth of Embedment (m)	1.00
	Though the over all foundation excavation	3.00
	Breadth of Footing "B" (m)	1.50
	Length of Footing "L" (m)	1.50
	B/L	1.00
	Inclination of Vertical Load with the Vertical (a)	0.00
1.2 Soil Data		
	Type of Effective Bearing Strata :	Completely Weathered Rock
	Design SPT-value of the Bearing Strata :	60.00
	Type of Shear Failure:	General
	Angle of Shearing Resistance	42.50
1.3 Design Parameters		
	Bulk Density of Soil above the foundation depth (γ_{bulk})	20.00
	Effective Overburden pressure at foundation level (q)	10.00
	Water Table Correction Factor (w')	0.50
	Bearing Capacity Factors:	
	N_c =	N/A
	N_q =	99.54
	N_g =	190.59
	Shape Factors:	
	S_c =	-
	S_q =	1.20
	S_g =	0.60
	Depth Factors :	
	D_c =	-
	D_q =	1.01
	D_g =	1.01
	Inclination Factor:	
	I_c =	1.00
	I_q =	1.00
	I_g =	1.00
1.4 Ultimate Bearing Capacity (Qu)		
	Qu=q*(Nq-1)*Sq*Dq*Iq + 0.5*B*g*Ng*Sg*Dg*Ig*w' (g should be read as gama)	**2051.99 kPa**
1.5 Safe Bearing Capacity (Qsafe) :		
	Factor of Safety (FOS) :	2.50
	Qsafe :	820.80 kPa
	However limit Q_{safe}	**800 kPa**

2.0 Computation of Settlement for Maximum Pressure and Size of Footing: (as per IS:8009-Part-I-Ref. Eq.11) (Elastic Analysis)

Type of compressible strata	Completely Weathered Rock
Immediate Settlement (S_i)=	$qB(1-m^2)*I/E_s$
Bearing Capacity (q)	800.00
Poission's Ratio (μ)	0.20
Modulus of Elasticity (E_s)(Ref. Joseph E Bowels,1996,page316,Table5.6, Japanese design standards)	
Modulus of Elasticity (E_s)	156000
Size of footing/Raft considered for maximum settlement(m)	1.50
Influence factor	1.00
Rigidity Factor	1.00
Elastic Settlement (DH,)	7.38 mm
	<50 mm

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TYPICAL BEARING CAPACITY COMPUTATIONS FOR SHALLOW FOUNDATIONS

1.0 COMPUTATION OF BEARING CAPACITY AS PER IS:6403

	Reference Borehole No.	BH-06
1.1 Geometrical Data		
	Shape of the Foundation	Raft
	Depth of Basement floor Height Below R.L (m)	2.00
	Assumed Thickness of Foundation or Depth of Embedment (m)	1.00
	Though the over all foundation excavation	3.00
	Breadth of Footing "B" (m)	10.00
	Length of Footing "L" (m)	10.00
	B/L	1.00
	Inclination of Vertical Load with the Vertical (a)	0.00
1.2 Soil Data		
	Type of Effective Bearing Strata :	Completely Weathered Rock
	Design SPT-value of the Bearing Strata :	60.00
	Type of Shear Failure:	General
	Angle of Shearing Resistance	42.50
1.3 Design Parameters		
	Bulk Density of Soil above the foundation depth (γ_{bulk})	20.00
	Effective Overburden pressure at foundation level (q)	10.00
	Water Table Correction Factor (w')	0.50
	Bearing Capacity Factors:	
	N_c =	N/A
	N_q =	99.54
	N_g =	190.59
	Shape Factors:	
	S_c =	-
	S_q =	1.20
	S_g =	0.60
	Depth Factors :	
	D_c =	-
	D_q =	1.00
	D_g =	1.00
	Inclination Factor:	
	I_c =	1.00
	I_q =	1.00
	I_g =	1.00
1.4 Ultimate Bearing Capacity (Qu)		
	Qu=q*(Nq-1)*Sq*Dq*Iq + 0.5*B*g*Ng*Sg*Dg*Ig*w' (g should be read as gama)	**6906.06 kPa**
1.5 Safe Bearing Capacity (Qsafe) :		
	Factor of Safety (FOS) :	2.50
	Qsafe :	2762.42 kPa
	However limit Q_{safe}	**800 kPa**

2.0 Computation of Settlement for Maximum Pressure and Size of Footing: (as per IS:8009-Part-I-Ref. Eq.11) (Elastic Analysis)

Type of compressible strata	Completely Weathered Rock
Immediate Settlement (S_i)=	$qB(1-m^2)*I/E_s$
Bearing Capacity (q)	800.00
Poission's Ratio (μ)	0.20
Modulus of Elasticity (E_s)(Ref. Joseph E Bowels,1996,page316,Table5.6, Japanese design standards)	
Modulus of Elasticity (E_s)	156000
Size of footing/Raft considered for maximum settlement(m)	10.00
Influence factor	1.00
Rigidity Factor	0.80
Elastic Settlement (DH_i)	39.38 mm
	<50 mm

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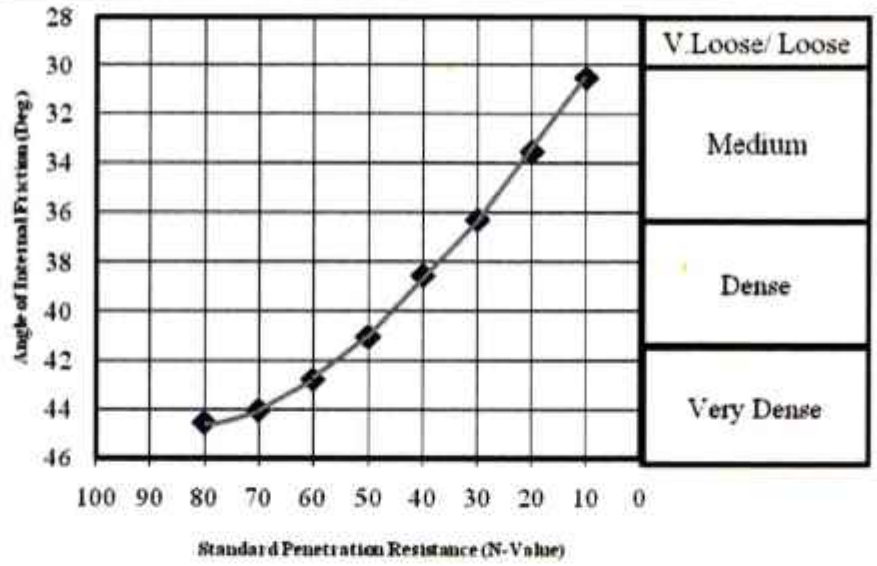


FIG. A1 Relation Ship between Angle of Internal Friction & N-value (Reproduced from IS:6403-1981)

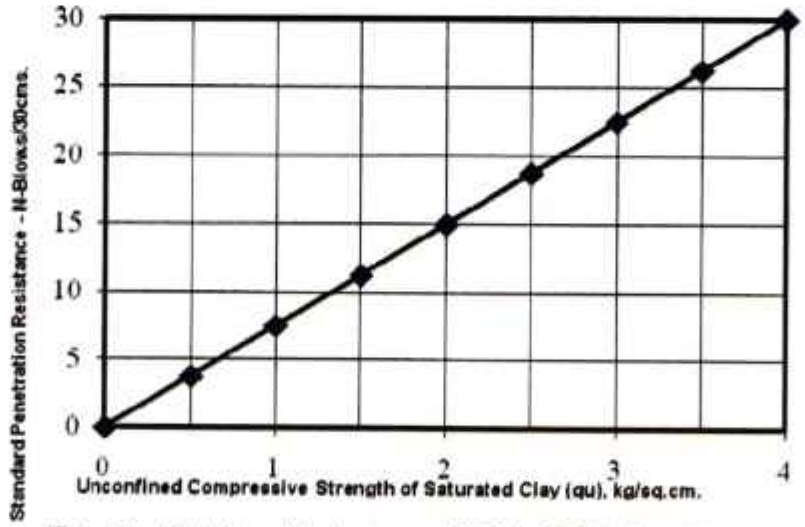


FIG. A2 : Relationship between UCC & SPT-Value (N) of Saturated Clay (AfterTerzhagi & Peck, 1948)

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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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