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PROJECT NAME

PLANNING PERMISSION APPLICATION FOR THE PROPOSED CONSTRUCTION OF HIGH RISE GROUP DEVELOPMENT CONSISTING OF COMBINED EXTENDED BASEMENT FLOOR (BLOCK 4 TO 18) WITH BLOCK 1: GROUND FLOOR + 1ST FLOOR + 2ND FLOOR (PART) ROW HOUSES VILLA (4 DWELLING UNIT), BLOCK 2: GROUND FLOOR + 1ST FLOOR + 2ND FLOOR (PART) ROW HOUSES VILLA (4 DWELLING UNIT), BLOCK 3: GROUND FLOOR + 1ST FLOOR + 2ND FLOOR (PART) ROW HOUSES VILLA (14 DWELLING UNIT), BLOCK 4: GROUND FLOOR + 9 FLOOR (138 DWELLING UNIT), BLOCK 5: GROUND FLOOR + 8 FLOOR (36 DWELLING UNIT), BLOCK 6 : GROUND FLOOR + 9 FLOOR (117 DWELLING UNIT), BLOCK 7: GROUND FLOOR + 9 FLOOR (209 DWELLING UNIT), BLOCK 8 : GROUND FLOOR + 9 FLOOR (170 DWELLING UNIT), BLOCK 9: GROUND FLOOR + 9 FLOOR (120 DWELLING UNIT), BLOCK 10 : GROUND FLOOR + 9 FLOOR (150 DWELLING UNIT), BLOCK 11 : GROUND FLOOR + 9 FLOOR (170 DWELLING UNIT), BLOCK 12 : GROUND FLOOR + 9 FLOOR (170 DWELLING UNIT), BLOCK 13: GROUND FLOOR + 9 FLOOR (170 DWELLING UNIT), BLOCK 14 : GROUND FLOOR + 9 FLOOR (140 DWELLING UNIT), BLOCK 15: GROUND FLOOR + 8 FLOOR (36 DWELLING UNIT), BLOCK 16 : GROUND FLOOR + 9 FLOOR (170 DWELLING UNIT), BLOCK 17: CLUB HOUSE-1: GROUND FLOOR + 3 FLOOR, BLOCK 18 : CLUB HOUSE -2 : GROUND FLOOR + 5 FLOOR & 2 NOS OF OPEN SWIMMING POOL, TOTALLY 1818 DWELLING UNITS, COMPRISED IN SURVEY NOS: 508/4A, 508/4B, 508/6A1, 508/6A2, 508/6B, 508/6C, 508/6D, 508/7A, 508/7B, 508/7C, 508/7D, 508/7E, 508/7F, 508/7G, 508/7H, 508/7I, 508/8A, 508/8B1, 508/8B2, 508/11A, 508/11B, 508/21A, 508/28, 508/36B, 508/36C1, 508/36C2, 508/38A1, 508/45, 508/48, 575/2A2A1, 575/2A2A2, 575/2A2A3, 575/2A2B1, 575/2A2B2, 575/2A2B3, 575/2A3, 575/2B, 575/2C, 575/3B1, 575/4A, 575/4B, 575/4C, 575/5A, 575/5B, 575/6A, 575/6B, 575/6C, 575/7A1, 575/7A2, 575/7B, 575/7C, 575/7D, 575/8A1, 575/8A2, 575/8A3, 575/8B1, 575/8B2, 575/9A, 575/9B1, 575/9B2, 575/9B3, 575/9C1, 575/10A1, 575/10A2, 575/10B, 575/10C, 575/10D1, 575/10D2, 575/10E, 575/10F, 575/10G, 575/12A, 575/12B, 575/12C, 575/13A, 575/13B, 575/13C, 575/13D, 575/13E1, 575/13E2, 575/13F, 575/14A, 575/14B, 575/14C, 575/15, 575/16, 575/17, 575/18, 575/19, 575/20, 575/21, 575/22, 575/23, 575/24, 575/25, 579/1, 579/2, 580, 581/1, 581/2, 581/3, 581/4, 581/5, 724/3 & 724/5 OF SHOLINGANALLUR-1 VILLAGE, SHOLINGANALLUR TALUK, CHENNAI DISTRICT, WITHIN THE LIMITS OF GREATER CHENNAI CORPORATION.

CLIENT NAME

CASAGRANDE VIVAACE PVT. LTD.,
NEW NO.111, NPL DEVI BUILDING,
LB ROAD, THIRUVANMIYUR, CHENNAI 600 041.

TITLE

GEOTECHNICAL INVESTIGATION REPORT

PROJECT NO: GEC-JC-GT-4105/2022-2023

DATE: 14/03/2023

GEO ENGINEERING CONSULTANT
G. MANOJ KUMAR
DDTC - No: GTE/TVLR/01/2019
CMDA No: GTE/19/03/012
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REPORT TEXT



INTRODUCTION

1.0 Project Information Matrix

Nature of project : Proposed construction of Residential Building (1B+G+9 Upper Floors)
Project Owner : **Casagrand Vivaace (P) Limited,**
Project Location : Sholinganallur, Chennai.
Job Code : GEC-JC-GT-4105

1.1 Scope of Work

1.1.1 Field Work

- ❖ Conducting twenty two soil investigation bore holes of 150 mm & NX diameter up to 10.0m 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

1.1.2 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:**

Twenty 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.



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 2.22. The graphical representation of grain size distribution curve for the representative samples in each bore is presented in Fig. 2.23 to 2.44.

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 2.22. The graphical representation of hydrometer analyses curve for the representative samples in each bore is presented in Fig. 2.45 to 2.56.

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 - 2.23.

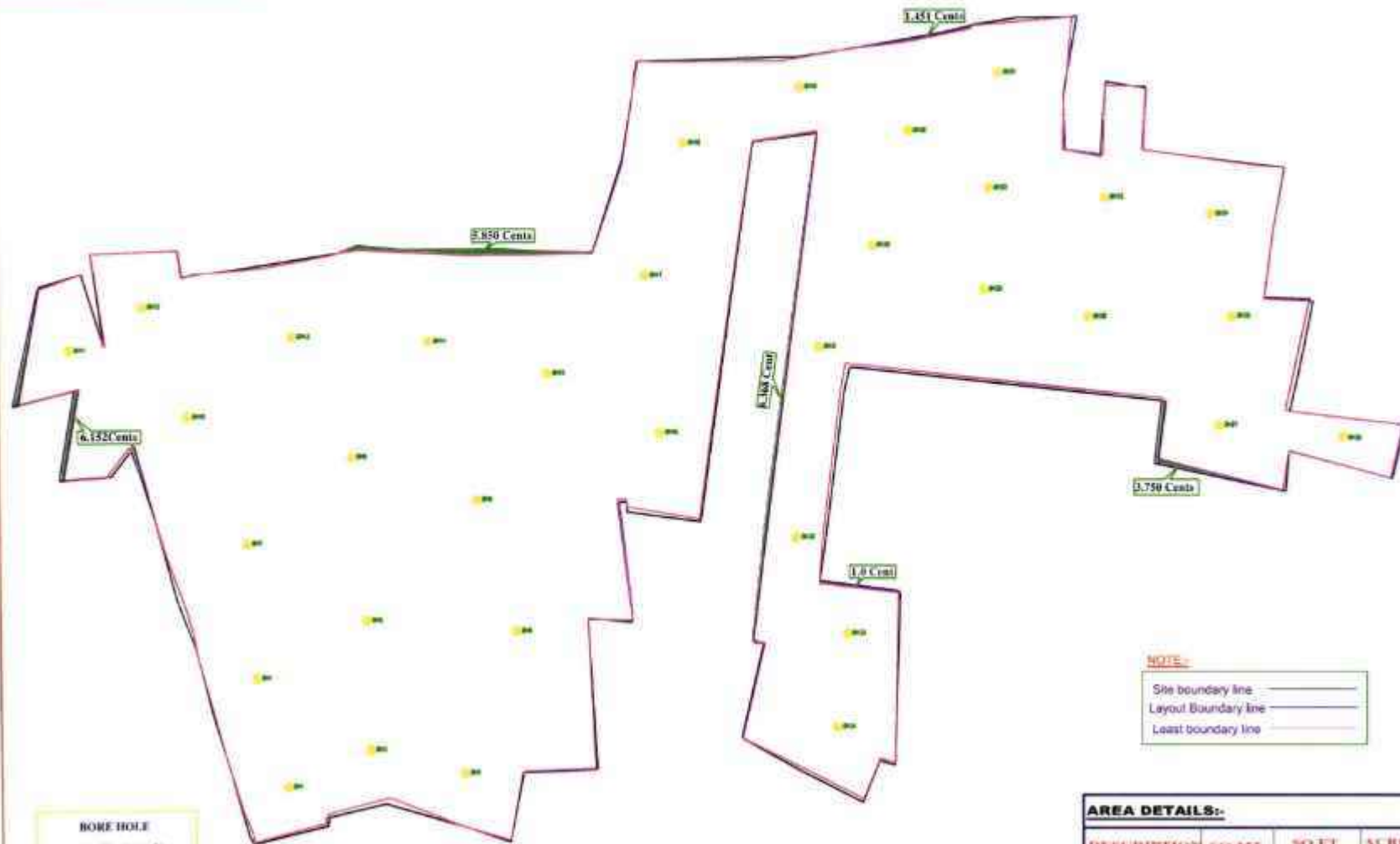
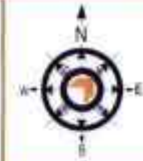
2.3 Summary:

The twenty two 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 2.22.

SITE PLAN



SITE BOUNDARY SUPERIMPOSED WITH FMB SURVEY No: 508(Pt),575(Pt),579,580 & 581,724(pt)
524/3,SHOLINGANALLUR VILLAGE,SHOLINGANALLUR TALUK,& CHENNAI DISTRICT.



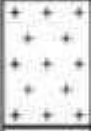
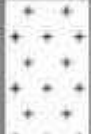
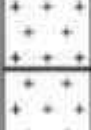
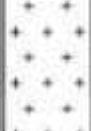
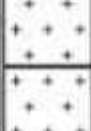
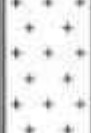
BORE HOLE
Total number of bore holes - 30 nos
Building Type- Apartment
2+2

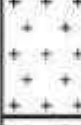
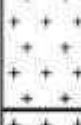
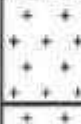
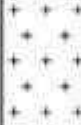
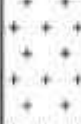
NOTE:-

Site boundary line _____
Layout Boundary line _____
Least boundary line _____

AREA DETAILS:-			
DESCRIPTION	SQ.MET	SQ.FT	ACRES
SITE AREA	120083.963	1292572.966	29.873
FMB AREA	119883.676	1290417.163	29.824
LEAST AREA	118634.838	1278975.797	29.311

SOIL PROFILE

		SITE INVESTIGATION RECORD						BORE HOLE No.		BH-01(Ref:28)									
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING (1B+G+9 UPPER FLOORS) AT SHOLINGANALLUR, CHENNAI						SHEET		1	OF	1							
LOCATION		Sholinganallur		MACHINE No.		CRI-01		CHAINAGE (m)		-		BORE START DATE		12/01/2023					
STRUCTURE		1B+G+9 Upper Floors		DRILLING METHOD		Rotary		CO-ORDINATES		N	-	BORE END DATE		13/01/2023					
JOB CODE		GEC-JC-GT-4105		FLUSHING MEDIUM		Bentonite				E	-	TOTAL DRILL DAYS		2					
Depth below E.G.L. (m)	Drilling progress per metre			Type of Core 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	
		He.	Min.				0-15	15-30	30-45										
12/01/2023	1	15	45	SC	-	-	4	5	13	18	1.00	1	SS	7.4		L1	2.0	Brownish,Moist, Medium Dense, Clayey Silty SAND(SC) Sand-Clay mixtures	
		To	15																47
	2	16	00	SC	-	-	4	4	6	10	2.00	2	SS	6.4		L2	3.0	Brownish Grey,Moist, Loose, Clayey Silty SAND(SC) Sand-Clay mixtures	
		To	16																04
	3	16	11	SC	-	-	15	22	30	52	3.00	3	SS	5.4		L3	4.0	Brownish, V.Dense, Residual Soil , Descent from Granite Rock	
		To	16																14
	4	16	28	SC	-	-	45	11 cm Penet.for 50 Blows			>100	4.00	4	SS	4.4		L4	5.5	Brownish, V.Dense, Completely Weathered Rock , Descent from Granite Rock
		To	16																
	5	16	50	SC	-	-	6 cm Penet.for 50 Blows			>100	5.00	5	WS	3.4		L5	8.5	Greyish Brown, Slightly Weathered Rock , Descent from Granite Rock	
		To	16																55
6	17	08	SC	-	-	SPT Hammer Rebounded			>100	5.50	6	WS	2.9		L6	10.0	Greyish Brown, Fresh Hard Rock , Granite Rock		
	To	17																12	
7	17	24	DB	65	15	-	-	-	-	7.00	7	CS	1.4		L6	10.0			
	To	18																10	
8	06	35	DB	70	33	-	-	-	-	8.50	8	CS	-0.1		L6	10.0			
	To	07																28	
9	07	45	DB	80	40	-	-	-	-	10.00	9	CS	-1.6		L6	10.0			
	To	08																37	
10	08	37																	
	To																		
CS - Core Sample		DS - Disturbed Sample		LOGGED		M. PANDIRAJAN		PROJECT SITE DETAILS				REMARKS							
SS - Split Spoon Sample		SC - Soil Cutter		DATE		13/01/2023		GROUND LEVEL (m)				8.44							
UDS - Undisturbed Sample		TCB - Tungsten Carbide Bit		CHECKED		JALEEL YASIN		WATER TABLE (m)				1.50							
WS - Wash Sample		DB - Diamond Bit		DATE		19/01/2023		CASING DEPTH (m)				0.00							
Borehole terminated at 10 m depth below E.G.L																			
FIG.2.1 Sub Soil Profile at BH-01(Ref:28) Location																			

		SITE INVESTIGATION RECORD						BORE HOLE No. BH-02(Ref:25)										
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING (1B+G+9 UPPER FLOORS) AT SHOLINGANALLUR, CHENNAI						SHEET 1 OF 1										
LOCATION		Sholinganallur		MACHINE No. CR-01		CHAINAGE (m) -		BORE START DATE 13/01/2023										
STRUCTURE		1B+G+9 Upper Floors		DRILLING METHOD Rotary		CO-ORDINATES N -		BORE END DATE 13/01/2023										
JOB CODE		GEC-JC-GT-4105		FLUSHING MEDIUM Bentonite		E -		TOTAL DRILL DAYS 2										
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.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									
1	13/01/2023	09:30 To 09:32		SC	-	-	3	4	6	10	1.00	1	SS	7.4		L1	2.0	Brownish, Moist, Loose, Clayey Silty SAND(SC) Sand-Clay mixtures
2	09:40 To 09:43		SC	-	-	5	6	10	16	1.45	2	SS	6.4					
3	09:52 To 09:56		SC	-	-	32	12 cm Penet. for 50 Blows			>100	3.00	3	SS	5.4		L2	3.0	Brownish, Moist, Medium Dense, Clayey Silty SAND(SC) Sand-Clay mixtures
4	10:10 To 10:14		SC	-	-	47	6 cm Penet. for 50 Blows			>100	3.27	4	SS	4.4				
5	10:25 To 10:35		SC	-	-	SPT Hammer Rebounded			>100	4.00	4	SS	4.4		L3	4.0	Brownish, V.Dense, Residual Soil, Descent from Granite Rock	
6	10:47 To 11:05		DB	20	0	SPT Hammer Rebounded			>100	4.21	5	WS	3.4					
7	11:17 To 11:49		DB	55	21	-	-	-	-	5.00	5	WS	3.4		L4	5.0	Brownish, V.Dense, Completely Weathered Rock, Descent from Granite Rock	
8	12:05 To 12:46		DB	75	40	-	-	-	-	6.00	6	CS	2.4					
9	13:00 To 14:03		DB	88	52	-	-	-	-	7.00	7	CS	1.4		L5	6.0	Greyish Brown, Moderately Weathered Rock, Descent from Granite Rock	
10			DB	88	52	-	-	-	-	8.50	8	CS	-0.1					
			DB	88	52	-	-	-	-	10.00	8	CS	-1.6		L6	8.5	Greyish Brown, Slightly Weathered Rock, Descent from Granite Rock	
			DB	88	52	-	-	-	-	10.00	8	CS	-1.6					
			DB	88	52	-	-	-	-	10.00	8	CS	-1.6		L7	10.0	Greyish Brown, Fresh Hard Rock, Granite Rock	
			DB	88	52	-	-	-	-	10.00	8	CS	-1.6					

CS - Core Sample	DS - Disturbed Sample	LOGGED	M. PANDIRAJAN	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	13/01/2023	GROUND LEVEL (m)	8.44	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	JALEEL YASIN	WATER TABLE (m)	1.50	
WS - Wash Sample	DB - Diamond Bit	DATE	19/01/2023	CASING DEPTH (m)	9.00	

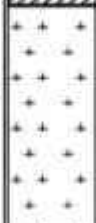
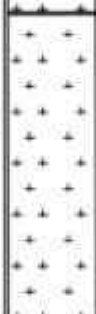
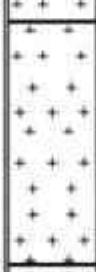
Borehole terminated at 10 m depth below E.G.L

FIG.2.2 Sub Soil Profile at BH-02(Ref:25) Location

 SITE INVESTIGATION RECORD										BORE HOLE No.		BH-03(Ref:27)						
PROJECT NAME										SHEET		1 OF 1						
PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING (1B+G+9 UPPER FLOORS) AT SHOLINGANALLUR, CHENNAI										DIA OF BORE HOLE		150mm NX						
LOCATION		Sholinganallur		MACHINE No.		CR-01		CHAINAGE (m)		-		BORE START DATE		13/01/2023				
STRUCTURE		1B+G+9 Upper Floors		DRILLING METHOD		Rotary		CO-ORDINATES		N -		BORE END DATE		13/01/2023				
JOB CODE		GEC-JC-GT-4105		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
		Hi.	Min.				0-15	15-30	30-45									
1	15	10	To	SC	-	-	3	4	5	9	1.00	1	SS	7.6				Brownish, Moist, Loose, Clayey Silty SAND(SC) Sand-Clay mixtures
2	15	20	To	SC	-	-	3	6	8	14	1.45	2	SS	6.6		L1	2.0	
3	15	33	To	SC	-	-	8	20	22	42	2.00	3	SS	5.6		L2	3.0	Brownish, Moist, Medium Dense, Clayey Silty SAND(SC) Sand-Clay mixtures
4	15	46	To	SC	-	-	40	8 cm Penet. for 50 Blows		>100	3.00	4	SS	4.6		L3	4.0	Brownish, Moist, Dense, Clayey Silty SAND(SC) Sand-Clay mixtures
5	16	05	To	SC	-	-	9 cm Penet. for 50 Blows		>100	4.00	5	WS	3.6		L4	5.0	Brownish, V.Dense, Residual Soil , Descent from Granite Rock	
6	16	21	To	SC	-	-	SPT Hammer Rebounded		>100	5.00	6	WS	2.6		L5	6.0	Brownish, V.Dense, Completely Weathered Rock , Descent from Granite Rock	
7	16	45	To	DB	35	22	-	-	-	-	6.00	7	CS	1.1		L6	7.5	Greyish Brown, Moderately Weathered Rock , Descent from Granite Rock
8	17	22	To	DB	68	41	-	-	-	-	7.50	8	CS	-0.4		L7	9.0	Greyish Brown, Slightly Weathered Rock , Descent from Granite Rock
9	17	57	To	DB	76	55	-	-	-	-	9.00	9	CS	-1.4		L8	10.0	Greyish Brown, Fresh Hard Rock , Granite Rock
10	18	12	To	DB	-	-	-	-	-	-	10.00	-	-	-		-	-	
CS - Core Sample		DS - Disturbed Sample		LOGGED		M. PANDIRAJAN		PROJECT SITE DETAILS				REMARKS						
SS - Split Spoon Sample		SC - Soil Cutter		DATE		13/01/2023		GROUND LEVEL (m)				8.61						
UDS - Undisturbed Sample		TCB - Tungsten Carbide Bit		CHECKED		JALEEL YASIN		WATER TABLE (m)				1.50						
WS - Wash Sample		DB - Diamond Bit		DATE		19/01/2023		CASING DEPTH (m)				0.00						
Borehole terminated at 10 m depth below E.G.L.																		
FIG.2.3 Sub Soil Profile at BH-03(Ref:27) Location																		

		SITE INVESTIGATION RECORD										BORE HOLE No. BH-4 REF:(BH-26)								
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING (1B+G+9 UPPER FLOORS) AT SHOLINGANALLUR, CHENNAI										SHEET		1	OF	1				
												DIA OF BORE HOLE		150mm	✓					
LOCATION		Sholinganallur, Chennai		MACHINE No.		CR-01		CHAINAGE (m)		-		BORE START DATE		07/02/2023						
STRUCTURE		1B+ G+ 9 Upper floors		DRILLING METHOD		Rotary		CO-ORDINATES		N		-		BORE END DATE		07/02/2023				
JOB CODE		GEC-JC-GT-4105		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		
		Dr	Min.				0-15	15-30	30-45											
07/02/2023		To	10:30	SC	-	-													Brownish, Moist, Medium Dense, Poorly Graded, Clayey Silty SAND (SC) Sand-Clay mixtures	
	1		To	10:31				2	6	17	23	1.00	1	SS	7.7					
			To	10:43	SC	-	-					1.45							Brownish, Moist, Medium Dense, Poorly Graded, Clayey Silty SAND (SC) Sand-Clay mixtures/Residual Soil	
	2		To	10:44				5	10	14	24	2.00	2	SS	6.7		L1	2.0		
			To	10:59	SC	-	-					2.45							Brownish, Moist, V.Dense, Completely Weathered Rock , Descent from Charnockite	
	3		To	11:03				13 cm Penet. For 50 Blows			>100	3.00	3	SS	5.7		L2	3.0		
			To	11:26	SC	-	-					3.13							Brownish, Moist, V.Dense, Completely Weathered Rock , Descent from Charnockite	
	4		To	11:40				6	20		>100	4.00	4	SS	4.7					
			To	11:43	SC	-	-					4.43								Brownish, Moderately Weathered Rock , Descent from Charnockite
	5		To	11:57				14 cm Penet. For 50 Blows			>100	5.00	5	SS	3.7					
			To	12:07	SC	-	-					5.14								Brownish, Slightly Weathered Rock , Descent from Charnockite
6							SPT Hammer Rebounded			>100	6.00	6	WS	2.7		L3	6.0			
		To	12:30	DB	34	11												Brownish, Slightly Weathered Rock , Descent from Charnockite		
7		To	13:17								7.50	7	CS	1.2		L4	7.5			
		To	14:30	DB	51	22												Brownish, Slightly Weathered Rock , Descent from Charnockite		
8		To	15:21																Brownish, Slightly Weathered Rock , Descent from Charnockite	
9		To	15:33	DB	70	50					9.00	8	CS	-0.3						
10		To	16:29								10.00	9	CS	-1.3						
																L5	10.0			
CS - Core Sample				DS - Disturbed Sample				LOGGED		K.J.VINOD PRADAP				PROJECT SITE DETAILS				REMARKS		
SS - Split Spoon Sample				SC - Soil Cutter				DATE		07/02/2023				GROUND LEVEL (m)		6.66				
UDS - Undisturbed Sample				TCB - Tungsten Carbide Bit				CHECKED		JALEEL YASIN				WATER TABLE (m)		1.50				
WS - Wash Sample				DB - Diamond Bit				DATE		10/03/2023				CASING DEPTH (m)		0.00				
Borehole terminated at 10 m depth below E.G.L.																				
FIG.2.4 Sub Soil Profile at BH-4 REF:(BH-26) Location																				

		SITE INVESTIGATION RECORD						BORE HOLE No.		BH-5 REF:(BH-24)									
								SHEET		1	OF	1							
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING (1B+G+9 UPPER FLOORS) AT SHOLINGANALLUR, CHENNAI						DIA OF BORE HOLE		150mm	☒								
LOCATION		Sholinganallur, Chennai		MACHINE No.		CR-01		CHAINAGE (m)		-		BORE START DATE		07/02/2023					
STRUCTURE		1B+ G+ 9 Upper floors		DRILLING METHOD		Rotary		CO-ORDINATES		N	-	BORE END DATE		08/02/2023					
JOB CODE		GEC-JC-GT-4105		FLUSHING MEDIUM		Bentonite				E	-	TOTAL DRILL DAYS		2					
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	
	07/02/2023	17	45	SC	-	-	2	4	3	7	1.00	1	SS	7.4					Brownish/Greyish, Moist, Loose; Poorly Graded, Clayey Silty SAND (SC) Sand Clay mixtures
		17	46																
		17	56	SC	-	-	16	35	7cm Penet. For 50Blows	>100	2.00	2	SS	6.4		L1	2.0		
		17	59																
	08/02/2023	18	13	SC	-	-	24	34	5cm Penet. For 50Blows	>100	3.00	3	SS	5.4			L2	3.0	Brownish, Moist, V.Dense, Residual Soil , Descent from Charnockite
		18	17																
		07	30	SC	-	-	SPT Hammer Rebounded			>100	4.00	4	WS	4.4			L3	4.0	Brownish, Moist, V.Dense, Completely Weathered Rock , Descent from Charnockite
	07	39																	
	08	00	DB	8	0	-	-	-	-	-	5.50	5	CS	2.9					Brownish Grey, Highly Weathered Rock , Descent from Charnockite
	08	36																	
09	20	DB	10	0	-	-	-	-	-	7.00	6	CS	1.4			L4	7.0	Brownish Grey, Slightly Weathered Rock , Descent from Charnockite	
10	00																		
10	13	DB	55	21	-	-	-	-	-	8.50	7	CS	-0.1			L5	8.5		
11	16																		
11	35	DB	80	45	-	-	-	-	-	10.00	8	CS	-1.6			L6	10.0	Greyish, Fresh Hard Rock , Charnockite Rock	
12	49																		
CS - Core Sample		DS - Disturbed Sample		LOGGED		K.J.VINOD PRADAP		PROJECT SITE DETAILS		REMARKS									
SS - Split Spoon Sample		SC - Soil Cutter		DATE		08/02/2023		GROUND LEVEL (m)		8.37									
UDS- Undisturbed Sample		TCB - Tungsten Carbide Bit		CHECKED		JALEEL YASIN		WATER TABLE (m)		1.50									
WS- Wash Sample		DB - Diamond Bit		DATE		10/03/2023		CASING DEPTH (m)		0.00									
Borehole terminated at 10 m depth below E.G.L																			
FIG.2.5 Sub Soil Profile at BH-5 REF:(BH-24) Location																			

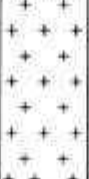
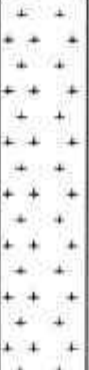
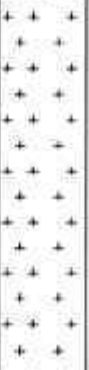
		SITE INVESTIGATION RECORD										BORE HOLE No.		BH-6 REF:(BH-22)			
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING (1B+G+9 UPPER FLOORS) AT SHOLINGANALLUR, CHENNAI										SHEET		1	OF	1	
												DIA OF BORE HOLE		150mm		✓	
LOCATION		Sholinganallur, Chennai		MACHINE No.		CR-01		CHAINAGE (m)		-		BORE START DATE		08/02/2023			
STRUCTURE		1B+ G+ 9 Upper floors		DRILLING METHOD		Rotary		CO-ORDINATES		N		-		BORE END DATE		09/02/2023	
JOB CODE		GEC-JC-GT-4105		FLUSHING MEDIUM		Bentonite				E		-		TOTAL DRILL DAYS		2	
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.			Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description	
		Hr.				Min.	6-15	15-30									30-45
	08/02/2023	14:50 To 14:51	SC	-	-	12	10	14	24	1.00	1	SS	7.4		L1	2.0	Brownish/Reddish Brown, Moist, Medium Dense, Poorly Graded, Clayey Silty SAND (SC) Sand-Clay mixtures/Residual Soil
		15:03 To 15:05	SC	-	-	14	13cm Penet. For 50Blows		>100	2.00 2.27	2	SS	6.4				
		15:17 To 15:20	SC	-	-		3cm Penet. For 50Blows		>100	3.00 3.03	3	SS	5.4		L2	4.0	Brownish, Moist, V.Dense, Completely Weathered Rock , Descent from Charnockite
		15:35 To 15:47	SC	-	-		SPT Hammer Rebounded		>100	4.00	4	WS	4.4				
		16:03 To 16:45	DB	8	0	-	-	-	-	5.00	5	CS	3.4		L3	6.5	Brownish Grey/Greyish Black, Highly Weathered Rock , Descent from Charnockite
		16:57 To 17:36	DB	13	0	-	-	-	-	6.50	6	CS	1.9				
		17:50 To 18:44	DB	42	11	-	-	-	-	8.50	7	CS	-0.1		L4	8.5	Greyish Black, Moderately Weathered Rock , Descent from Charnockite
		07:30 To 08:27	DB	75	30	-	-	-	-	10.00	8	CS	-1.6				
		09/02/2023													L5	10.0	Greyish Black, Fresh Hard Rock , Charnockite Rock
	CS - Core Sample		DS - Disturbed Sample		LOGGED		K.J.VINOD PRADAP		PROJECT SITE DETAILS				REMARKS				
SS - Split Spoon Sample		SC - Soil Cutter		DATE		09/02/2023		GROUND LEVEL (m)				8.43					
UDS- Undisturbed Sample		TCB - Tungsten Carbide Bit		CHECKED		JALEEL YASIN		WATER TABLE (m)				1.50					
WS - Wash Sample		DB - Diamond Bit		DATE		10/03/2023		CASING DEPTH (m)				0.00					
Borehole terminated at 10 m depth below E.G.L																	
FIG.2.6 Sub Soil Profile at BH-6 REF:(BH-22) Location																	

GEC		SITE INVESTIGATION RECORD						BORE HOLE No. BH-7 REF:(BH-29)									
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING (1B+G+9 UPPER FLOORS) AT SHOLINGANALLUR, CHENNAI						SHEET 1 OF 1									
LOCATION		Sholinganallur, Chennai		MACHINE No.		CR-01		CHAINAGE (m)									
STRUCTURE		1B+ G+ 9 Upper floors		DRILLING METHOD		Rotary		CO-ORDINATES									
JOB CODE		GEC-JC-GT-4105		FLUSHING MEDIUM		Bentonite		TOTAL DRILL DAYS									
BORE START DATE		09/02/2023		BORE END DATE		09/02/2023		1									
Depth below E.G.L. (m)	Drilling progress per metre		Core Details		SPT Details		Sample Details		Layer Data								
	Time		Type of Drill Bit (SC / TCB / DB)	Total Core Recovery %	R.O.D %	Blows/cm.		SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description	
	Date	Hr.				Min.	0-15										15-30
1	10	00	To	SC	-	-	7	11	14	25	1.00	1	SS	7.4			Brownish, Moist, Medium Dense, Poorly Graded, Clayey Silty SAND (SC) Sand-Clay mixtures
2	10	01	To	SC	-	-	6	18	13cm Penet. For 50Blows	>100	1.45	2	SS	6.4	L1	2.0	
3	10	10	To	SC	-	-	3cm Penet. For 50Blows			>100	2.00	3	WS	5.4	L2	3.0	Brownish, Moist, V.Dense, Residual Soil , Descent from Charnockite
4	10	12	To	SC	-	-	SPT Hammer Rebounded			>100	2.43	4	WS	4.4	L3	4.5	Brownish, Moist, V.Dense, Completely Weathered Rock , Descent from Charnockite
5	10	30	To	SC	-	-	SPT Hammer Rebounded			>100	3.00	5	WS	3.9			
6	10	45	To	SC	-	-					3.03	6	CS	2.4	L4	6.0	Blackish, Highly Weathered Rock , Descent from Charnockite
7	10	47	To	SC	-	-					4.00	7	CS	0.9			Blackish, Moderately Weathered Rock , Descent from Charnockite
8	10	58	To	SC	-	-					4.50	8	CS	-0.6	L5	9.0	
9	11	06	To	DB	10	0					6.00	9	CS	-1.6	L6	10.0	Blackish, Slightly Weathered Rock , Descent from Charnockite
10	11	20	To	DB	21	0					7.50						
11	11	56	To	DB	50	20					9.00						
12	12	30	To	DB	60	40					10.00						
13	13	39	To	DB													
14	14	30	To	DB													

CS - Core Sample	DS - Disturbed Sample	LOGGED	K.J.VINOD PRADAP	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	09/02/2023	GROUND LEVEL (m)	8.42	
UCS - Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	JALEEL YASIN	WATER TABLE (m)	1.50	
WS - Wash Sample	DB - Diamond Bit	DATE	10/03/2023	CASING DEPTH (m)	0.00	

Borehole terminated at 10 m depth below E.G.L

FIG.2.7 Sub Soil Profile at BH-7 REF:(BH-29) Location

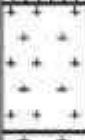
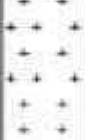
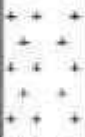
		SITE INVESTIGATION RECORD					BORE HOLE No. BH-8 REF:(BH-23)										
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING (1B+G+9 UPPER FLOORS) AT SHOLINGANALLUR, CHENNAI					SHEET 1 OF 1										
LOCATION		SHOLINGANALLUR, CHENNAI		MACHINE No.	CR-01	CHAINAGE (m)	-	DIA OF BORE HOLE	150mm NX								
STRUCTURE		1B+ G+ 9 Upper floors		DRILLING METHOD	Rotary	CO-ORDINATES	N -	BORE START DATE	09/02/2023								
JOB CODE		GEC-JC-GT-4105		FLUSHING MEDIUM	Bentonite	E -	-	BORE END DATE	10/02/2023								
								TOTAL DRILL DAYS	2								
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									
	09/02/2023	15:36 To 15:37	SC	-	-	7	13	15	28	1.00	1	SS	7.4		L1	2.0	Brownish, Moist, Medium Dense, Poorly Graded, Clayey Silty SAND (SC) Sand Clay mixtures/Residual Soil
		15:49 To 15:51	SC	-	-	9	20	27	47	1.45	2	SS	6.4				
		16:07 To 16:10	SC	-	-	13cm Penet. For 50Blows			>100	2.00	2	SS	6.4		L2	3.0	Brownish, Moist, Dense, Poorly Graded, Silty SAND (SM) Sand-Silt Mixtures
		16:21 To 16:24	SC	-	-	14cm Penet. For 50Blows			>100	2.45	3	SS	5.4				
		16:40 To 16:47	SC	-	-	SPT Hammer Rebounded			>100	3.00	3	SS	5.4		L3	4.5	Brownish, Moist, V.Dense, Completely Weathered Rock , Descent from Charnockite
		16:40 To 16:47	SC	-	-	SPT Hammer Rebounded			>100	3.13	4	WS	4.4				
		17:01 To 17:28	DB	9	0					4.00	4	WS	4.4		L4	7.5	Brownish/Brownish Grey, Highly Weathered Rock , Descent from Charnockite
		17:40 To 18:15	DB	11	0					4.14	5	WS	3.9				
		17:40 To 18:15	DB	11	0					4.50	6	CS	2.4		L5	10.0	Greyish, Slightly Weathered Rock , Descent from Charnockite
		18:00 To 18:49	DB	60	25					6.00	7	CS	0.9				
18:00 To 18:49	DB	60	25					7.50	8	CS	-0.6						
18:00 To 18:49	DB	60	25					9.00	9	CS	-1.6						
18:00 To 18:49	DB	60	25					10.00									

CS - Core Sample	DS - Disturbed Sample	LOGGED	K.J.VINOD PRADAP	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	10/02/2023	GROUND LEVEL (m)	8.38	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	JALEEL YASIN	WATER TABLE (m)	1.50	
WS - Wash Sample	DB - Diamond Bit	DATE	10/03/2023	CASING DEPTH (m)	0.00	

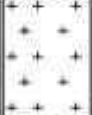
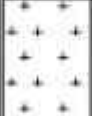
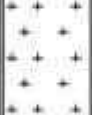
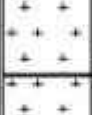
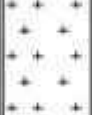
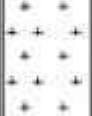
Borehole terminated at 10 m depth below E.G.L

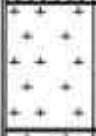
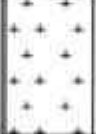
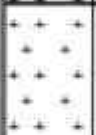
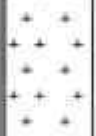
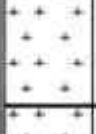
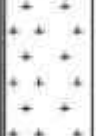
FIG.2.8 Sub Soil Profile at BH-8 REF:(BH-23) Location

		SITE INVESTIGATION RECORD										BORE HOLE No.		BH-09 REF:(BH-21)				
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING (1B+G+9 UPPER FLOORS) AT SHOLINGANALLUR, CHENNAI										SHEET		1	OF	1		
LOCATION		Sholinganallur, Chennai		MACHINE No.		CR-01		CHAINAGE (m)		-		DIA OF BORE HOLE		150mm	✓			
STRUCTURE		1B+ G+ 9 Upper floors		DRILLING METHOD		Rotary		CO-ORDINATES		N	-	BORE START DATE		10/02/2023				
JOB CODE		GEC-JC-GT-4105		FLUSHING MEDIUM		Bentonite				E	-	BORE END DATE		10/02/2023				
												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	
		Hi.				Min.	0-15	15-30										30-45
10/02/2023	1	10:40	To	SC	-	-	6	8	12	20	1.00	1	SS	7.1		L1	1.5	Brownish, Moist, Medium Dense, Poorly Graded, Clayey Silty SAND (SC) Sand-Clay mixtures/Residual Soil
		10:45	SC	-	-					1.45								
	2	11:03	To	DB	10	0	SPT Hammer Rebounded			>100	2.00	2	WS	6.1		L2	2.0	Brownish, Moist, V.Dense, Residual Soil Descent from Charnockite
		11:19	DB	12	0													
	3	12:10	To	DB	12	0					3.00	3	CS	5.1				
		12:50	DB															
	4										4.00	4	CS	4.1				Brownish Grey/Greyish, Highly Weathered Rock , Descent from Charnockite
	5	13:06	To	DB	9	0					5.50	5	CS	2.6				
		13:50	DB	15	0													
6	14:20	To	DB	15	0										L3	6.5		
	15:15	DB																
7										7.00	6	CS	1.1				Brownish Grey, Moderately to Slightly Weathered Rock , Descent from Charnockite	
8	15:30	To	DB	73	35					8.50	7	CS	-0.4		L4	8.5		
	16:35	DB																
9	16:50	To	DB	80	60												Greyish, Fresh Hard Rock , Charnockite Rock	
	18:02	DB																
10										10.00	8	CS	-1.9		L5	10.0		
CS - Core Sample		DS - Disturbed Sample		LOGGED		K.J.VINOD PRADAP		PROJECT SITE DETAILS				REMARKS						
SS - Split Spoon Sample		SC - Soil Cutter		DATE		10/02/2023		GROUND LEVEL (m)				6.09						
UDS- Undisturbed Sample		TCB - Tungsten Carbide Bit		CHECKED		JALEEL YASIN		WATER TABLE (m)				1.50						
WS - Wash Sample		DB - Diamond Bit		DATE		10/03/2023		CASING DEPTH (m)				0.00						
Borehole terminated at 10 m depth below E.G.L.																		
FIG.2.9 Sub Soil Profile at BH-09 REF:(BH-21) Location																		

		SITE INVESTIGATION RECORD										BORE HOLE No.		BH-10 REF:(BH-20)					
												SHEET		1	OF	1			
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING (1B+G+9 UPPER FLOORS) AT SHOLINGANALLUR, CHENNAI										DIA OF BORE HOLE		150mm	☒				
LOCATION		Sholinganallur, Chennai		MACHINE No.		CR-01		CHAINAGE (m)		-		BORE START DATE		11/02/2023					
STRUCTURE		1B+ G+ 9 Upper floors		DRILLING METHOD		Rotary		CO-ORDINATES		N		-		BORE END DATE		11/02/2023			
JOB CODE		GEC-JC-QT-4105		FLUSHING MEDIUM		Bentonite				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.			Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description			
		Hr.				Min.	0-15	15-30									30-45	SPT 'N' Value	
	11/02/2023	08:00	To	08:01	SC	-	-	2	3	4	7	1.00	1	SS	7.3		L1	2.0	Brownish, Moist, Loose, Poorly Graded, Clayey Silty SAND (SC) Sand-Clay mixtures
		08:11	To	08:12	SC	-	-					1.45							
		08:25	To	08:30	SC	-	-	8	15	18	33	2.00	2	SS	6.3		L2	3.0	Brownish, Moist, Dense, Poorly Graded, Silty SAND (SM) Sand-Silt mixtures
		08:45	To	08:55	SC	-	-	6	11 cm Penet. For 50 Blows		>100	3.00	3	SS	5.3				
		09:30	To	10:07	DB	18	0	SPT Hammer Rebounded			>100	4.00	4	WS	4.3		L3	4.0	Brownish, Moist, V.Dense, Completely Weathered Rock, Descent from Charnockite
		10:20	To	11:00	DB	11	0					5.00	5	CS	3.3				
		11:10	To	12:03	DB	47	19					6.50	6	CS	1.8		L4	6.5	Brownish/Brownish Grey, Highly Weathered Rock, Descent from Charnockite
		12:15	To	13:10	DB	65	40					8.00	7	CS	0.3				
		14:00	To	15:01	DB	88	64					9.00	8	CS	-0.7		L5	8.0	Greyish White, Moderately to Slightly Weathered Rock, Descent from Charnockite
												10.00	9	CS	-1.7				
														L6	10.0		Greyish White, Fresh Hard Rock, Charnockite Rock		
CS - Core Sample		DS - Disturbed Sample		LOGGED		K.J.VINOD PRADAP		PROJECT SITE DETAILS		REMARKS									
SS - Split Spoon Sample		SC - Soil Cutter		DATE		11/02/2023		GROUND LEVEL (m)		8.30									
UDS- Undisturbed Sample		TCB - Tungsten Carbide Bit		CHECKED		JALEEL YASIN		WATER TABLE (m)		1.50									
WS - Wash Sample		DB - Diamond Bit		DATE		10/03/2023		CASING DEPTH (m)		0.00									
Borehole terminated at 10 m depth below E.G.L.																			
FIG.2.10 Sub Soil Profile at BH-10 REF:(BH-20) Location																			

		SITE INVESTIGATION RECORD										BORE HOLE No.		BH-11 REF:(BH-30)						
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING (1B+G+9 UPPER FLOORS) AT SHOLINGANALLUR, CHENNAI										SHEET		1	OF	1				
LOCATION		Sholinganallur, Chennai		MACHINE No.		CR-01		CHAINAGE (m)		-		DIA OF BORE HOLE		150mm	✓					
STRUCTURE		1B+ G+ 9 Upper floors		DRILLING METHOD		Rotary		CO-ORDINATES		N	-	BORE START DATE		11/02/2023						
JOB CODE		GEC-JC-GT-4105		FLUSHING MEDIUM		Bentonite		CO-ORDINATES		E	-	BORE END DATE		12/02/2023						
												TOTAL DRILL DAYS		2						
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		
1 2 3 4 5 6 7 8 9 10	11/02/2023	16 30 To 16 31	SC	-	-	8	10	14	24	1.00	↓	1	SS	7.5		L1	2.0	Brownish, Moist, Medium Dense, Poorly Graded, Clayey Silty SAND (SC) Sand-Clay mixtures		
		16 43 To 16 44	SC	-	-					1.45	↓									
		16 59 To 17 00	SC	-	-	8	12	10	22	2.00	↓	2	SS	6.5		L3	3.5	Brownish, Moist, Medium Dense, Poorly Graded, Clayey Silty SAND (SC) Residual Soil Sand-Clay mixtures		
		17 13 To 17 18	SC	-	-	4	8	15	23	3.00	↓	3	SS	5.5						
								SPT Hammer Rebounded			>100	4.00	↓	4	WS	4.5		L4	4.0	Brownish, Moist, V.Dense, Completely Weathered Rock, Descent from Charnockite
		17 35 To 18 07	DB	10	0	-	-	-	-	5.50	↓	5	CS	3.0						
				07 30 To 08 19	DB	9	0						↓					L5	7.0	Brownish/Greyish Black, Highly Weathered Rock, Descent from Charnockite
		08 31 To 09 33	DB	59	23	-	-	-	-	8.50	↓	7	CS	0.0						
				09 50 To 10 59	DB	79	34						↓					L6	8.5	Blackish, Slightly Weathered Rock, Descent from Charnockite
											↓					L7	10.0	Blackish, Fresh Hard Rock, Charnockite Rock		
OS - Core Sample		DS - Disturbed Sample		LOGGED		K.J.VINOD PRADAP		PROJECT SITE DETAILS		REMARKS										
SS - Split Spoon Sample		SC - Soil Cutter		DATE		12/02/2023		GROUND LEVEL (m)		8.50										
UDS- Undisturbed Sample		TCB - Tungsten Carbide Bit		CHECKED		JALEEL YASIN		WATER TABLE (m)		1.50										
WS - Wash Sample		DB - Diamond Bit		DATE		10/03/2023		CASING DEPTH (m)		0.00										
Borehole terminated at 10 m depth below E.G.L																				
FIG.2.11 Sub Soil Profile at BH-11 REF:(BH-30) Location																				

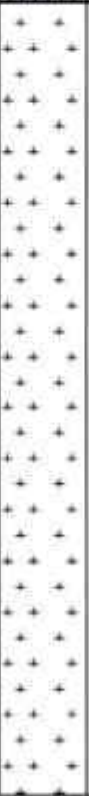
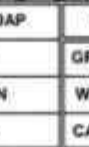
		SITE INVESTIGATION RECORD										BORE HOLE No. BH-12(REF:BH-31)																																																																																																									
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING (1B+G+9 UPPER FLOORS) AT SHOLINGANALLUR, CHENNAI										SHEET		1	OF	1																																																																																																					
												DIA OF BORE HOLE		150mm	✓																																																																																																						
LOCATION		Sholinganallur, Chennai		MACHINE No.		CR-01		CHAINAGE (m)		-		BORE START DATE		12/02/2023																																																																																																							
STRUCTURE		1B+ G+ 9 Upper floors		DRILLING METHOD		Rotary		CO-ORDINATES		N		-		BORE END DATE		13/02/2023																																																																																																					
JOB CODE		GEC-JC-GT-4105		FLUSHING MEDIUM		Bentonite				E		-		TOTAL DRILL DAYS		2																																																																																																					
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.C.D %	Blows/cm.			SPT 'N' Value	Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description																																																																																																			
		Hr.	Min.				0-15	15-30	30-45																																																																																																												
12/02/2023	12:40 To 12:41 12:50 To 12:52 13:05 To 13:07 14:15 To 14:33 14:48 To 15:13 15:25 To 15:46 16:00 To 16:49 17:03 To 18:16	SC	-	-	-	6	7	10	17	1.00 ↓ 1.45 ↓ 2.00 2.12 ↓ 3.00 ↓ 4.50 ↓ 5.50 ↓ 6.50 ↓ 7.50 ↓ 9.00 ↓ 10.00	1	SS	7.5		L1	2.0	Brownish, Moist, Medium Dense, Poorly Graded, Clayey Silty SAND (SC) Sand Clay mixtures																																																																																																				
																		12cm Penet. For 50Blows			>100	2	SS	6.5																																																																																													
																		SPT Hammer Rebounded							>100	3	WS	5.5																																																																																									
																		13/02/2023	07:09 To 08:17	DB									11	0	-	-	-	-	-	4	CS	4.0		L2	3.0	Brownish, Moist, V.Dense, Completely Weathered Rock , Descent from Charnockite																																																																											
																																											13	0	-	-	-	-	-	-	5	CS	3.0		L3	5.5	Brownish Grey/Greyish, Highly Weathered Rock , Descent from Charnockite																																																												
																																																										41	0	-	-	-	-	-	-	6	CS	2.0		L4	9.0	Greyish, Moderately to Slightly Weathered Rock , Descent from Charnockite																																													
																																																																									48	0	-	-	-	-	-	-	7	CS	1.0		L5	10.0	Greyish, Fresh Hard Rock , Charnockite Rock																														
																																																																																								74	30	-	-	-	-	-	-	8	CS	-0.5		L5	10.0	Greyish, Fresh Hard Rock , Charnockite Rock															
																																																																																																							81	60	-	-	-	-	-	-	9	CS	-1.5		L5	10.0	Greyish, Fresh Hard Rock , Charnockite Rock
SS - Split Spoon Sample			SC - Soil Cutter			DATE		13/02/2023		GROUND LEVEL (m)		8.54																																																																																																									
UDS - Undisturbed Sample			TCB - Tungsten Carbide Bit			CHECKED		JALEEL YASIN		WATER TABLE (m)		1.50																																																																																																									
WS - Wash Sample			DB - Diamond Bit			DATE		10/03/2023		CASING DEPTH (m)		0.00																																																																																																									
Borehole terminated at 10 m depth below E.G.L																																																																																																																					
FIG.2.12 Sub Soil Profile at BH-12(REF:BH-31) Location																																																																																																																					

		SITE INVESTIGATION RECORD						BORE HOLE No.		BH-13(REF: BH-32)								
								SHEET		1	OF	1						
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING (1B+G+9 UPPER FLOORS) AT SHOLINGANALLUR, CHENNAI						DIA OF BORE HOLE		150mm	☒							
LOCATION		Sholinganallur, Chennai	MACHINE No.		CR-01	CHAINAGE (m)				BORE START DATE		13/02/2023						
STRUCTURE		1B+ G+ 9 Upper floors	DRILLING METHOD		Rotary	CO-ORDINATES		N	-	BORE END DATE		13/02/2023						
JOB CODE		GEC-JC-GT-4105	FLUSHING MEDIUM		Bentonite			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
13/02/2023	1	09:40	To	SC	-	-	8	10	14	24	1.00	1	SS	7.4		L1	2.0	Brownish, Moist, Medium Dense, Poorly Graded, Clayey Silty SAND (SC) Sand- Clay mixtures/Residual Soil
		09:41	To	SC	-	-				1.45								
	2	09:52	To	SC	-	-	14	14	17	31	2.00	2	SS	6.4		L2	3.0	Greyish White, Moist, Dense, Poorly Graded, Clayey Silty SAND (SC) /Residual Soil, Sand- Clay mixtures
		09:53	To	SC	-	-	2cm Penet. For 50Blows			>100	3.00	3	WS	5.4				
	3	10:05	To	SC	-	-					3.02					L3	4.0	Whitish, Moist, V.Dense, Completely Weathered Rock , Descent from Charnockite
		10:10	To	SC	-	-	SPT Hammer Rebounded			>100	4.00	4	WS	4.4				
	5	10:47	To	DB	4	0	-	-	-	-	5.50	5	CS	2.9		L4	7.0	Brownish/Brownish Grey, Highly Weathered Rock , Descent from Charnockite
		11:15	To	DB	8	0												
	7	11:30	To	DB			-	-	-	-	7.00	6	CS	1.4		L5	8.5	Brownish/Brownish Grey, Moderately Weathered Rock , Descent from Charnockite
		12:00	To	DB	35	11					8.50	7	CS	-0.1				
9	12:12	To	DB			-	-	-	-						L6	10.0	Greyish, Slightly Weathered Rock , Descent from Charnockite.	
	13:00	To	DB	55	27					10.00	8	CS	-1.6					
10	13:11	To	DB			-	-	-	-									
	14:03	To	DB															
CS - Core Sample		DS - Disturbed Sample		LOGGED		K.J.VINOD PRADAP		PROJECT SITE DETAILS		REMARKS								
SS - Split Spoon Sample		SC - Soil Cutter		DATE		13/02/2023		GROUND LEVEL (m)		8.37								
UDS- Undisturbed Sample		TCB - Tungsten Carbide Bit		CHECKED		JALEEL YASIN		WATER TABLE (m)		1.50								
WS - Wash Sample		DB - Diamond Bit		DATE		10/03/2023		CASING DEPTH (m)		0.00								
Borehole terminated at 10 m depth below E.G.L																		
FIG.2.13 Sub Soil Profile at BH-13(REF: BH-32) Location																		

GEC		SITE INVESTIGATION RECORD						BORE HOLE No. BH-15 REF:(BH-34)										
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING (1B+G+9 UPPER FLOORS) AT SHOLINGANALLUR, CHENNAI						SHEET 1 OF 1										
LOCATION		Sholinganallur, Chennai		MACHINE No.		CR-01		CHAINAGE (m)										
STRUCTURE		1B+ G+ 9 Upper floors		DRILLING METHOD		Rotary		CO-ORDINATES										
JOB CODE		GEC-JC-GT-4105		FLUSHING MEDIUM		Bentonite		TOTAL DRILL DAYS										
BORE START DATE		14/02/2023		BORE END DATE		14/02/2023		TOTAL DRILL DAYS										
150mm		✓		N		-		E										
NX																		
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						
	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										
1	10	30	SC	-	-	5	5	8	13	1.00	1	SS	7.2		L1	3.0	Brownish Grey, Moist, Medium Dense, Poorly Graded, Clayey Silty SAND (SC) Sand-Clay mixtures/Residual Soil	
	To	10	31	SC	-	-	4	5	8	13	1.45	2	SS					6.2
2	10	40	SC	-	-	8	11cm Penet. For 50Blows	>100	3.00	3	SS	5.2						
	To	10	41	SC	-	-	SPT Hammer Rebounded	>100	4.00	4	WS	4.2		L2	5.0	Brownish, Moist, V.Dense, Completely Weathered Rock , Descent from Charnockite		
3	10	53	SC	-	-	SPT Hammer Rebounded	>100	5.00	5	WS	3.2							
	To	10	57	SC	-	-	SPT Hammer Rebounded	>100	6.00	6	CS	2.2						
4	11	18	SC	-	-	-	-	-	-	6.00	7	CS	0.7		L3	7.5	Brownish/Brownish Grey, Highly Weathered Rock , Descent from Charnockite	
	To	11	27	SC	-	-	-	-	-	7.50	8	CS	-0.8					
5	11	45	SC	-	-	-	-	-	-	9.00	9	CS	-1.8					
	To	11	52	SC	-	-	-	-	-	10.00	9	CS	-1.8		L4	9.0	Greyish, Moderately Weathered Rock , Descent from Charnockite	
6	12	10	DB	11	-	-	-	-	-	10.00	9	CS	-1.8					
	To	12	37	DB	13	0	-	-	-	10.00	9	CS	-1.8					
7	12	50	DB	13	0	-	-	-	-	10.00	9	CS	-1.8		L5	10.0	Greyish, Slightly Weathered Rock , Descent from Charnockite	
	To	13	20	DB	47	12	-	-	-	10.00	9	CS	-1.8					
8	14	01	DB	47	12	-	-	-	-	10.00	9	CS	-1.8					
	To	14	41	DB	70	50	-	-	-	10.00	9	CS	-1.8					
	To	14	53	DB	70	50	-	-	-	10.00	9	CS	-1.8					
	To	15	49	DB	70	50	-	-	-	10.00	9	CS	-1.8					
9	14	53	DB	70	50	-	-	-	-	10.00	9	CS	-1.8					
10	15	49	DB	70	50	-	-	-	-	10.00	9	CS	-1.8					
CS - Core Sample		DS - Disturbed Sample		LOGGED		K.J.VINOD PRADAP		PROJECT SITE DETAILS		REMARKS								
SS - Split Spoon Sample		SC - Soil Cutler		DATE		09/02/2023		GROUND LEVEL (m)		8.22								
UDS - Undisturbed Sample		TCB - Tungsten Carbide Bit		CHECKED		JALEEL YASIN		WATER TABLE (m)		1.50								
WS - Wash Sample		DB - Diamond Bit		DATE		10/03/2023		CASING DEPTH (m)		0.00								
Borehole terminated at 10 m depth below E.G.L																		
FIG.2.15 Sub Soil Profile at BH-15 REF:(BH-34) Location																		

		SITE INVESTIGATION RECORD							BORE HOLE No.		BH-16 REF:(BH-19)							
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING (1B+G+9 UPPER FLOORS) AT SHOLINGANALLUR, CHENNAI							SHEET		1	OF	1					
LOCATION		Sholinganallur, Chennai		MACHINE No.		CR-01		CHAINAGE (m)		-		BORE START DATE		14/02/2023				
STRUCTURE		1B+ G+ 9 Upper floors		DRILLING METHOD		Rotary		CO-ORDINATES		N	-	BORE END DATE		15/02/2023				
JOB CODE		GEC-JC-GT-4105		FLUSHING MEDIUM		Bentonite				E	-	TOTAL DRILL DAYS		2				
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
14/02/2023	17:00	To	SC	-	-	12	18	25	43	1.00	1	SS	7.1		L1	2.0	Brownish, Moist, Hard, Sandy Silty CLAY (CI) , Clays of Medium Plasticity	
	17:01		SC	-	-	6	22	30	52	1.45	2	SS	6.1					
	17:10	To	SC	-	-	11cm Penet. For 50 Blows			>100	2.45	3	SS	5.1		L2	3.0	Brownish, Moist, V. Hard, Sandy Silty CLAY (CH) , Clays of High Plasticity	
	17:12		SC	-	-	3cm Penet. For 50 Blows			>100	3.11	4	WS	4.1					
	17:26	To	SC	-	-	SPT Hammer Rebounded			>100	4.03	5	WS	3.1		L3	5.0	Brownish, Moist, V. Dense, Completely Weathered Rock , Descent from Charnockite	
	17:31		SC	-	-	-	-	-	5.00	6	CS	1.6						
	17:46	To	DB	8	0	-	-	-	-	6.50	7	CS	0.1		L4	6.5	Brownish, Highly Weathered Rock , Descent from Charnockite	
	17:49		DB	36	16	-	-	-	-	8.00	8	CS	-0.9					
	18:05	To	DB	59	27	-	-	-	-	9.00	9	CS	-1.9		L5	9.0	Brownish Grey, Moderately Weathered Rock , Descent from Charnockite	
	18:09		DB	75	46	-	-	-	-	10.00	10	CS	-1.9					
15/02/2023	07:00	To	DB	36	16	-	-	-	-	6.50	7	CS	0.1		L4	6.5	Brownish, Highly Weathered Rock , Descent from Charnockite	
	07:40		DB	59	27	-	-	-	-	8.00	8	CS	-0.9					
07:53	To	DB	75	46	-	-	-	-	9.00	9	CS	-1.9		L5	9.0	Brownish Grey, Moderately Weathered Rock , Descent from Charnockite		
07:40		DB	75	46	-	-	-	-	10.00	10	CS	-1.9						
09:00	To	DB	75	46	-	-	-	-	9.00	9	CS	-1.9		L5	9.0	Brownish Grey, Moderately Weathered Rock , Descent from Charnockite		
09:56		DB	75	46	-	-	-	-	10.00	10	CS	-1.9						
10													L6	10.0		Brownish Grey, Slightly Weathered Rock , Descent from Charnockite		
CS - Core Sample		DS - Disturbed Sample		LOGGED		K.J.VINOD PRADAP		PROJECT SITE DETAILS		REMARKS								
SS - Split Spoon Sample		SC - Soil Cutter		DATE		15/02/2023		GROUND LEVEL (m)		8.09								
UDS- Undisturbed Sample		TCB - Tungsten Carbide Bit		CHECKED		JALEEL YASIN		WATER TABLE (m)		1.40								
WS - Wash Sample		DB - Diamond Bit		DATE		10/03/2023		CASING DEPTH (m)		0.00								
Borehole terminated at 10 m depth below E.G.L																		
FIG.2.16 Sub Soil Profile at BH-16 REF:(BH-19) Location																		

		SITE INVESTIGATION RECORD										BORE HOLE No.		BH-17 (REF: BH-18)			
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING (1B+G+9 UPPER FLOORS) AT SHOLINGANALLUR, CHENNAI										SHEET		1	OF	1	
LOCATION		Sholinganallur, Chennai		MACHINE No.		CR-01		CHAINAGE (m)		-		DIA OF BORE HOLE		150mm	✓		
STRUCTURE		1B+ G+ 9 Upper floors		DRILLING METHOD		Rotary		CO-ORDINATES		N	-	BORE START DATE		15/02/2023			
JOB CODE		GEC-JC-GT-4105		FLUSHING MEDIUM		Bentonite				E	-	BORE END DATE		15/02/2023			
												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									
15/02/2023	11	09	SC	-	-	2	3	5	8	1.00	1	SS	6.9		L1	2.0	Brownish, Moist, Stiff, Silty CLAY (Cl) , Clays of Medium Plasticity
	To	11								10	1.45	2	SS				
	11	20	SC	-	-	5	8	10	18	2.00	2	SS	5.9		L2	3.0	Brownish, Moist, V.Stiff, Silty CLAY(CH) , Clays of High Plasticity
	To	11								21	2.45	3	SS				
	11	31	SC	-	-	15	25	37	62	3.00	3	SS	4.9				
	To	11								32	3.45	4	SS				
	12	45	SC	-	-	24	30	50	80	4.00	4	SS	3.9				
	To	12								00	4.45	5	SS				
	12	09	SC	-	-	9cm Penet. For 50Blows			>100	5.00	5	SS	2.9				
	To	12				20	SPT Hammer Rebounded	>100	5.50	6	WS	2.4					
12	23	SC	-	-													
To	12				20												
12	46	DB	7	0													Brownish/Brownish Grey, Highly Weathered Rock , Descent from Charnockite
To	13																
14	00	DB	49	16													Brownish/Brownish Grey, Moderately Weathered Rock , Descent from Charnockite
To	14																
14	50	DB	65	33													Greyish, Slightly Weathered Rock , Descent from Charnockite
To	15																
CS - Core Sample		DS - Disturbed Sample		LOGGED		K.J.VINOD PRADAP		PROJECT SITE DETAILS		REMARKS							
SS - Split Spoon Sample		SC - Soil Cutter		DATE		15/02/2023		GROUND LEVEL (m)		7.87							
UDS- Undisturbed Sample		TCB - Tungsten Carbide Bit		CHECKED		JALEEL YASIN		WATER TABLE (m)		1.40							
WS - Wash Sample		DB - Diamond Bit		DATE		10/03/2023		CASING DEPTH (m)		0.00							
Borehole terminated at 10 m depth below E.G.L																	
FIG.2.17 Sub Soil Profile at BH-17 (REF: BH-18) Location																	

		SITE INVESTIGATION RECORD						BORE HOLE No. BH-18 (REF: BH-17)									
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING (1B+G+9 UPPER FLOORS) AT SHOLINGANALLUR, CHENNAI						SHEET 1 OF 1									
LOCATION		Sholinganallur, Chennai		MACHINE No.		CR-01		CHAINAGE (m)									
STRUCTURE		1B+ G+ 9 Upper floors		DRILLING METHOD		Rotary		CO-ORDINATES									
JOB CODE		GEC-JC-GT-4105		FLUSHING MEDIUM		Bentonite		TOTAL DRILL DAYS									
BORE START DATE		15/02/2023		BORE END DATE		16/02/2023		TOTAL DRILL DAYS									
BORE END DATE		16/02/2023		TOTAL DRILL DAYS		2											
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				
	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									
1	17	00	SC	-	-	3	5	5	10	1.00	1	SS	7.0		L1	2.0	Brownish, Moist, Loose, Poorly Graded, Clayey Silty SAND (SC) Sand-Clay mixtures
	17	01								1.45							
2	17	10	SC	-	-	5	9	12	21	2.00	2	SS	6.0		L2	3.0	Brownish, Moist, M.Dense, Poorly Graded, Clayey Silty SAND (SC) / Residual Soil , Sand-Clay mixtures
	17	11								2.45							
3	17	22	SC	-	-	10	15	18	33	3.00	3	SS	5.0		L3	4.5	Brownish, Moist, Dense to V.Dense, Poorly Graded, Silt SAND (SM) , Sand- Silt Mixture
	17	36								3.45							
4	17	37	SC	-	-	10	30	35	65	4.00	4	SS	4.0				
	17	52	SC	-	-	2cm Penet. For 50 Blows			>100	5.00	5	WS	3.0		L4	10.0	Brownish, Moist, V.Dense, Completely Weathered Rock , Descent from Charnockite
	17	54							5.02								
5	18	10	SC	-	-	1cm Penet. For 50 Blows			>100	6.50	6	WS	1.5				
	18	12							6.51								
6	18	26	SC	-	-	1cm Penet. For 50 Blows			>100	8.00	7	WS	0.0				
	18	29							8.01								
7	06	40	SC	-	-	SPT Hammer Rebounded			>100	9.00	8	WS	-1.0		L4	10.0	
	06	45							9.50								
8	07	02	SC	-	-	SPT Hammer Rebounded			>100		9	WS	-1.5				
	07	08															

CS - Core Sample	DS - Disturbed Sample	LOGGED	K.J.VINOD PRADAP	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	16/02/2023	GROUND LEVEL (m)	8.01	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	JALEEL YASIN	WATER TABLE (m)	1.30	
WS - Wash Sample	DB - Diamond Bit	DATE	10/03/2023	CASING DEPTH (m)	0.00	



SITE INVESTIGATION RECORD

BORE HOLE No.	BH-18 (REF: BH-17)		
SHEET	1	OF	1
DIA OF BORE HOLE	150mm	✓	
	NX		
BORE START DATE	15/02/2023		
BORE END DATE	16/02/2023		
TOTAL DRILL DAYS	2		

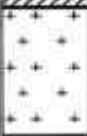
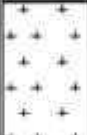
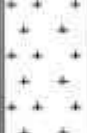
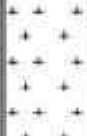
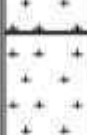
PROJECT NAME	PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING (1B+G+9 UPPER FLOORS) AT SHOLINGANALLUR, CHENNAI			
LOCATION	Sholinganallur, Chennai	MACHINE No.	CR-01	CHAINAGE (m)
STRUCTURE	1B+ G+ 9 Upper floors	DRILLING METHOD	Rotary	CO-ORDINATES
JOB CODE	GEC-JC-GT-4105	FLUSHING MEDIUM	Bentonite	N E

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									
11	16/02/2023	07	30	DB	25	0				-	-	-	-	11.00	8	CS	-3.0	</

CS - Core Sample	DS - Disturbed Sample	LOGGED	K.J.VINOD PRADAP	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	15/02/2023	GROUND LEVEL (m)	8.01	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	JALEEL YASIN	WATER TABLE (m)	1.30	
WS - Wash Sample	DB - Diamond Bit	DATE	16/03/2023	CASING DEPTH (m)	0.00	

Borehole terminated at 13 m depth below E.G.L

FIG.2.18 Sub Soil Profile at BH-18 (REF: BH-17) Location

		SITE INVESTIGATION RECORD										BORE HOLE No.		BH-19 REF: (BH-16)				
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING (1B+G+9 UPPER FLOORS) AT SHOLINGANALLUR, CHENNAI										SHEET		1	OF	1		
LOCATION		Sholinganallur, Chennai		MACHINE No.		CR-01		CHAINAGE (m)		-		BORE START DATE		16/02/2023				
STRUCTURE		1B+ G+ 9 Upper floors		DRILLING METHOD		Rotary		CO-ORDINATES		N	-	BORE END DATE		16/02/2023				
JOB CODE		GEC-JC-GT-4105		FLUSHING MEDIUM		Bentonite				E	-	TOTAL DRILL DAYS		1				
Depth below E.G.L. (m)	Drilling progress per metre		Type of Drill Bit (SG / TCB / DB)	Core Details		SPT Details			Sample Details				Layer Data					
	Date	Time		Total Core Recovery %	R.Q.D %	Blows/cm.			Depth	No.	Type	RL (m)	Legend	No	Depth	Geotechnical Description		
		Hr.				Min.	0-15	15-30									30-45	SPT 'N' Value
	16/02/2023	11	15	SC	-	-	6	8	10	18	1.00	1	SS	6.6		L1	2.0	Brownish, Moist, Medium Dense, Poorly Graded, Clayey Silty SAND (SC) Sand-Clay mixtures/Residual Soil
		To	11															
		11	25	SC	-	-	15	25	34	59	1.45	2	SS	5.6		L2	3.0	Brownish, Moist, V.Dense, Residual Soil , Descent from Charnockite
		To	11															
		11	40	SC	-	-	SPT Hammer Rebounded			>100	3.00	3	WS	4.6		L3	5.5	Brownish, Highly Weathered Rock , Descent from Charnockite
		To	11				42											
		12	00	DB	11	0	-	-	-	-	4.00	4	CS	3.6		L4	8.5	Brownish Grey, Moderately to Slightly Weathered Rock , Descent from Charnockite
		To	12															
		12	40	DB	12	0	-	-	-	-	5.50	5	CS	2.1		L5	10.0	Greyish, Fresh Hard Rock Charnockite Rock
		To	13															
13	30	DB	25	10	-	-	-	-	7.00	6	CS	0.6		L6	11.0			
To	14																16	
15	20	DB	69	35	-	-	-	-	8.50	7	CS	-0.9		L7	12.0			
To	16																10	
16	25	DB	80	70	-	-	-	-	10.00	8	CS	-2.4		L8	13.0			
To	17																45	
CS - Core Sample		DS - Disturbed Sample		LOGGED		K.J.VINOD PRADAP		PROJECT SITE DETAILS		REMARKS								
SS - Split Spoon Sample		SG - Soil Cutter		DATE		16/02/2023		GROUND LEVEL (m)		7.63								
UDS - Undisturbed Sample		TCB - Tungsten Carbide Bit		CHECKED		JALEEL YASIN		WATER TABLE (m)		1.30								
WS - Wash Sample		DB - Diamond Bit		DATE		10/03/2023		CASING DEPTH (m)		0.00								
Borehole terminated at 10 m depth below E.G.L																		
FIG.2.19 Sub Soil Profile at BH-19 REF: (BH-16) Location																		

GEC		SITE INVESTIGATION RECORD										BORE HOLE No. BH-20 REF:(BH-07)						
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING (1B+G+9 UPPER FLOORS) AT SHOLINGANALLUR, CHENNAI										SHEET 1 OF 1						
LOCATION		Sholinganallur, Chennai		MACHINE No.		CR-02		CHAINAGE (m)		-		DIA OF BORE HOLE						
STRUCTURE		1B+ G+ 9 Upper floors		DRILLING METHOD		Rotary		CO-ORDINATES		N - E -		BORE START DATE						
JOB CODE		GEC-JC-GT-4105		FLUSHING MEDIUM		Bentonite		CO-ORDINATES		N - E -		BORE END DATE						
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						
	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										
08:00 To 08:01	SC	-	-	8	13	19	32	1.00	1	SS	6.8							Brownish, Moist, Dense, Poorly Graded, Silty SAND (SM) Sand-Silt mixtures
08:15 To 08:16	SC	-	-	28	13cm Penet. For 50Blows		>100	2.00 2.28	2	SS	5.8			L1	2.0			
08:30 To 08:32	SC	-	-	21	11cm Penet. For 50Blows		>100	3.00 3.11	3	SS	4.8							Brownish/Greyish, Moist, V.Dense, Completely Weathered Rock, Descent from Charnockite
08:50 To 09:00	SC	-	-				>100	4.00	4	WS	3.8							
09:20 To 09:25	SC	-	-				>100	4.50	5	WS	3.3			L2	4.5			
10:10 To 10:35	DB	10	0											L3	6.0			Brownish, Highly Weathered Rock, Descent from Charnockite
10:50 To 11:30	DB	49	13											L4	7.5			Greyish, Moderately Weathered Rock, Descent from Charnockite
11:45 To 12:50	DB	60	39											L5	9.0			Greyish, Slightly Weathered Rock, Descent from Charnockite
13:01 To 14:10	DB	76	56											L6	10.0			Greyish, Fresh Hard Rock, Charnockite Rock
CS - Core Sample		DS - Disturbed Sample		LOGGED		K.J.VINOD PRADAP		PROJECT SITE DETAILS		REMARKS								
SS - Split Spoon Sample		SC - Soil Cuber		DATE		16/02/2023		GROUND LEVEL (m)		7.80								
UDS- Undisturbed Sample		TCB - Tungsten Carbide Bit		CHECKED		JALEEL YASIN		WATER TABLE (m)		1.00								
WS - Wash Sample		DB - Diamond Bit		DATE		10/03/2023		CASING DEPTH (m)		0.00								
Borehole terminated at 10 m depth below E.G.L.																		
FIG.2.20 Sub Soil Profile at BH-20 REF:(BH-07) Location																		

		SITE INVESTIGATION RECORD						BORE HOLE No. BH-21 REF:(BH-10)									
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING (1B+G+9 UPPER FLOORS) AT SHOLINGANALLUR, CHENNAI						SHEET 1 OF 1									
LOCATION		Sholinganallur, Chennai		MACHINE No.		CR-02		CHAINAGE (m)									
STRUCTURE		1B+ G+ 9 Upper floors		DRILLING METHOD		Rotary		BORE START DATE									
JOB CODE		GEC-JC-GT-4105		FLUSHING MEDIUM		Bentonite		BORE END DATE									
								TOTAL DRILL DAYS									
								2									
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					
	Time			Type of 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									
1	16	00	SC	-	-	1	2	1	3	1.00	1	SS	6.9		L1	2.0	Brownish, Moist, Very Loose, Poorly Graded, Clayey Silty SAND (SC) Sand-Clay mixtures
	16	01															
2	16	12	SC	-	-	4	15	22	37	2.00	2	SS	5.9				Brownish, Moist, Dense, Poorly Graded, Silty SAND (SM) Sand-Silt mixtures
	16	14															
3	16	30	SC	-	-	5	17	11cm Penet. For 50 Blows	>100	3.00	3	SS	4.9				Brownish Grey/Greyish, Moist, V.Dense, Completely Weathered Rock, Descent from Charnockite
	16	31															
4	16	50	SC	-	-	33	41	45	86	4.00	4	SS	3.9				Brownish Grey/Greyish, Moist, V.Dense, Completely Weathered Rock, Descent from Charnockite
	16	54															
5	17	19	SC	-	-	SPT Hammer Rebounded			>100	5.00	5	WS	2.9				Brownish, Highly Weathered Rock, Descent from Charnockite
	17	24															
6	17	49	DB	13	0	-	-	-	-	6.50	6	CS	1.4				Brownish, Highly Weathered Rock, Descent from Charnockite
	18	24															
7	09	00	DB	49	0	-	-	-	-	8.00	7	CS	-0.1				Brownish Grey, Moderately Weathered Rock, Descent from Charnockite
	09	50															
8	10	10	DB	57	14	-	-	-	-	9.00	8	CS	-1.1				Brownish Grey/Grey, Slightly Weathered Rock, Descent from Charnockite
	11	29															
9	11	50	DB	72	53	-	-	-	-	10.00	9	CS	-2.1				Brownish Grey/Grey, Slightly Weathered Rock, Descent from Charnockite
	13	07															
10						-	-	-	-								

CS - Core Sample	DS - Disturbed Sample	LOGGED	K.J.VINOD PRADAP	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	17/03/2023	GROUND LEVEL (m)	7.87	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	JALEEL YASIN	WATER TABLE (m)	1.00	
WS - Wash Sample	DB - Diamond Bit	DATE	18/03/2023	CASING DEPTH (m)	9.00	

Borehole terminated at 10 m depth below E.G.L.

FIG.2.21 Sub Soil Profile at BH-21 REF:(BH-10) Location

GEC		SITE INVESTIGATION RECORD										BORE HOLE No.		BH-22 REF:(BH-11)				
PROJECT NAME		PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING (1B+G+9 UPPER FLOORS) AT SHOLINGANALLUR, CHENNAI										SHEET		1 OF 1				
LOCATION		Sholinganallur, Chennai		MACHINE No.		CR-01		CHAINAGE (m)		-		DIA OF BORE HOLE		150mm ✓				
STRUCTURE		1B+ G+ 9 Upper floors		DRILLING METHOD		Rotary		CO-ORDINATES		N -		BORE START DATE		17/02/2023				
JOB CODE		GEC-JC-GT-4105		FLUSHING MEDIUM		Bentonite		CO-ORDINATES		E -		BORE END DATE		17/02/2023				
												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					
	Time			Type of Drill Bit (SC / TCB / DB)	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									
1	10	00	SC	-	-	3	8	12	20	1.00	1	SS	7.0					Brownish, Moist, Medium Dense, Poorly Graded, Clayey Silty SAND (SC) Sand-Clay mixtures
2	10	01	SC	-	-	18	11.5cm Penet. For 50 Blows		>100	1.45	2	SS	6.0		L1	2.0		
3	10	15	SC	-	-		14cm Penet. For 50 Blows		>100	2.00	3	SS	5.0					Brownish, Moist, V.Dense, Completely Weathered Rock , Descent from Charnockite
4	10	17	SC	-	-				>100	2.12	3	SS	5.0					
5	10	35	SC	-	-				>100	3.00	4	WS	4.0		L2	4.0		
6	10	37	SC	-	-		SPT Hammer Rebounded		>100	3.14	4	WS	4.0					
7	10	50	DB	9	0					4.00	5	CS	3.0					Brownish, Highly Weathered Rock , Descent from Charnockite
8	11	19	DB	13	0					5.00	6	CS	1.5		L3	6.5		
9	11	43	DB	60	11					6.50	7	CS	0.0					Greyish, Slightly Weathered Rock , Descent from Charnockite
10	11	59	DB	69	32					8.00	8	CS	-1.0		L4	9.0		
11	12	40	DB	83	67					9.00	9	CS	-2.0		L5	10.0		Greyish, Fresh Hard Rock , Charnockite Rock
12	13	00								10.00								
13	13	52																
14	14	49																
15	15	40																
16	16	00																
17	17	02																

CS - Core Sample	DS - Disturbed Sample	LOGGED	K.J.VINOD PRADAP	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	17/02/2023	GROUND LEVEL (m)	8.00	
UDS - Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	JALEEL YASIN	WATER TABLE (m)	1.00	
WS - Wash Sample	DB - Diamond Bit	DATE	10/03/2023	CASING DEPTH (m)	0.00	

Borehole terminated at 10 m depth below E.G.L

FIG.2.22 Sub Soil Profile at BH-22 REF:(BH-11) Location

Grain Size Distribution Curves

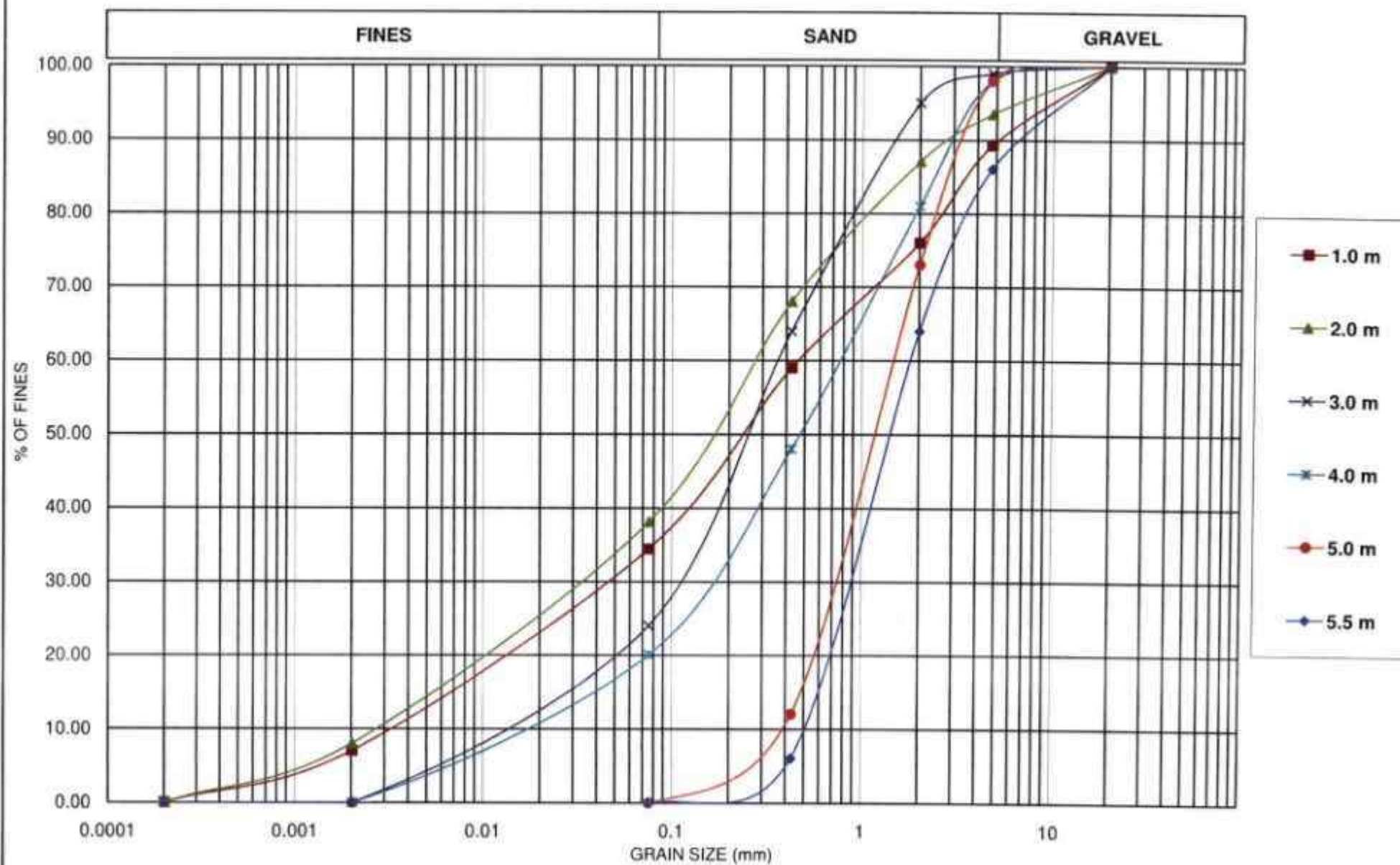


Fig. 2.23 GRAIN SIZE DISTRIBUTION CURVE - BH-01

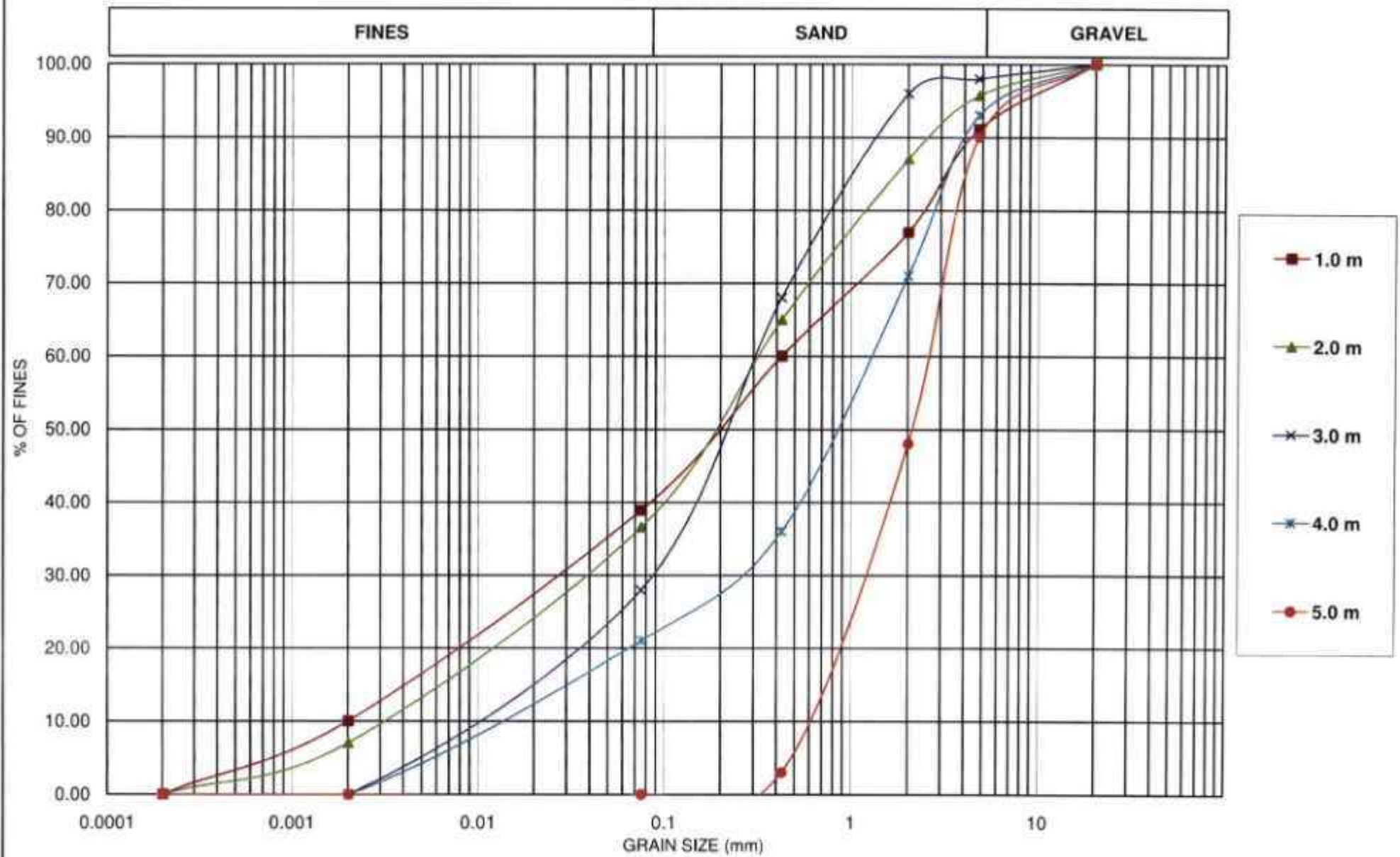


Fig. 2.24 GRAIN SIZE DISTRIBUTION CURVE - BH-02

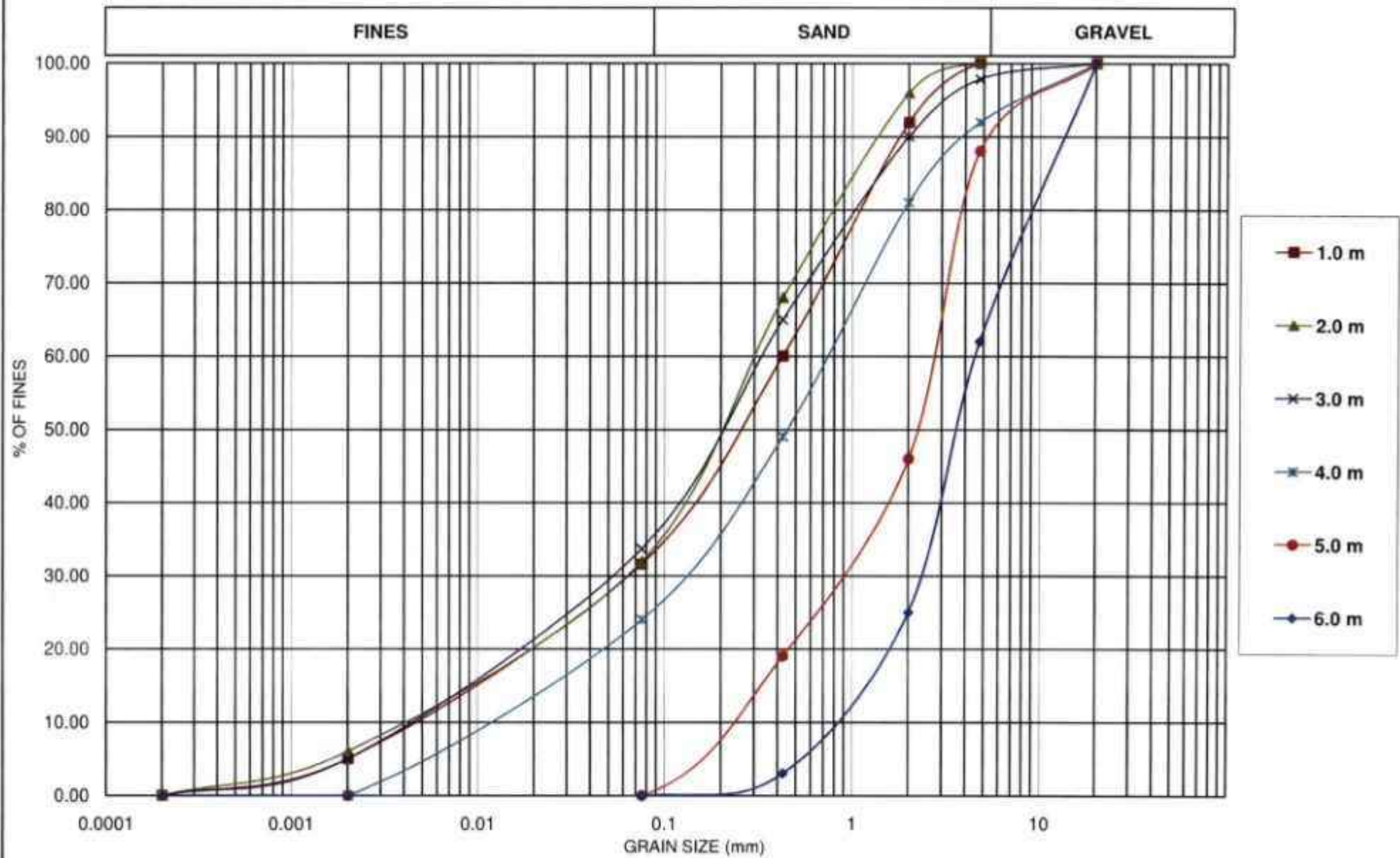


Fig. 2.25 GRAIN SIZE DISTRIBUTION CURVE - BH-03

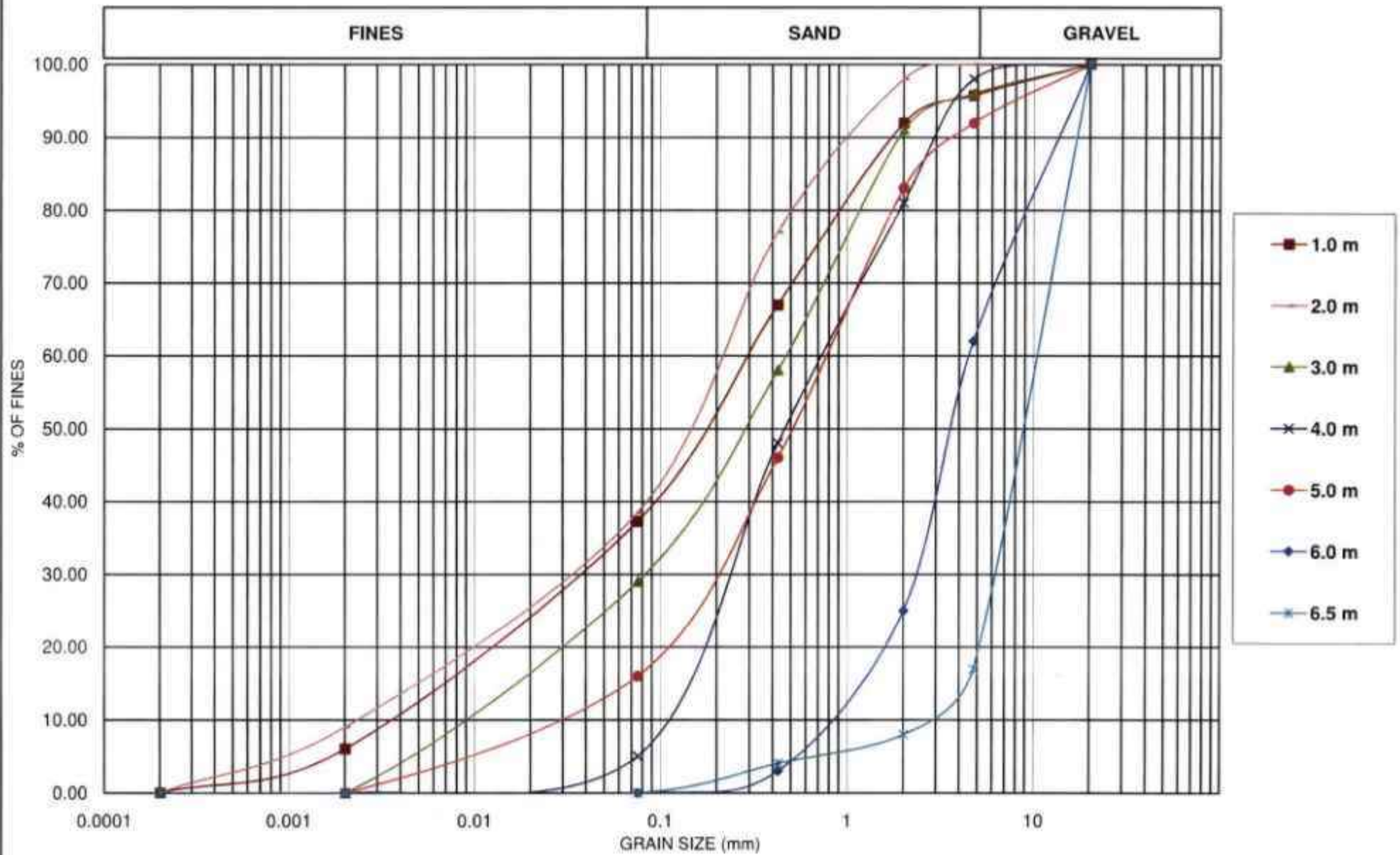


Fig. 2.26 GRAIN SIZE DISTRIBUTION CURVE - BH-04

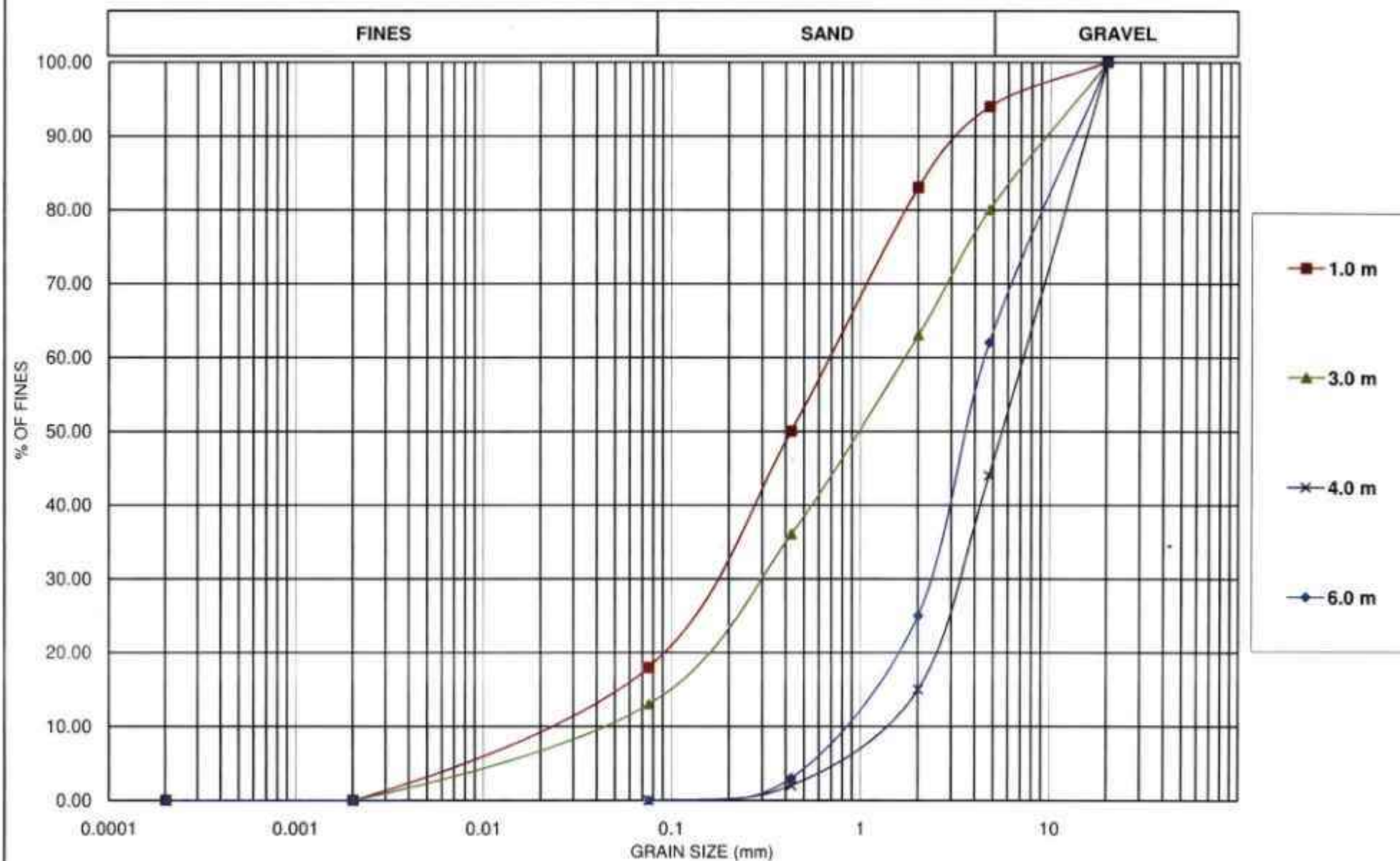


Fig. 2.27 GRAIN SIZE DISTRIBUTION CURVE - BH-05

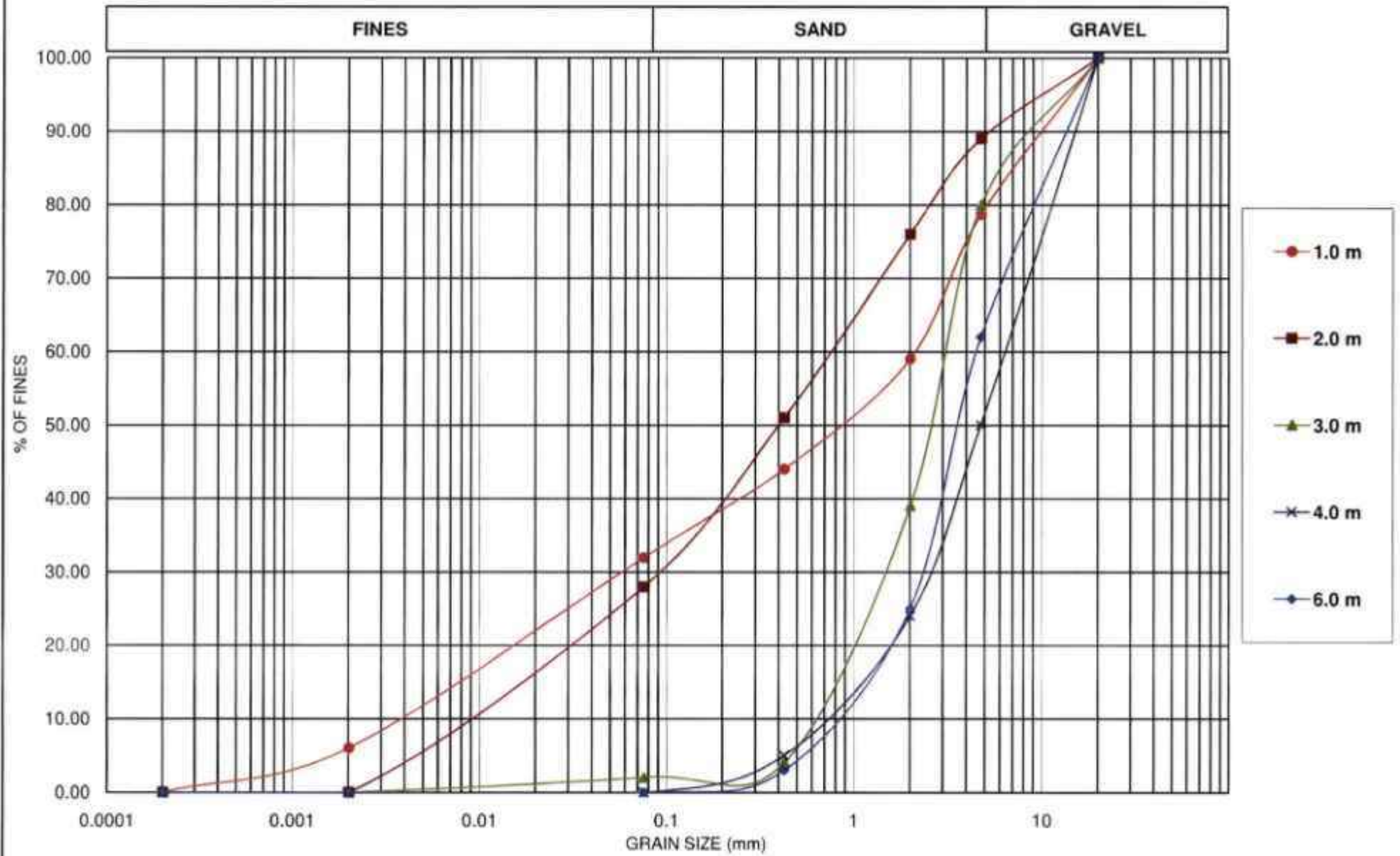


Fig. 2.28 GRAIN SIZE DISTRIBUTION CURVE - BH-06

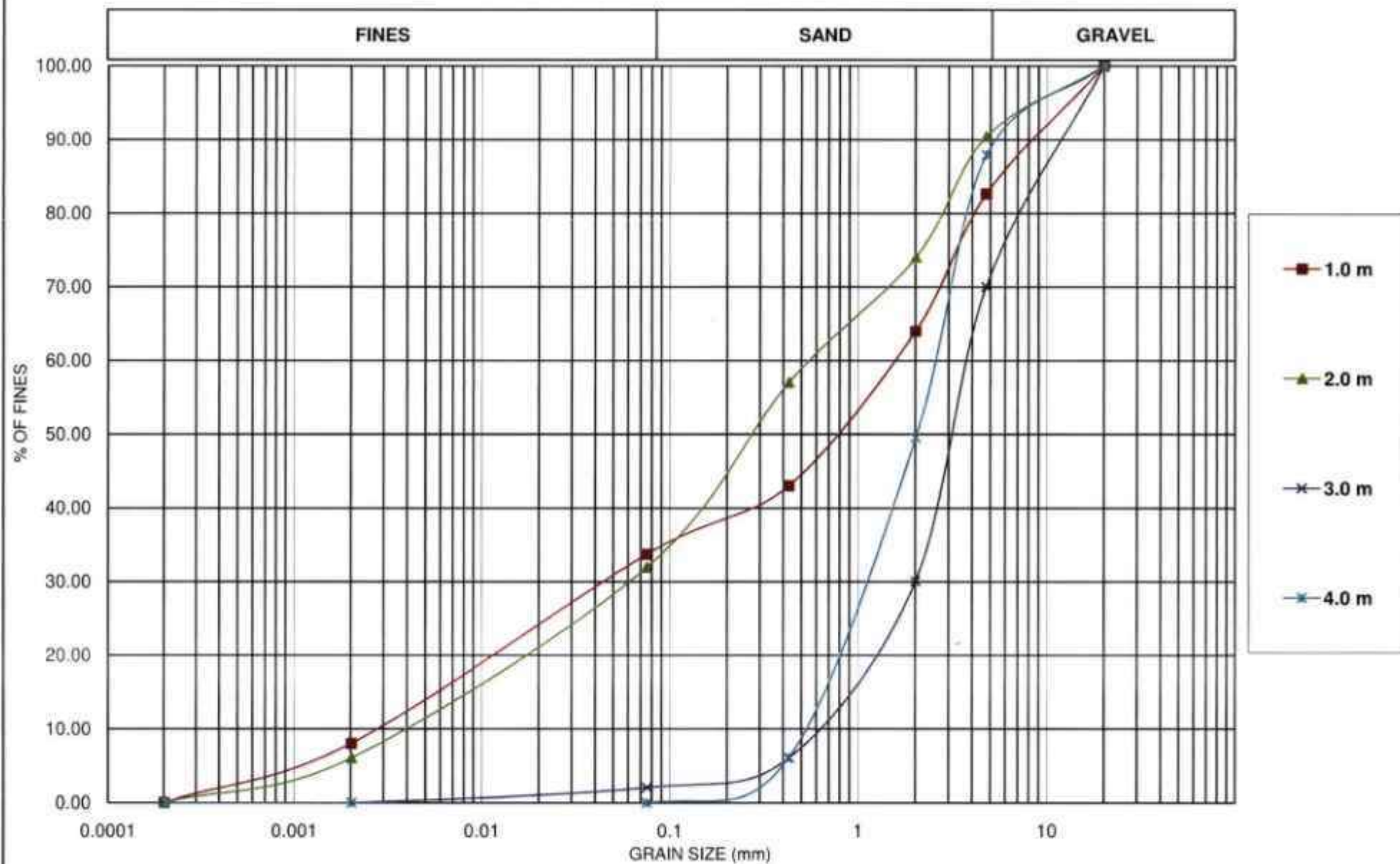


Fig. 2.29 GRAIN SIZE DISTRIBUTION CURVE - BH-07

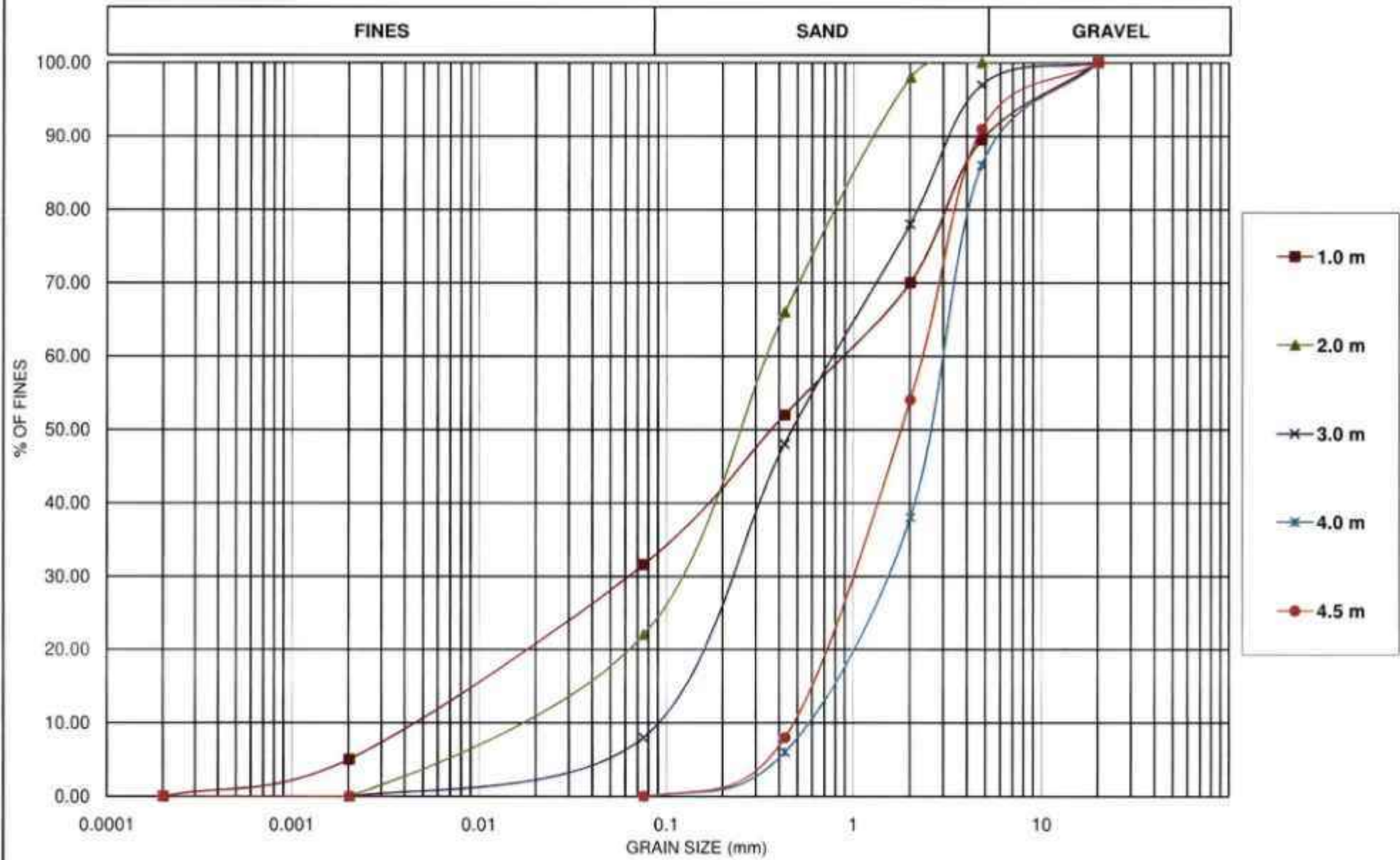


Fig. 2.30 GRAIN SIZE DISTRIBUTION CURVE - BH-08

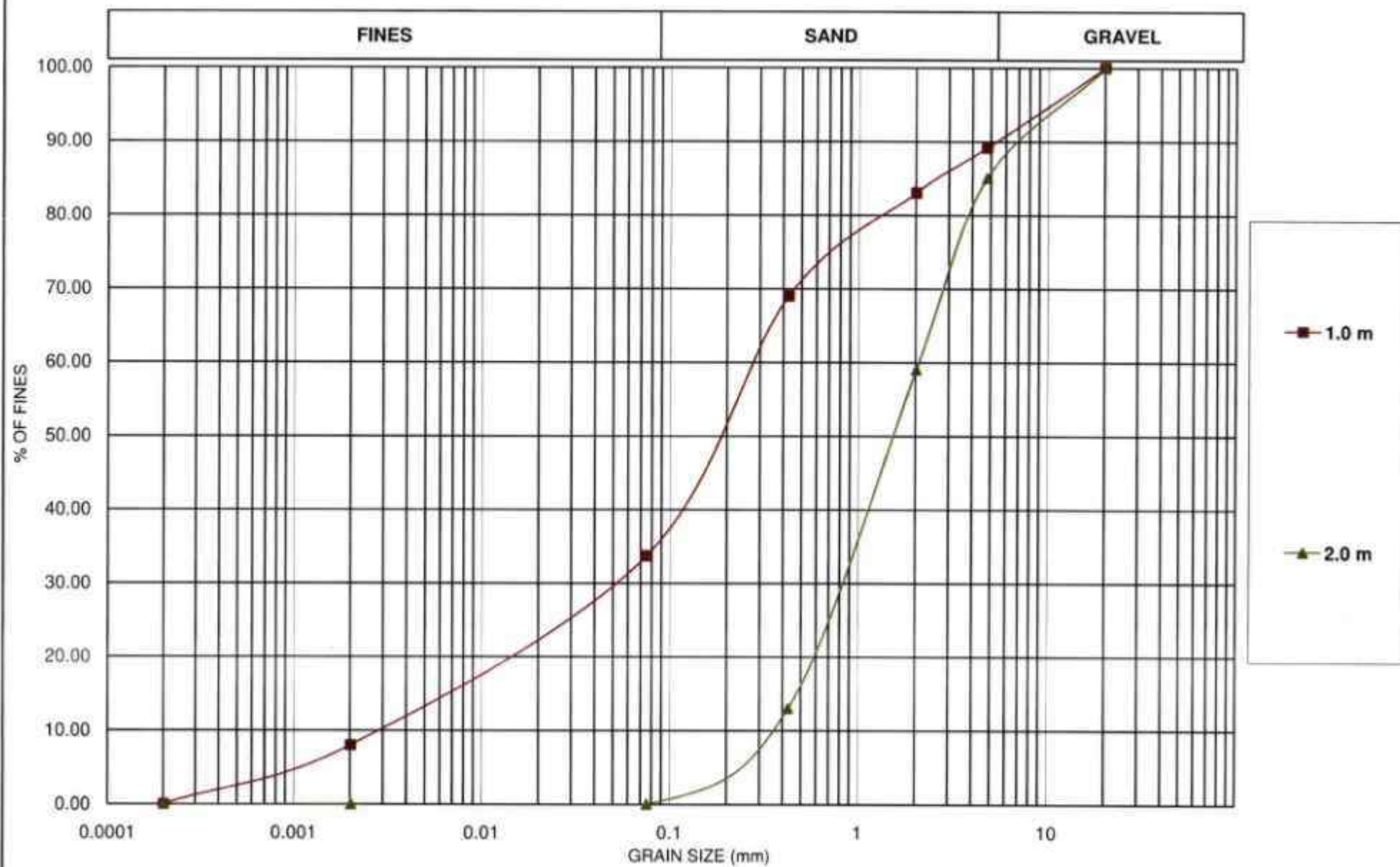


Fig. 2.31 GRAIN SIZE DISTRIBUTION CURVE - BH-09

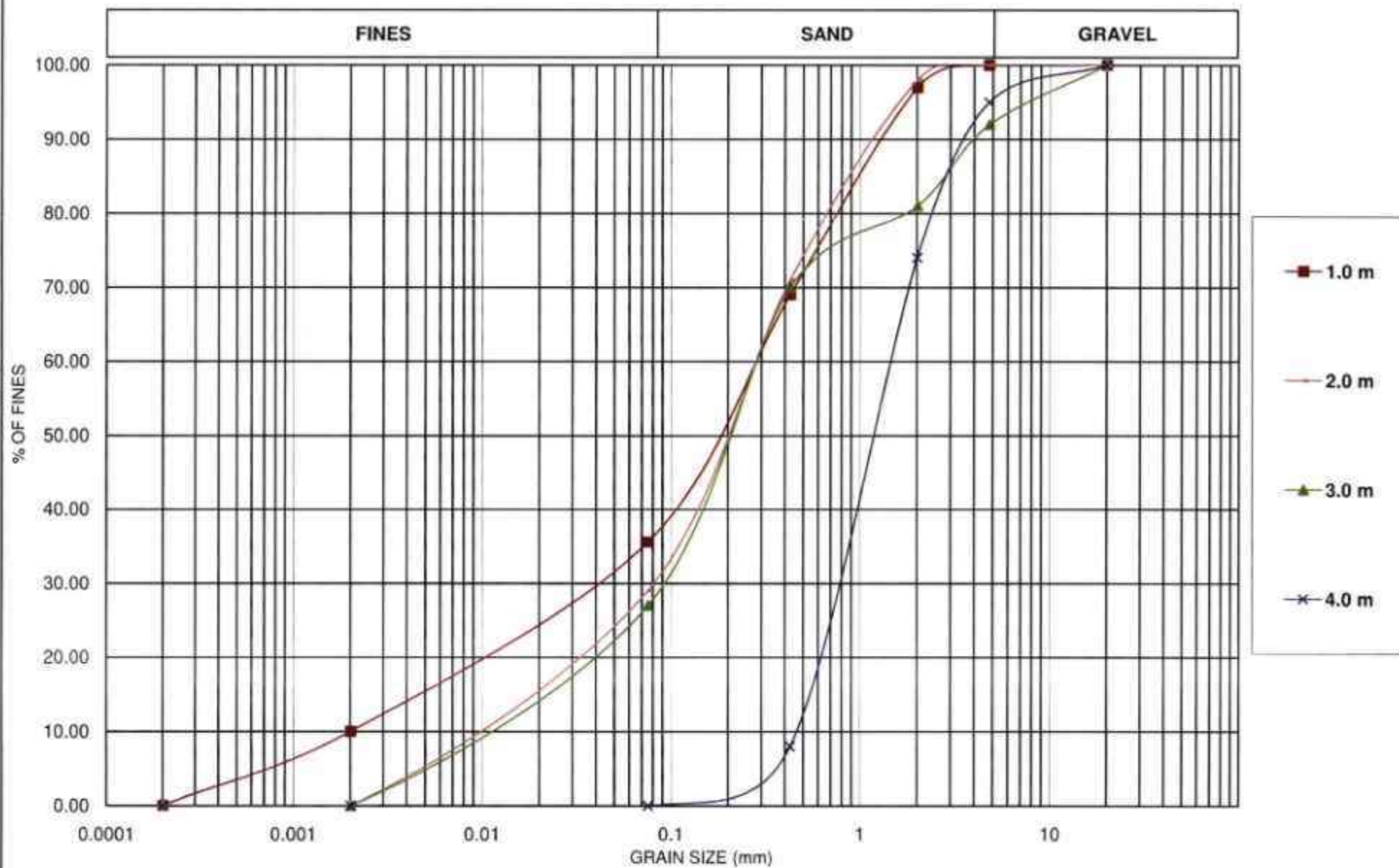


Fig. 2.32 GRAIN SIZE DISTRIBUTION CURVE - BH-10

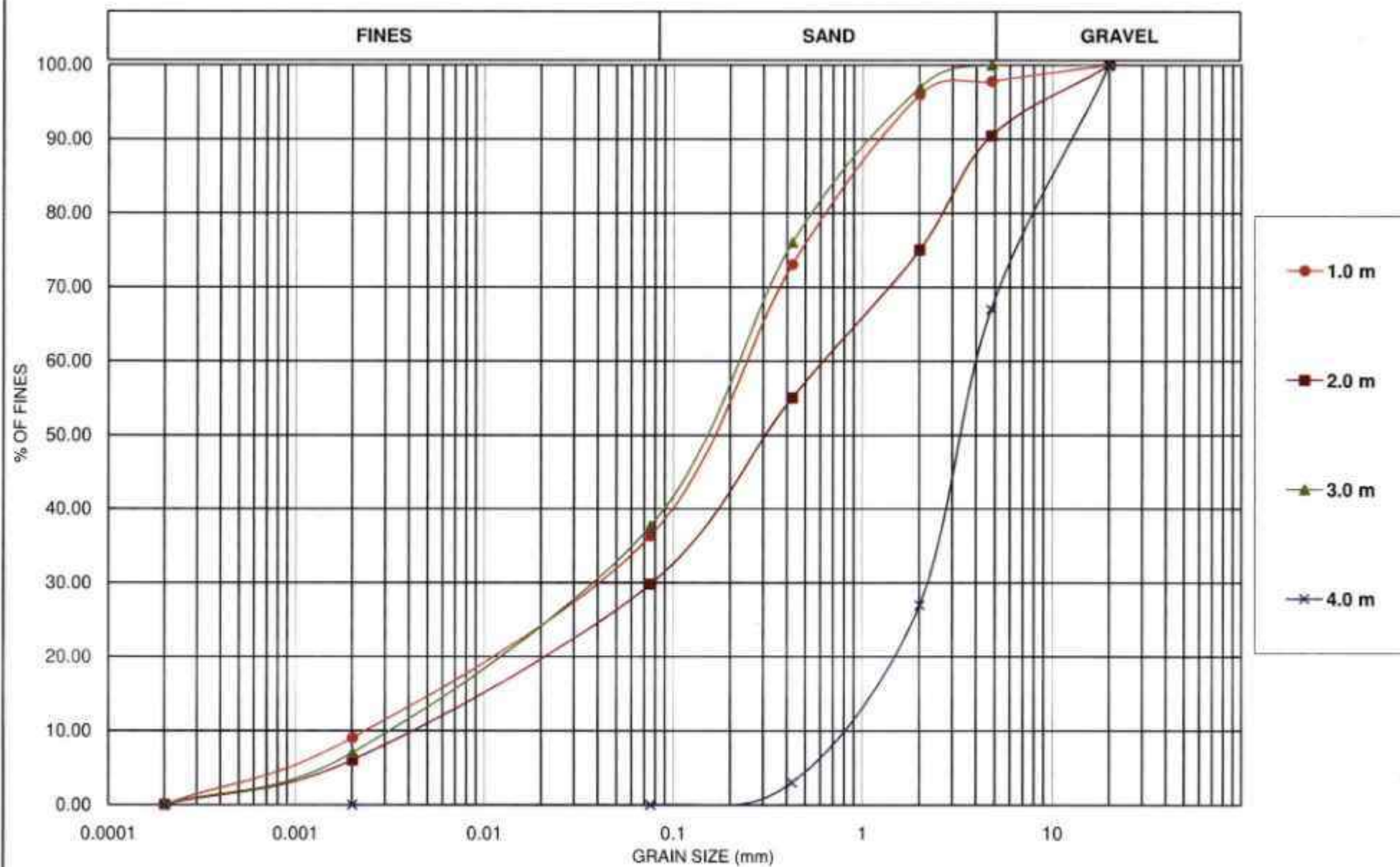


Fig. 2.33 GRAIN SIZE DISTRIBUTION CURVE - BH-11

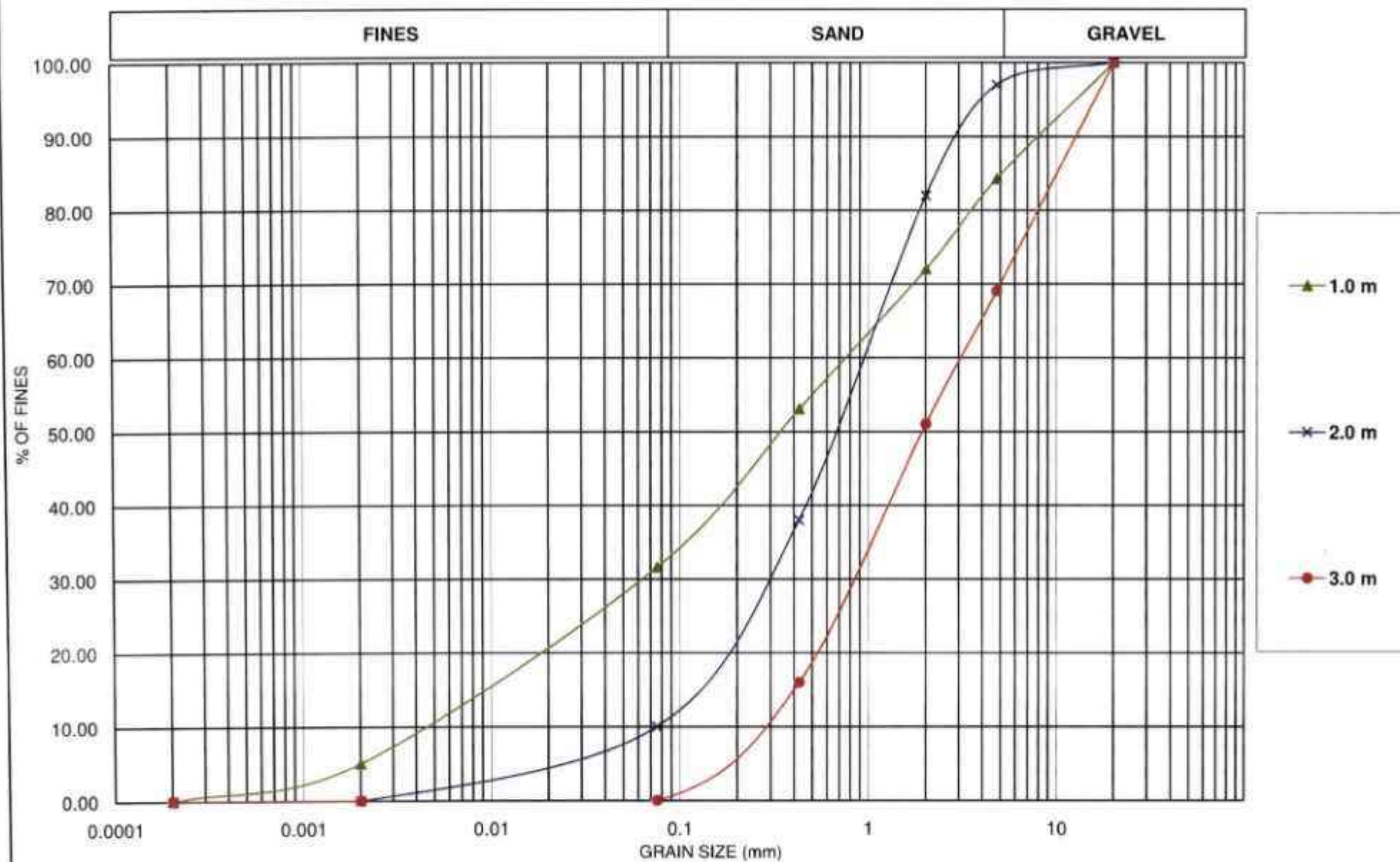


Fig. 2.34 GRAIN SIZE DISTRIBUTION CURVE - BH-12

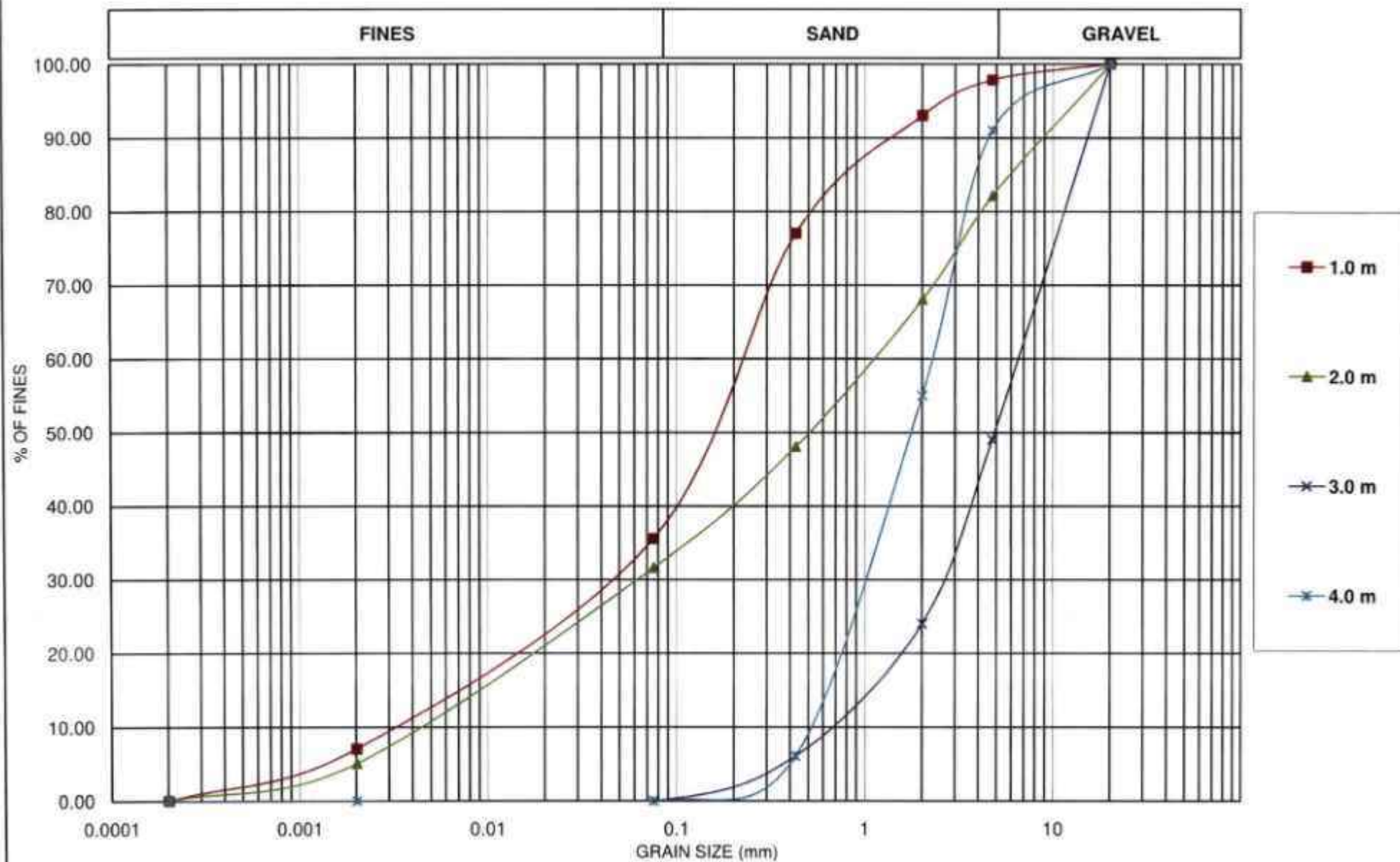


Fig. 2.35 GRAIN SIZE DISTRIBUTION CURVE - BH-13

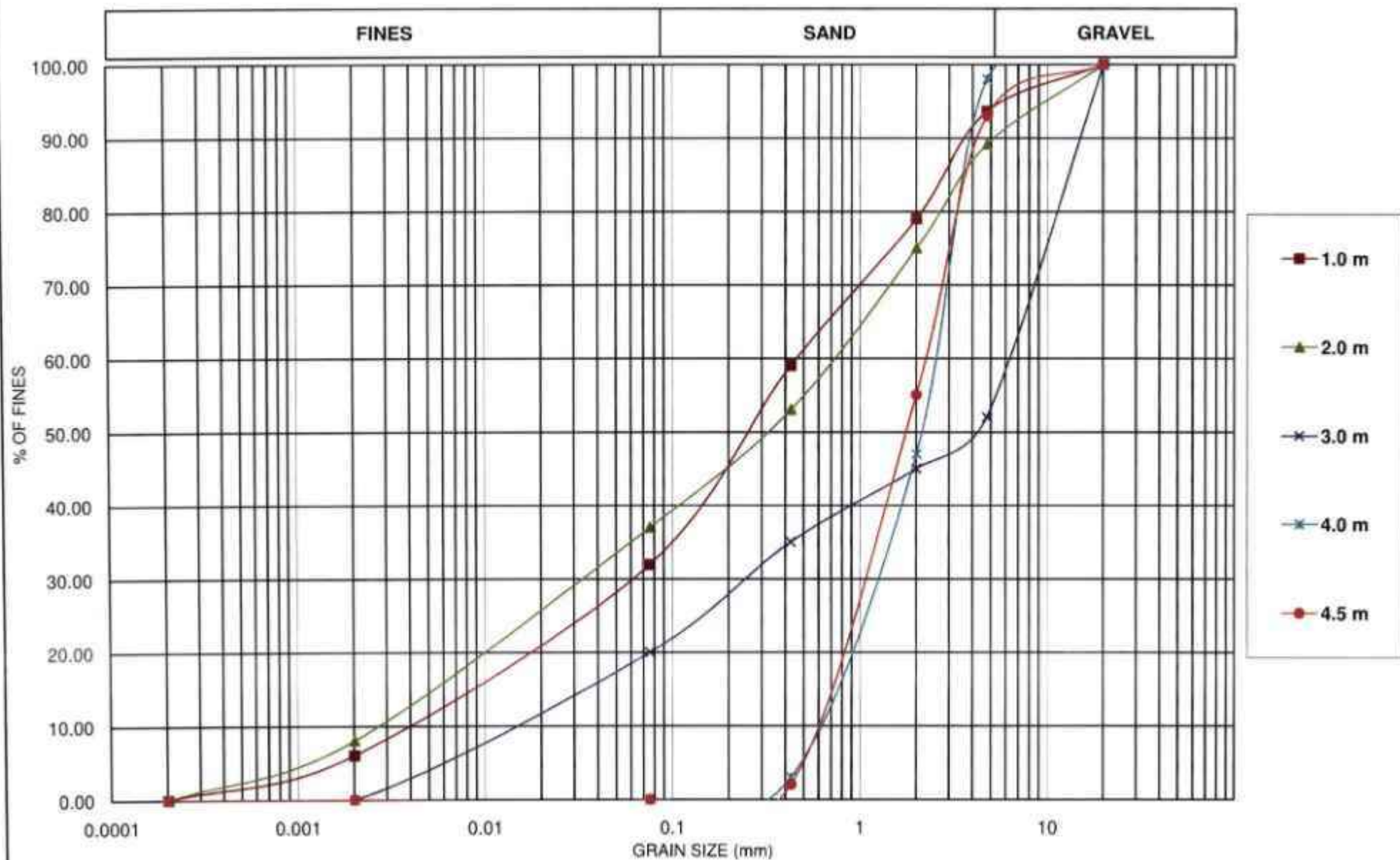


Fig. 2.36 GRAIN SIZE DISTRIBUTION CURVE - BH-14

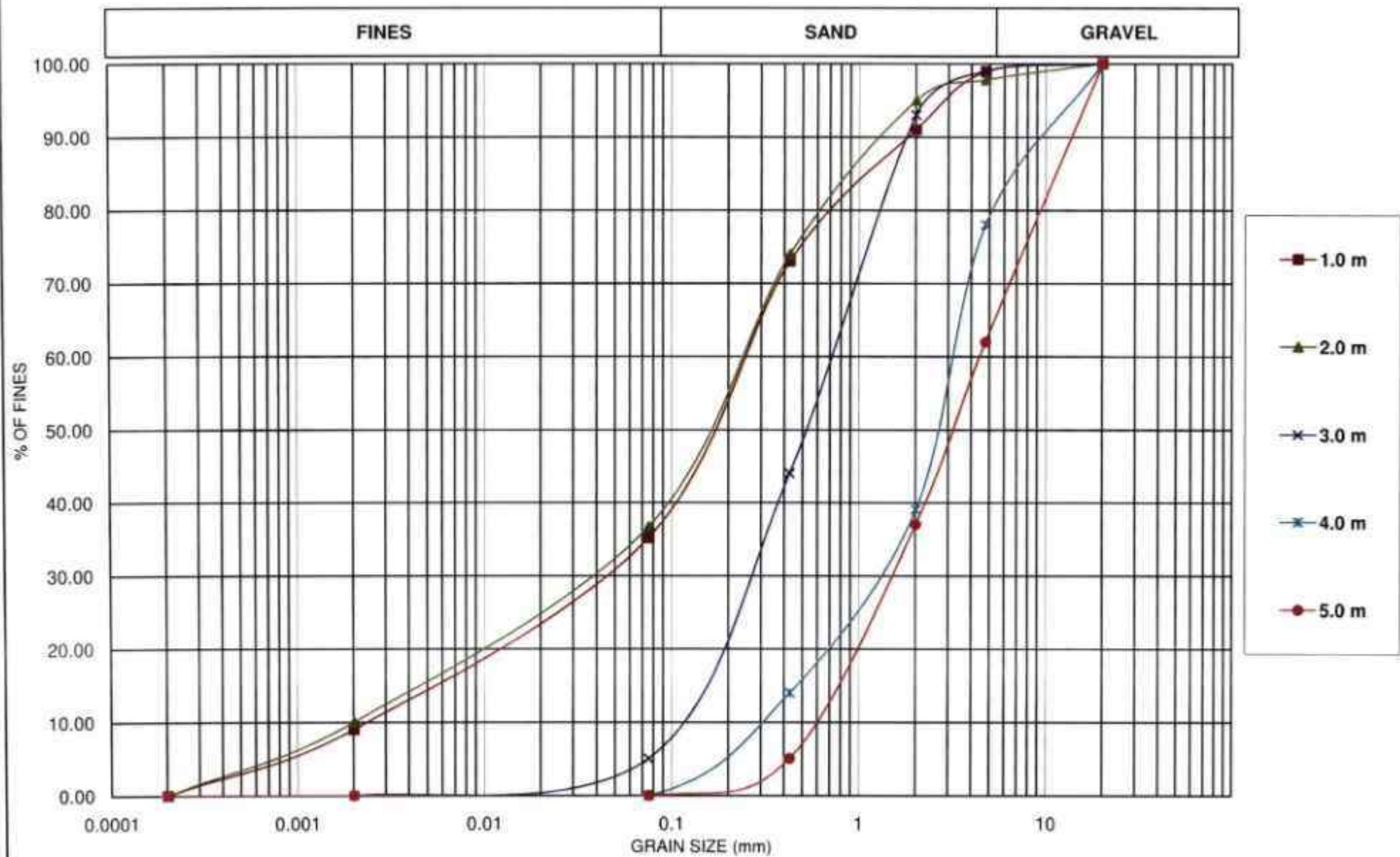


Fig. 2.37 GRAIN SIZE DISTRIBUTION CURVE - BH-15

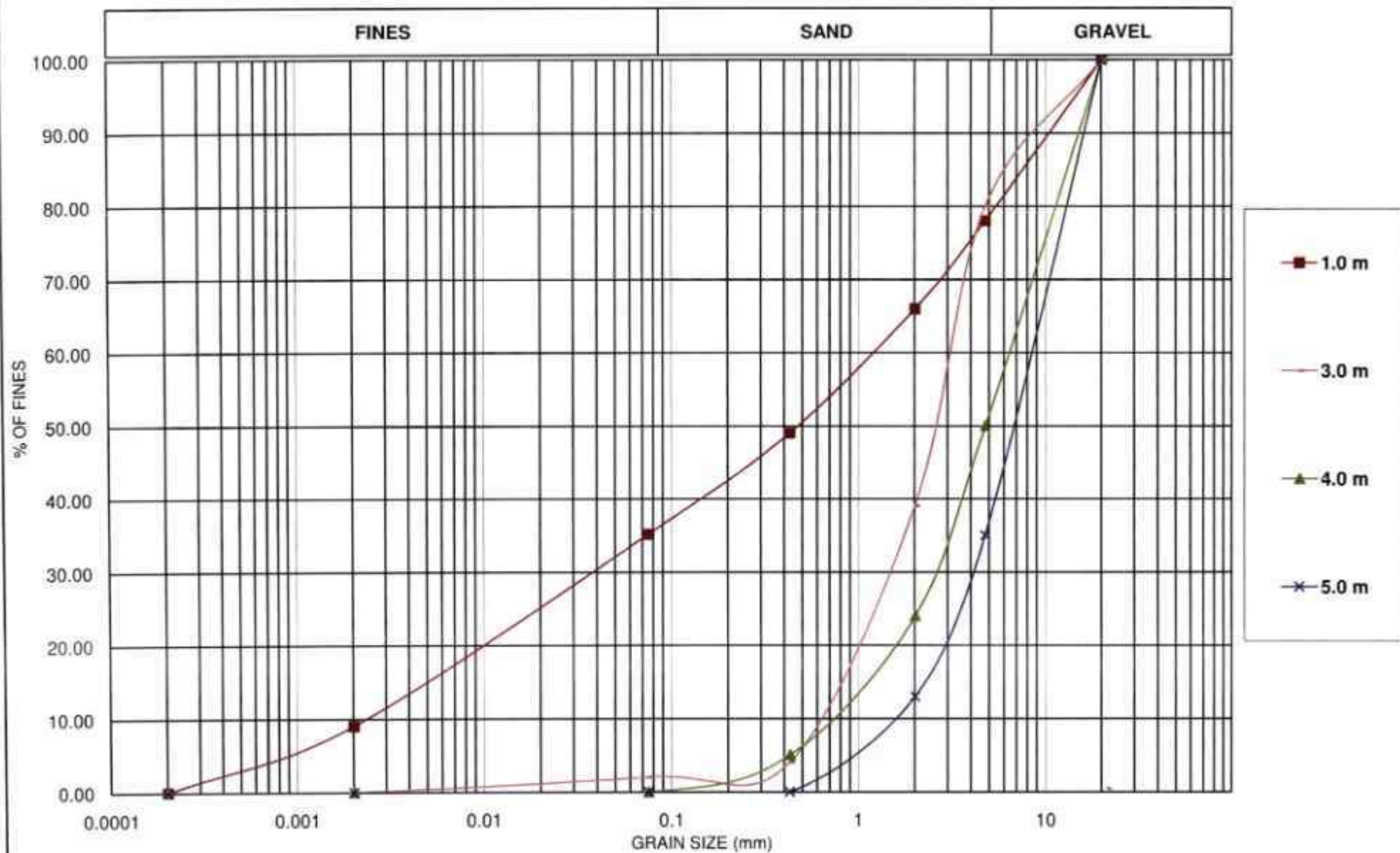


Fig. 2.38 GRAIN SIZE DISTRIBUTION CURVE - BH-16

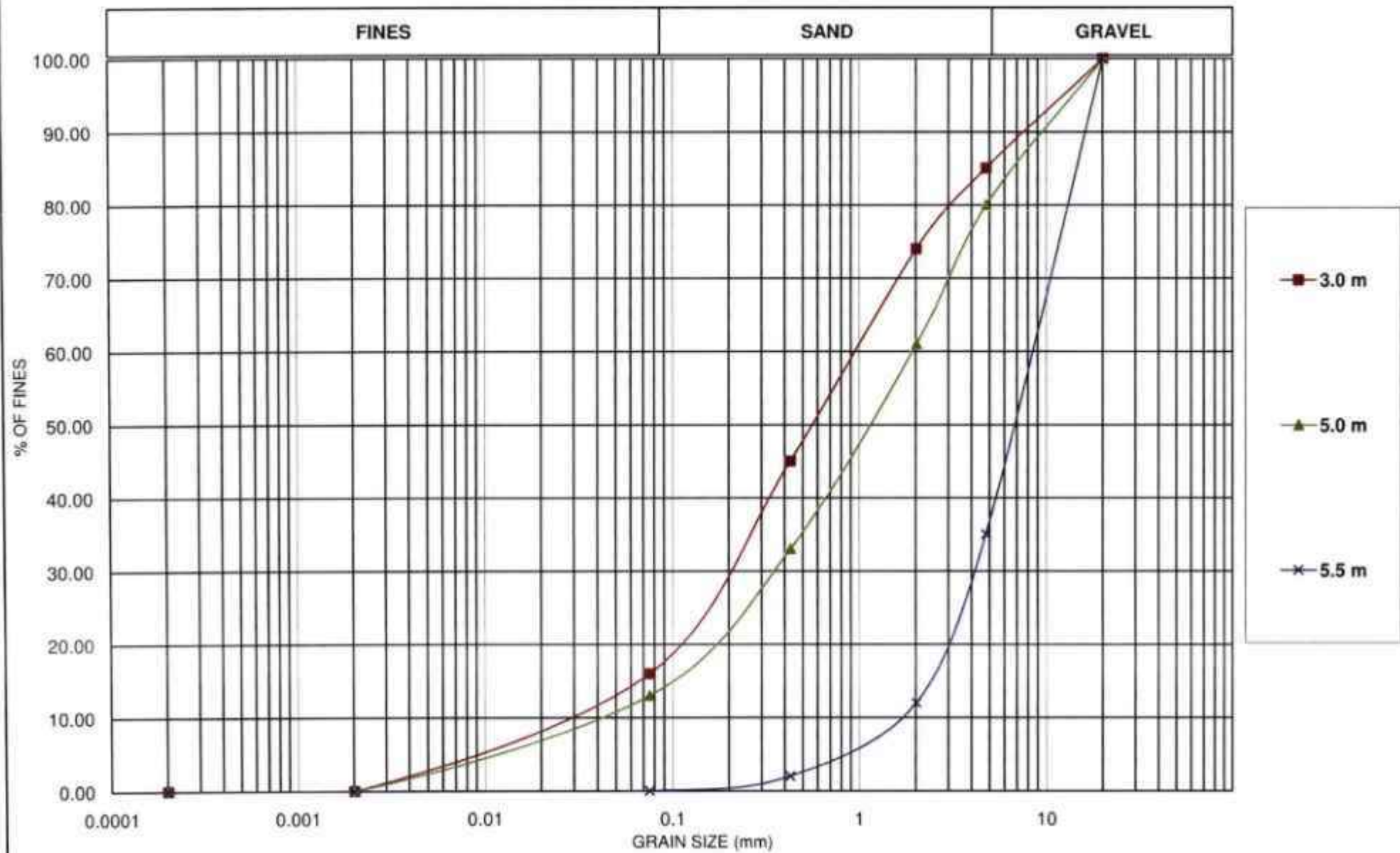


Fig. 2.39 GRAIN SIZE DISTRIBUTION CURVE - BH-17

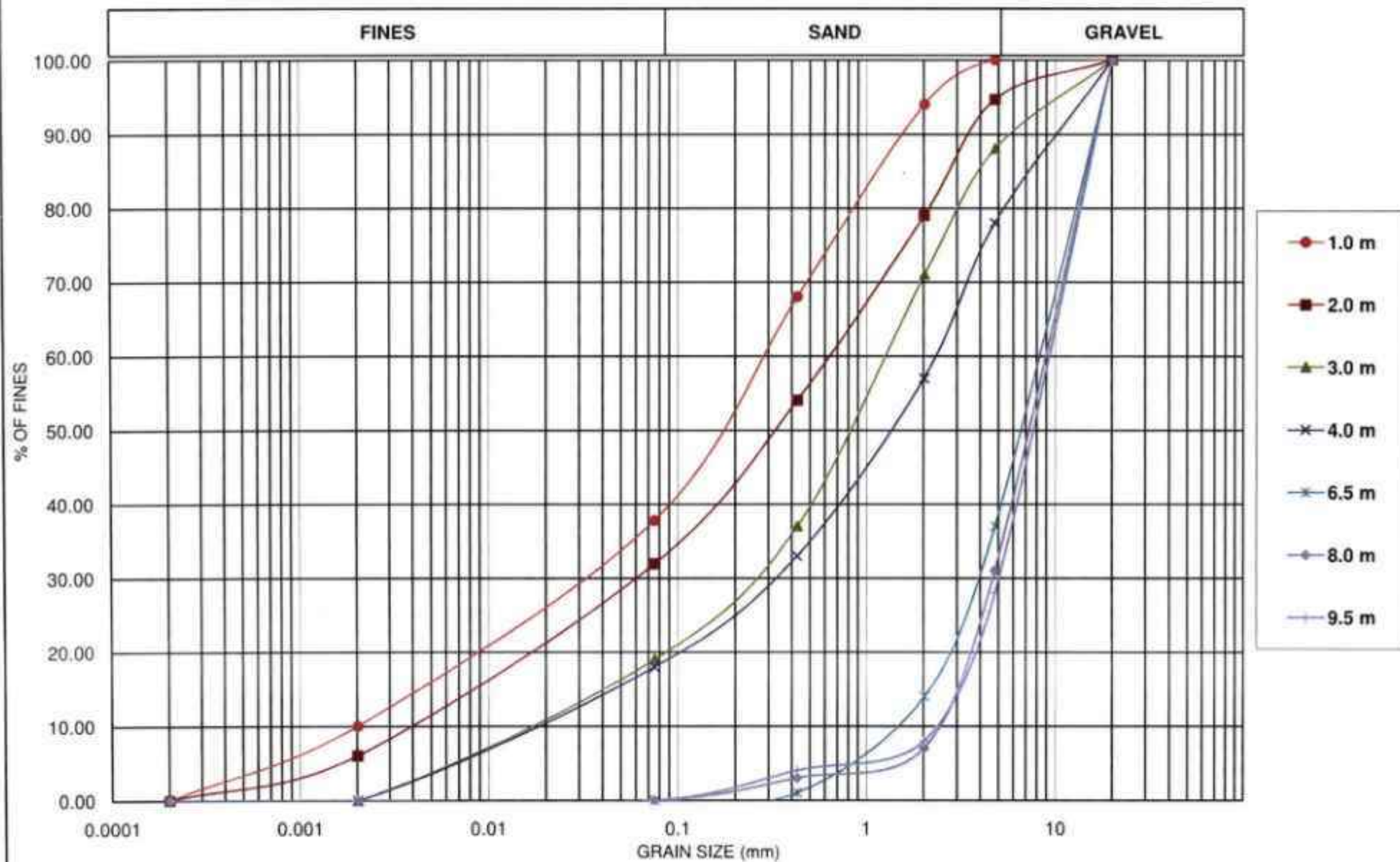


Fig. 2.40 GRAIN SIZE DISTRIBUTION CURVE - BH-18

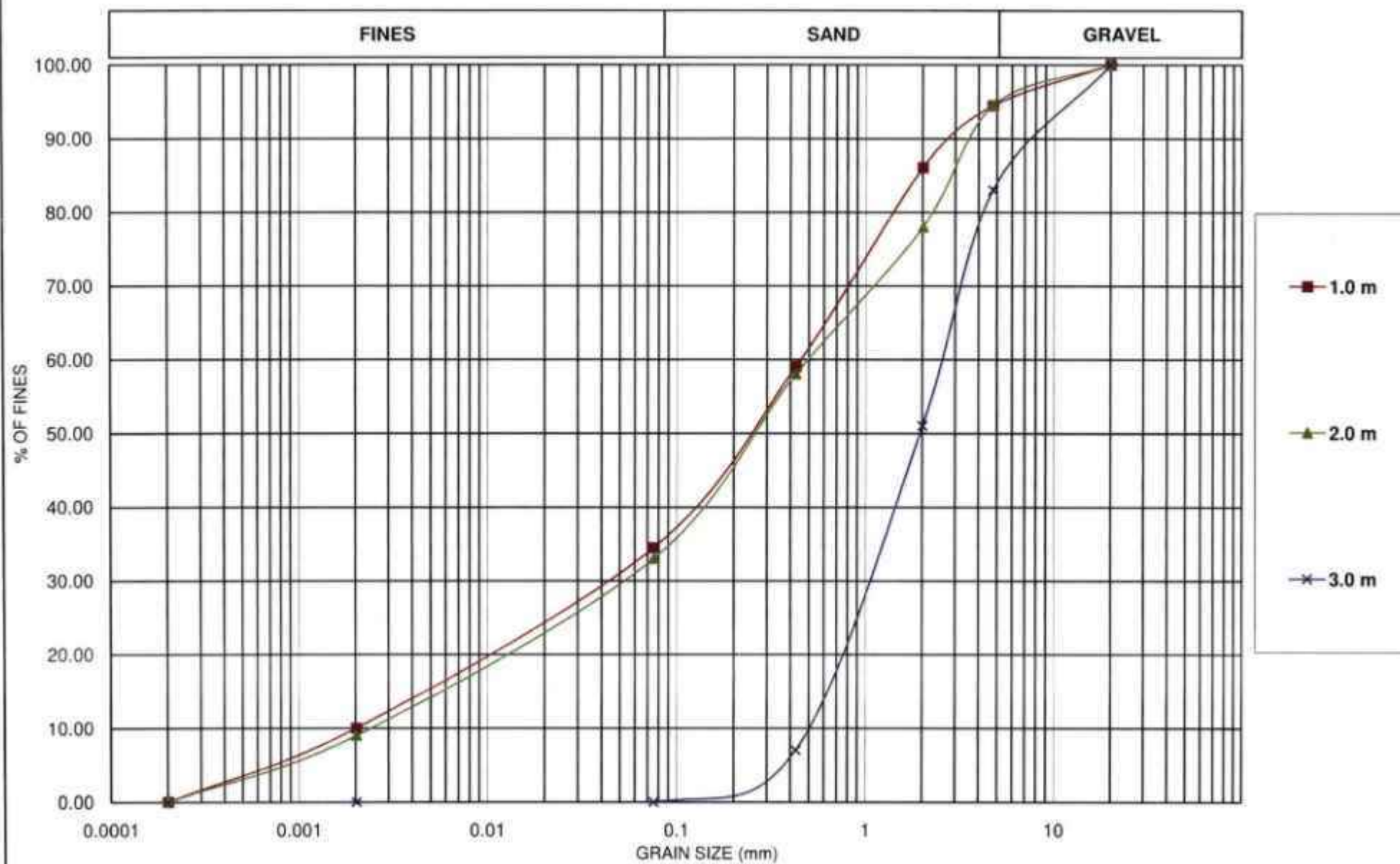


Fig. 2.41 GRAIN SIZE DISTRIBUTION CURVE - BH-19

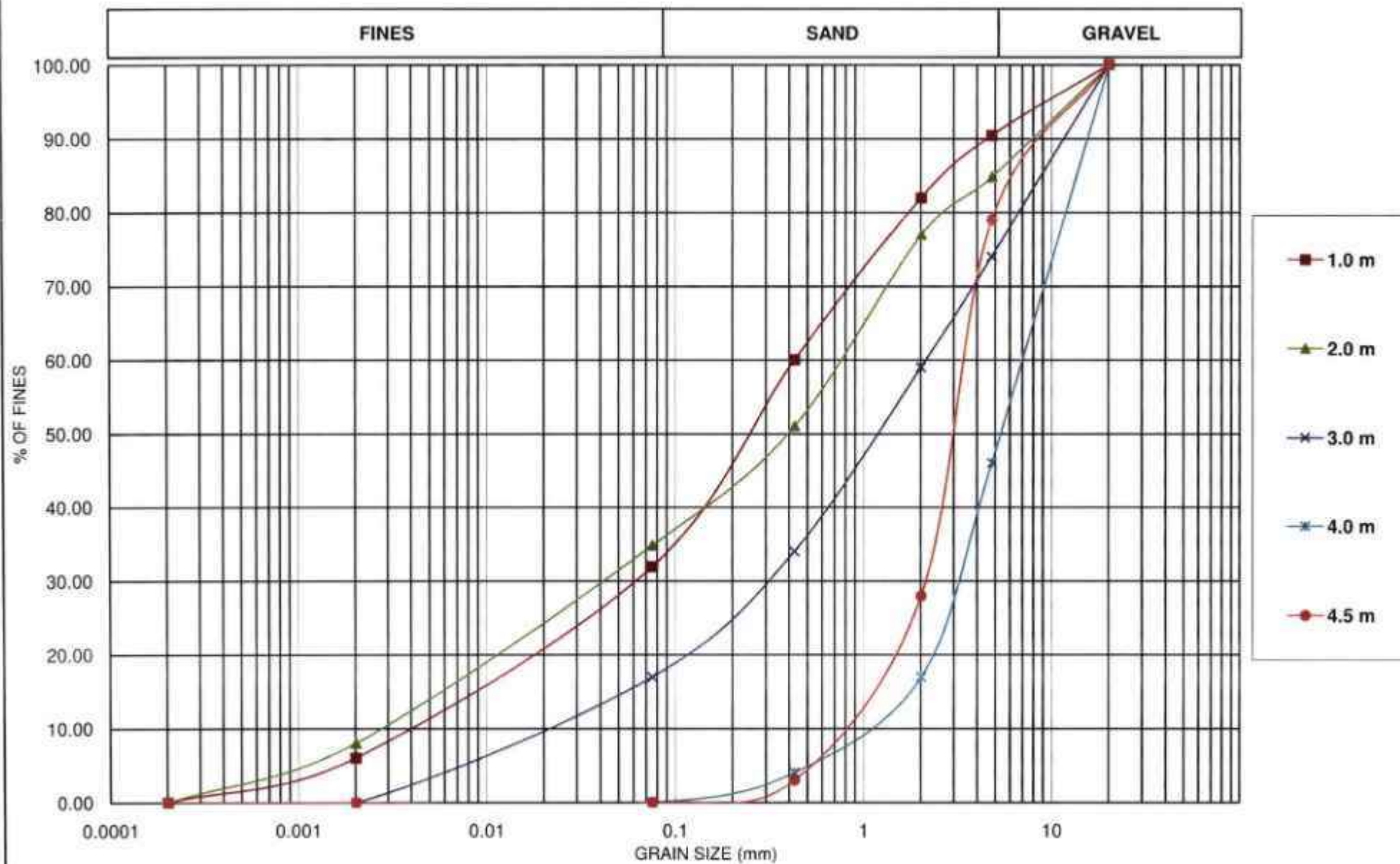


Fig. 2.42 GRAIN SIZE DISTRIBUTION CURVE - BH-20

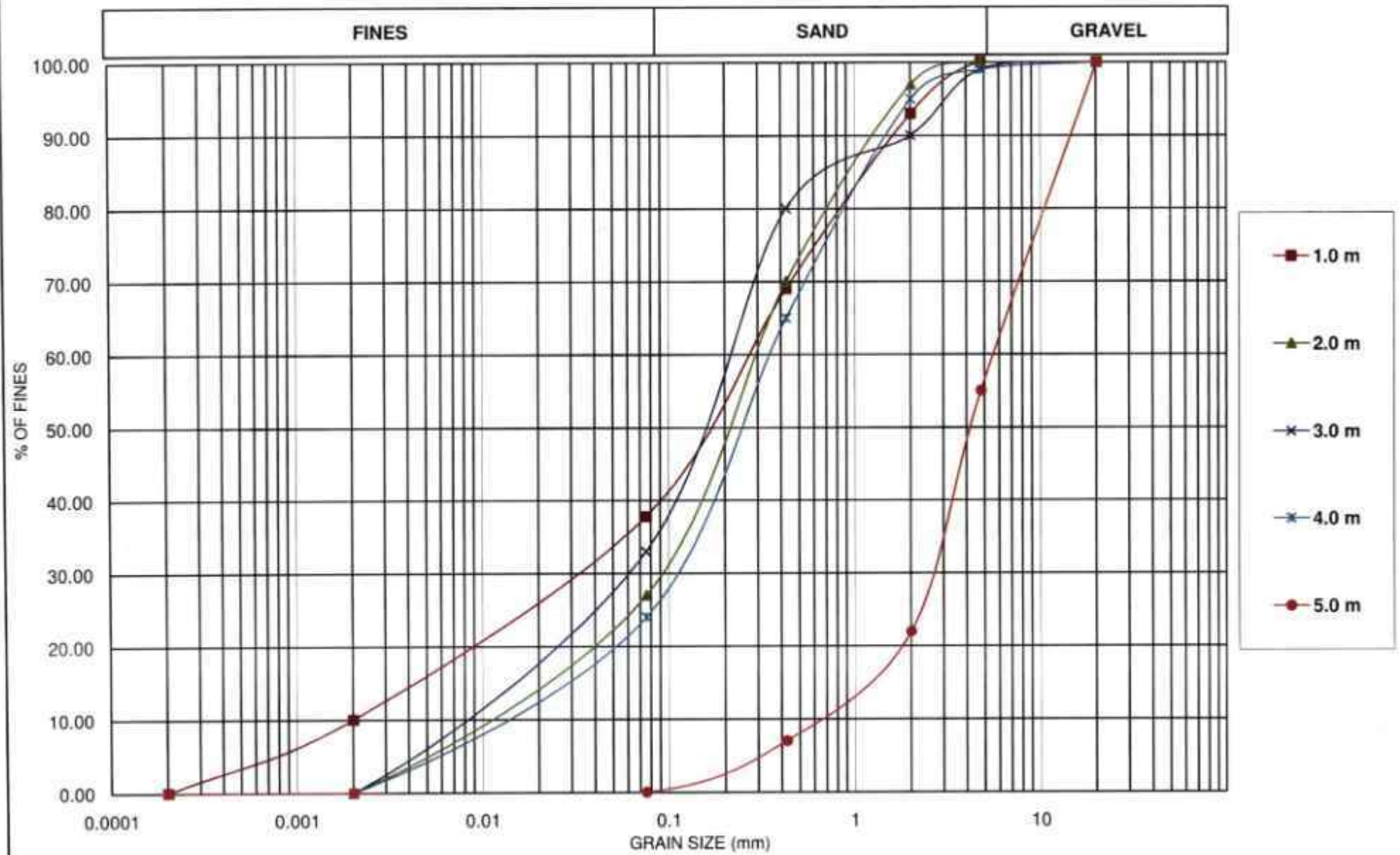


Fig. 2.43 GRAIN SIZE DISTRIBUTION CURVE - BH-21

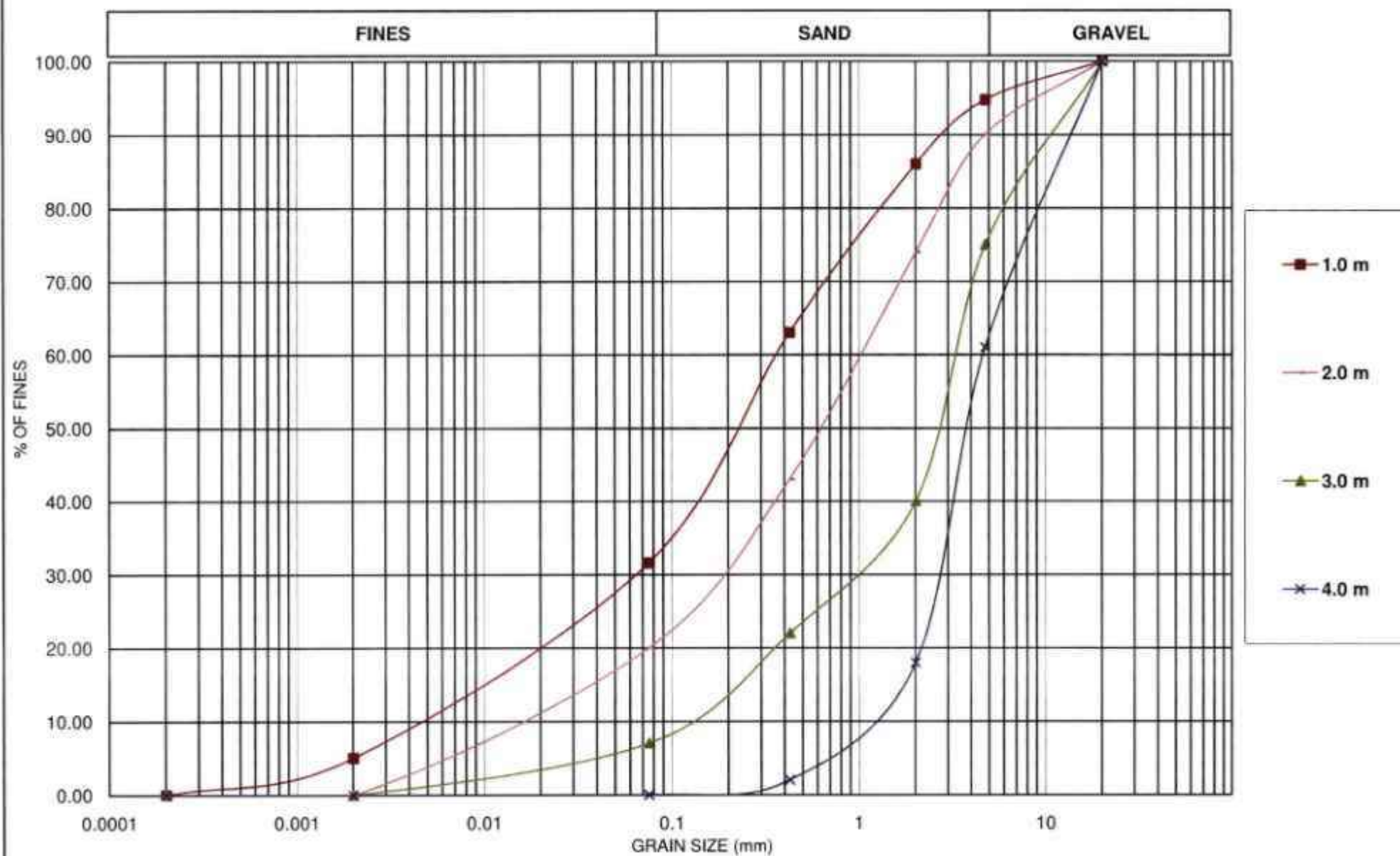


Fig. 2.44 GRAIN SIZE DISTRIBUTION CURVE - BH-22

HYDROMETER ANALYSIS CURVE

—◆— Bore Hole No: 01 Depth: 1.0m

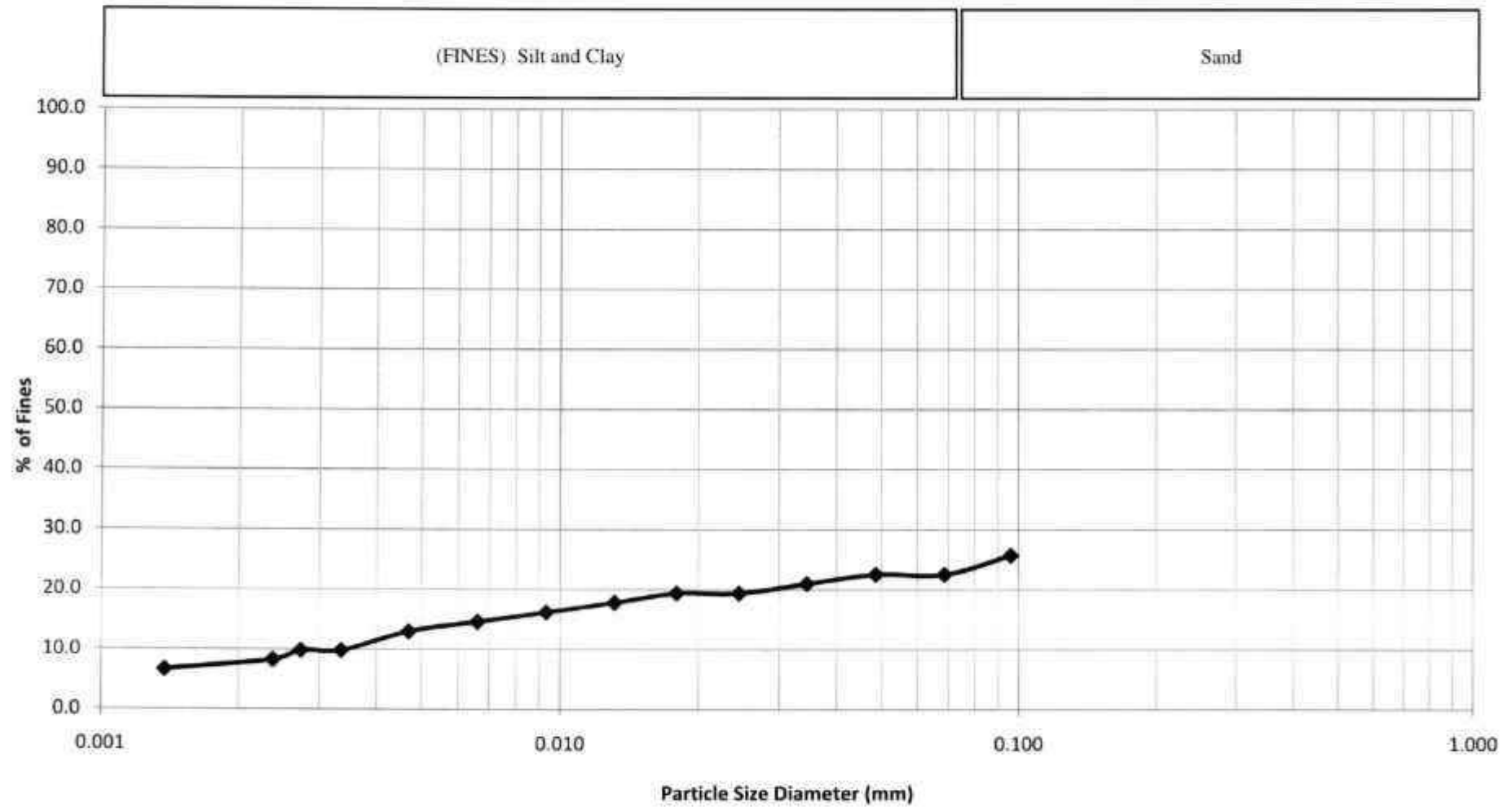


Fig 2.45 Hydrometer Analysis Master Curve

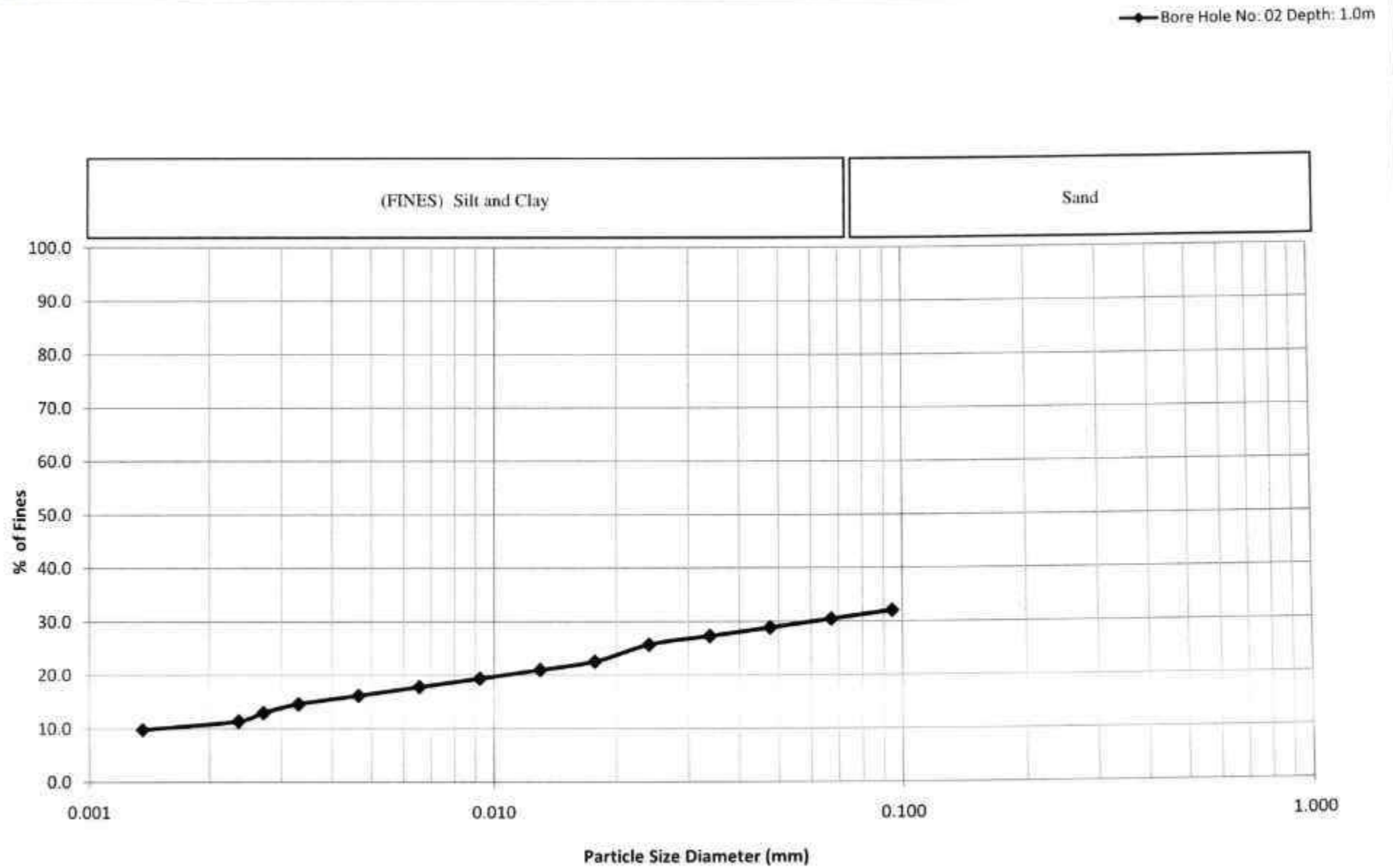
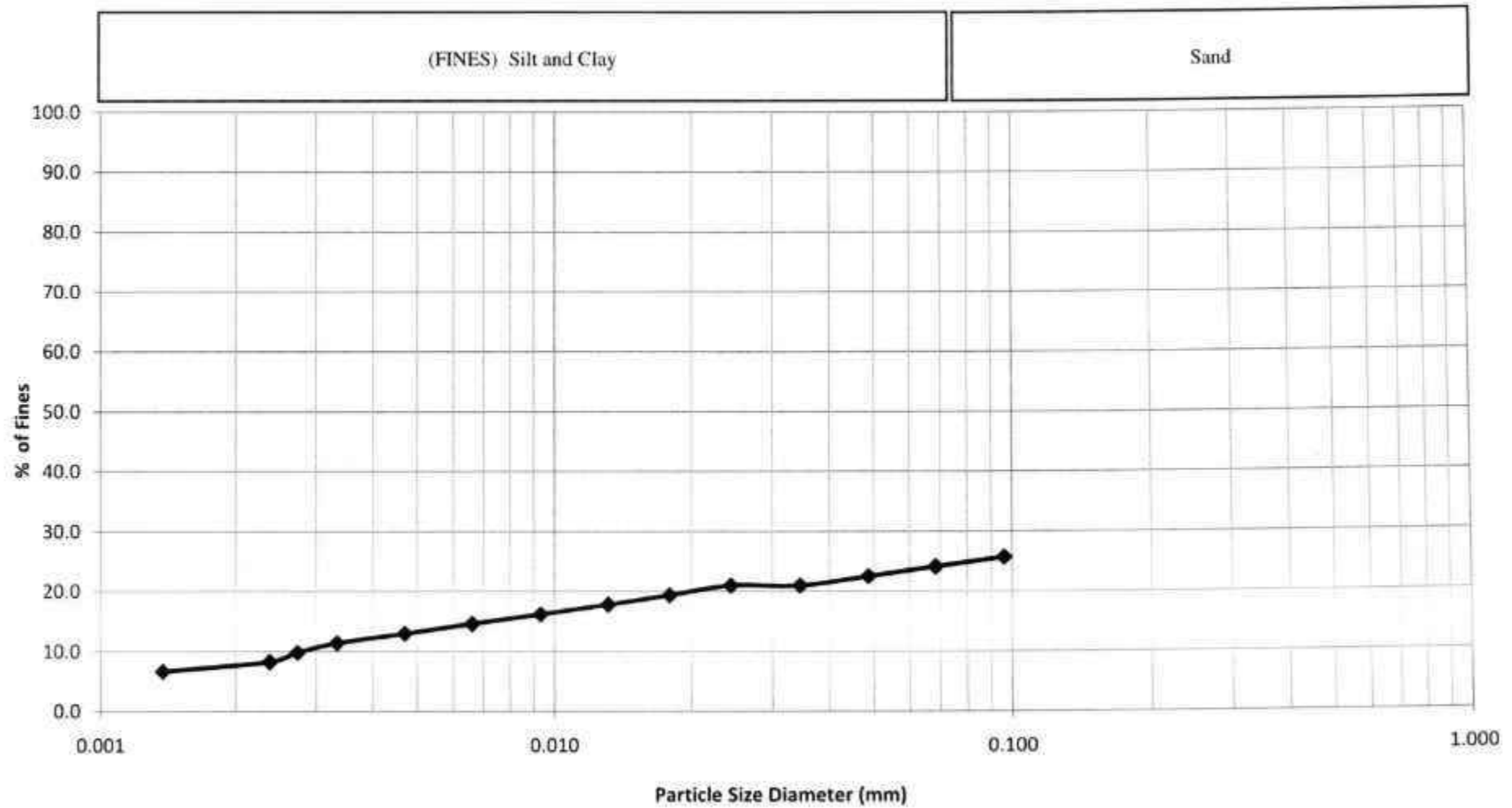


Fig 2.46 Hydrometer Analysis Master Curve

Bore Hole No: 03 Depth: 2.0m

**Fig 2.47 Hydrometer Analysis Master Curve**

 Bore Hole No; 04 Depth: 2.0m

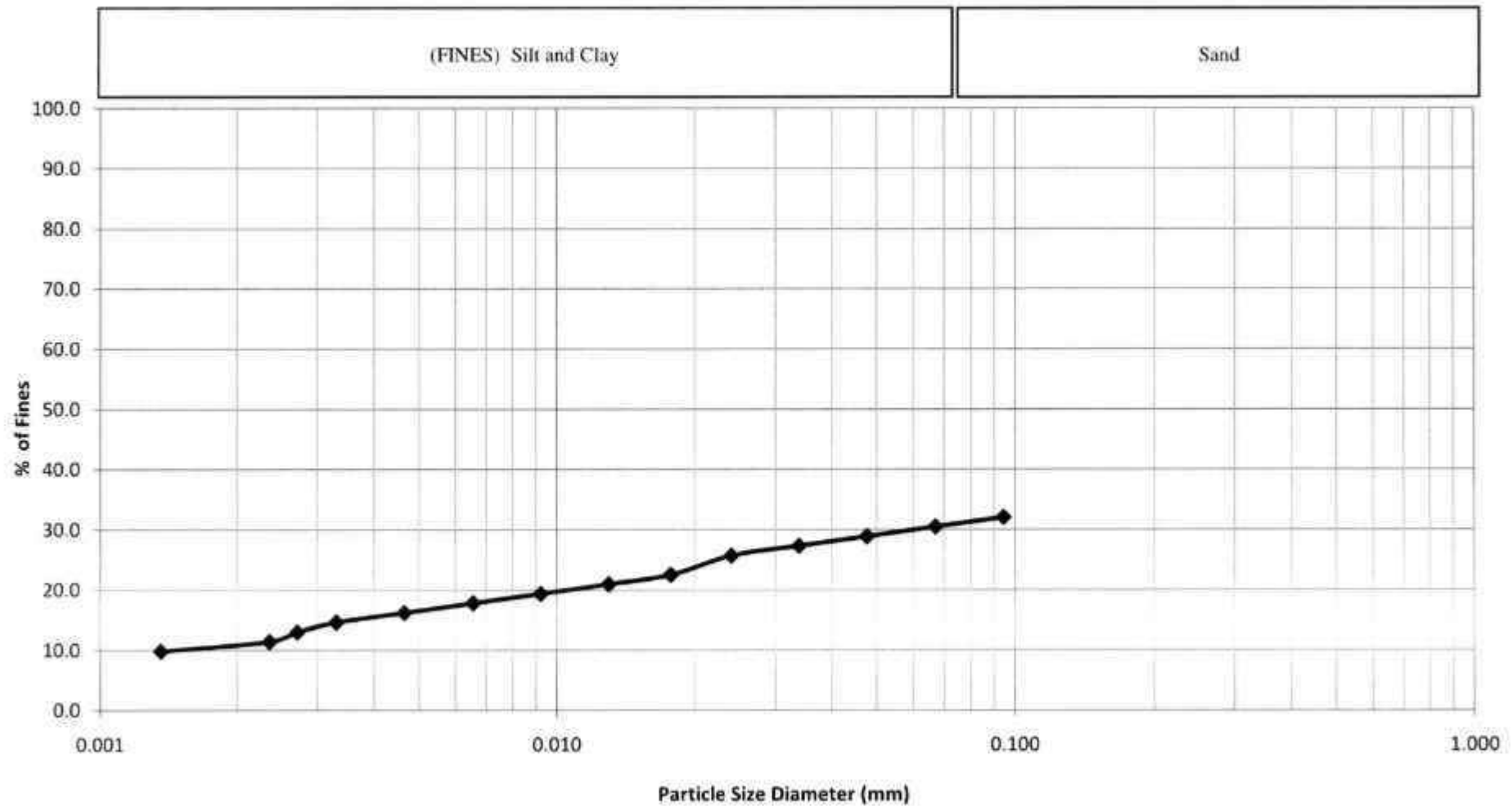


Fig 2.48 Hydrometer Analysis Master Curve

—◆— Bore Hole No: 05 Depth: 1.0m

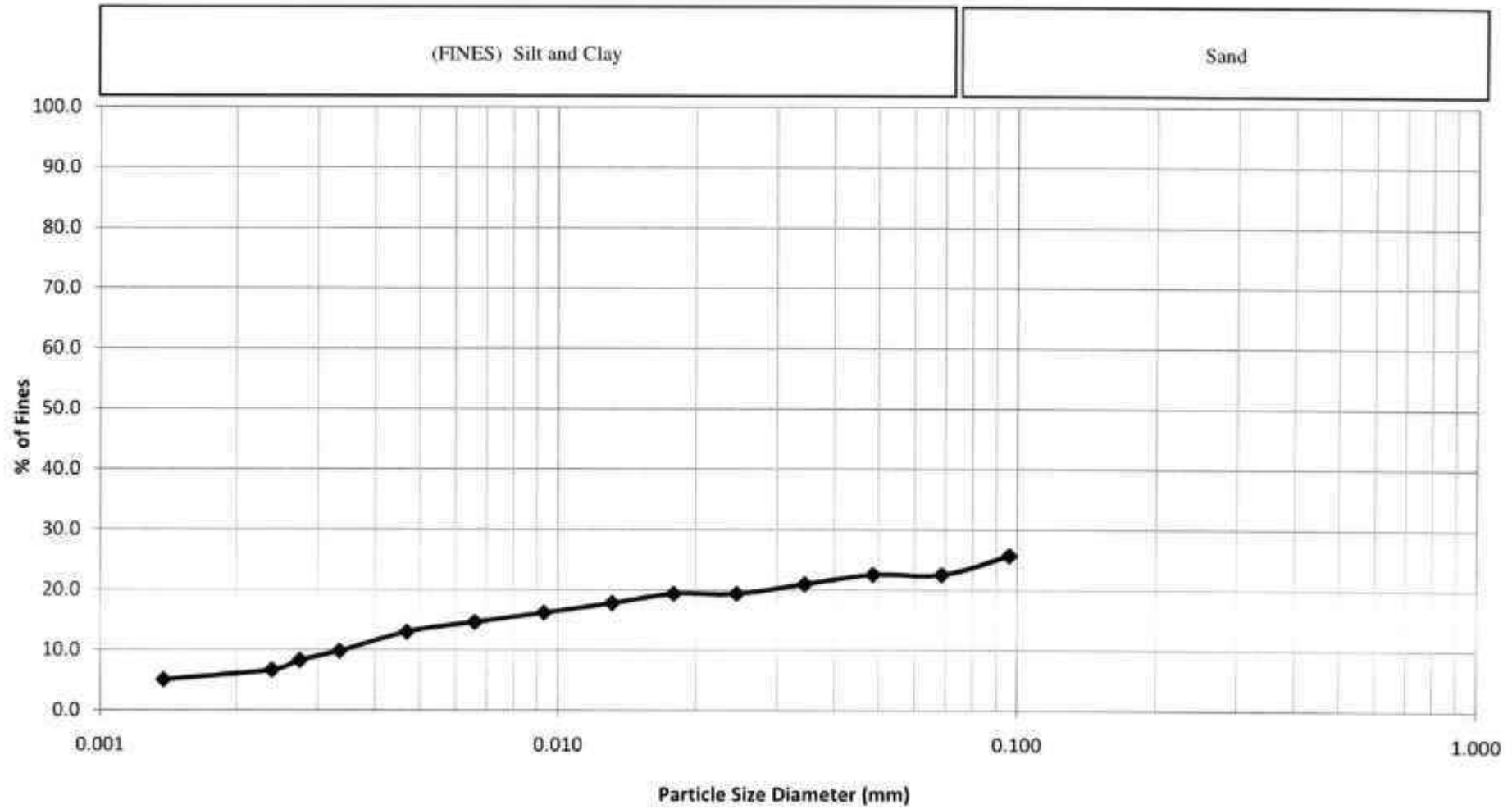


Fig 2.49 Hydrometer Analysis Master Curve

 Bore Hole No: 07 Depth: 1.0m

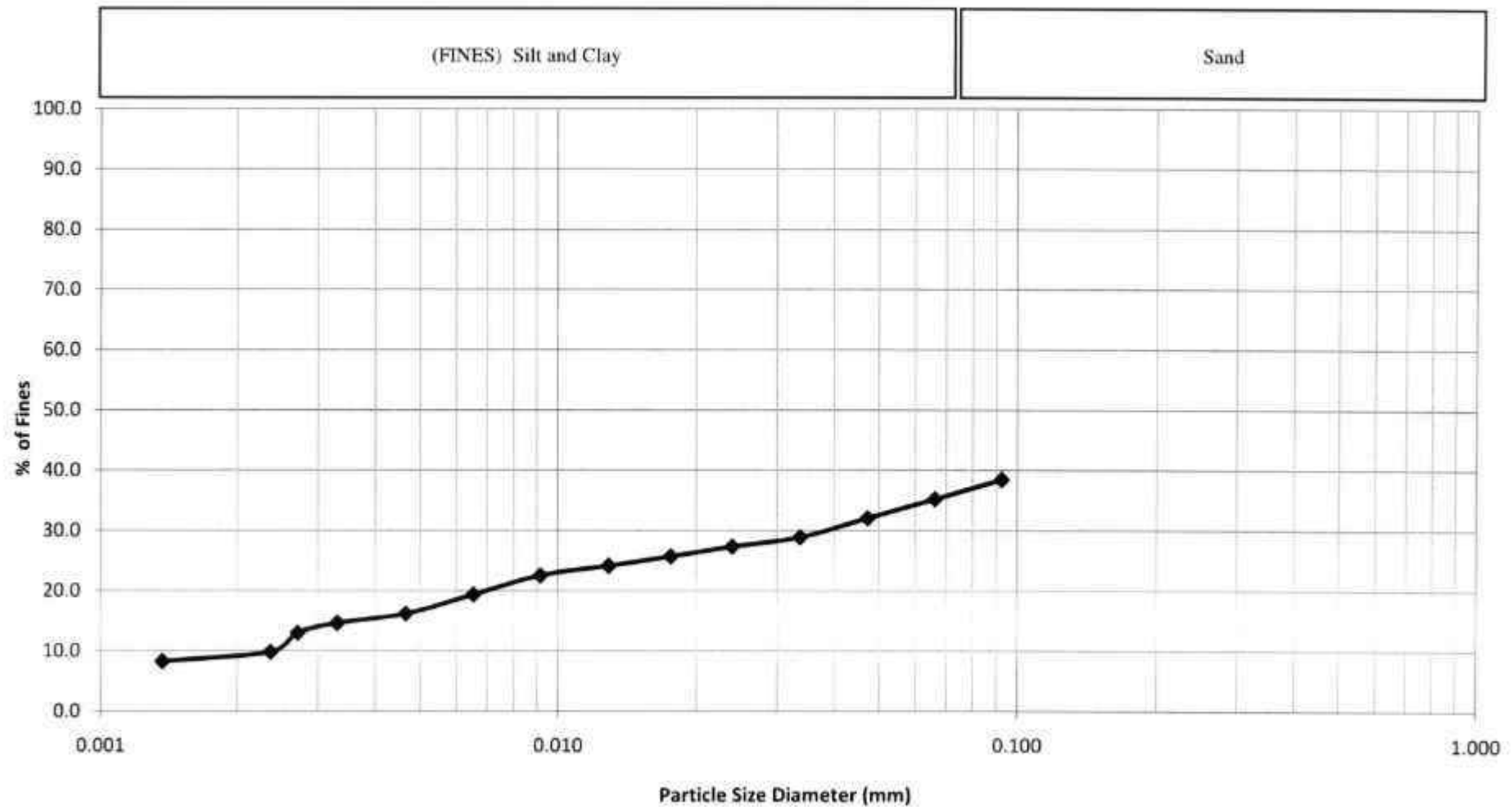


Fig 2.50 Hydrometer Analysis Master Curve

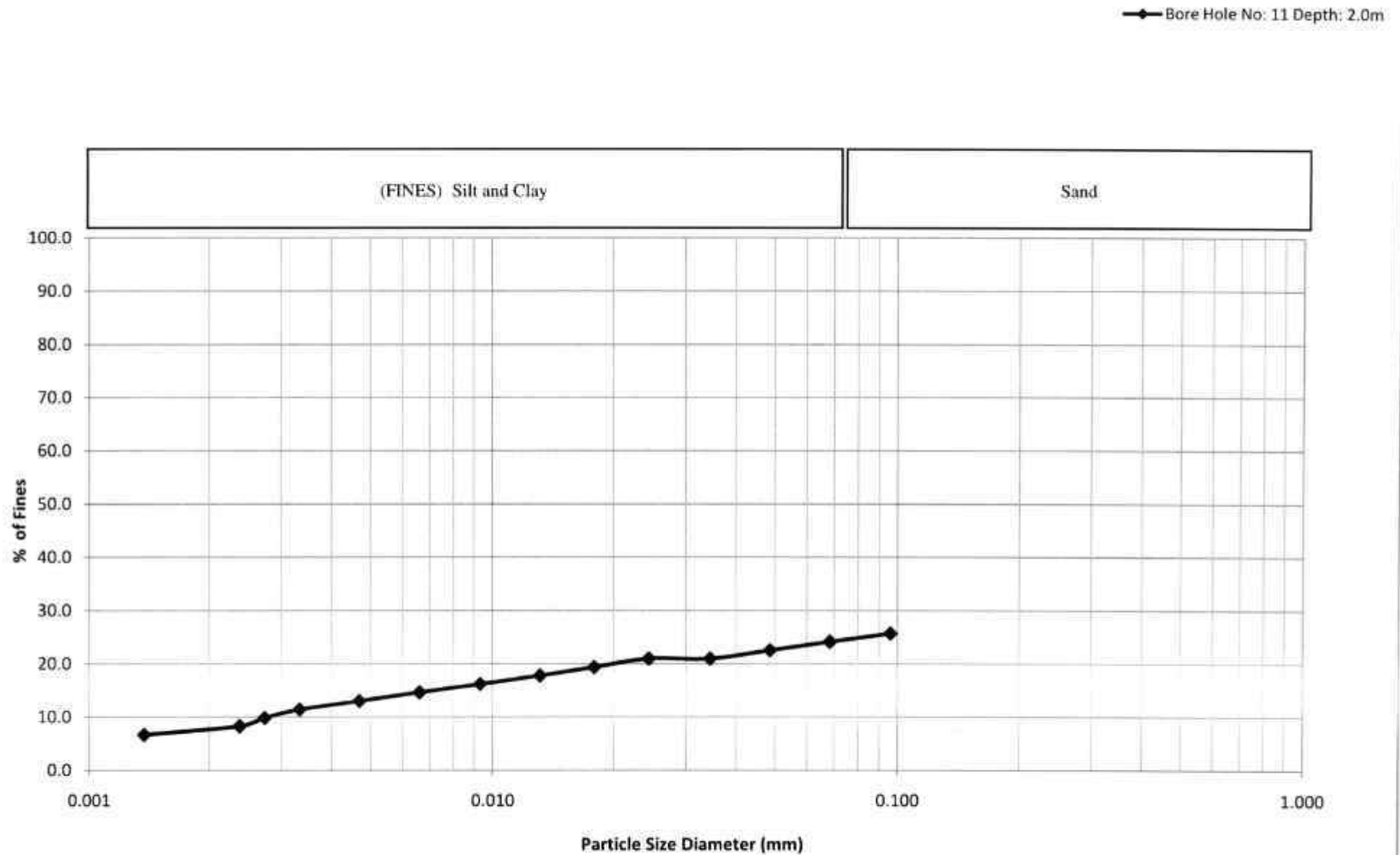


Fig 2.51 Hydrometer Analysis Master Curve

—●— Bore Hole No: 16 Depth: 2.0m

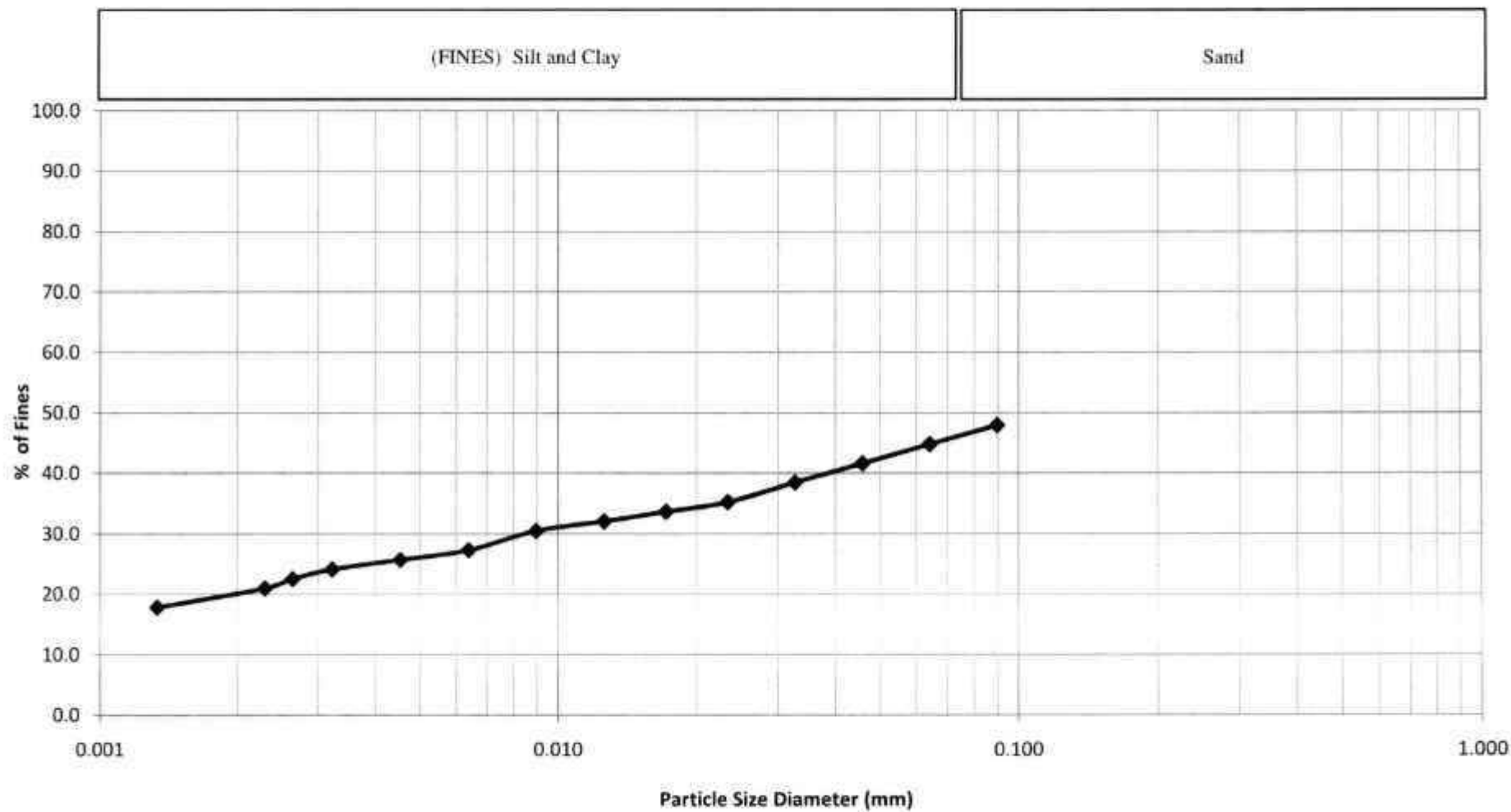


Fig 2.52 Hydrometer Analysis Master Curve

—◆— Bore Hole No: 17 Depth: 2.0m

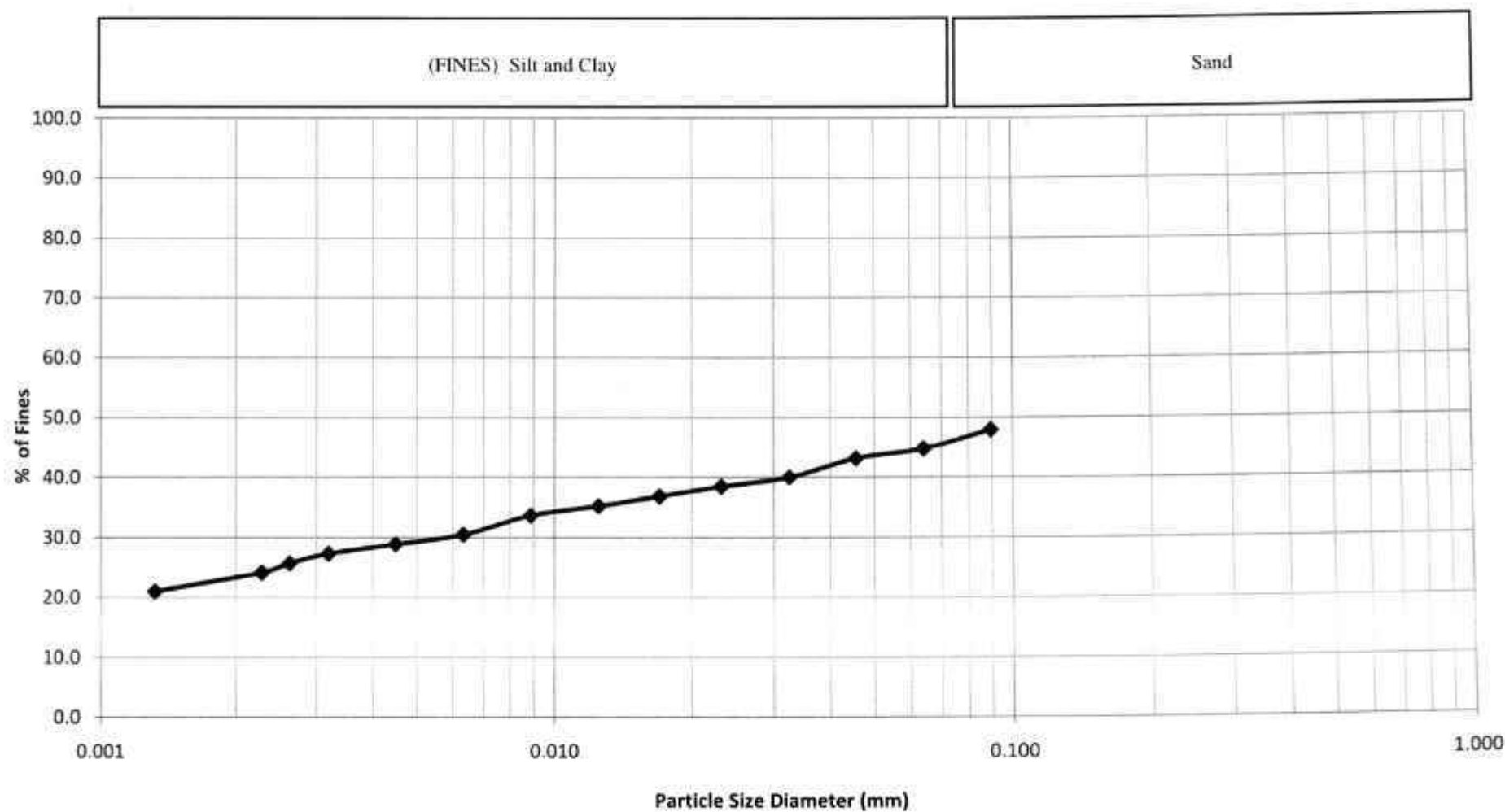


Fig 2.53 Hydrometer Analysis Master Curve

—◆— Bore Hole No: 18 Depth: 1.0m

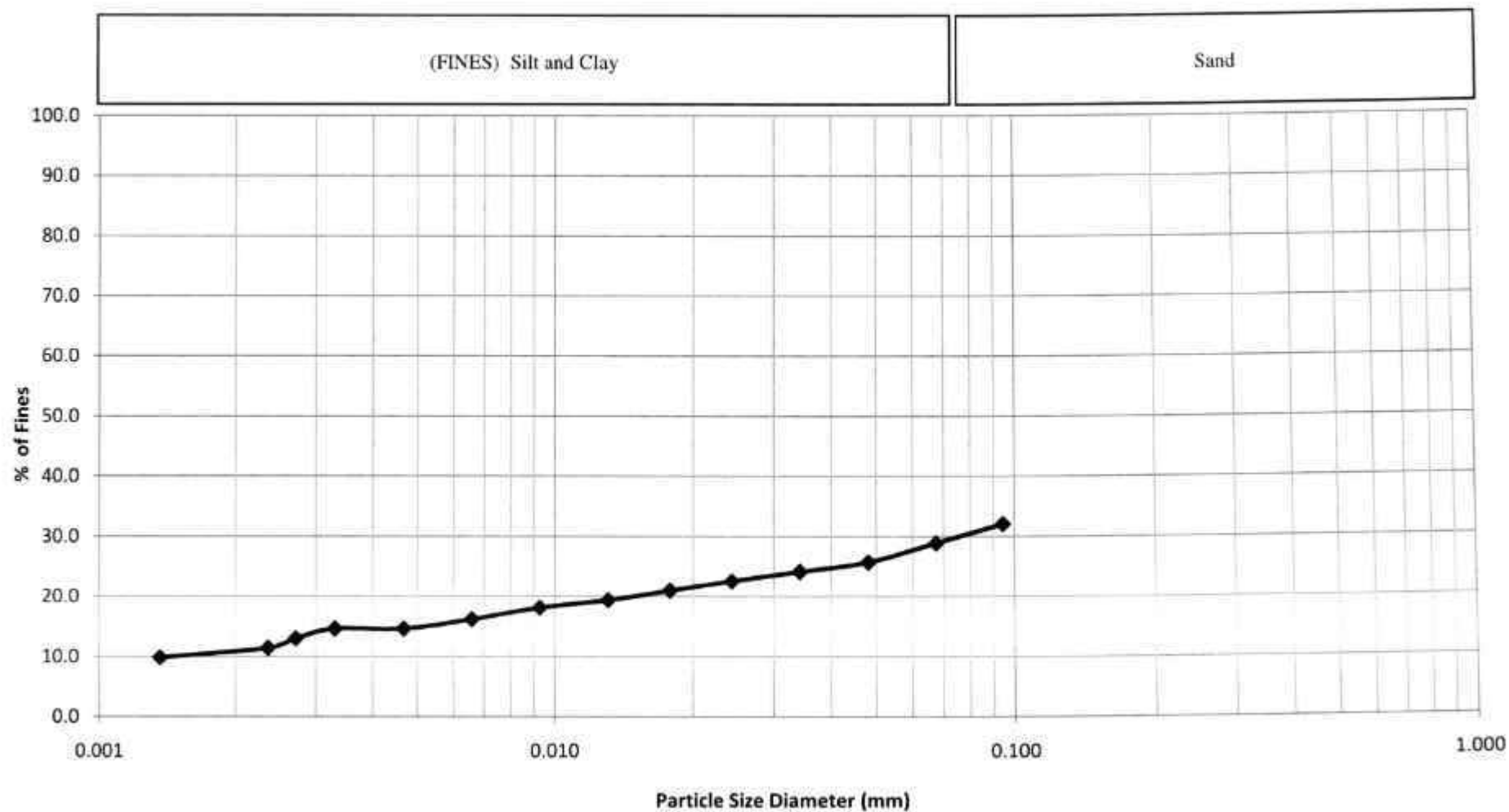


Fig 2.54 Hydrometer Analysis Master Curve

—●— Bore Hole No: 20 Depth: 2.0m

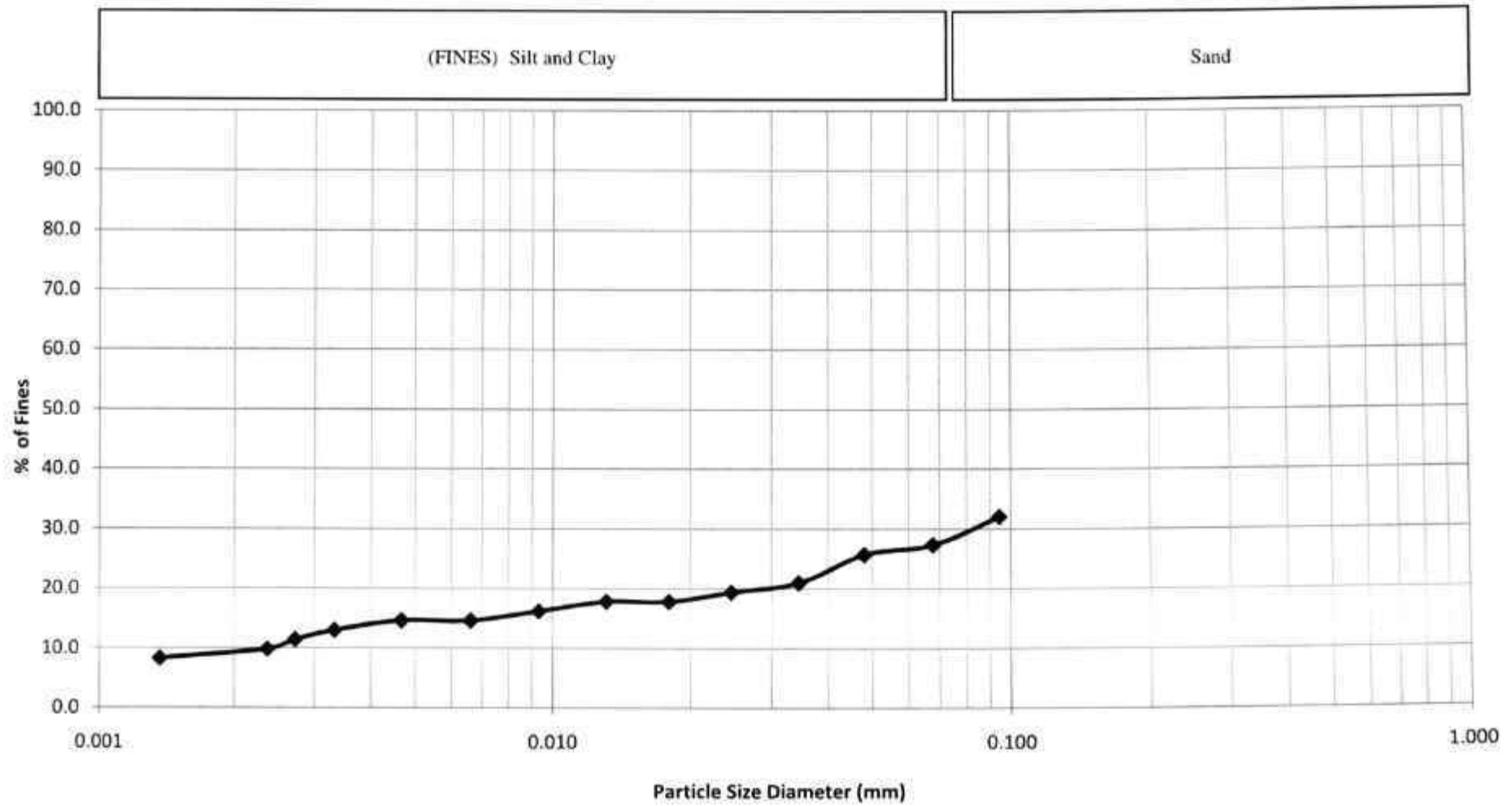


Fig 2.55 Hydrometer Analysis Master Curve

—●— Bore Hole No: 21 Depth: 1.0m

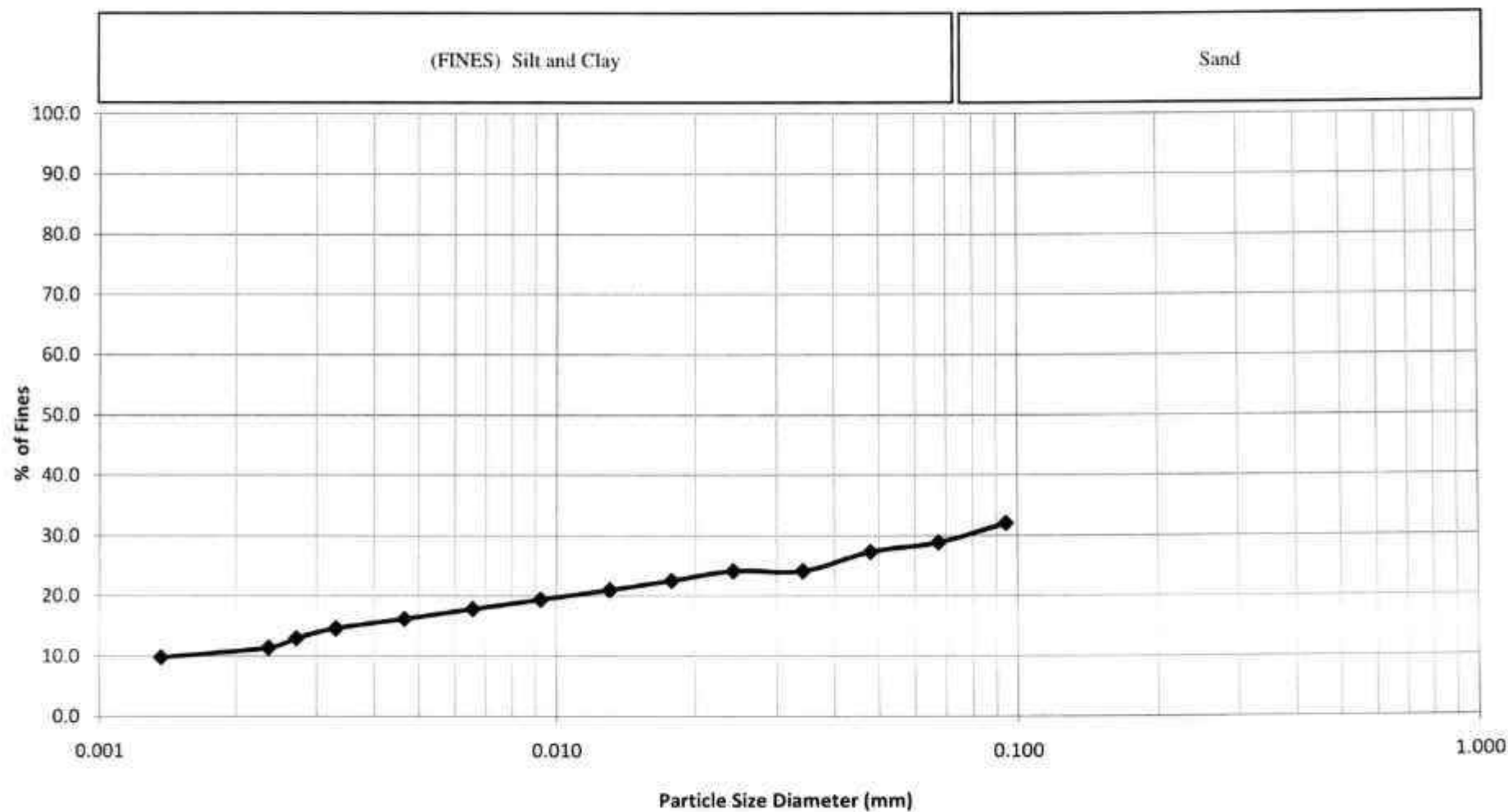


Fig 2.56 Hydrometer Analysis Master Curve

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																										
Depth of Sample below E.G.L. (m)	SPT-Value	Type of Sample	Sub Soil Classification																							
			Fine Grained (FG)										Coarse Grained (CG)													
			NMC(%)	LL (%)	PL (%)	I _p	I _c	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	18	SS	15	40	16	24	1.04	14	63	CG>50%	Above	-	10	14	17	20	32	7	-	-	-	-	-	M.Dense	<50%	SC
2.0	10	SS	23	42	19	23	0.83	15	40	CG>50%	Above	-	6	7	19	25	35	8	-	-	-	-	-	Loose	<50%	SC
3.0	52	SS	-	-	-	-	-	-	-	CG>50%	-	-	1	4	31	40	24	0	-	-	-	-	-	V.Dense	<50%	SM
4.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	2	17	33	28	20	0	-	-	-	-	-	V.Dense	<50%	SM
5.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	2	25	61	12	0	0	-	-	-	-	-	V.Dense	<50%	SP
5.5	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	14	22	58	6	0	0	-	-	-	-	-	V.Dense	<50%	SP
FG = Fine Grained			PL = Plastic Limit			FS = Differential Free Well Index												LAB IN-CHARGE				PRAVEEN				
CG = Coarse Grained			I _p = Plasticity Index			C _u = Uniformity Coefficient												REVIEWED BY				JALEEL YASIN				
NMC= Nature Moisture Content			I _c = (LL-NMC)/I _p			C _c = Coefficient of Curvature																				
LL = Liquid Limit			SL = Shrinkage Limit																							



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

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)													
			NMC(%)	LL (%)	PL (%)	Ip	Ic	SL (%)	FS (%)	Consistency	Position With Respect to A-Aline	IS-Notation	Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)	D10 (mm)	D30(mm)	D60 (mm)	Cu=D60/D10	Cc=D30 ² /(D10xD60)	Relative Density	IS-Notation	
																									Gravel	Sand
1.0	10	SS	22	48	18	30	0.87	14	78	CG>50%	Above	-	8	15	17	15	35	10	-	-	-	-	-	Loose	<50%	SC
2.0	16	SS	15	44	17	27	1.07	15	55	CG>50%	Above	-	4	9	22	24	34	7	-	-	-	-	-	M.Dense	<50%	SC
3.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	2	2	28	40	28	0	-	-	-	-	-	#REF!	<50%	SM
4.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	7	22	35	15	21	0	-	-	-	-	-	V.Dense	<50%	SM
5.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	10	42	45	3	0	0	-	-	-	-	-	V.Dense	<50%	SP
FG = Fine Grained			PL = Plastic Limit			FS = Differential Free Well Index												LAB IN-CHARGE			PRAVEEN					
CG = Coarse Grained			Ip = Plasticity Index			Cu = Uniformity Coefficient																				
NMC= Nature Moisture Content			Ic = (LL-NMC)/Ip			Cc = Coefficient of Curvature																				
LL = Liquid Limit			SL = Shrinkage Limit																REVIEWED BY			JALEEL YASIN				



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

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)																	
			NMC(%)	LL (%)	PL (%)	I _p	I _c	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	9	SS	23	45	21	24	0.92	13	88	CG>50%	Above	-	0	8	32	25	30	5	-	-	-	-	-	Loose	<50%	SC				
2.0	14	SS	22	40	20	20	0.90	14	68	CG>50%	Above	-	0	4	28	32	30	6	-	-	-	-	-	M.Dense	<50%	SC				
3.0	42	SS	15	38	18	20	1.15	15	37	CG>50%	Above	-	2	8	25	28	32	5	-	-	-	-	-	Dense	<50%	SC				
4.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	8	11	32	25	24	0	-	-	-	-	-	V.Dense	<50%	SM				
5.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	12	42	27	19	0	0	-	-	-	-	-	V.Dense	<50%	SP				
6.5	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	38	37	22	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 Free Well Index C _u = Uniformity Coefficient C _c = Coefficient of Curvature					LAB IN-CHARGE		PRAVEEN	
																											REVIEWED BY		JALEEL YASIN	



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																				Relative Density	IS-Notation		
			Fine Grained (FG)										Coarse Grained (CG)											Gravel	Sand	
			NMC(%)	LL (%)	PL (%)	I _p	I _c	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)
1.0	23	SS	15	48	17	31	1.06	12	111	CG>50%	Above	-	4	4	25	26	35	6	-	-	-	-	-	M.Dense	<50%	SC
2.0	24	SS	18	54	20	34	1.06	13	159	CG>50%	Above	-	0	2	21	33	35	9	-	-	-	-	-	M.Dense	<50%	SC
3.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	4	5	33	29	29	0	-	-	-	-	-	V.Dense	<50%	SM
4.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	2	17	33	43	5	0	-	-	-	-	-	V.Dense	<50%	SP-SM
5.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	8	9	37	30	16	0	-	-	-	-	-	V.Dense	<50%	SM
6.5	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	83	9	4	4	0	0	-	-	-	-	-	V.Dense	GP	<50%
FG = Fine Grained			PL = Plastic Limit			FS = Differential Free Well Index							LAB IN-CHARGE					M.PRAVEEN								
CG = Coarse Grained			I _p = Plasticity Index			C _u = Uniformity Coefficient							REVIEWED BY					JALEEL YASIN								
NMC= Nature Moisture Content			I _c = (LL-NMC)/I _p			C _c = Coefficient of Curvature																				
LL = Liquid Limit			SL = Shrinkage Limit			IP=LL-PL																				



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

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)														
			NMC(%)	LL (%)	PL (%)	I _p	I _c	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 *D ₆₀)	Relative Density	IS-Notation			
																										Gravel	Sand	
1.0	7	SS	35	55	26	29	0.69	12	45	CG>50%	Above	-	6	25	24	10	30	5	-	-	-	-	-	Loose	<50%	SC		
2.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	6	11	33	32	18	0	-	-	-	-	-	V.Dense	<50%	SM		
3.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	20	17	27	23	13	0	-	-	-	-	-	V.Dense	<50%	SM		
4.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	56	29	13	2	0	0	-	-	-	-	-	V.Dense	GP	<50%		
FG = Fine Grained CG = Coarse Grained NMC= Nature Moisture Content LL = Liquid Limit											PL = Plastic Limit I _p = Plasticity Index I _c = (LL-NMC)/I _p SL = Shrinkage 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-2.6 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	I _c	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		
																									Gravel	Sand
1.0	24	SS	14	45	18	27	1.15	18	78	CG>50%	Above	-	20	21	15	8	30	6	-	-	-	-	-	M.Dense	<50%	SC
2.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	11	13	25	23	28	0	-	-	-	-	-	V.Dense	<50%	SM
3.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	20	41	35	2	2	0	-	-	-	-	-	V.Dense	<50%	SP
4.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	50	26	19	5	0	0	-	-	-	-	-	V.Dense	GP	<50%
FG = Fine Grained CG = Coarse Grained NMC= Nature Moisture Content LL = Liquid Limit			PL = Plastic Limit I _p = Plasticity Index I _c = (LL-NMC)/I _p SL = Shrinkage 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-2.7 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)													
			NMC(%)	LL (%)	PL (%)	Ip	Ic	SL (%)	FS (%)	Consistency	Position With Respect to A-Aline	IS-Notation	Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)	D15 (mm)	D30 (mm)	D60 (mm)	Cu=D60/D10	Cc=D30 ² /(D10xD60)	Relative Density	IS-Notation	
																									Gravel	Sand
1.0	25	SS	16	39	17	22	1.05	13	105	CG>50%	Above	-	16	20	21	4	31	8	-	-	-	-	-	M.Dense	<50%	SC
2.0	>100	SS	12	36	17	19	1.26	13	85	CG>50%	Above	-	9	17	17	21	30	6	-	-	-	-	-	V.Dense	<50%	SC
3.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	30	40	24	4	2	0	-	-	-	-	-	V.Dense	<50%	SP
4.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	12	38	43	6	0	0	-	-	-	-	-	V.Dense	<50%	SP
FG = Fine Grained			PL = Plastic Limit			FS = Differential Free Well Index							LAB IN-CHARGE					M.PRAVEEN								
CG = Coarse Grained			Ip = Plasticity Index			Cu = Uniformity Coefficient							REVIEWED BY					JALEEL YASIN								
NMC= Nature Moisture Content			Ic = (LL-NMC)/Ip			Cc = Coefficient of Curvature																				
LL = Liquid Limit			SL = Shrinkage Limit			IP=LL-PL																				



Table-2.8 Laboratory Classification of Soil Samples from BH-08

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 (%)	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
																									Gravel	Sand
1.0	28	SS	13	36	17	19	1.21	15	41	CG>50%	Above	-	10	20	18	17	30	5	-	-	-	-	-	M.Dense	<50%	SC
2.0	47	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	2	32	44	22	0	-	-	-	-	-	Dense	<50%	SM
3.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	3	19	30	40	8	0	-	-	-	-	-	V.Dense	<50%	SP-SM
4.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	14	48	32	6	0	0	-	-	-	-	-	V.Dense	<50%	SP
4.5	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	9	37	46	8	0	0	-	-	-	-	-	V.Dense	<50%	SP
FG = Fine Grained CG = Coarse Grained NMC= Nature Moisture Content LL = Liquid Limit			PL = Plastic Limit I _p = Plasticity Index I _c = (LL-NMC)/I _p SL = Shrinkage 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-2.9 Laboratory Classification of Soil Samples from BH-09

Depth of Sample below E.G.L. (m)	SPT-Value	Type of Sample	Sub Soil Classification																														
			Fine Grained (FG)										Coarse Grained (CG)																				
			NMC(%)	LL (%)	PL (%)	I _p	I _c	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	20	SS	22	41	23	18	1.06	15	56	CG>50%	Above	-	10	7	14	30	31	8	-	-	-	-	-	M.Dense	<50%	SC							
2.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	15	26	46	13	0	0	-	-	-	-	-	V.Dense	<50%	SP							
FG = Fine Grained CG = Coarse Grained NMC= Nature Moisture Content LL = Liquid Limit																		PL = Plastic Limit I _p = Plasticity Index I _c = (LL-NMC)/I _p SL = Shrinkage 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-2.10 Laboratory Classification of Soil Samples from BH-10

Depth of Sample below E.G.L. (m)	SPT-Value	Type of Sample	Sub Soil Classification																							
			Fine Grained (FG)										Coarse Grained (CG)													
			NMC(%)	LL (%)	PL (%)	Ip	Ic	SL (%)	FS (%)	Consistency	Position With Respect to A-Aline	IS-Notation	Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)	D10 (mm)	D30 (mm)	D60 (mm)	Cu=D60/D10	Cc=D30 ² /(D10xD60)	Relative Density	IS-Notation	
																									Gravel	Sand
1.0	7	SS	25	41	18	23	0.70	15	67	CG>50%	Above	-	0	3	28	27	32	10	-	-	-	-	-	Loose	<50%	SC
2.0	33	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	2	27	42	29	0	-	-	-	-	-	Dense	<50%	SM
3.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	8	11	11	43	27	0	-	-	-	-	-	V.Dense	<50%	SM
3.5	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	5	21	66	8	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 Free Well Index Cu = Uniformity Coefficient Cc = Coefficient of Curvature IP=LL-PL							LAB IN-CHARGE		M.PRAVEEN											
													REVIEWED BY		JALEEL YASIN											

Table-2.11 Laboratory Classification of Soil Samples from BH-11

Depth of Sample below E.G.L. (m)	SPT-Value	Type of Sample	Sub Soil Classification																							
			Fine Grained (FG)										Coarse Grained (CG)													
			NMC(%)	LL (%)	PL (%)	I _p	I _c	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	24	SS	15	41	18	23	1.13	14	65	CG>50%	Above	-	2	2	23	31	33	9	-	-	-	-	-	M.Dense	<50%	SC
2.0	22	SS	16	42	20	22	1.18	15	79	CG>50%	Above	-	9	16	20	21	28	6	-	-	-	-	-	M.Dense	<50%	SC
3.0	23	SS	18	40	19	21	1.05	15	70	CG>50%	Above	-	0	3	21	34	35	7	-	-	-	-	-	M.Dense	<50%	SC
4.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	33	40	24	3	0	0	-	-	-	-	-	V.Dense	<50%	SP
FG = Fine Grained			PL = Plastic Limit			FS = Differential Free Well Index						LAB IN-CHARGE									M.PRAVEEN					
CG = Coarse Grained			I _p = Plasticity Index			C _u = Uniformity Coefficient																				
NMC= Nature Moisture Content			I _c = (LL-NMC)/I _p			C _c = Coefficient of Curvature						REVIEWED BY									JALEEL YASIN					
LL = Liquid Limit			SL = Shrinkage Limit			IP=LL-PL																				



Table-2.12 Laboratory Classification of Soil Samples from BH-12

Depth of Sample below E.G.L (m)	SPT-Value	Type of Sample	Sub Soil Classification																							
			Fine Grained (FG)										Coarse Grained (CG)													
			NMC(%)	LL (%)	PL (%)	I _p	I _c	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 ×D ₆₀)	Relative Density	IS-Notation	
																									Gravel	Sand
1.0	17	SS	14	37	16	21	1.10	14	56	CG>50%	Above	-	15	13	19	18	30	5	-	-	-	-	-	M.Dense	<50%	SC
2.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	3	15	44	28	10	0	-	-	-	-	-	V.Dense	<50%	SP-SM
2.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	31	18	35	16	0	0	-	-	-	-	-	V.Dense	<50%	SP
FG = Fine Grained CG = Coarse Grained NMC= Nature Moisture Content LL = Liquid Limit			PL = Plastic Limit I _p = Plasticity Index I _c = (LL-NMC)/I _p SL = Shrinkage 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-2.13 Laboratory Classification of Soil Samples from BH-13

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 (%)	Consistency	Position With Respect to A-Aline	IS-Notation	Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)	D ₁₅ (mm)	D ₃₀ (mm)	D ₆₀ (mm)	C _u =D ₆₀ /D ₁₀	C _c =D ₃₀ ² /(D ₁₅ x D ₆₀)			Relative Density
																									Gravel	Sand
1.0	24	SS	15	35	21	14	1.43	15	33	CG>50%	Above	-	2	5	16	37	33	7	-	-	-	-	-	M.Dense	<50%	SC
2.0	31	SS	18	42	22	20	1.20	16	25	CG>50%	Above	-	17	15	20	13	30	5	-	-	-	-	-	Dense	<50%	SC
3.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	51	25	18	6	0	0	-	-	-	-	-	V.Dense	GP	<50%
4.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	9	36	49	6	0	0	-	-	-	-	-	V.Dense	<50%	SP
FG = Fine Grained CG = Coarse Grained NMC= Nature Moisture Content LL = Liquid Limit			PL = Plastic Limit I _p = Plasticity Index I _c = (LL-NMC)/I _p SL = Shrinkage 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-2.14 Laboratory Classification of Soil Samples from BH-14

Depth of Sample below E.G.L. (m)	SPT-Value	Type of Sample	Sub Soil Classification																							
			Fine Grained (FG)										Coarse Grained (CG)													
			NMC(%)	LL (%)	PL (%)	I _p	I _c	SL (%)	FS (%)	Consistency	Position With Respect to A-Aline	IS-Notation	Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)	D ₁₂ (mm)	D ₃₀ (mm)	D ₆₀ (mm)	C _u =D ₆₀ /D ₁₀	C _c =D ₃₀ ² /(D ₁₀ ×D ₆₀)	Relative Density	IS-Notation	
																									Gravel	Sand
1.0	26	SS	14	45	19	26	1.19	14	88	CG>50%	Above	-	6	15	20	23	30	6	-	-	-	-	-	M.Dense	<50%	SC
2.0	23	SS	16	45	18	27	1.07	14	68	CG>50%	Above	-	10	15	22	11	34	8	-	-	-	-	-	M.Dense	<50%	SC
3.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	48	7	10	15	20	0	-	-	-	-	-	V.Dense	GM	<50%
4.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	2	51	44	3	0	0	-	-	-	-	-	V.Dense	<50%	SP
4.5	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	7	38	53	2	0	0	-	-	-	-	-	V.Dense	<50%	SP
FG = Fine Grained CG = Coarse Grained NMC= Nature Moisture Content LL = Liquid Limit			PL = Plastic Limit I _p = Plasticity Index I _c = (LL-NMC)/I _p SL = Shrinkage 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-2.15 Laboratory Classification of Soil Samples from BH-15

Depth of Sample below E.G.L. (m)	SPT-Value	Type of Sample	Sub Soil Classification																							
			Fine Grained (FG)										Coarse Grained (CG)													
			NMC(%)	LL (%)	PL (%)	I _p	I _c	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 ×D ₆₀)	Relative Density	IS-Notation	
																									Gravel	Sand
1.0	13	SS	25	42	22	20	0.85	15	42	CG>50%	Above	-	1	8	18	32	32	9	-	-	-	-	-	M.Dense	<50%	SC
2.0	13	SS	23	38	20	18	0.83	15	38	CG>50%	Above	-	2	3	21	31	33	10	-	-	-	-	-	M.Dense	<50%	SC
3.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	1	6	49	39	5	0	-	-	-	-	-	V.Dense	<50%	SP-SM
4.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	22	39	25	14	0	0	-	-	-	-	-	V.Dense	<50%	SP
5.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	38	25	32	5	0	0	-	-	-	-	-	V.Dense	<50%	SP
FG = Fine Grained CG = Coarse Grained NMC= Nature Moisture Content LL = Liquid Limit																		LAB IN-CHARGE		M.PRAVEEN						
PL = Plastic Limit I _p = Plasticity Index I _c = (LL-NMC)/I _p SL = Shrinkage Limit																		REVIEWED BY		JALEEL YASIN						
FS = Differential Free Well Index C _u = Uniformity Coefficient C _c = Coefficient of Curvature IP=LL-PL																										

Table-2.16 Laboratory Classification of Soil Samples from BH-16

Depth of Sample below E.G.L. (m)	SPT-Value	Type of Sample	Sub Soil Classification																				Relative Density	IS-Notation		
			Fine Grained (FG)										Coarse Grained (CG)													
			NMC(%)	LL (%)	PL (%)	I_p	I_c	SL (%)	FS (%)	Consistency	Position With Respect to A-Alline	IS:Notation	Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)	D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	$C_u=D_{60}/D_{10}$				$C_c=D_{30}^2/(D_{10} \times D_{60})$
																										Gravel
1.0	43	SS	16	46	25	21	1.43	14	60	CG>50%	Above	-	20	14	17	8	32	9	-	-	-	-	-	Dense	<50%	SC
2.0	52	SS	21	65	26	39	1.13	10	95	Hard	Above	CH	5	10	17	8	42	18	-	-	-	-	-	FG>50%	FG>50%	FG>50%
3.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	20	41	35	2	2	0	-	-	-	-	-	V.Dense	<50%	SP
4.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	50	26	19	5	0	0	-	-	-	-	-	V.Dense	GP	<50%
5.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	65	22	13	0	0	0	-	-	-	-	-	V.Dense	GP	<50%
FG = Fine Grained			PL = Plastic Limit			FS = Differential Free Well Index												LAB IN-CHARGE		M.PRAVEEN						
CG = Coarse Grained			I_p = Plasticity Index			C_u = Uniformity Coefficient																				
NMC= Nature Moisture Content			I_c = (LL-NMC)/ I_p			C_c = Coefficient of Curvature																				
LL = Liquid Limit			SL = Shrinkage Limit			IP=LL-PL												REVIEWED BY		JALEEL YASIN						



Table-2.17 Laboratory Classification of Soil Samples from BH-17

Depth of Sample below E.G.L. (m)	SPT-Value	Type of Sample	Sub Soil Classification																								
			Fine Grained (FG)										Coarse Grained (CG)														
			NMC(%)	LL (%)	PL (%)	I _p	I _c	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	8	SS	20	46	16	30	0.87	13	75	Stiff	Above	CI	0	2	18	16	46	18	-	-	-	-	-	FG>50%	FG>50%	FG>50%	
2.0	18	SS	25	75	27	48	1.04	12	108	V.Stiff	Above	CH	9	3	8	14	46	20	-	-	-	-	-	FG>50%	FG>50%	FG>50%	
3.0	62	SS	-	-	-	-	-	-	-	CG>50%	-	-	3	6	29	39	23	0	-	-	-	-	-	V.Dense	<50%	SM	
4.0	80	SS	-	-	-	-	-	-	-	CG>50%	-	-	15	11	29	29	16	0	-	-	-	-	-	V.Dense	<50%	SM	
5.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	20	19	28	20	13	0	-	-	-	-	-	V.Dense	<50%	SM	
5.5	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	65	23	10	2	0	0	-	-	-	-	-	V.Dense	GP	<50%	
FG = Fine Grained			PL = Plastic Limit			FS = Differential Free Well Index			LAB IN-CHARGE																		
CG = Coarse Grained			I _p = Plasticity Index			C _u = Uniformity Coefficient																					
NMC= Nature Moisture Content			I _c = (LL-NMC)/I _p			C _c = Coefficient of Curvature			REVIEWED BY																		
LL = Liquid Limit			SL = Shrinkage Limit			IP=LL-PL																					
													M.PRAVEEN														
													JALEEL YASIN														

Table-2.18 Laboratory Classification of Soil Samples from BH-18

Depth of Sample below E.G.L. (m)	SPT-Value	Type of Sample	Sub Soil Classification																				Relative Density	IS-Notation		
			Fine Grained (FG)										Coarse Grained (CG)											Gravel	Sand	
			NMC(%)	LL (%)	PL (%)	I _p	I _c	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 xD ₆₀)
1.0	10	SS	24	48	20	28	0.86	13	95	CG>50%	Above	-	0	6	26	24	34	10	-	-	-	-	-	Loose	<50%	SC
2.0	21	SS	22	65	25	40	1.08	14	105	CG>50%	Above	-	5	16	25	18	30	6	-	-	-	-	-	M.Dense	<50%	SC
3.0	33	SS	-	-	-	-	-	-	-	CG>50%	-	-	12	17	34	18	19	0	-	-	-	-	-	Dense	<50%	SM
4.0	65	SS	-	-	-	-	-	-	-	CG>50%	-	-	22	21	24	15	18	0	-	-	-	-	-	V.Dense	<50%	SM
5.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	53	33	12	2	0	0	-	-	-	-	-	V.Dense	GP	<50%
6.5	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	63	23	13	1	0	0	-	-	-	-	-	V.Dense	GP	<50%
8.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	69	24	4	3	0	0	-	-	-	-	-	V.Dense	GP	<50%
9.5	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	72	20	4	4	0	0	-	-	-	-	-	V.Dense	GP	<50%
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 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-2.19 Laboratory Classification of Soil Samples from BH-19

Depth of Sample below E.G.L. (m)	SPT-Value	Type of Sample	Sub Soil Classification																							
			Fine Grained (FG)										Coarse Grained (CG)													
			NMC(%)	LL (%)	PL (%)	I _p	I _c	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 xD ₆₀)	Relative Density	IS-Notation	
																									Gravel	Sand
1.0	18	SS	18	46	22	24	1.17	16	95	CG>50%	Above	-	5	9	27	18	31	10	-	-	-	-	-	M.Dense	<50%	SC
2.0	59	SS	14	33	18	15	1.27	17	33	CG>50%	Above	-	5	17	20	19	30	9	-	-	-	-	-	V.Dense	<50%	SC
3.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	17	32	44	7	0	0	-	-	-	-	-	V.Dense	<50%	SP
FG = Fine Grained			PL = Plastic Limit			FS = Differential Free Well Index												LAB IN-CHARGE		M.PRAVEEN						
CG = Coarse Grained			I _p = Plasticity Index			C _u = Uniformity Coefficient																				
NMC= Nature Moisture Content			I _c = (LL-NMC)/I _p			C _c = Coefficient of Curvature																				
LL = Liquid Limit			SL = Shrinkage Limit			IP=LL-PL												REVIEWED BY		JALEEL YASIN						

Table-2.20 Laboratory Classification of Soil Samples from BH-20

Table-2.20 Laboratory Classification of Soil Samples from BH-20																										
Depth of Sample below E.G.L. (m)	SPT-Value	Type of Sample	Sub Soil Classification																							
			Fine Grained (FG)										Coarse Grained (CG)													
			NMC(%)	LL (%)	PL (%)	I _p	I _c	SL (%)	FS (%)	Consistency	Position With Respect to A-Aline	IS-Notation	Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)	D ₁₅ (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	32	SS	14	42	22	20	1.40	13	44	CG>50%	Above	-	9	9	22	24	30	6	-	-	-	-	-	Dense	<50%	SC
2.0	>100	SS	12	55	27	28	1.54	13	35	CG>50%	Above	-	14	9	26	11	32	8	-	-	-	-	-	V.Dense	<50%	SC
3.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	26	15	25	17	17	0	-	-	-	-	-	V.Dense	<50%	SM
4.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	54	29	13	4	0	0	-	-	-	-	-	V.Dense	GP	<50%
4.5	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	21	51	25	3	0	0	-	-	-	-	-	V.Dense	<50%	SP
FG = Fine Grained			PL = Plastic Limit			FS = Differential Free Well Index												LAB IN-CHARGE		M.PRAVEEN						
CG = Coarse Grained			I _p = Plasticity Index			C _u = Uniformity Coefficient												REVIEWED BY		JALEEL YASIN						
NMC= Nature Moisture Content			I _c = (LL-NMC)/I _p			C _c = Coefficient of Curvature																				
LL = Liquid Limit			SL = Shrinkage Limit			IP=LL-PL																				

Table-2.21 Laboratory Classification of Soil Samples from BH-21

Table-2.21 Laboratory Classification of Soil Samples from BH-21																										
Depth of Sample below E.G.L. (m)	SPT-Value	Type of Sample	Sub Soil Classification																							
			Fine Grained (FG)										Coarse Grained (CG)													
			NMC(%)	LL (%)	PL (%)	I _p	I _c	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
1.0	3	SS	50	58	27	31	0.26	15	104	CG>50%	Above	-	0	7	24	25	34	10	-	-	-	-	-	V.Loose	<50%	SC
2.0	37	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	3	27	43	27	0	-	-	-	-	-	Dense	<50%	SM
3.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	1	9	10	47	33	0	-	-	-	-	-	V.Dense	<50%	SM
4.0	86	SS	-	-	-	-	-	-	-	CG>50%	-	-	1	4	30	41	24	0	-	-	-	-	-	V.Dense	<50%	SM
5.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	45	33	15	7	0	0	-	-	-	-	-	V.Dense	<50%	SP
FG = Fine Grained			PL = Plastic Limit			FS = Differential Free Well Index												LAB IN-CHARGE			M.PRAVEEN					
CG = Coarse Grained			I _p = Plasticity Index			C _u = Uniformity Coefficient																				
NMC= Nature Moisture Content			I _c = (LL-NMC)/I _p			C _c = Coefficient of Curvature																				
LL = Liquid Limit			SL = Shrinkage Limit			IP=LL-PL												REVIEWED BY			JALEEL YASIN					

Table-2.22 Laboratory Classification of Soil Samples from BH-22

Depth of Sample below E.G.L. (m)	SPT-Value	Type of Sample	Sub Soil Classification																							
			Fine Grained (FG)										Coarse Grained (CG)													
			NMC(%)	LL (%)	PL (%)	I _p	I _c	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 xD ₆₀)	Relative Density	IS-Notation	
																									Gravel	Sand
1.0	20	SS	18	34	22	12	1.33	19	60	CG>50%	Above	-	5	9	23	28	30	5	-	-	-	-	-	M.Dense	<50%	SC
2.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	10	16	31	23	20	0	-	-	-	-	-	V.Dense	<50%	SM
3.0	>100	SS	-	-	-	-	-	-	-	CG>50%	-	-	25	35	18	15	7	0	-	-	-	-	-	V.Dense	<50%	SP-SM
4.0	>100	WS	-	-	-	-	-	-	-	CG>50%	-	-	39	43	16	2	0	0	-	-	-	-	-	V.Dense	<50%	SP
FG = Fine Grained			PL = Plastic Limit			FS = Differential Free Well Index							LAB IN-CHARGE					M.PRAVEEN								
CG = Coarse Grained			I _p = Plasticity Index			C _u = Uniformity Coefficient																				
NMC= Nature Moisture Content			I _c = (LL-NMC)/I _p			C _c = Coefficient of Curvature							REVIEWED BY					JALEEL YASIN								
LL = Liquid Limit			SL = Shrinkage Limit			IP=LL-PL																				

Table-2.23 Results of Chemical Analysis

SL No.	Bore HoleNo.	Water				Soil (2:1)			
		Depth of Sample (m)	pH	Chlorides (mg/l)	Sulphates (mg/l)	Depth of Sample (m)	pH	Chlorides (mg/l)	Sulphates (mg/l)
1	BH-01	1.50	7.12	339	410	2.00	7.08	315	381
2	BH-03	1.50	7.12	341	412	3.00	7.08	318	385
3	BH-06	1.50	7.13	341	418	2.00	7.10	320	375
4	BH-09	1.50	7.12	338	420	2.00	7.08	315	369
5	BH-13	1.50	7.13	335	415	3.00	7.10	325	395
6	BH-16	1.50	7.13	332	411	3.00	7.08	321	389
7	BH-19	1.30	7.12	325	405	3.00	7.08	310	370
8	BH-21	1.00	7.12	329	407	2.00	7.08	308	372

GEOLOGY & SUB-SURFACE STRATIFICATION

3.0 Preamble:

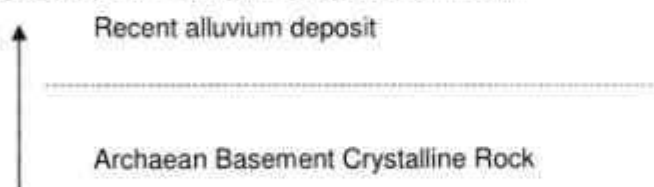
Geotechnical investigation carried out at a specific site provides location specific sub surface characteristics based on which the design of sub structures/foundations is generally carried out. However, the macro-level understanding of the sub surface is also needed for a comprehensive understanding 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 Chennai district, which can be geologically classified as hard rock formation Granite (Charnockite of Meta igneous origin) of Archaean Rock Group, overlain by recent alluvium deposits. The entire area is mostly covered by recent alluvium on the site. The rocks present in this site are of Archaean age undergone weathering to variable extent. The thickness of alluvium deposit is around 12m meter underlain by varying degree of weathering.

The present site is Shoilinanallur village, Sholingnallur Taluk, geologically it is classified as recent alluvium deposits consisting of Sandy Silty Clay/Clayey Silty Sand, which is underlying by varying degree of weathering and basement 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:



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	2.00	2.00	Clayey Silty Sand	Brownish	18	Medium Dense	-	18	-	32.4
2	2.00	3.00	1.00	Clayey Silty Sand	Brownish Grey	10	Loose	-	15	-	30
3	3.00	4.00	1.00	Residual Soil	Brownish	52	Very Dense	-	20.5	-	41.3
4	4.00	5.50	1.50	Completely Weathered Rock	Brownish	>100	Very Dense	-	21	-	42.5
5	5.50	8.50	3.00	Slightly Weathered Rock	Greyish Brown	CRR-65% & 70% RQD-15% & 33%					
6	8.50	10.00	1.50	Fresh Hard Granite Rock	Greyish Brown	CRR-80% RQD-40%					



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	2.00	2.00	Clayey Silty Sand	Brownish	10	Loose	-	15	-	30
2	2.00	3.00	1.00	Clayey Silty Sand	Brownish	16	Medium Dense	-	18	-	31.8
3	3.00	4.00	1.00	Residual Soil	Brownish	>100	Very Dense	-	21	-	42.5
4	4.00	5.00	1.00	Completely Weathered Rock	Brownish	>100	Very Dense	-	21	-	42.5
5	5.00	6.00	1.00	Moderately Weathered Rock	Greyish Brown	CRR-20% RQD-0%					
6	6.00	8.50	2.50	Slightly Weathered Rock	Greyish Brown	CRR-55% & 75% RQD-21% & 40%					
7	8.50	10.00	1.50	Fresh Hard Granite Rock	Greyish Brown	CRR-82% RQD-52%					



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. R.L.	Bot. R.L.	Thickness							(C _u) kPa	(φ) Deg.
1	0.00	2.00	2.00	Clayey Silty Sand	Brownish	9	Loose	-	14.5	-	29.8
2	2.00	3.00	1.00	Clayey Silty Sand	Brownish	14	Medium Dense	-	17	-	31.2
3	3.00	4.00	1.00	Clayey Silty Sand	Brownish	42	Dense	-	20	-	39.2
4	4.00	5.00	1.00	Residual Soil	Brownish	>100	Very Dense	-	21	-	42.5
5	5.00	6.00	1.00	Completely Weathered Rock	Brownish	>100	Very Dense	-	21	-	42.5
6	6.00	7.50	1.50	Moderately Weathered Rock	Greyish Brown	CRR-35% RQD-22%					
7	7.50	9.00	1.50	Slightly Weathered Rock	Greyish Brown	CRR-68% RQD-41%					
8	9.00	10.00	1.00	Fresh Hard Granite Rock	Greyish Brown	CRR-76% RQD-55%					

REFERENCE BORE HOLE-BH:				BH-4	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	2.00	2.00	Clayey Silty Sand	Brownish	23	Medium Dense	-	18.5	-	33.9
2	2.00	3.00	1.00	Clayey Silty Sand	Brownish	24	Medium Dense	-	18.5	-	34.2
3	3.00	6.00	3.00	Completely Weathered Rock	Brownish	>100	Very Dense	-	21	-	42.5
4	6.00	7.50	1.50	Moderately Weathered Rock	Brownish	CRR-34%, RQD-11%					
5	7.50	10.00	2.50	Slightly Weathered Rock	Brownish	CRR-51%&70%, RQD-22%&50%					

REFERENCE BORE HOLE-BH:				BH-5	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	2.00	2.00	Clayey Silty Sand	Brownish	7	Loose	-	14.5	-	29.4
2	2.00	3.00	1.00	Residual Soil	Brownish	>100	Very Dense	-	21	-	42.5
3	3.00	4.00	1.00	Completely Weathered Rock	Brownish	>100	Very Dense	-	21	-	42.5
4	4.00	7.00	3.00	Highly Weathered Rock	Brownish Grey	CRR-8% & 10%, RQD-0%					
5	7.00	8.50	1.50	Slightly Weathered Rock	Brownish Grey	CRR-55%, RQD-21%					
6	8.50	10.00	1.50	Fresh Hard Rock	Greyish	CRR- 80%, RQD-45%					

REFERENCE BORE HOLE-BH:					BH-6	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	2.00	2.00	Clayey Silty Sand	Brownish	24	Medium Dense	-	18.5	-	34.2
2	2.00	4.00	2.00	Completely Weathered Rock	Brownish	>100	Very Dense	-	21	-	42.5
3	4.00	6.50	2.50	Highly Weathered Rock	Brownish Grey	CRR-8% & 13%, RQD-0%					
4	6.50	8.50	2.00	Moderately Weathered Rock	Greyish Black	CRR-42%, RQD-11%,					
5	8.50	10.00	1.50	Fresh Hard Rock	Greyish Black	CRR-75%, RQD-30%					

REFERENCE BORE HOLE-BH:					BH-7	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	2.00	2.00	Clayey Silty Sand	Brownish	25	Medium Dense	-	18.5	-	34.5
2	2.00	3.00	1.00	Residual Soil	Brownish	>100	Very Dense	-	21	-	42.5
3	3.00	4.50	1.50	Completely Weathered Rock	Brownish	>100	Very Dense	-	21	-	42.5
4	4.50	6.00	1.50	Highly Weathered Rock	Blackish	CRR-10%, RQD-0%					
5	6.00	9.00	3.00	Moderately Weathered Rock	Blackish	CRR-21% & 50%, RQD-20%					
6	9.00	10.00	1.00	Slightly Weathered Rock	Blackish	CRR-60%, RQD-40%					

REFERENCE BORE HOLE-BH:					BH-8	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	2.00	2.00	Clayey Silty Sand	Brownish	28	Medium Dense	-	19	-	35.4
2	2.00	3.00	1.00	Silty Sand	Brownish	47	Dense	-	20	-	40.3
3	3.00	4.50	1.50	Completely Weathered Rock	Brownish	>100	Very Dense	-	21	-	42.5
4	4.50	7.50	3.00	Highly Weathered Rock	Brownish Grey	CRR-9% & 11%, RQD-0%					
5	7.50	10.00	2.50	Slightly Weathered Rock	Greyish	CRR- 60% & 75%, RQD-25% & 35%					

REFERENCE BORE HOLE-BH:				BH-9	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	1.50	1.50	Clayey Silty Sand	Brownish	20	Medium Dense	-	18	-	33
2	1.50	2.00	0.50	Completely Weathered Rock	Brownish	>100	Very Dense	-	21	-	42.5
3	2.00	6.50	4.50	Highly Weathered Rock	Brownish Grey	CRR-10%, 12%, 9% & 15&. RQD-0%					
4	6.50	8.50	2.00	Moderately Weathered Rock	Brownish Grey	CRR-73%, RQD-35%					
5	8.50	10.00	1.50	Fresh Hard Rock	Greyish	CRR-80%, RQD-60%					

REFERENCE BORE HOLE-BH:				BH-10	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	2.00	2.00	Clayey Silty Sand	Brownish	7	Loose	-	14.5	-	29.4
2	2.00	3.00	1.00	Silty Sand	Brownish	33	Dense	-	19.5	-	36.8
3	3.00	4.00	1.00	Completely Weathered Rock	Brownish	>100	Very Dense	-	21	-	42.5
4	4.00	6.50	2.50	Highly Weathered Rock	Brownish Grey	CRR-18% & 16%, RQD-0%					
5	6.50	8.00	1.50	Moderately to Slightly Weathered Rock	Greyish White	CRR-47% & 65%, RQD-19% & 40%					
6	8.00	10.00	2.00	Hard Rock	Greyish White	CRR-88%, RQD-64%					

REFERENCE BORE HOLE-BH:				BH-11	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	2.00	2.00	Clayey Silty Sand	Brownish	24	Medium Dense	-	18.5	-	34.2
2	2.00	3.50	1.50	Clayey Silty Sand	Brownish	22	Medium Dense	-	18.5	-	33.6
4	3.50	4.00	0.50	Completely Weathered Rock	Brownish	>100	Very Dense	-	21	-	42.5
5	4.00	7.00	3.00	Highly Weathered Rock	Brownish	CRR-10% & 9%, RQD-0%					
6	7.00	8.50	1.50	Moderately Weathered Rock	Blackish	CRR-59%, RQD-23%					
7	8.50	8.50	0.00	Fresh Hard Rock	Blackish	CRR-79%, RQD-34%					

REFERENCE BORE HOLE-BH:				BH-12	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	2.00	2.00	Clayey Silty Sand	Brownish	17	Medium Dense	-	18	-	32.1
2	2.00	3.00	1.00	Completely Weathered Rock	Brownish	>100	Very Dense	-	21	-	42.5
3	3.00	5.50	2.50	Highly Weathered Rock	Brownish Grey	CRR-11% & 1%, RQD-0%					
4	5.50	9.00	3.50	Moderately to Slightly Weathered Rock	Greyish	CRR- 41%,48% & 74%, RQD-0%,0% & 30%					
5	9.00	10.00	1.00	Frash Hard Rock	Greyish	CRR- 81%, RQD-60%					

REFERENCE BORE HOLE-BH:				BH-13	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	2.00	2.00	Clayey Silty Sand	Brownish	24	Medium Dense	-	18.5	-	34.2
2	2.00	3.00	1.00	Residual Soil	Greyish White	31	Dense	-	19.5	-	36.3
3	3.00	4.00	1.00	Completely Weathered Rock	Whitish	>100	Very Dense	-	21	-	42.5
4	4.00	7.00	3.00	Highly Weathered Rock	Brownish Grey	CRR-4% & 8%, RQD-0%,					
5	7.00	8.50	1.50	Moderately Weathered Rock	Brownish Grey	CRR-35%, RQD-11%,					
6	8.50	10.00	1.50	Slightly Weathered Rock	Greyish	CRR- 55%, RQD-27%					

REFERENCE BORE HOLE-BH:				BH-14	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	2.00	2.00	Clayey Silty Sand	Brownish	26	Medium Dense	-	19	-	34.8
2	2.00	3.00	1.00	Residual Soil	Brownish	23	Medium Dense	-	18.5	-	33.9
3	3.00	4.50	1.50	Completely Weathered Rock	Brownish	>100	Very Dense	-	21	-	42.5
4	4.50	7.50	3.00	Highly Weathered Rock	Brownish Grey	CRR-5% & 7%, RQD-0%					
5	7.50	9.00	1.50	Moderately Weathered Rock	Brownish Grey	CRR-27%, RQD-0%					
6	9.00	10.00	1.00	Slightly Weathered Rock	Brownish Grey	CRR-69%, RQD-24%					

REFERENCE BORE HOLE-BH:				BH-15	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	3.00	3.00	Clayey Silty Sand	Brownish	13	Medium Dense	-	16.5	-	30.9
2	3.00	5.00	2.00	Completely Weathered Rock	Brownish	>100	Very Dense	-	21	-	42.5
3	5.00	7.50	2.50	Highly Weathered Rock	Brownish	CRR-11% & 13%, RQD-0%					
4	7.50	9.00	1.50	Moderately Weathered Rock	Brownish	CRR-47%, RQD-12%					
5	9.00	10.00	1.00	Slightly Weathered Rock	Brownish Grey	CRR-70%, RQD-50%					

REFERENCE BORE HOLE-BH:				BH-16	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	2.00	2.00	Clayey Silty Sand	Brownish	43	Dense	-	20	-	39.4
2	2.00	3.00	1.00	Sandy Silty Clay	Brownish	52	Very Dense	-	20.5	-	41.3
3	3.00	5.00	2.00	Completely Weathered Rock	Brownish	>100	Very Dense	-	21	-	42.5
4	5.00	6.50	1.50	Highly Weathered Rock	Brownish	CRR-8%, RQD-0%					
5	6.50	9.00	2.50	Moderately Weathered Rock	Brownish	CRR-36% & 59%, RQD-16% & 27%					
6	9.00	10.00	1.00	Slightly Weathered Rock	Brownish Grey	CRR-75%, RQD-46%					

REFERENCE BORE HOLE-BH:				BH-17	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	2.00	2.00	Clayey Silty Sand	Brownish	8	Loose	-	14.5	-	29.6
2	2.00	3.00	1.00	Sandy Silty Clay	Brownish	18	-	Very Stiff	20	120	-
3	3.00	5.50	2.50	Completely Weathered Rock	Brownish	>100	Very Dense	-	21	-	42.5
4	5.50	7.00	1.50	Highly Weathered Rock	Brownish Grey	CRR-7%, RQD-0%					
5	7.00	8.50	1.50	Moderately Weathered Rock	Brownish Grey	CRR-49%, RQD-16%					
6	8.50	10.00	1.50	Slightly Weathered Rock	Greyish	CRR-65%, RQD-33%					



REFERENCE BORE HOLE-BH:					BH-18	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	2.00	2.00	Clayey Silty Sand	Brownish	10	Loose	-	15	-	30
2	2.00	3.00	1.00	Clayey Silty Sand	Brownish	21	Medium Dense	-	18.5	-	33.3
3	3.00	4.30	1.30	Silty Sand	Brownish	49	Dense	-	20	-	40.8
4	4.30	10.00	5.70	Completely Weathered Rock	Brownish	>100	Very Dense	-	21	-	42.5
5	10.00	12.00	2.00	Moderately Weathered Rock	Brownish Grey	CRR-25%&34%, RQD-0%					
6	12.00	13.00	1.00	Slightly Weathered Rock	Grey	CRR-59%, RQD-22%					

REFERENCE BORE HOLE-BH:					BH-19	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	2.00	2.00	Clayey Silty Sand	Brownish	18	Medium Dense	-	18	-	32.4
2	2.00	3.00	1.00	Residual Soil	Brownish	52	Very Dense	-	20.5	-	41.3
3	3.00	5.50	2.50	Highly Weathered Rock	Brownish	CRR-11% & 12, RQD-0%					
4	5.50	8.50	3.00	Moderately to Slightly Weathered Rock	Brownish Grey	CRR-25%&69%, RQD-10%&35%					
5	8.50	10.00	1.50	Fresh Hard Rock	Brownish Grey	CRR-80%, RQD-70%					

REFERENCE BORE HOLE-BH:				BH-20	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	2.00	2.00	Silty Sand	Brownish	32	Dense	-	19.5	-	36.6
2	2.00	4.50	2.50	Completely Weathered Rock	Brownish	>100	Very Dense	-	21	-	42.5
3	4.50	6.00	1.50	Highly Weathered Rock	Brownish	CRR-10%, RQD-0%					
4	6.00	7.50	1.50	Moderately Weathered Rock	Brownish	CRR-49%, RQD-13%					
5	7.50	9.00	1.50	Slightly Weathered Rock	Grey	CRR-60%, RQD-39%					
6	9.00	10.00	1.00	Fresh Hard Rock	Grey	CRR-76%, RQD-56%					

REFERENCE BORE HOLE-BH:				BH-21	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	2.00	2.00	Clayey Silty Sand	Brownish	3	Very Loose	-	13	-	20.1
2	2.00	3.00	1.00	Silty Sand	Brownish	37	Dense	-	19.5	-	37.9
3	3.00	5.00	2.00	Completely Weathered Rock	Brownish Grey	>100	Very Dense	-	21	-	42.5
4	5.00	6.50	1.50	Highly Weathered Rock	Brownish Grey	CRR-13%, RQD-0%					
5	6.50	8.00	1.50	Moderately Weathered Rock	Brownish Grey	CRR-49%, RQD-0%					
6	8.00	10.00	2.00	Slightly Weathered Rock	Brownish Grey	CRR-57% & 75, RQD-14% & 53					



REFERENCE BORE HOLE-BH:				BH-22	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	2.00	2.00	Clayey Silty Sand	Brownish	20	Medium Dense	-	18	-	33
2	2.00	4.00	2.00	Completely Weathered Rock	Brownish	>100	Very Dense	-	20	-	42.5
3	4.00	6.50	2.50	Highly Weathered Rock	Brownish	CRR-9% & 13%, RQD-0%					
4	6.50	9.00	2.50	Slightly Weathered Rock	Greyish	CRR-60% & 69, RQD-11% & 32%					
5	9.00	10.00	1.00	Fresh Hard Rock	Greyish	CRR-83%, RQD-67%					

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 one basement plus ground plus 9 upper floors, and is meant for residential building occupancy. For this kind of structure, the column loads could vary between 3000 kN to 4500 kN. The above-mentioned loads have no bearing on the design of either sub or super structures and are mentioned just to provide an insight to choose an appropriate foundation system with respect to subsoil conditions.

4.2 Foundation System

4.2.1 Villa (G+2 Upper Floors)

For the kind of proposed structure, shallow foundation system coupled with soil replacement type ground improvement technique can be adopted. The isolated column footings can be located at a depth of 1.70m over a well compacted sand-gravel (1:1) mix or quarry dust of 300mm thick laid in non-compacted layers of 150mm at optimum moisture content using a plate vibrator or hand rammer. The depth of foundation excavation shall be 2.00m. The schematic arrangement of the foundation is shown in Fig.4.1.

The footings shall be designed for a recommended allowable bearing pressure of 150kPa.

Typical computations are presented in annexure

4.2.2 Apartments Building (1B+G+9 Upper Floors)

In order to construct one basement floors an excavation of varying from 2.0m to 3.0m including 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 or R.C.C raft foundation can be adopted.

The foundation system can be isolated column footing or R.C.C raft and the allowable safe bearing pressure at different depth of footings below basement floor along with elastic settlement is worked out as per IS 6403 and are presented in Table 4.2.1 & 4.2.2.



Since the sub soil stratum below the founding level is sand/rock formation only immediate elastic settlement will takes place.

Typical bearing capacity computation is presented in the Annexure

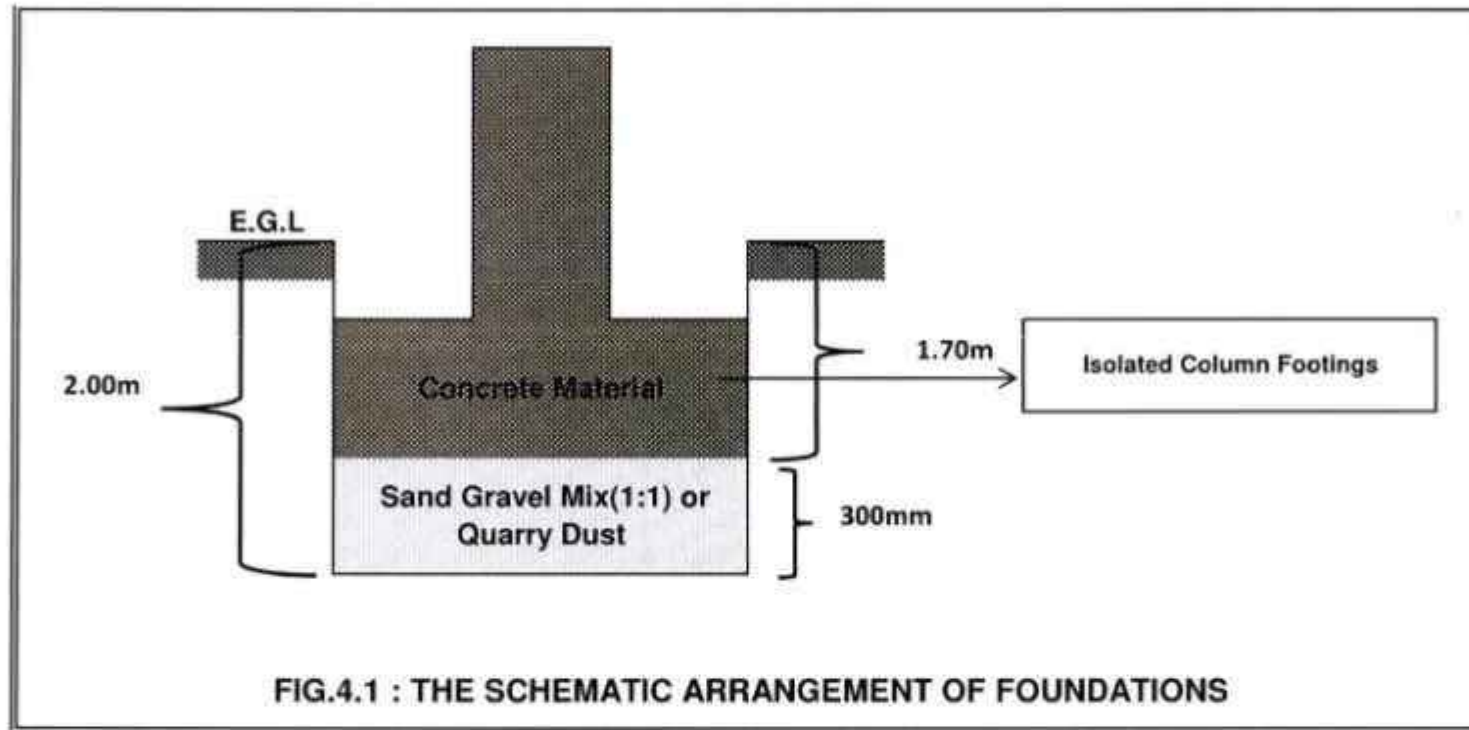




Table-4.2.1 Recommended Allowable Safe Bearing Pressures for Isolated footing

Sl. No.	Ref. Borehole No.	Depth of Foundation below NGL (m)	Thickness of Soil Replacment CNS Layer (m)	Over all Depth of Excavation/ Foundation below NGL (m)	Allowable Safe Bearing Pressure (kPa)	Elastic Settlement (mm)
					Minimum Size of Foundation (m)	Minimum Size of Foundation (m)
					1.5	1.5
1	BH-1(Ref.BH-28)	2.00	0.30	2.30	70	3.88
2	BH-1(Ref.BH-28)	2.60	0.30	2.90	150	4.15
3	BH-18(Ref.BH-17)	3.00	100mm thick P.C.C. of M10 Grade levelling coarse bed	3.10	250	4.62



Table-4.2.2 Recommended Allowable Safe Bearing Pressures for Raft

Sl. No.	Ref. Borehole No.	Depth of Foundation below NGL (m)	Thickness of Soil Replacment CNS Layer (m)	Over all Depth of Excavation/ Foundation below NGL (m)	Allowable Safe Bearing Pressure (kPa)	Elastic Settlement (mm)
					Size of Foundation (m)	Size of Foundation (m)
					10	10
1	BH-1(Ref.BH-28)	2.00	0.30	2.30	125	36.92
2	BH-1(Ref.BH-28)	2.60	100mm thick P.C.C. of M10 Grade levelling coarse bed	2.70	250	36.92
3	BH-18(Ref.BH-17)	3.00	100mm thick P.C.C. of M10 Grade levelling coarse bed	3.10	350	34.46

DEEP EXCAVATION DESIGN

**DEEP EXCAVATION DESIGN****5.1 Preamble:**

All deep excavations need shoring system that fulfils the functionality irrespective of the cycles of season that is experienced during its lift time. The primary functions of the shoring system are:

- ❖ To maintain the stability and safety of the excavation line.
- ❖ To prevent possible subsidence in the neighborhood either due to ground water lowering or due to release of overburden pressure
- ❖ To prevent soil flow or erosion from the excavation line.

To achieve the above, different shoring systems have been developed and are in practice based on the suitability of the system pertinent to the subsoil characteristics as described below:

- ❖ Anchored Sheet Piles
- ❖ Anchored R.C.C. diaphragm walls
- ❖ Contiguous Piles (Anchored or Free Standing/Cantilever)
- ❖ Secant Piles (Anchored or Free Standing/Cantilever)
- ❖ Soil Nailing
- ❖ Open slope with Geo-grids

However, in Rocks, many a time deep excavations may not need any protection, as they stand stably, but for in case of intruded boulders, where in rock bolting is needed to achieve the stability. Further, the tie back anchors shall be located in passive zone, which requires sufficient space behind the excavation line for the implementation of anchored systems mentioned above.

Thus, for the design of deep excavation in soils, an insight of the soil behavior under seasonal cycles, knowledge subsurface hydrogeology along with Topography details of the excavation region are pre-requisites for the successful design of deep excavations.

The above aspects of deep excavation pertinent to the present site conditions are discussed below:

5.2 Geology of Site & Hydro-geological nature of sub strata:

The stratigraphy of the present location consists of alluvial formation overlying the Archean rocky formation. The thickness of alluvium soil/overburden soil is 3.00m.

The sub soil stratification consists of the following soil layers:

0.0m to 3.0m	:	Loose, Medium Dense, Dense Clayey Silty Sand
3.00m to 6.00m	:	Dense to Very Dense Residual Soil/ Completely & Highly Weathered Rock
6.00m to 7.50m	:	Moderately to Slightly Weathered Rock
7.5m to 10.00m	:	Slightly Weathered Rock to Fresh Hard Rock



During the time of investigation (2nd Week January 2023 and 3rd week February 2023) the ground water table is observed varying depth from 1.00 to 1.50m the existing ground level.

5.3 Dewatering Technique:

Since the excavation extending into the weathered rock formation (completely Weathered Rock) that is 3.0m depth below the existing ground level, for effective lowering of ground water it is ideal to provide ground water lowering bore wells in a grid pattern with grid spacing not exceeding 15m centre to centre outside the excavation line for a minimum depth of 10.0m depth below the existing ground level shall be installed and operated.

Further the borehole can be connected to a common header and the pumped water shall be connected to the source away from the excavation preferably to a storm drainage network or any unobjectionable location by ensuring that the pumped water will not recharge the same aquifer.

Before carrying out the basement excavation ground water shall be lowered 1.0m below the foundation depth and pumping shall not be stopped until the dead weight of the structures resists the ground water pressure.

5.4 Excavation Design Philosophy

From 0.0m to 3.0m depth:

The excavation in the top 3.0m depth shall be carried out by using mechanical excavator.

The sub soil strata in the excavation zone being clayey silty sand/Sandy Clay/Silty Sand/Residual soil/Completely Weathered Rock formation of consistency Stiff to Very Stiff and medium dense to very dense, open excavation by providing mild slope as discussed below shall be adopted.

In the present case, though vertical cut is possible to make, it is recommended to adopt a minimum slope of 2 Vertical: 1 Horizontal for excavation.

However, considering the monsoon rains or unpredicted showers during the period of construction it is recommended to cover the surface of the slope with 1mm thick HDPE sheet suitably anchored at top and toe location with either sand bags or 100mm thick P.C.C of M10 grade for a minimum 1.0m width.

5.5 Design of Basement slab for Uplift

In the present case, the basement slab shall be designed for the uplift pressure corresponding to assumed ground water table at ground level. In order to optimize the basement slab design vertical anchors can be adopted. The fixed length of anchors can be provided in the moderately weathered rock layers which exists beyond 9.0m from the existing ground level.

RECOMMENDATIONS

RECOMMENDATIONS

6.1 Recommendation for shallow foundation:

Villa (G+2 Upper Floors)

- ❖ For the kind of sub soil conditions, the foundation system as described in Chapter-4, Section 4.2.1 can be adopted
- ❖ The depth of foundation excavation shall be 2.00m below the ground level and shall be back filled with either sand-gravel mix (1:1) or quarry dust of 300mm thickness laid in non-compacted layers of thickness not more than 150mm and compacted at optimum moisture content using a plate vibrator or hand rammer.
- ❖ The isolated column footings can be located at 1.70m over the prepared bed and shall be designed for an allowable bearing pressure of 150 kPa.
- ❖ The back filling of foundation trenches shall be carried out using either sand/gravel or quarry dust.
- ❖ All columns shall be connected with grade beams in both the directions irrespective of wall layout
- ❖ The ground floor shall be minimum 1.0m above the natural ground and the plinth shall be filled with sand/gravel/quarry dust. This height is recommended to contain the influence of soil volume change on the flooring. In case, floor is not raised, the ground floor shall be constructed as a suspended R.C.C. slab.

Apartments Building (1B+G+9 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 varying from 2.0m to 3.0m below the existing ground level.
- ❖ The Recommended allowable safe bearing pressures at different depth of footings are worked out as per IS: 6403 and are presented in Table-4.2.1 to 4.2.2.
- ❖ 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 back filling of foundation trenches shall be carried out using either sand/gravel or quarry dust.
- ❖ The strata beyond the founding depth is sand/rock formation the settlement will be of immediate elastic in nature.

6.2 Recommendations for Excavation

- ❖ As discussed in chapter-5, Section 5.4 it is recommended to adopt open excavation with a slope of 2 Vertical : 1 Horizontal



- ❖ Considering the possible monsoon rains during construction, it is recommended to cover the surface of the slope with 1mm thick HDPE sheet suitably anchored at top and toe with either sand bags or 100mm thick P.C.C. of M10 grade with minimum 1.0m width

6.3 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

BH-3(Ref:BH-27)

1.1 Geometrical Data :

Shape of the Foundation Square
 Depth of Foundation Below E.G.L."Df" (m) 1.70
 Soil Replacement Thickness of CNS Layer (m) 0.30
 Total Depth of Foundation (m) 2.00
 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
 Design SPT-value of the Bearing Strata 14.00
 Type of Shear Failure: General
 Angle of Shearing Resistance 31.20

phi

1.3 Design Parameters:

Bulk Density of Soil above the foundation depth (γ_{bulk}) 17.00 kN/m³
 Water Table Correction Factor (w') 0.50
 Effective Overburden pressure at foundation level (q) 11.90 kPa

Bearing Capacity Factors:

$N_c = N/A$
 $N_q = 21.98$
 $N_g = 28.55$

Shape Factors:

$S_c = -$
 $S_q = 1.20$
 $S_g = 0.80$

Depth Factors :

$D_c = -$
 $D_q = 1.04$
 $D_g = 1.04$

Inclination Factor:

$I_c = 1.00$
 $I_q = 1.00$
 $I_g = 1.00$

1.4 Ultimate Bearing Capacity (Qu) :

$Qu = q \cdot (N_q - 1) \cdot S_q \cdot D_q \cdot I_q + 0.5 \cdot B \cdot g \cdot N_g \cdot S_g \cdot D_g \cdot I_g \cdot w'$ 413.17 kPa
 (g should be read as gamma)

1.5 Safe Bearing Capacity (Qsafe) :

Factor of Safety (F.S.) : 2.50
 $Q_{safe} = 165.27$ kPa
Say Q_{safe} 150 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_e)= $qB(1-\mu^2)/E_s$

q= bearing pressure 150.00 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_s) 36400.00 kPa

Size of footing considered for maximum settlement(m) 1.00

Influence factor 1.00

Rigidity Factor 1.00

Elastic Settlement (DH_s) 3.75 mm
<50 mm



TYPICAL BEARING CAPACITY COMPUTATIONS FOR SHALLOW FOUNDATIONS

1.0 COMPUTATION OF BEARING CAPACITY AS PER IS:6403

Reference Borehole No. BH-1(Ref: BH-28)

1.1 Geometrical Data

Shape of the Foundation	Square
Depth of Basement floor Height Below R.L. (m)	1.60
Thickness of Soil Replacement CNS Layer (m)	0.30
Assumed Thickness of Foundation or Depth of Embedment (m)	1.00
Though the over all foundation excavation (m)	2.90
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 (α)	0.00

1.2 Soil Data

Type of Effective Bearing Strata :	Sand
Design SPT-value of the Bearing Strata :	20.00
Type of Shear Failure:	General
Angle of Shearing Resistance	33.00

1.3 Design Parameters

Bulk Density of Soil above the foundation depth (γ_{bulk})	18.50
Effective Overburden pressure at foundation level (q)	8.50
Water Table Correction Factor (w')	0.50
Bearing Capacity Factors:	
$N_c =$	N/A
$N_q =$	27.34
$N_{\phi} =$	37.78

Shape Factors:

$S_c =$	-
$S_q =$	1.20
$S_{\phi} =$	0.60

Depth Factors :

$D_c =$	-
$D_q =$	1.02
$D_{\phi} =$	1.02

Inclination Factor:

$i_c =$	1.00
$i_q =$	1.00
$i_{\phi} =$	1.00

1.4 Ultimate Bearing Capacity (Qu)

$$Q_u = q \cdot (N_q - 1) \cdot S_q \cdot D_q \cdot I_q + 0.5 \cdot B \cdot g \cdot N_g \cdot S_g \cdot D_g \cdot I_g \cdot w' \quad \mathbf{435.58 \text{ kPa}}$$

(g should be read as gamma)

1.5 Safe Bearing Capacity (Qsafe) :

Factor of Safety (FOS) :	2.50
Qsafe :	174.23 kPa
However limit Q _{safe}	150 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	Sand
Immediate Settlement (S_i)=	$qB(1-\mu^2)/E_s$
Bearing Capacity (q)	150.00
Poisson'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)	52000
Size of footing/Raft considered for maximum settlement(m)	1.50
Influence factor	1.00
Rigidity Factor	1.00
Elastic Settlement (DH_i)	4.15 mm
	<50 mm



TYPICAL BEARING CAPACITY COMPUTATIONS FOR SHALLOW FOUNDATIONS

1.0 COMPUTATION OF BEARING CAPACITY AS PER IS:6403

Reference Borehole No. BH-18(Ref:BH-17)

1.1 Geometrical Data

Shape of the Foundation	Raft
Depth of Basement floor Height Below R.L (m)	2.00
Thickness of Soil Replacement CNS Layer (m)	0.00
100mm thick P.C.C. of M10 Grade	0.10
Assumed Thickness of Foundation or Depth of Embedment (m)	1.00
Though the over all foundation excavation	3.10
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 :	Sand
Design SPT-value of the Bearing Strata :	30.00
Type of Shear Failure:	General
Angle of Shearing Resistance	36.00

1.3 Design Parameters

Bulk Density of Soil above the foundation depth (γ_{sub})	18.50
Effective Overburden pressure at foundation level (q)	8.50
Water Table Correction Factor (w)	0.50
Bearing Capacity Factors:	
$N_c =$	N/A
$N_q =$	39.48
$N_\gamma =$	60.31
Shape Factors:	
$S_c =$	-
$S_q =$	1.20
$S_\gamma =$	0.60
Depth Factors :	
$D_c =$	-
$D_q =$	1.00
$D_\gamma =$	1.00
Inclination Factor:	
$I_c =$	1.00
$I_q =$	1.00
$I_\gamma =$	1.00

1.4 Ultimate Bearing Capacity (Q_u)

$$Q_u = q \cdot (N_q - 1) \cdot S_q \cdot D_q \cdot I_q + 0.5 \cdot B \cdot \gamma \cdot N_\gamma \cdot S_\gamma \cdot D_\gamma \cdot I_\gamma \cdot w$$

(g should be read as gama) **2072.53 kPa**

1.5 Safe Bearing Capacity (Q_{safe}) :

Factor of Safety (FOS) :	2.50
$Q_{safe} :$	829.01 kPa
However limit Q_{safe}	350 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	Sand
Immediate Settlement (S_i)=	$qB(1-\mu^2)/E_s$
Bearing Capacity (q)	350.00
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)	78000
Size of footing/Raft considered for maximum settlement(m)	10.00
Influence factor	1.00
Rigidity Factor	0.80
Elastic Settlement (DH_1)	34.46 mm
	<50 mm

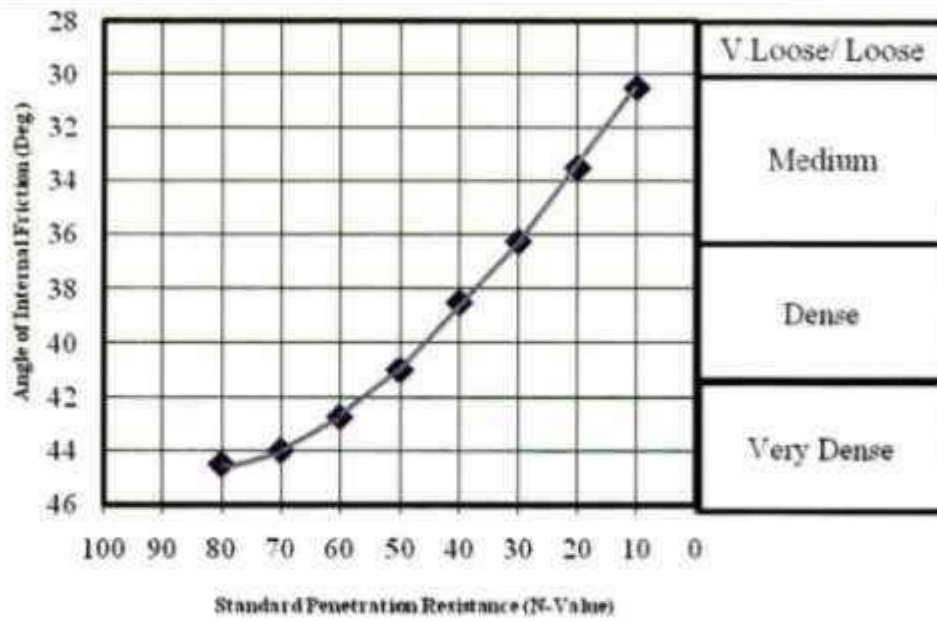


FIG. A1 Relation Ship between Angle of Internal Friction & N-value (Reproduced from IS:6403-1981)

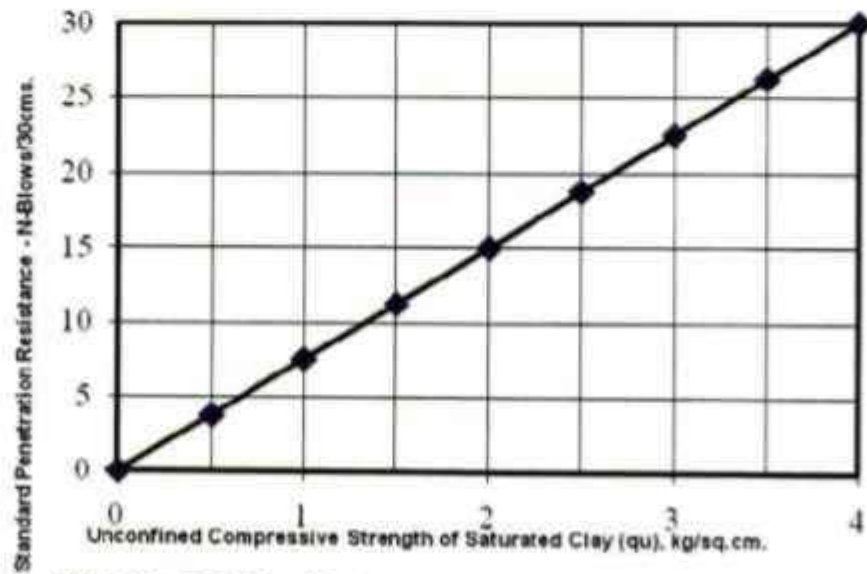
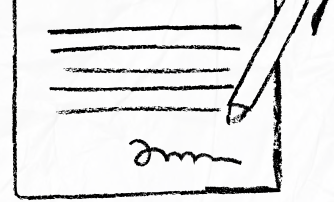


FIG. A2 : Relationship between UCC & SPT-Value (N) of Saturated Clay (After Terzhagi & Peck, 1948)



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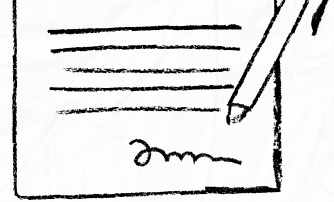
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