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GEO ENGINEERING CONSULTANTS

(An ISO 9001:2015 Certified Company)

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PROJECT NAME

PROPOSED CONSTRUCTION OF LML LEAGUE ONE APARTMENT SITUATED AT NEW DOOR NO 4/121,GOPARASANALLUR MAIN ROAD KATTUPAKKAM CHENNAI 600056 COMPRISED IN SURVEY NO 84/1A,85/1,91/4B,92/3,91/3,92/2,83/1 &84/2 SITUATED AT GOPARASANALLUR VILLAGE,POONAMALLEE TALUK,THIRUVALLUR DISTRICT,MEASURING AN EXTENT OF 122.25 CENTS.

CLIENT NAME

LML HOMES LLP,
OLD NO. 58, NEW NO. 119, AUDIAPPAN NAICKEN STREET,
SOWCARPET, CHENNAI-600 001.

TITLE

GEOTECHNICAL INVESTIGATION REPORT

PROJECT NO: GEC-JC-GT-4072/2022-2023

REPORTING DATE: 20/10/2022

GEO ENGINEERING CONSULTANTS Chennai 600 042

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REPORT TEXT

CHAPTER-1

INTRODUCTION

1.0 Project Information Matrix

Nature of project : Proposed Residential building (Stilt+5upper floors)

Project Owner : **M/s LML Homes LLP,**

Project Location : Poonamallee, Chennai

Job Code : GEC-JC-GT-4072

1.1 Scope Of Work

1.1.1 Field Work

- Conducting six soil investigation bore holes of 150 mm diameter up to 30.0m 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 up to 20m after that every 2.0m interval up to the termination depth
- Collection of soil samples and undisturbed samples from the clayey strata with SPT-value greater than 2 to less than 15 if met within the investigation depth
- Collection of water samples if groundwater table met within the investigation depth

1.1.2 Laboratory Work

- Natural Moisture Content
- Atterberg's limits
- Grain Size Analysis
- Chemical Analysis test on soil and water samples to give pH, Chlorides and Sulphates

1.2 Structure of the Report

- Contents
- Introduction
- Investigation Methodology & Test Results
- Sub-Surface Stratification
- Foundation System
- Recommendation
- Annexure

CHAPTER-2

INVESTIGATION METHODOLOGY & TEST RESULTS

2.0 Preamble:

Six 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 2.6. The graphical representation of grain size distribution curve for the representative samples in each bore is presented in Fig. 2.7 to 2.12.

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 2.6. The graphical representation of hydrometer analyses curve for the representative samples in each bore is presented in Fig. 2.13 to 2.18

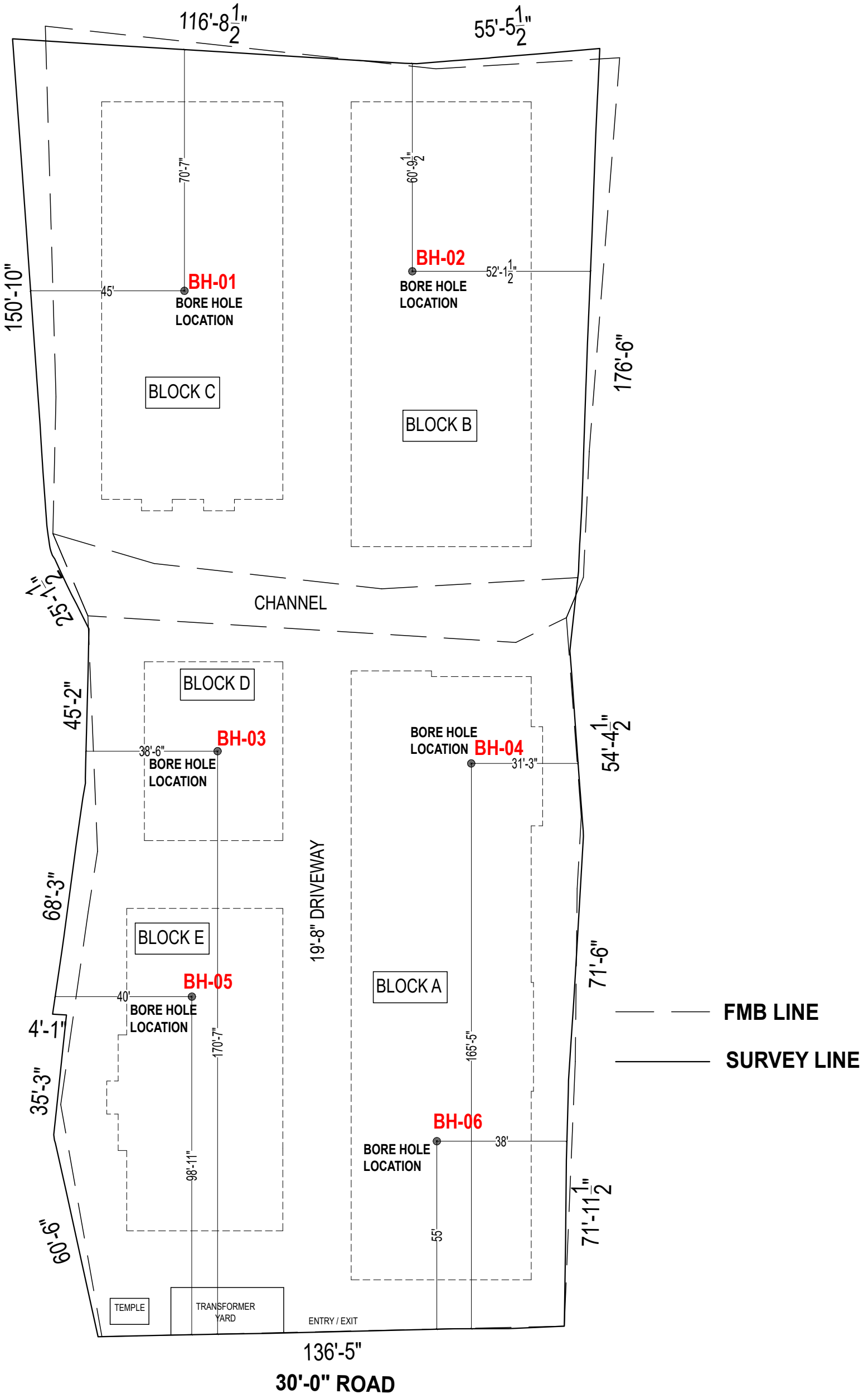
2.2.3 Chemical Analysis Tests

On representative soil and water samples chemical analysis tests were conducted to estimate pH, Chloride and Sulphates and these results are presented in Table - 2.7.

2.3 Summary:

The locations of the field investigation boreholes are shown in site plan given in Fig.2.0. The average sub soil profiles encountered at each location along with their classification and engineering properties are presented in Figs.2.1 to 2.6.

SITE PLAN



PROPOSED HIGH RISE APARTMENT COMPLEX

(STILT+FIVE FLOORS)

AT POONAMALLEE

DATE :09.09.2022

NORTH
W
E
S

CLIENT:

MAHESH KOTHARI

PROJECT ARCHITECT:

SHARMILA SANJAY (PARTNER)

ARCHITECT:

CHERALATHAN ASSOCIATES

N0. 13 ,Shanti Enclave
25 Venkatakrishna Road
R.A.Puram
Chennai - 600 028 PH: 2495 7991

SOIL PROFILE

SITE INVESTIGATION RECORD

BORE HOLE No.	BH-01		
SHEET	1	OF	3
PROJECT NAME	PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING	DIA OF BORE HOLE	150mm ✓ / 100mm
LOCATION	Poonamallee, Chennai	MACHINE No.	CR-01
CHAINAGE (m)	-	BORE START DATE	29/09/2022
STRUCTURE	Stilt + 5 Upper Floors	DRILLING METHOD	Rotary
CO-ORDINATES	N -	BORE END DATE	30/09/2022
JOB CODE	GEC-JC-GT-4072	FLUSHING MEDIUM	Bentonite
CO-ORDINATES	E -	TOTAL DRILL DAYS	2

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min.	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	15-30	30-45	SPT 'N' Value	Sample Details: Depth	No.	Type	RL (m)	Legend	Layer Data: No	Depth	Geotechnical Description
		08	37													L1	0.3	**Filled Up Soil** (Concrete with waste material)
		To																
		08	38															
1				SC	-	-	3	4	5	**9**	1.00	1	SS	-1.0				
		08	48								1.45							
		To																
		08	50															Brown,Moist,Poorly graded,Loose,**Silty Sand(SM)** Sand-Silt Mixtures.
2				SC	-	-	3	4	4	**8**	2.00	2	SS	-2.0				
		09	09								2.45							
		To																
		09	10															
3				SC	-	-	4	5	7	**12**	3.00	3	SS	-3.0		L2	3.0	
		09	18								3.45							
		To																
		09	20															
4				SC	-	-	4	5	9	**14**	4.00	4	SS	-4.0				
		09	32								4.45							
		To																Brown,Moist,Poorly graded,Medium Dense,**Silty Sand(SM)** Sand-Silt Mixtures.
		09	35															
5	**29/09/2022**			SC	-	-	7	7	8	**15**	5.00	5	SS	-5.0				
		09	45								5.45							
		To																
		09	48													L3	6.0	
6																		
				SC	-	-	2	3	3	**6**	6.50	6	SS	-6.5				
											6.95							
7		10	00															
		To																
		10	05															
8				SC	-	-	3	4	4	**8**	8.00	7	SS	-8.0				Black, Moist, Medium Stiff to Stiff **Silty CLAY(Cl)** Silty Clays of Medium plasticity
											8.45							
		10	40															
9		To																
		10	45															
				SC	-	-	7	4	2	**6**	9.50	8	SS	-9.5				
10											9.95							

CS - Core Sample	DS - Disturbed Sample	LOGGED	M.Raja	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	29/09/2022	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	J.Yasin	WATER TABLE (m) 1.70	
WS - Wash Sample	DB - Diamond Bit	DATE	18/10/2022	CASING DEPTH (m) 0.00	

SITE INVESTIGATION RECORD

BORE HOLE No.	BH-01		
SHEET	2	OF	3
PROJECT NAME	PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING	DIA OF BORE HOLE	150mm ✓ / 100mm
LOCATION	Poonamallee, Chennai	MACHINE No.	CR-01
CHAINAGE (m)	-	BORE START DATE	29/09/2022
STRUCTURE	Stilt + 5 Upper Floors	DRILLING METHOD	Rotary
CO-ORDINATES	N -	BORE END DATE	30/09/2022
JOB CODE	GEC-JC-GT-4072	FLUSHING MEDIUM	Bentonite
CO-ORDINATES	E -	TOTAL DRILL DAYS	2

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min.	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	15-30	30-45	SPT 'N' Value	Sample Details: Depth	No.	Type	RL (m)	Legend	Layer Data: No	Depth	Geotechnical Description
11	29/09/2022	11	40	SC	-	-	2	2	4	6	11.00	9	SS	-11.0				Black,Moist, Medium Stiff, **Silty CLAY(CH)** Silty Clays of High plasticity
		To									11.45							
		11	20															
		11	50															
		To																
12		11	55															
				SC	-	-	2	7	8	15	12.50	10	SS	-12.5		L4	12.5	
											12.95							Black,Moist,Stiff, **Silty CLAY(CI)** Silty Clays of Medium plasticity
13		12	20															
		To																
		12	25															
14				SC	-	-	4	7	9	16	14.00	11	SS	-14.0		L5	14.5	
											14.45							Black,Moist,Poorly graded,Medium Dense,**Silty Sand(SM)** Sand-Silt Mixtures.
		12	53															
		To																
15		12	58															
				SC	-	-	2	3	4	7	15.50	12	SS	-15.5		L6	15.5	
											15.95							
16		13	30															
		To																
		13	45															
17				SC	-	-	2	4	4	8	17.00	13	SS	-17.0				
											17.45							Black,Moist, Stiff,**Silty CLAY(CI/CH)** Silty Clays of medium/high plasticity
		14	10															
		To																
18		14	25															
				SC	-	-	1	3	4	7	18.50	14	SS	-18.5				
											18.95							
19		15	10															
		To																
		15	25													L7	19.5	
20				SC	-	-	7	10	12	22	20.00	15	SS	-20.0				Black, Moist, Medium Dense, **Clayey Silty SAND(SC)** Sand-Clay mixtures
											20.45							

CS - Core Sample	DS - Disturbed Sample	LOGGED	M.Raja	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	29/09/2022	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	J.Yasin	WATER TABLE (m) 1.70	
WS - Wash Sample	DB - Diamond Bit	DATE	18/10/2022	CASING DEPTH (m) 0.00	

SITE INVESTIGATION RECORD

BORE HOLE No.	BH-01		
SHEET	3	OF	3
PROJECT NAME	PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING	DIA OF BORE HOLE	150mm ✓ / 100mm
LOCATION	Poonamallee, Chennai	MACHINE No.	CR-01
CHAINAGE (m)	-	BORE START DATE	29/09/2022
STRUCTURE	Stilt + 5 Upper Floors	DRILLING METHOD	Rotary
CO-ORDINATES	N -	BORE END DATE	30/09/2022
JOB CODE	GEC-JC-GT-4072	FLUSHING MEDIUM	Bentonite
CO-ORDINATES	E -	TOTAL DRILL DAYS	2

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min.	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	15-30	30-45	SPT 'N' Value	Sample Details: Depth	No.	Type	RL (m)	Layer Data: Legend	No	Depth	Geotechnical Description
21		16	15 To 16 20															
22				SC	-	-	6	7	8	**15**	22.00 / 22.45	16	SS	-22.0				Black, Moist, Medium Dense, **Clayey Silty SAND(SC)** Sand-Clay mixtures
23	**29/09/2022**	16	50 To 17 01															
24				SC	-	-	17	21	18	**39**	24.00 / 24.45	17	SS	-24.0		L8	24.0	
25		17	30 To 17 44															Brown,Moist,Poorly graded,Dense,**Silty Sand(SM)** Sand-Silt Mixtures.
26				SC	-	-	6	12	13	**25**	26.00 / 26.45	18	SS	-26.0		L9	26.0	
27		09	30 To 09 40															Brownish,Moist,Very Stiff, **Silty CLAY(CH)** Silty Clays of High plasticity
28	**30/09/2022**			SC	-	-	17	27	42	**69**	28.00 / 28.45	19	SS	-28.0		L10	28.0	
29		10	50 To 11 05															Brownish,Moist,Very Hard, **Compacted CLAY(CH)** Silty Clays of High plasticity
30				SC	-	-	23	13 cm penet. for 50 blows		**>100**	30.00 / 30.28	20	SS	-30.0		L11	30.0	

CS - Core Sample	DS - Disturbed Sample	LOGGED	M.Raja	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	30/09/2022	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	J.Yasin	WATER TABLE (m) 1.70	
WS - Wash Sample	DB - Diamond Bit	DATE	18/10/2022	CASING DEPTH (m) 0.00	

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

FIG.2.1 Sub Soil Profile at BH-01 Location

SITE INVESTIGATION RECORD

BORE HOLE No.	BH-02		
SHEET	1	OF	3
PROJECT NAME	PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING	DIA OF BORE HOLE	150mm ✓ / 100mm
LOCATION	Poonamallee, Chennai	MACHINE No.	CR-01
CHAINAGE (m)	-	BORE START DATE	30/09/2022
STRUCTURE	Stilt + 5 Upper Floors	DRILLING METHOD	Rotary
CO-ORDINATES	N -	BORE END DATE	01/10/2022
JOB CODE	GEC-JC-GT-4072	FLUSHING MEDIUM	Bentonite
CO-ORDINATES	E -	TOTAL DRILL DAYS	2

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min.	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	15-30	30-45	SPT 'N' Value	Sample Details: Depth	No.	Type	RL (m)	Legend	Layer Data: No	Depth	Geotechnical Description
		13	47													L1	0.3	**Filled Up Soil** (Concrete with waste material)
		To																
		13	55															
1				SC	-	-	4	5	5	**10**	1.00	1	SS	-1.0				
		14	08								1.45							
		To																Brown,Moist,Poorly graded,Loose,**Silty Sand(SM)** Sand-Silt Mixtures.
		14	10															
2				SC	-	-	3	4	3	**7**	2.00	2	SS	-2.0				
		14	20								2.45							
		To																
		14	21															
3				SC	-	-	5	5	7	**12**	3.00	3	SS	-3.0		L2	3.0	
		14	30								3.45							
		To																
		14	32															
4				SC	-	-	5	7	8	**15**	4.00	4	SS	-4.0				Brown,Moist,Poorly graded,Medium Dense,**Silty Sand(SM)** Sand-Silt Mixtures.
		14	45								4.45							
		To																
		14	48															
5	**30/09/2022**			SC	-	-	2	3	4	**7**	5.00	5	SS	-5.0		L3	5.0	
		15	03								5.45							
		To																
6		15	08															Black, Moist, Loose, **Clayey Silty SAND(SC)** Sand-Clay mixtures
				SC	-	-	4	5	4	**9**	6.50	6	SS	-6.5				
7		15	24								6.95							
		To														L4	7.5	
		15	32															
8				SC	-	-	2	2	4	**6**	8.00	7	SS	-8.0				
		15	50								8.45							
		To																Black, Moist, Medium Stiff, **Silty CLAY(Cl)** Silty Clays of Medium plasticity
9		16	00															
				SC	-	-	2	2	3	**5**	9.50	8	SS	-9.5				
10											9.95							

CS - Core Sample	DS - Disturbed Sample	LOGGED	M.Raja	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	30/09/2022	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	J.Yasin	WATER TABLE (m) 1.70	
WS - Wash Sample	DB - Diamond Bit	DATE	18/10/2022	CASING DEPTH (m) 0.00	

SITE INVESTIGATION RECORD

BORE HOLE No.	BH-02		
SHEET	2	OF	3
PROJECT NAME	PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING	DIA OF BORE HOLE	150mm ✓ / 100mm
LOCATION	Poonamallee, Chennai	MACHINE No.	CR-01
CHAINAGE (m)	-	BORE START DATE	30/09/2022
STRUCTURE	Stilt + 5 Upper Floors	DRILLING METHOD	Rotary
CO-ORDINATES	N -	BORE END DATE	01/10/2022
JOB CODE	GEC-JC-GT-4072	FLUSHING MEDIUM	Bentonite
CO-ORDINATES	E -	TOTAL DRILL DAYS	2

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min.	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	15-30	30-45	SPT 'N' Value	Sample Details: Depth	No.	Type	RL (m)	Layer Data: Legend	No	Depth	Geotechnical Description
11	30/09/2022	16	15	SC	-	-	2	4	3	7	11.00	9	SS	-11.0				Black,Moist, Medium Stiff, **Silty CLAY(CH)** Silty Clays of High plasticity
		To									11.45							
		16	25															
		16	38															
		To																
12		16	49															
				SC	-	-	5	17	18	35	12.50	10	SS	-12.5		L5	12.5	
											12.95							
13		17	02															Black,Moist,Hard, **Silty CLAY(CI)** Silty Clays of Medium plasticity
		To																
		17	11															
14				SC	-	-	6	15	17	32	14.00	11	SS	-14.0		L6	14.0	
											14.45							
		17	28															
		To																
15		17	38															Black,Moist,Poorly graded,Medium Dense to Dense,**Silty Sand(SM)** Sand-Silt Mixtures.
				SC	-	-	6	9	12	21	15.50	12	SS	-15.5				
											15.95							
16		17	56															
		To																
		18	04															
17				SC	-	-	5	8	8	16	17.00	13	SS	-17.0		L7	17.0	
											17.45							
		18	20															
		To																
18		18	28															Black,Moist, Stiff,**Silty CLAY(CI/CH)** Silty Clays of medium/high plasticity
				SC	-	-	3	5	8	13	18.50	14	SS	-18.5				
											18.95							
19		18	51															
		To														L8	19.5	
		18	59															
20				SC	-	-	6	13	10	23	20.00	15	SS	-20.0				Black, Moist, Medium Dense, **Clayey Silty SAND(SC)** Sand-Clay mixtures
											20.45							

CS - Core Sample	DS - Disturbed Sample	LOGGED	M.Raja	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	30/09/2022	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	J.Yasin	WATER TABLE (m) 1.70	
WS - Wash Sample	DB - Diamond Bit	DATE	18/10/2022	CASING DEPTH (m) 0.00	

SITE INVESTIGATION RECORD

BORE HOLE No.	BH-02		
SHEET	3	OF	3
PROJECT NAME	PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING	DIA OF BORE HOLE	150mm ✓ / 100mm
LOCATION	Poonamallee, Chennai	MACHINE No.	CR-01
CHAINAGE (m)	-	BORE START DATE	30/09/2022
STRUCTURE	Stilt + 5 Upper Floors	DRILLING METHOD	Rotary
CO-ORDINATES	N -	BORE END DATE	01/10/2022
JOB CODE	GEC-JC-GT-4072	FLUSHING MEDIUM	Bentonite
CO-ORDINATES	E -	TOTAL DRILL DAYS	2

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min.	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	15-30	30-45	SPT 'N' Value	Sample Details: Depth	No.	Type	RL (m)	Legend	Layer Data: No	Depth	Geotechnical Description
21	01/10/2022	06	10 To 06 19															
22				SC	-	-	7	6	8	**14**	22.00 / 22.45	16	SS	-22.0				Black, Moist, Medium Dense, **Clayey Silty SAND(SC)** Sand-Clay mixtures
23		06	39 To 06 48															
24				SC	-	-	15	20	21	**41**	24.00 / 24.45	17	SS	-24.0		L9	24.0	
25		07	28 To 07 39															Brown,Moist,Poorly graded, Dense,**Silty Sand(SM)** Sand-Silt Mixtures.
26				SC	-	-	11	17	24	**41**	26.00 / 26.45	18	SS	-26.0		L10	26.0	
27		08	10 To 08 15															Brownish,Moist,Hard, **Silty CLAY(CH)** Silty Clays of High plasticity
28				SC	-	-	15	22	42	**64**	28.00 / 28.45	19	SS	-28.0		L11	28.0	
29		08	50 To 09 12															Brownish,Moist,Very Hard, **Compacted CLAY(CH)** Silty Clays of High plasticity
30				SC	-	-	25	10 cm penet. for 50 blows		**>100**	30.00 / 30.28	20	SS	-30.0		L12	30.0	

CS - Core Sample	DS - Disturbed Sample	LOGGED	M.Raja	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	01/10/2022	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	J.Yasin	WATER TABLE (m) 1.70	
WS - Wash Sample	DB - Diamond Bit	DATE	18/10/2022	CASING DEPTH (m) 0.00	

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

FIG.2.2 Sub Soil Profile at BH-02 Location

SITE INVESTIGATION RECORD

BORE HOLE No.	BH-03		
SHEET	1	OF	3
PROJECT NAME	PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING	DIA OF BORE HOLE	150mm ✓ / 100mm
LOCATION	Poonamallee, Chennai	MACHINE No.	CR-01
CHAINAGE (m)	-	BORE START DATE	01/10/2022
STRUCTURE	Stilt + 5 Upper Floors	DRILLING METHOD	Rotary
CO-ORDINATES	N -	BORE END DATE	02/10/2022
JOB CODE	GEC-JC-GT-4072	FLUSHING MEDIUM	Bentonite
CO-ORDINATES	E -	TOTAL DRILL DAYS	2

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min.	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	15-30	30-45	SPT 'N' Value	Sample Details: Depth	No.	Type	RL (m)	Layer Data: Legend	No	Depth	Geotechnical Description
		14	10													L1	0.3	**Filled Up Soil** (Concrete with waste material)
		To																
		14	14															
1				SC	-	-	4	4	5	**9**	1.00	1	SS	-1.0				Brownish,Moist,Stiff,**Silty CLAY(Cl)** Silty Clays of medium plasticity
		14	20								1.45							
		To																
		14	24													L2	2.0	
2				SC	-	-	2	4	6	**10**	2.00	2	SS	-2.0				
		14	30								2.45							
		To																
		14	33															
3				SC	-	-	7	8	6	**14**	3.00	3	SS	-3.0				
		14	41								3.45							Brown,Moist,Poorly graded,Loose to Medium Dense,**Silty Sand(SM)** Sand-Silt Mixtures.
		To																
		14	43															
4				SC	-	-	5	7	8	**15**	4.00	4	SS	-4.0				
		14	55								4.45							
		To																
		14	59													L3	5.0	
5	01/10/2022			SC	-	-	2	1	2	**3**	5.00	5	SS	-5.0				
		15	10								5.45							
		To																
6		15	13															
				SC	-	-	2	3	2	**5**	6.50	6	SS	-6.5				Black, Moist, Soft to Medium Stiff **Silty CLAY(Cl)** Silty Clays of Medium plasticity
7		15	23								6.95							
		To																
		15	27													L4	8.0	
8				SC	-	-	2	3	6	**9**	8.00	7	SS	-8.0				
											8.45							
		15	37															Black, Moist, Loose, **Clayey Silty SAND(SC)** Sand-Clay mixtures
9		To																
		15	39													L5	9.5	
				SC	-	-	9	15	5	**20**	9.50	8	SS	-9.5				
10											9.95							Black, Moist, Medium Dense, **Clayey Silty SAND(SC)** Sand-Clay mixtures
																L6	10.0	

CS - Core Sample	DS - Disturbed Sample	LOGGED	M.Raja	PROJECT SITE DETAILS		REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	01/10/2022	GROUND LEVEL (m)	0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	J.Yasin	WATER TABLE (m)	2.40	
WS - Wash Sample	DB - Diamond Bit	DATE	18/10/2022	CASING DEPTH (m)	0.00	

SITE INVESTIGATION RECORD

BORE HOLE No.	BH-03		
SHEET	2	OF	3
PROJECT NAME	PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING	DIA OF BORE HOLE	150mm ✓ / 100mm
LOCATION	Poonamallee, Chennai	MACHINE No.	CR-01
CHAINAGE (m)	-	BORE START DATE	01/10/2022
STRUCTURE	Stilt + 5 Upper Floors	DRILLING METHOD	Rotary
CO-ORDINATES	N -	BORE END DATE	02/10/2022
JOB CODE	GEC-JC-GT-4072	FLUSHING MEDIUM	Bentonite
CO-ORDINATES	E -	TOTAL DRILL DAYS	2

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min.	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	15-30	30-45	SPT 'N' Value	Sample Details: Depth	No.	Type	RL (m)	Layer Data: Legend	No	Depth	Geotechnical Description
11	01/10/2022	15	50 To 15 55	SC	-	-	5	7	5	12	11.00 – 11.45	9	SS	-11.0				Brownish,Moist, Stiff,**Silty CLAY(CH)** Silty Clays of High plasticity
12	01/10/2022	16	15 To 16 20	SC	-	-	2	2	4	6	12.50 – 12.95	10	SS	-12.5		L7	12.5	
13	01/10/2022	16	40 To 16 44															
14	01/10/2022	17	02 To 17 06	SC	-	-	2	3	3	6	14.00 – 14.45	11	SS	-14.0				Black,Moist,Medium Stiff, **Silty CLAY(CI)** Silty Clays of Medium plasticity
15	01/10/2022			SC	-	-	7	11	8	19	15.50 – 15.95	12	SS	-15.5		L8	15.5	
16	02/10/2022	07	45 To 07 55															Black,Moist,Poorly graded,Medium Dense,**Silty Sand(SM)** Sand-Silt Mixtures.
17	02/10/2022			SC	-	-	2	2	4	6	17.00 – 17.45	13	SS	-17.0		L9	17.0	
18	02/10/2022	08	20 To 08 30															
19	02/10/2022	08	50 To 08 59	SC	-	-	3	2	3	5	18.50 – 18.95	14	SS	-18.5				Black,Moist, Medium Stiff to Stiff,**Silty CLAY(CI/CH)** Silty Clays of medium/high plasticity
20	02/10/2022			SC	-	-	2	4	4	8	20.00 – 20.45	15	SS	-20.0		L10	20.0	

CS - Core Sample	DS - Disturbed Sample	LOGGED	M.Raja	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	02/10/2022	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	J.Yasin	WATER TABLE (m) 2.40	
WS - Wash Sample	DB - Diamond Bit	DATE	18/10/2022	CASING DEPTH (m) 0.00	

SITE INVESTIGATION RECORD

BORE HOLE No.	BH-03		
SHEET	3	OF	3
PROJECT NAME	PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING	DIA OF BORE HOLE	150mm ✓ / 100mm
LOCATION	Poonamallee, Chennai	MACHINE No.	CR-01
CHAINAGE (m)	-	BORE START DATE	01/10/2022
STRUCTURE	Stilt + 5 Upper Floors	DRILLING METHOD	Rotary
CO-ORDINATES	N -	BORE END DATE	02/10/2022
JOB CODE	GEC-JC-GT-4072	FLUSHING MEDIUM	Bentonite
CO-ORDINATES	E -	TOTAL DRILL DAYS	2

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min.	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	15-30	30-45	SPT 'N' Value	Sample Details: Depth	No.	Type	RL (m)	Layer Data: Legend	No	Depth	Geotechnical Description
21	02/10/2022	09	30															
		To																
		09	38															
22				SC	-	-	7	9	13	22	22.00	16	SS	-22.0				Black, Moist, Medium Dense, **Clayey Silty SAND(SC)** Sand-Clay mixtures
											22.45							
		10	10															
23		To																
		10	12															
24				SC	-	-	9	11	15	26	24.00	17	SS	-24.0		L11	24.0	
											24.45							
		10	33															
25		To																
		10	42															
26				SC	-	-	10	18	22	40	26.00	18	SS	-26.0				Brownish,Moist,Very Stiff to Hard, Sandy **Silty CLAY(CI)** Silty Clays of Medium plasticity
											26.45							
		11	12															
27		To																
		11	23															
28				SC	-	-	14	25	35	60	28.00	19	SS	-28.0		L12	28.0	
											28.45							
		11	55															
29		To																
		12	15															
30				SC	-	-	23	13 cm penet. for 50 blows		>100	30.00	20	SS	-30.0		L13	30.0	Brownish,Moist,Very Hard, **Compacted CLAY(CH)** Silty Clays of High plasticity
											30.28							

CS - Core Sample	DS - Disturbed Sample	LOGGED	M.Raja	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	02/10/2022	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	J.Yasin	WATER TABLE (m) 2.40	
WS - Wash Sample	DB - Diamond Bit	DATE	18/10/2022	CASING DEPTH (m) 0.00	

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

FIG.2.3 Sub Soil Profile at BH-03 Location

SITE INVESTIGATION RECORD

BORE HOLE No.	BH-04		
SHEET	1	OF	3
PROJECT NAME	PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING	DIA OF BORE HOLE	150mm ✓ / 100mm
LOCATION	Poonamallee, Chennai	MACHINE No.	CR-01
CHAINAGE (m)	-	BORE START DATE	02/10/2022
STRUCTURE	Stilt + 5 Upper Floors	DRILLING METHOD	Rotary
CO-ORDINATES	N -	BORE END DATE	03/10/2022
JOB CODE	GEC-JC-GT-4072	FLUSHING MEDIUM	Bentonite
CO-ORDINATES	E -	TOTAL DRILL DAYS	2

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min.	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	SPT Details: Blows/cm. 15-30	SPT Details: Blows/cm. 30-45	SPT 'N' Value	Sample Details: Depth	Sample Details: No.	Sample Details: Type	Sample Details: RL (m)	Layer Data: Legend	Layer Data: No	Layer Data: Depth	Geotechnical Description
		13	30													L1	0.3	**Filled Up Soil** (Concrete with waste material)
		To																
		13	35															
1				SC	-	-	4	5	7	**12**	1.00 / 1.45	1	SS	-1.0				
		13	43															
		To																
		13	47															
2				SC	-	-	3	5	6	**11**	2.00 / 2.45	2	SS	-2.0				
		13	56															
		To																
		13	59															Brown,Moist,Poorly graded,Medium Dense,**Silty Sand(SM)** Sand-Silt Mixtures.
3				SC	-	-	4	5	7	**12**	3.00 / 3.45	3	SS	-3.0				
		14	10															
		To																
		14	12															
4				SC	-	-	3	6	7	**13**	4.00 / 4.45	4	SS	-4.0				
		14	21															
		To																
		14	22															
5	02/10/2022			SC	-	-	4	5	2	**7**	5.00 / 5.45	5	SS	-5.0		L2	5.0	
		14	32															
		To																
6		14	35															
				SC	-	-	2	3	2	**5**	6.50 / 6.95	6	SS	-6.5				
7		14	45															
		To																
		14	48															
8				SC	-	-	3	4	3	**7**	8.00 / 8.45	7	SS	-8.0				Black, Moist,Medium Stiff to Stiff **Silty CLAY(CI)** Silty Clays of Medium plasticity
		14	58															
		To																
9		15	04															
				SC	-	-	4	5	5	**10**	9.50 / 9.95	8	SS	-9.5				
10																L3	10.0	

CS - Core Sample	DS - Disturbed Sample	LOGGED	M.Raja	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	02/10/2022	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	J.Yasin	WATER TABLE (m) 2.40	
WS - Wash Sample	DB - Diamond Bit	DATE	18/10/2022	CASING DEPTH (m) 0.00	

SITE INVESTIGATION RECORD

BORE HOLE No.	BH-04		
SHEET	2	OF	3
PROJECT NAME	PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING	DIA OF BORE HOLE	150mm ✓ / 100mm
LOCATION	Poonamallee, Chennai	MACHINE No.	CR-01
CHAINAGE (m)	-	BORE START DATE	02/10/2022
STRUCTURE	Stilt + 5 Upper Floors	DRILLING METHOD	Rotary
CO-ORDINATES	N -	BORE END DATE	03/10/2022
JOB CODE	GEC-JC-GT-4072	FLUSHING MEDIUM	Bentonite
CO-ORDINATES	E -	TOTAL DRILL DAYS	2

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min.	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	15-30	30-45	SPT 'N' Value	Sample Details: Depth	No.	Type	RL (m)	Legend	Layer Data: No	Depth	Geotechnical Description
11	02/10/2022	15	14	SC	-	-	6	4	6	10	11.00	9	SS	-11.0				
		To									11.45							
		15	18															
12		15	33															
		To																Black,Moist,Poorly graded,Loose,**Silty Sand(SM)** Sand-Silt Mixtures.
		15	39															
13				SC	-	-	3	5	4	9	12.50	10	SS	-12.5				
		15	52								12.95							
		To																
		15	55															
14				SC	-	-	7	9	9	18	14.00	11	SS	-14.0		L4	14.0	
		16	11								14.45							
		To																Black,Moist,Poorly graded,Medium Dense,**Silty Sand(SM)** Sand-Silt Mixtures.
15		16	14															
				SC	-	-	4	4	3	7	15.50	12	SS	-15.5		L5	15.5	
											15.95							
16		16	32															
		To																
		16	33															
17				SC	-	-	3	5	4	9	17.00	13	SS	-17.0				
		16	51								17.45							
		To																
18		16	54															Black,Moist, Medium Stiff to Stiff,**Silty CLAY(CI/CH)** Silty Clays of medium/high plasticity
				SC	-	-	5	4	4	8	18.50	14	SS	-18.5				
											18.95							
19		17	13															
		To																
		17	16															
20				SC	-	-	4	4	6	10	20.00	15	SS	-20.0				
											20.45					L6	20.0	

CS - Core Sample	DS - Disturbed Sample	LOGGED	M.Raja	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	02/10/2022	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	J.Yasin	WATER TABLE (m) 2.40	
WS - Wash Sample	DB - Diamond Bit	DATE	18/10/2022	CASING DEPTH (m) 0.00	

SITE INVESTIGATION RECORD

BORE HOLE No.	BH-04		
SHEET	3	OF	3
PROJECT NAME	PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING	DIA OF BORE HOLE	150mm ✓ / 100mm
LOCATION	Poonamallee, Chennai	MACHINE No.	CR-01
CHAINAGE (m)	-	BORE START DATE	02/10/2022
STRUCTURE	Stilt + 5 Upper Floors	DRILLING METHOD	Rotary
CO-ORDINATES	N -	BORE END DATE	03/10/2022
JOB CODE	GEC-JC-GT-4072	FLUSHING MEDIUM	Bentonite
CO-ORDINATES	E -	TOTAL DRILL DAYS	2

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min.	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	15-30	30-45	SPT 'N' Value	Sample Details: Depth	No.	Type	RL (m)	Layer Data: Legend	No	Depth	Geotechnical Description
21		17	36															
		To																
		17	42															
22				SC	-	-	8	11	12	23	22.00	16	SS	-22.0				Black, Moist, Medium Dense, **Clayey Silty SAND(SC)** Sand-Clay mixtures
											22.45							
		18	08															
	02/10/2022	To																
23		18	13															
24				SC	-	-	10	13	16	29	24.00	17	SS	-24.0		L7	24.0	
											24.45							
		18	35															
25		To																
		18	44															
26				SC	-	-	11	18	24	42	26.00	18	SS	-26.0				Brownish,Moist,Very Stiff to Hard, **Sandy Silty CLAY(CI)** Silty Clays of Medium plasticity
											26.45							
27		06	35															
		To																
		06	44															
28	03/10/2022			SC	-	-	15	23	32	55	28.00	19	SS	-28.0		L8	28.0	
											28.45							
		07	15															
29		To																
		07	29															
30				SC	-	-	10 cm penet. for 50 blows			>100	30.00	20	SS	-30.0		L9	30.0	Brownish,Moist,Very Hard, **Compacted CLAY(CH)** Silty Clays of High plasticity
											30.10							

CS - Core Sample	DS - Disturbed Sample	LOGGED	M.Raja	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	03/10/2022	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	J.Yasin	WATER TABLE (m) 2.40	
WS - Wash Sample	DB - Diamond Bit	DATE	18/10/2022	CASING DEPTH (m) 0.00	

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

FIG.2.4 Sub Soil Profile at BH-04 Location

SITE INVESTIGATION RECORD

BORE HOLE No.	BH-05		
SHEET	1	OF	3
PROJECT NAME	PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING	DIA OF BORE HOLE	150mm ✓ / 100mm
LOCATION	Poonamallee, Chennai	MACHINE No.	CR-01
CHAINAGE (m)	-	BORE START DATE	03/10/2022
STRUCTURE	Stilt + 5 Upper Floors	DRILLING METHOD	Rotary
CO-ORDINATES	N -	BORE END DATE	03/10/2022
JOB CODE	GEC-JC-GT-4072	FLUSHING MEDIUM	Bentonite
CO-ORDINATES	E -	TOTAL DRILL DAYS	1

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min.	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	SPT Details: Blows/cm. 15-30	SPT Details: Blows/cm. 30-45	SPT 'N' Value	Sample Details: Depth	Sample Details: No.	Sample Details: Type	Sample Details: RL (m)	Layer Data: Legend	Layer Data: No	Layer Data: Depth	Geotechnical Description
		09	10													L1	0.3	**Filled Up Soil** (Concrete with waste material)
		To																
		09	11															
1				SC	-	-	4	5	7	**12**	1.00	1	SS	-1.0				
		09	20								1.45							
		To																
		09	21															
2				SC	-	-	5	6	6	**12**	2.00	2	SS	-2.0				
		09	30								2.45							
		To																
		09	32															Brown,Moist,Poorly graded,Medium Dense,**Silty Sand(SM)** Sand-Silt Mixtures.
3				SC	-	-	5	6	7	**13**	3.00	3	SS	-3.0				
		09	41								3.45							
		To																
		09	42															
4				SC	-	-	4	7	7	**14**	4.00	4	SS	-4.0				
		09	52								4.45							
		To																
		09	54													L2	5.0	
5	**03/10/2022**			SC	-	-	3	4	3	**7**	5.00	5	SS	-5.0				
		10	09								5.45							
		To																
6		10	12															
				SC	-	-	2	3	3	**6**	6.50	6	SS	-6.5				
7		10	22								6.95							
		To																
		10	25															Black, Moist,Medium Stiff to Stiff **Silty CLAY(CI)** Silty Clays of Medium plasticity
8				SC	-	-	5	4	3	**7**	8.00	7	SS	-8.0				
		10	35								8.45							
		To																
9		10	38															
				SC	-	-	4	5	4	**9**	9.50	8	SS	-9.5				
10											9.95					L3	10.0	

CS - Core Sample	DS - Disturbed Sample	LOGGED	M.Raja	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	03/10/2022	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	J.Yasin	WATER TABLE (m) 2.40	
WS - Wash Sample	DB - Diamond Bit	DATE	18/10/2022	CASING DEPTH (m) 0.00	

SITE INVESTIGATION RECORD

BORE HOLE No.	BH-05		
SHEET	2	OF	3
PROJECT NAME	PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING	DIA OF BORE HOLE	150mm ✓ / 100mm
LOCATION	Poonamallee, Chennai	MACHINE No.	CR-01
CHAINAGE (m)	-	BORE START DATE	03/10/2022
STRUCTURE	Stilt + 5 Upper Floors	DRILLING METHOD	Rotary
CO-ORDINATES	N -	BORE END DATE	03/10/2022
JOB CODE	GEC-JC-GT-4072	FLUSHING MEDIUM	Bentonite
CO-ORDINATES	E -	TOTAL DRILL DAYS	1

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min.	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	15-30	30-45	SPT 'N' Value	Sample Details: Depth	No.	Type	RL (m)	Legend	Layer Data: No	Depth	Geotechnical Description
11	03/10/2022	10	48 To 10 50	SC	-	-	2	3	2	5	11.00 – 11.45	9	SS	-11.0				Black,Moist,Poorly graded, Very Loose,**Silty Sand(SM)** Sand-Silt Mixtures.
12		11	05 To 11 06	SC	-	-	7	9	11	20	12.50 – 12.95	10	SS	-12.5		L4	12.5	
13		11	16 To 11 18															
14				SC	-	-	9	11	12	23	14.00 – 14.45	11	SS	-14.0				Black,Moist,Poorly graded,Medium Dense,**Silty Sand(SM)** Sand-Silt Mixtures.
15		11	29 To 11 32													L5	15.5	
				SC	-	-	4	2	3	5	15.50 – 15.95	12	SS	-15.5				
16		11	45 To 11 49															
17				SC	-	-	2	2	3	5	17.00 – 17.45	13	SS	-17.0				
18		12	05 To 12 09															Black,Moist, Medium Stiff to Stiff,**Silty CLAY(CI/CH)** Silty Clays of medium/high plasticity
				SC	-	-	3	2	3	5	18.50 – 18.95	14	SS	-18.5				
19		12	25 To 12 28															
20				SC	-	-	5	5	4	9	20.00 – 20.45	15	SS	-20.0		L6	20.0	

CS - Core Sample	DS - Disturbed Sample	LOGGED	M.Raja	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	03/10/2022	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	J.Yasin	WATER TABLE (m) 2.40	
WS - Wash Sample	DB - Diamond Bit	DATE	18/10/2022	CASING DEPTH (m) 0.00	

SITE INVESTIGATION RECORD

BORE HOLE No.	BH-05		
SHEET	3	OF	3
PROJECT NAME	PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING	DIA OF BORE HOLE	150mm ✓ / 100mm
LOCATION	Poonamallee, Chennai	MACHINE No.	CR-01
CHAINAGE (m)	-	BORE START DATE	03/10/2022
STRUCTURE	Stilt + 5 Upper Floors	DRILLING METHOD	Rotary
CO-ORDINATES	N -	BORE END DATE	03/10/2022
JOB CODE	GEC-JC-GT-4072	FLUSHING MEDIUM	Bentonite
CO-ORDINATES	E -	TOTAL DRILL DAYS	1

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min.	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	15-30	30-45	SPT 'N' Value	Sample Details: Depth	No.	Type	RL (m)	Legend	Layer Data: No	Depth	Geotechnical Description
21	03/10/2022	12	48															
		To																
		12	55															
22				SC	-	-	5	5	6	11	22.00	16	SS	-22.0				
											22.45							
		14	10															
		To																
23		14	21															Brownish,Moist,Stiff, **Sandy Silty CLAY(Cl)** Silty Clays of Medium plasticity
24				SC	-	-	4	5	6	11	24.00	17	SS	-24.0				
											24.45							
		15	11															
		To																
25		15	22															
26				SC	-	-	24	21	25	46	26.00	18	SS	-26.0		L7	26.0	
											26.45							
27		15	50															Brownish,Moist,Hard, **Sandy Silty CLAY(Cl)** Silty Clays of Medium plasticity
		To																
		16	05															
28				SC	-	-	10	14	20	34	28.00	19	SS	-28.0		L8	28.0	
											28.45							
		16	45															
29		To																Brownish,Moist,Very Hard, **Compacted CLAY(CH)** Silty Clays of High plasticity
		17	11															
30				SC	-	-	33	14 cm penet. for 50 blows		>100	30.00	20	SS	-30.0				
											30.29					L9	30.0	

CS - Core Sample	DS - Disturbed Sample	LOGGED	M.Raja	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	03/10/2022	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	J.Yasin	WATER TABLE (m) 2.40	
WS - Wash Sample	DB - Diamond Bit	DATE	18/10/2022	CASING DEPTH (m) 0.00	

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

FIG.2.5 Sub Soil Profile at BH-05 Location

SITE INVESTIGATION RECORD

BORE HOLE No.	BH-06		
SHEET	1	OF	3
PROJECT NAME	PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING	DIA OF BORE HOLE	150mm ✓ / 100mm
LOCATION	Poonamallee, Chennai	MACHINE No.	CR-01
CHAINAGE (m)	-	BORE START DATE	04/10/2022
STRUCTURE	Stilt + 5 Upper Floors	DRILLING METHOD	Rotary
CO-ORDINATES	N -	BORE END DATE	04/10/2022
JOB CODE	GEC-JC-GT-4072	FLUSHING MEDIUM	Bentonite
CO-ORDINATES	E -	TOTAL DRILL DAYS	1

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min.	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	15-30	30-45	SPT 'N' Value	Sample Details: Depth	No.	Type	RL (m)	Legend	Layer Data: No	Depth	Geotechnical Description
		08	15													L1	0.3	**Filled Up Soil** (Concrete with waste material)
		To																
		08	16															
1				SC	-	-	2	3	3	**6**	1.00	1	SS	-1.0				Brown,Moist,Poorly graded,Loose,**Silty Sand(SM)** Sand-Silt Mixtures.
		08	26								1.45							
		To																
		08	27															
2				SC	-	-	3	5	5	**10**	2.00	2	SS	-2.0		L2	2.0	
		08	36								2.45							
		To																
		08	38															
3				SC	-	-	5	6	7	**13**	3.00	3	SS	-3.0				
		08	48								3.45							
		To																
		08	50															
4				SC	-	-	6	7	8	**15**	4.00	4	SS	-4.0				Brown,Moist,Poorly graded,Medium Dense,**Silty Sand(SM)** Sand-Silt Mixtures.
		09	10								4.45							
		To																
		09	12															
5	04/10/2022			SC	-	-	5	6	8	**14**	5.00	5	SS	-5.0				
		09	22								5.45							
		To																
6		09	23															
				SC	-	-	6	3	2	**5**	6.50	6	SS	-6.5		L3	6.5	
		09	33								6.95							
7		To																
		09	36															
8				SC	-	-	3	2	3	**5**	8.00	7	SS	-8.0				Black, Moist,Medium Stiff **Silty CLAY(CI)** Silty Clays of Medium plasticity
		09	48								8.45							
		To																
9		08	52															
				SC	-	-	2	3	2	**5**	9.50	8	SS	-9.5				
10											9.95							

CS - Core Sample	DS - Disturbed Sample	LOGGED	M.Raja	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	04/10/2022	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	J.Yasin	WATER TABLE (m) 2.40	
WS - Wash Sample	DB - Diamond Bit	DATE	18/10/2022	CASING DEPTH (m) 0.00	

SITE INVESTIGATION RECORD

BORE HOLE No.	BH-06		
SHEET	2	OF	3
PROJECT NAME	PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING	DIA OF BORE HOLE	150mm ✓ / 100mm
LOCATION	Poonamallee, Chennai	MACHINE No.	CR-01
CHAINAGE (m)	-	BORE START DATE	04/10/2022
STRUCTURE	Stilt + 5 Upper Floors	DRILLING METHOD	Rotary
CO-ORDINATES	N -	BORE END DATE	04/10/2022
JOB CODE	GEC-JC-GT-4072	FLUSHING MEDIUM	Bentonite
CO-ORDINATES	E -	TOTAL DRILL DAYS	1

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min.	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	15-30	30-45	SPT 'N' Value	Sample Details: Depth	No.	Type	RL (m)	Layer Data: Legend	No	Depth	Geotechnical Description
11	04/10/2022	10	15	SC	-	-	3	3	3	6	11.00	9	SS	-11.0				
		To									11.45							
		10	18															
12		10	30															
		To																
		10	36															
				SC	-	-	1	3	2	5	12.50	10	SS	-12.5				Black,Moist, Medium Stiff,**Silty CLAY(CI/CH)** Silty Clays of medium/high plasticity
13		10	50								12.95							
		To																
		10	53															
14				SC	-	-	2	2	3	5	14.00	11	SS	-14.0				
											14.45							
		11	11															
		To																
15		11	15															
				SC	-	-	7	9	9	18	15.50	12	SS	-15.5		L4	15.5	
											15.95							
16		11	30															
		To																
		11	32															
17				SC	-	-	6	9	11	20	17.00	13	SS	-17.0				Black,Moist,Poorly graded,Medium Dense,**Silty Sand(SM)** Sand-Silt Mixtures.
											17.45							
		11	50															
		To																
18		11	53															
				SC	-	-	4	4	3	7	18.50	14	SS	-18.5		L5	18.5	
											18.95							
19		12	20															
		To																
		12	25															Black,Moist, Medium Stiff to Stiff,**Silty CLAY(CI/CH)** Silty Clays of medium/high plasticity
20				SC	-	-	3	4	5	9	20.00	15	SS	-20.0				
											20.45					L6	20.0	

CS - Core Sample	DS - Disturbed Sample	LOGGED	M.Raja	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	04/10/2022	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	J.Yasin	WATER TABLE (m) 2.40	
WS - Wash Sample	DB - Diamond Bit	DATE	18/10/2022	CASING DEPTH (m) 0.00	

SITE INVESTIGATION RECORD

BORE HOLE No.	BH-06		
SHEET	3	OF	3
PROJECT NAME	PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING	DIA OF BORE HOLE	150mm ✓ / 100mm
LOCATION	Poonamallee, Chennai	MACHINE No.	CR-01
CHAINAGE (m)	-	BORE START DATE	04/10/2022
STRUCTURE	Stilt + 5 Upper Floors	DRILLING METHOD	Rotary
CO-ORDINATES	N -	BORE END DATE	04/10/2022
JOB CODE	GEC-JC-GT-4072	FLUSHING MEDIUM	Bentonite
CO-ORDINATES	E -	TOTAL DRILL DAYS	1

Depth below E.G.L. (m)	Drilling progress per metre: Date	Time: Hr.	Time: Min.	Type of Drill Bit (SC / TCB / DB)	Core Details: Total Core Recovery %	Core Details: R.Q.D %	SPT Details: Blows/cm. 0-15	15-30	30-45	SPT 'N' Value	Sample Details: Depth	No.	Type	RL (m)	Legend	Layer Data: No	Depth	Geotechnical Description
21	04/10/2022	12	50 To 12 55	SC	-	-	7	7	9	16	22.00 / 22.45	16	SS	-22.0				Black, Moist, Medium Dense, **Clayey Silty SAND(SC)** Sand-Clay mixtures
22																		
23		13	50 To 13 58															
24				SC	-	-	6	8	10	18	24.00 / 24.45	17	SS	-24.0		L7	24.0	
25		14	30 To 14 39															
26				SC	-	-	15	21	33	54	26.00 / 26.45	18	SS	-26.0				Brownish,Moist,Very Stiff to Hard, **Sandy Silty CLAY(Cl)** Silty Clays of Medium plasticity
27		15	20 To 15 34															
28				SC	-	-	13	25	35	60	28.00 / 28.45	19	SS	-28.0		L8	28.0	
29		16	15 To 16 42															Brownish,Moist,Very Hard, **Compacted CLAY(CH)** Silty Clays of High plasticity
30				SC	-	-	28	10 cm penet. for 50 blows		>100	30.00 / 30.29	20	SS	-30.0		L9	30.0	

CS - Core Sample	DS - Disturbed Sample	LOGGED	M.Raja	PROJECT SITE DETAILS	REMARKS
SS - Split Spoon Sample	SC - Soil Cutter	DATE	04/10/2022	GROUND LEVEL (m) 0.00	
UDS- Undisturbed Sample	TCB - Tungsten Carbide Bit	CHECKED	J.Yasin	WATER TABLE (m) 2.40	
WS - Wash Sample	DB - Diamond Bit	DATE	18/10/2022	CASING DEPTH (m) 0.00	

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

FIG.2.6 Sub Soil Profile at BH-06 Location

Grain Size Distribution Curves

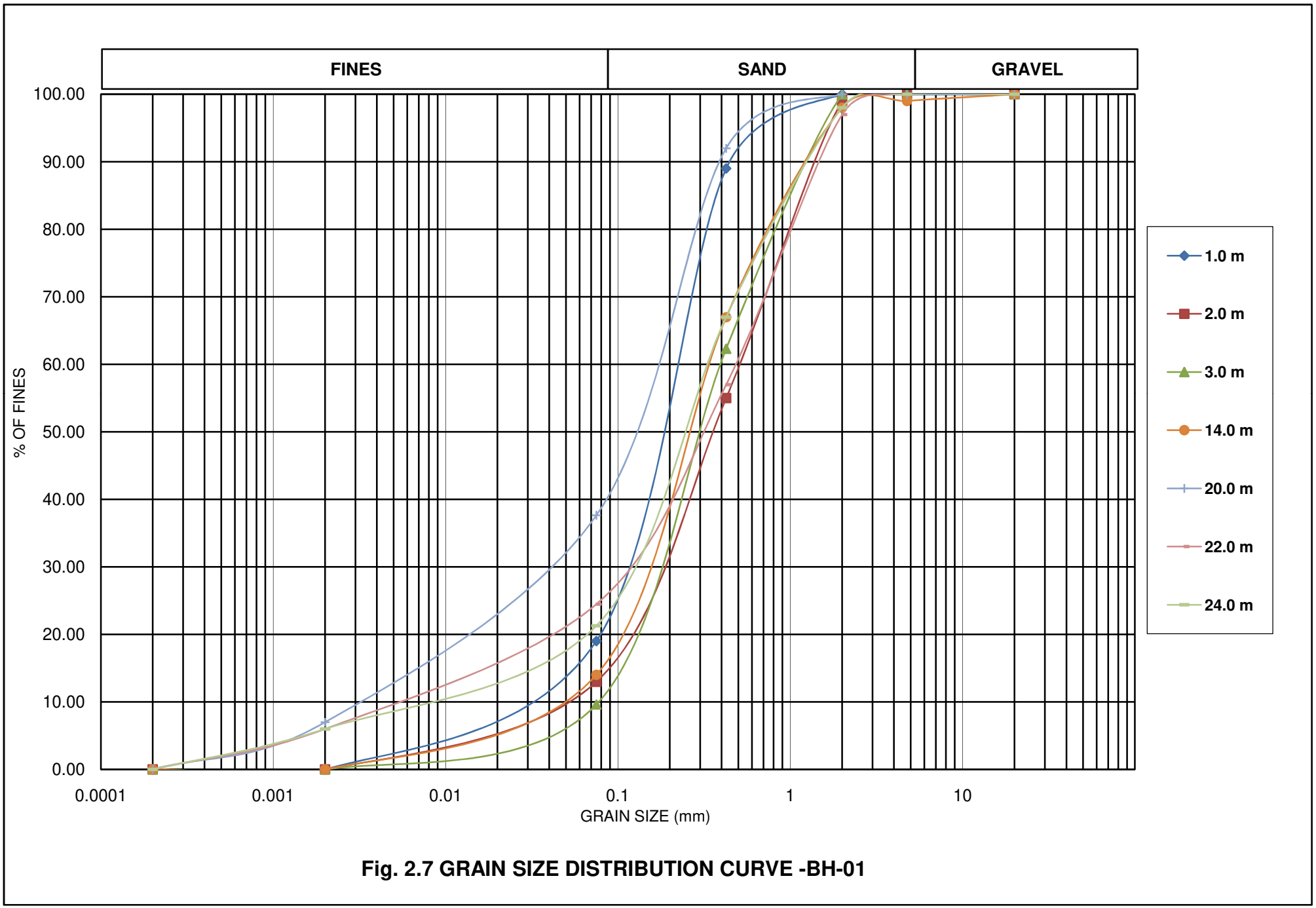


Fig. 2.7 GRAIN SIZE DISTRIBUTION CURVE -BH-01

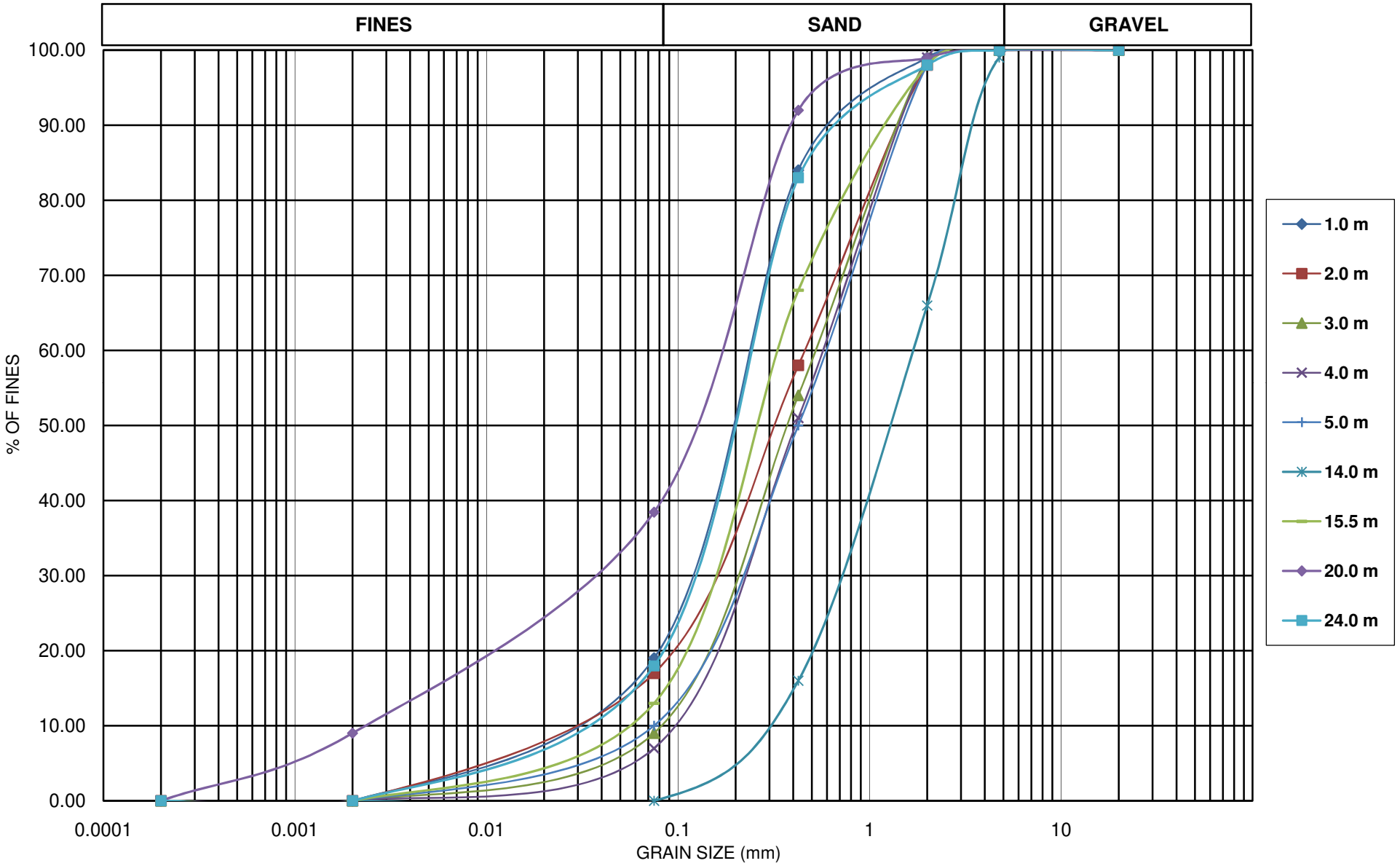


Fig. 2.8 GRAIN SIZE DISTRIBUTION CURVE -BH-02

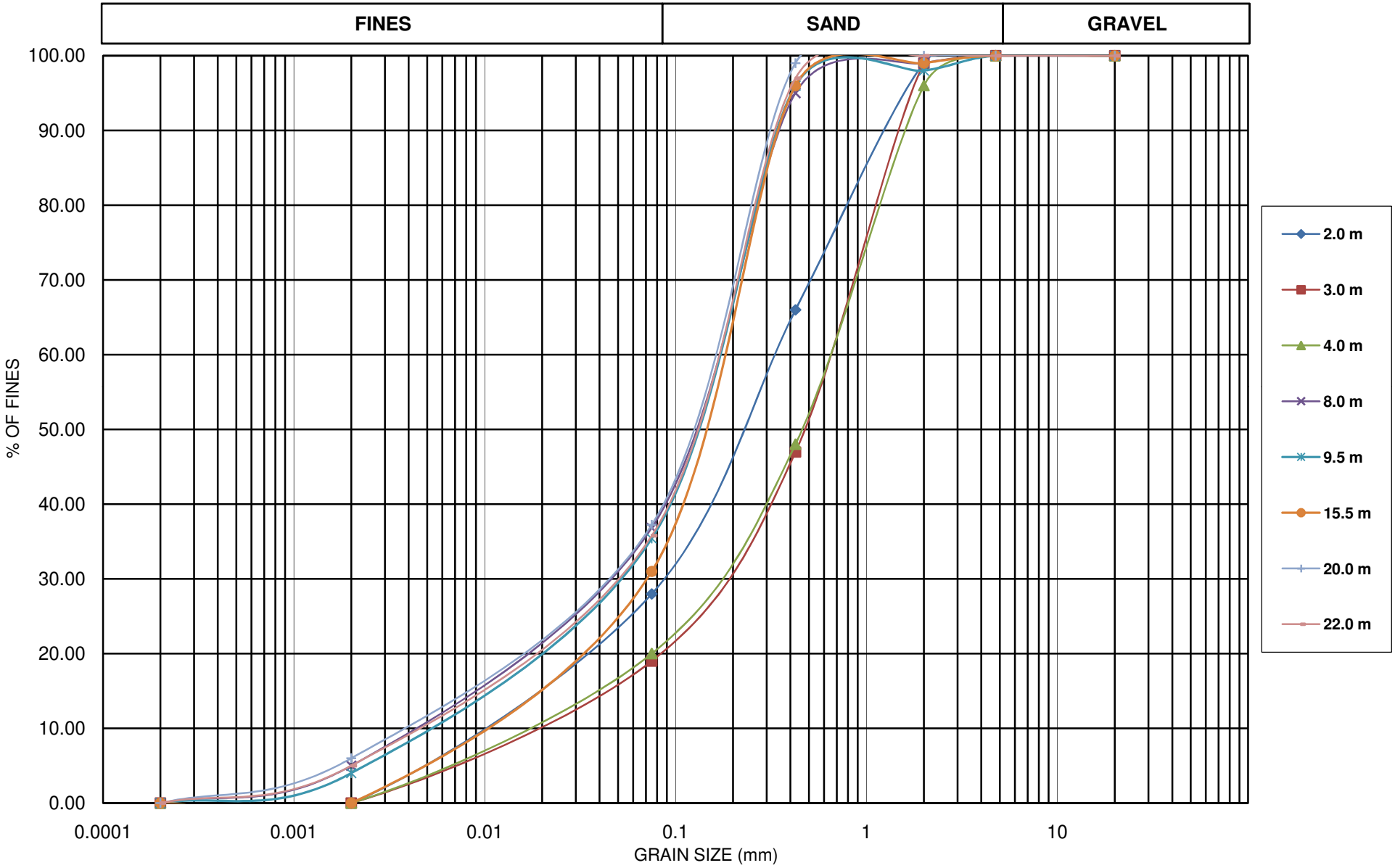


Fig. 2.9 GRAIN SIZE DISTRIBUTION CURVE -BH-03

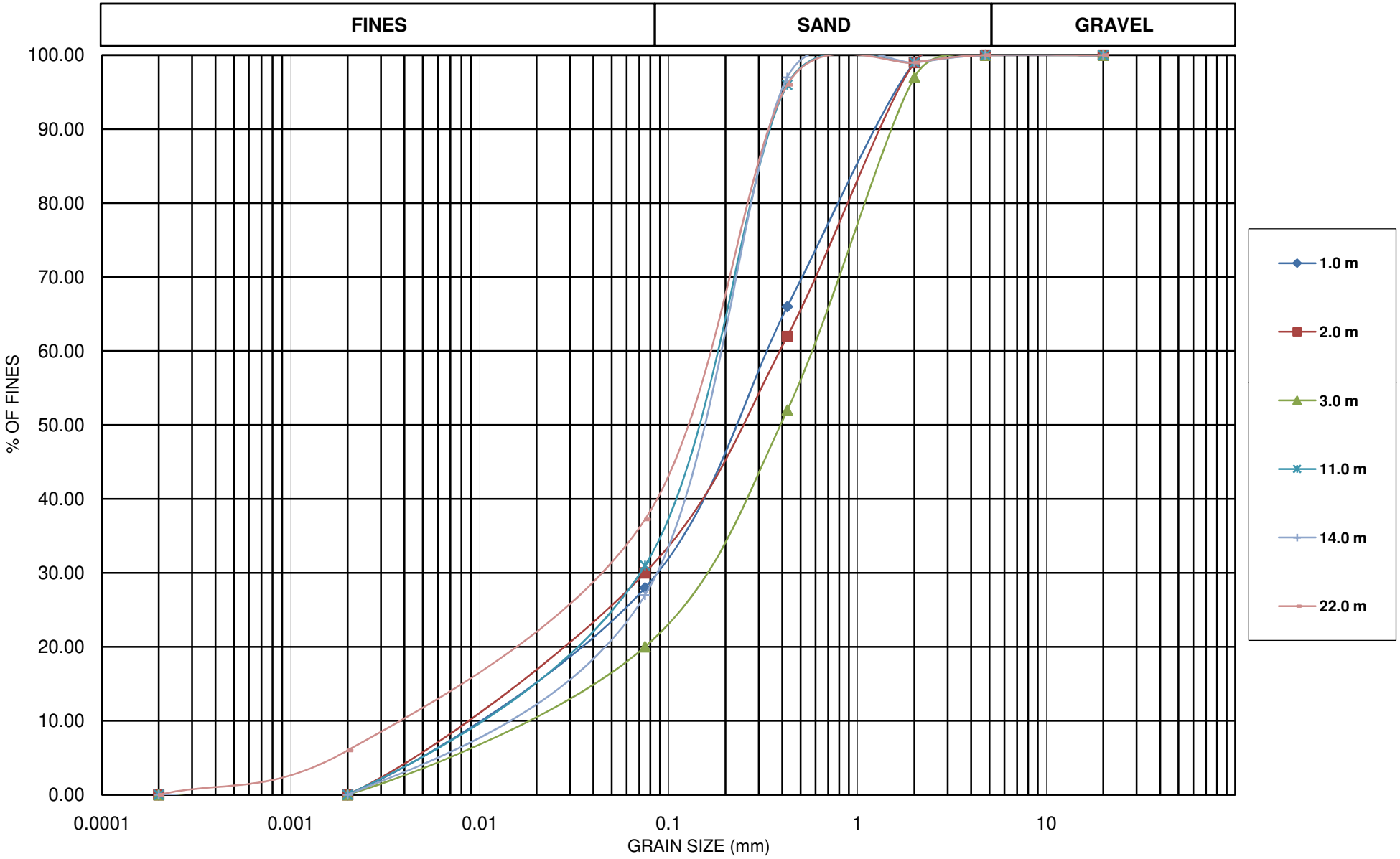


Fig. 2.10 GRAIN SIZE DISTRIBUTION CURVE -BH-04

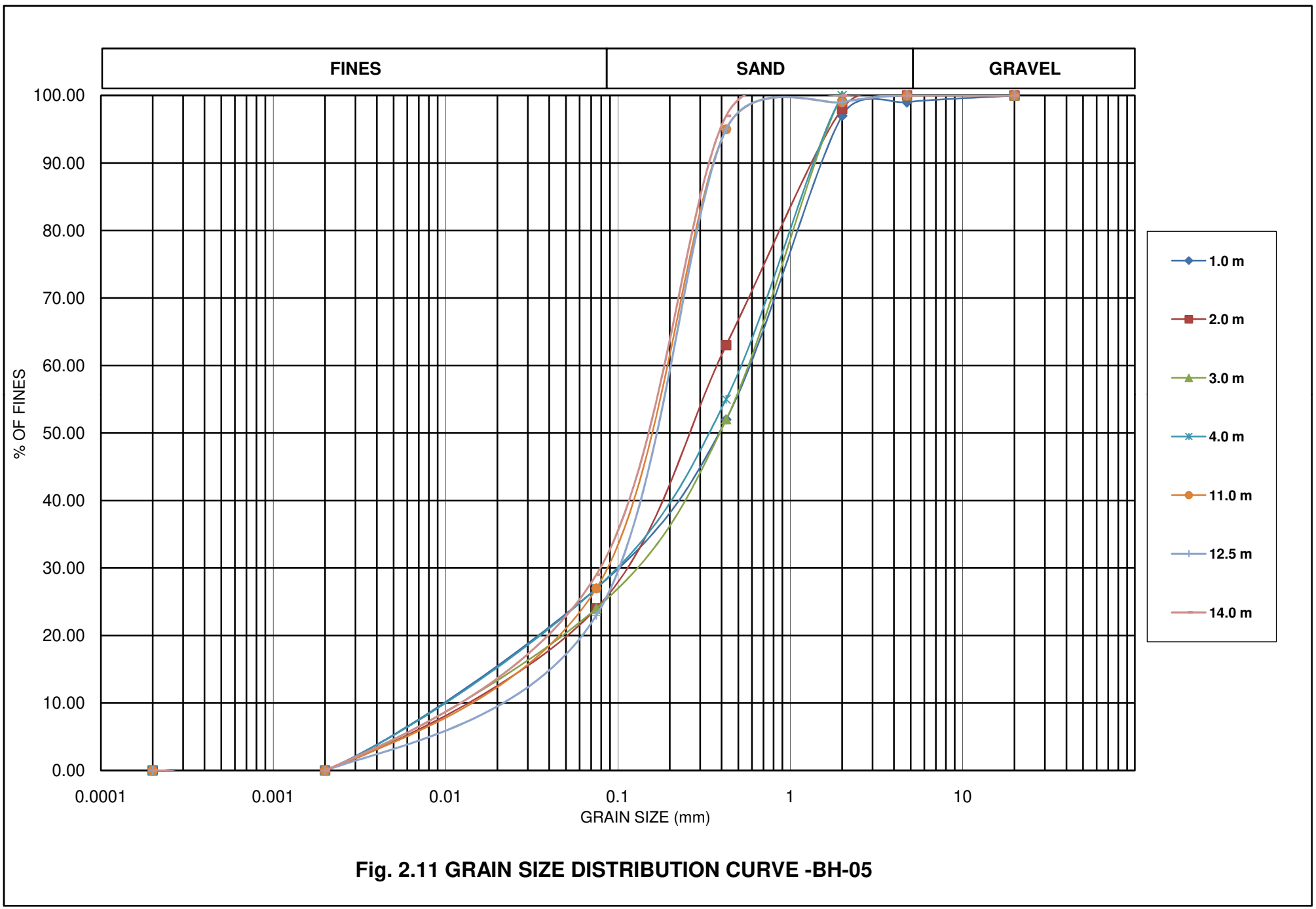


Fig. 2.11 GRAIN SIZE DISTRIBUTION CURVE -BH-05

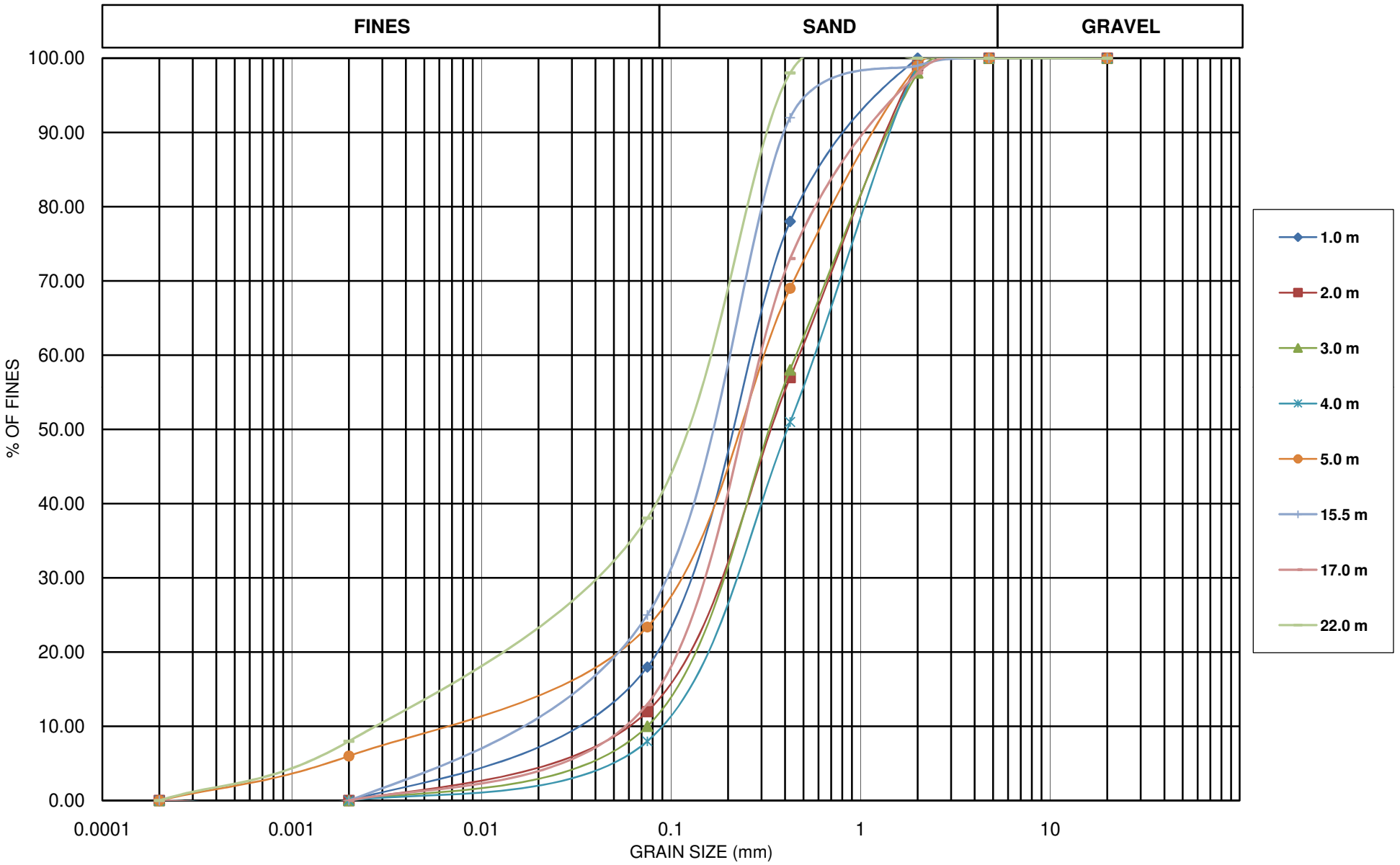


Fig. 2.12 GRAIN SIZE DISTRIBUTION CURVE -BH-06

HYDROMETER ANALYSIS CURVE

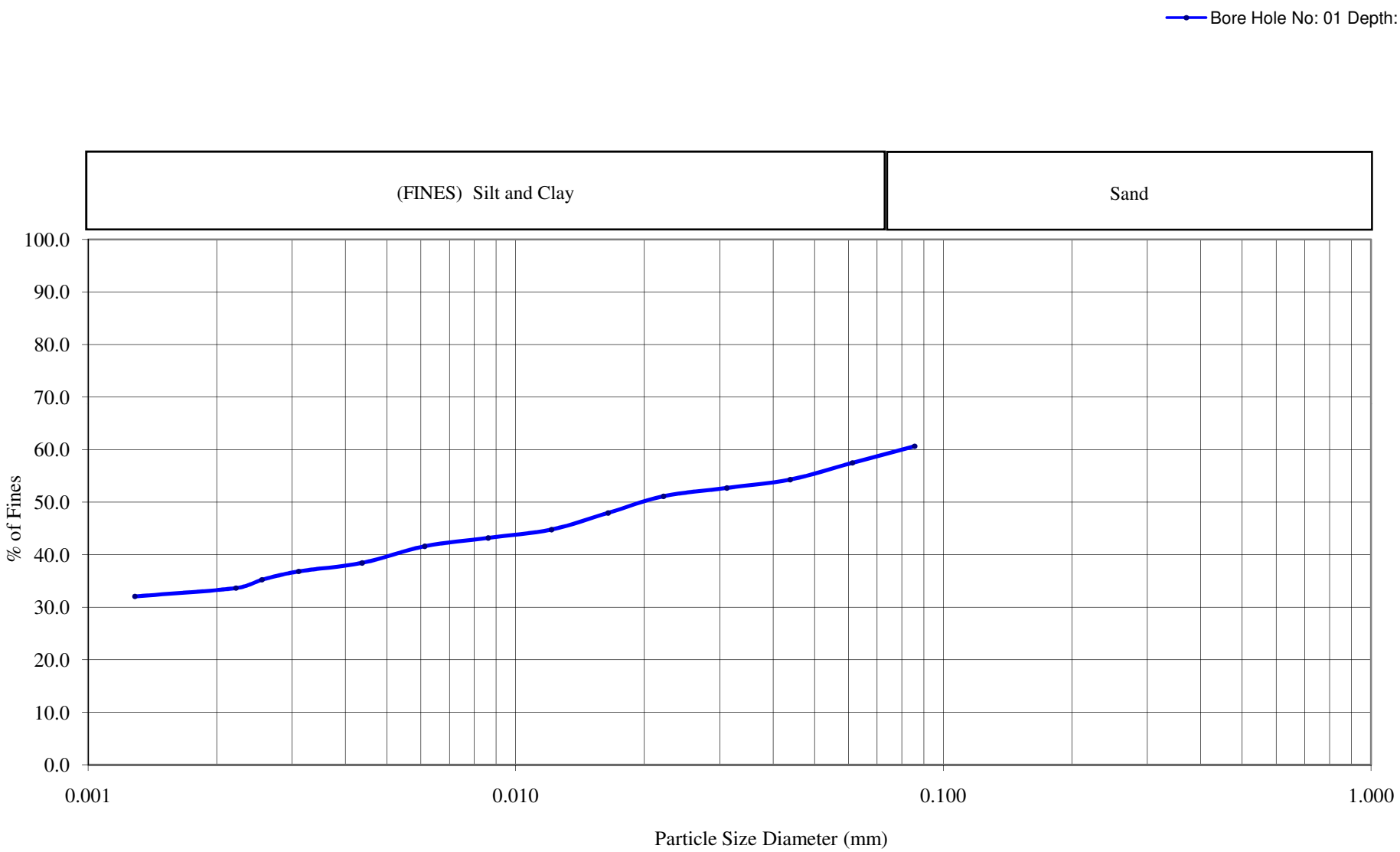


Fig.2.13 Hydrometer Analysis Master Curve

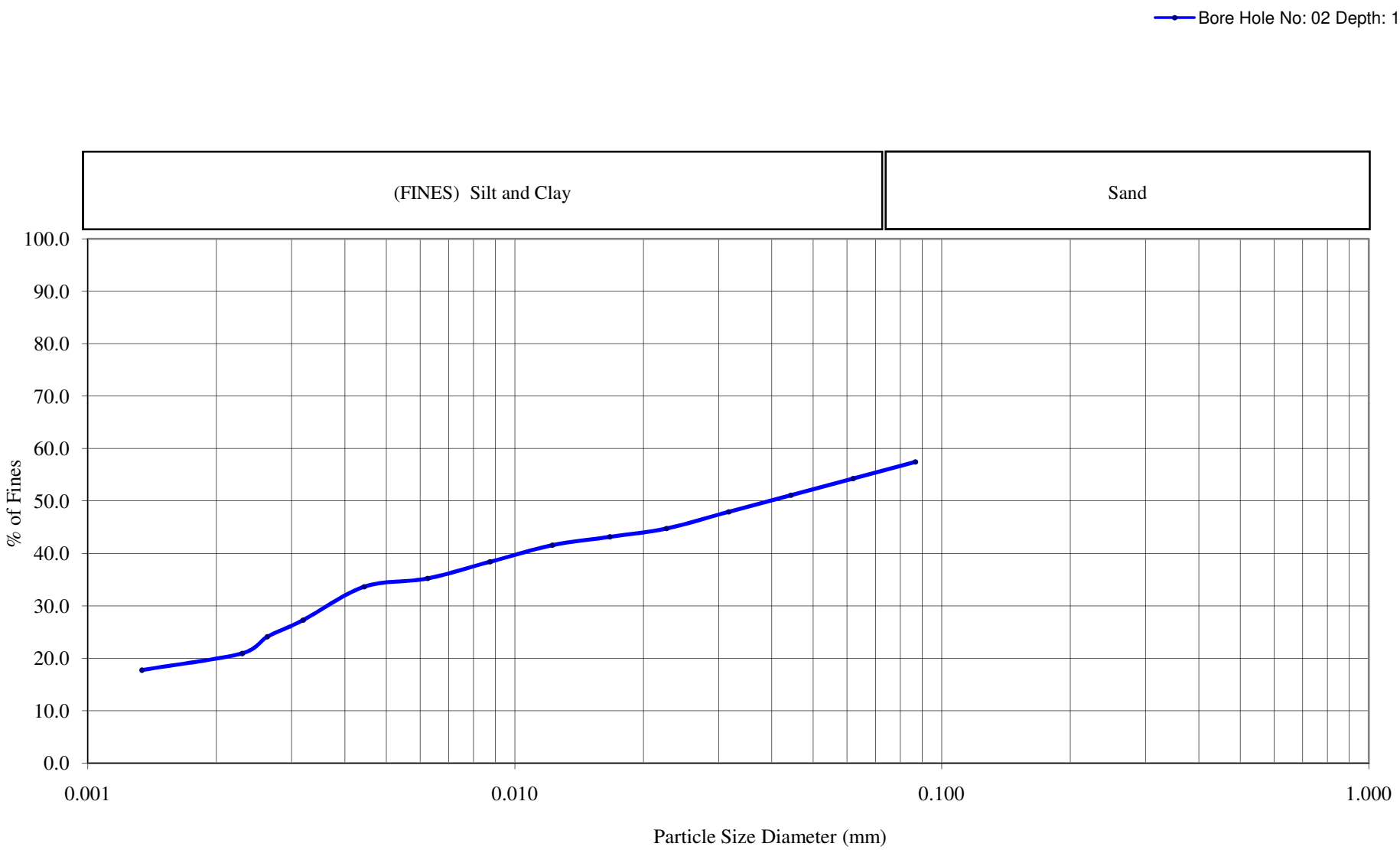


Fig.2.14 Hydrometer Analysis Master Curve

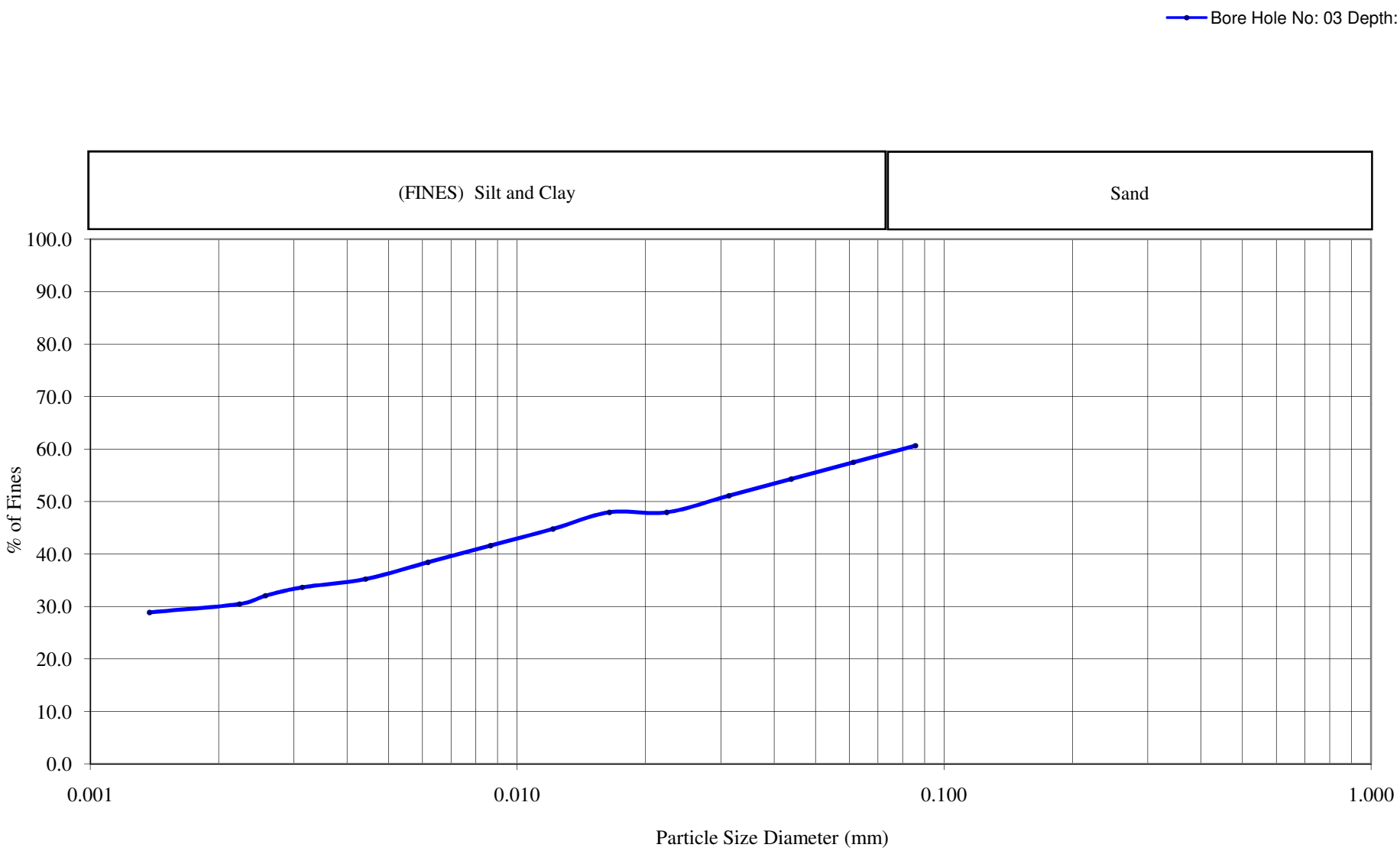


Fig.2.15 Hydrometer Analysis Master Curve

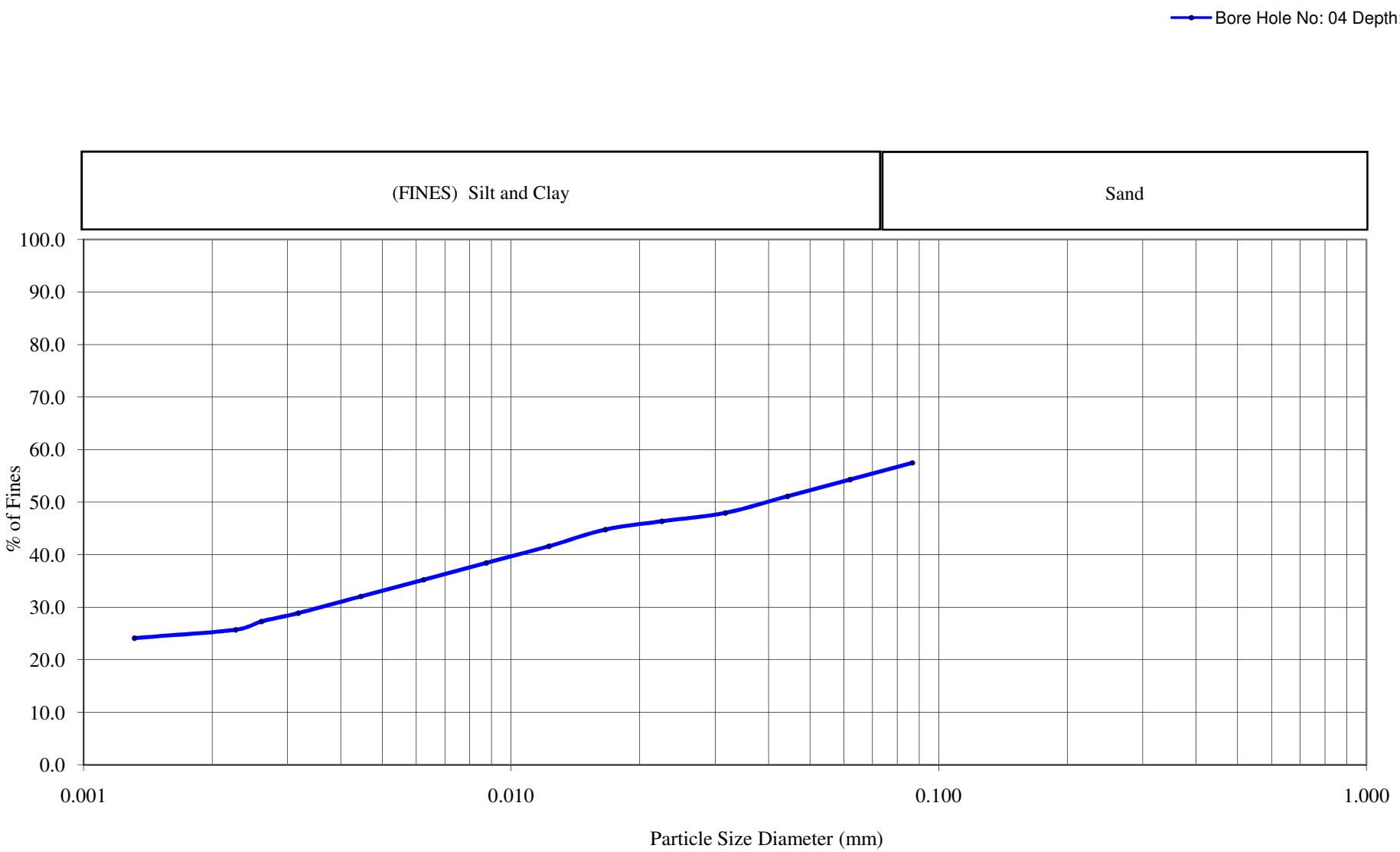


Fig.2.15 Hydrometer Analysis Master Curve

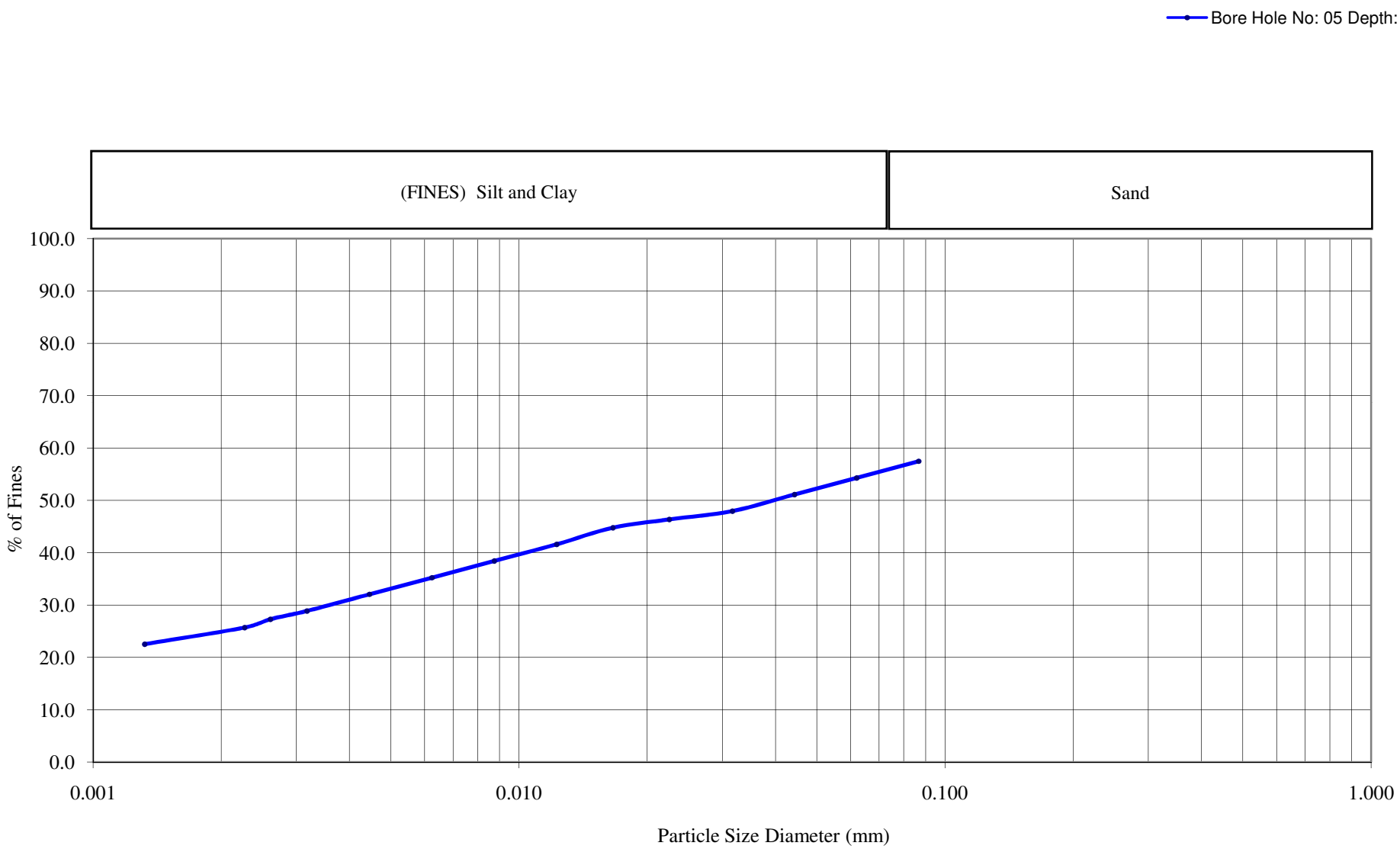


Fig.2.17 Hydrometer Analysis Master Curve

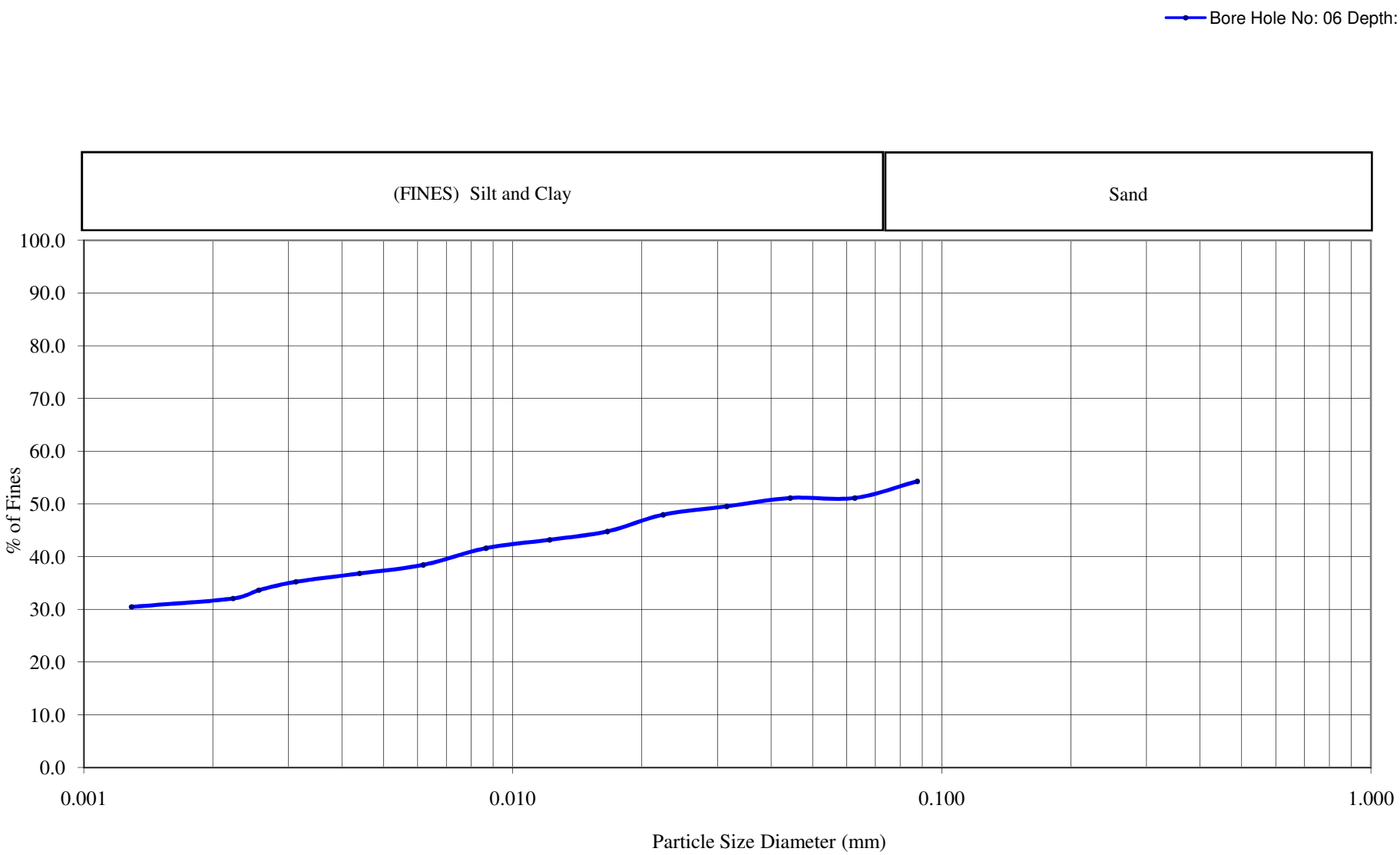


Fig.2.18 Hydrometer Analysis Master Curve

LABORATORY TEST RESULTS

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

Depth of Sample below E.G.L. (m)	SPT-Value	Type of Sample	Sub Soil Classification																								
			Fine Grained (FG)										Coarse Grained (CG)												IS-Notation	
			NMC(%)	LL (%)	PL (%)	I_P	Ic	SL (%)	FS (%)	Consistancy	Position With Respect to A-Aline	IS:Notation	Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)	D_{10} (mm)	D_{30}(mm)	D_{60} (mm)	$C_U=D_{60}/D_{10}$	$C_c=D_{30}^2/(D_{10}xD_{60})$	Relative Density	Gravel	Sand
1.0	9	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	0	11	70	19	0	-	-	-	-	-	Loose	<50%	SM
2.0	8	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	1	44	42	13	0	-	-	-	-	-	Loose	<50%	SM
3.0	12	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	1	42	47	10	0	-	-	-	-	-	M.Dense	<50%	SP-SM
4.0	14	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	0	52	41	7	0	-	-	-	-	-	M.Dense	<50%	SP-SM
5.0	15	SS	-	-	-	-	-	-	-	CG>50%	-	-	1	4	49	37	9	0	-	-	-	-	-	M.Dense	<50%	SP-SM
6.5	6	SS	25	40	16	24	0.63	14	67	M.Stiff	Above	CI	-	-	-	-	79	21	-	-	-	-	-	FG>50%	FG>50%	FG>50%
8.0	8	SS	20	38	17	21	0.86	15	50	Stiff	Above	CI	-	-	-	-	78	22	-	-	-	-	-	FG>50%	FG>50%	FG>50%
9.5	6	SS	24	42	16	26	0.69	14	48	M.Stiff	Above	CI	-	-	-	-	76	24	-	-	-	-	-	FG>50%	FG>50%	FG>50%
11.0	6	SS	35	55	23	32	0.63	13	56	M.Stiff	Above	CH	-	-	-	-	73	27	-	-	-	-	-	FG>50%	FG>50%	FG>50%
12.5	15	SS	18	37	16	21	0.90	15	45	Stiff	Above	CI	-	-	-	-	76	24	-	-	-	-	-	FG>50%	FG>50%	FG>50%
14.0	16	SS	-	-	-	-	-	-	-	CG>50%	-	-	1	1	31	53	14	0	-	-	-	-	-	M.Dense	<50%	SM
15.5	7	SS	44	64	25	39	0.51	12	82	M.Stiff	Above	CH	-	-	-	-	71	29	-	-	-	-	-	FG>50%	FG>50%	FG>50%
17.0	8	SS	30	60	24	36	0.83	12	75	Stiff	Above	CH	-	-	-	-	70	30	-	-	-	-	-	FG>50%	FG>50%	FG>50%
18.5	7	SS	25	37	16	21	0.57	16	63	M.Stiff	Above	CI	-	-	-	-	75	25	-	-	-	-	-	FG>50%	FG>50%	FG>50%
20.0	22	SS	15	42	16	26	1.04	14	89	CG>50%	Above	-	0	0	8	50	35	7	-	-	-	-	-	M.Dense	<50%	SC
22.0	15	SS	15	30	14	16	0.94	17	45	CG>50%	Above	-	0	0	1	62	32	5	-	-	-	-	-	M.Dense	<50%	SC
24.0	39	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	0	15	69	16	0	-	-	-	-	-	Dense	<50%	SM
26.0	25	SS	25	83	35	48	1.21	11	127	V.Stiff	Above	CH	-	-	-	-	70	30	-	-	-	-	-	FG>50%	FG>50%	FG>50%
28.0	69	SS	26	74	28	46	1.04	11	69	Hard	Above	CH	-	-	-	-	72	28	-	-	-	-	-	FG>50%	FG>50%	FG>50%
30.0	>100	SS	22	60	27	33	1.15	12	64	Hard	Above	CH	-	-	-	-	72	28	-	-	-	-	-	FG>50%	FG>50%	FG>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 Frees Well Index
C_U = Uniformity Coefficient
C_C = Coefficient of Curvature
IP=LL-PL

LAB IN-CHARGE	M.PRAVEEN
REVIEWED BY	JALEEL YASIN

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

Depth of Sample below E.G.L. (m)	SPT-Value	Type of Sample	Sub Soil Classification																								
			Fine Grained (FG)										Coarse Grained (CG)												IS-Notation	
			NMC(%)	LL (%)	PL (%)	I_P	Ic	SL (%)	FS (%)	Consistancy	Position With Respect to A-Aline	IS:Notation	Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)	D_{10} (mm)	D_{30}(mm)	D_{60} (mm)	$C_U=D_{60}/D_{10}$	$C_c=D_{30}^2/(D_{10}xD_{60})$	Relative Density	Gravel	Sand
1.0	10	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	1	15	65	19	0	-	-	-	-	-	Loose	<50%	SM
2.0	7	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	2	40	41	17	0	-	-	-	-	-	Loose	<50%	SM
3.0	12	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	1	45	45	9	0	-	-	-	-	-	M.Dense	<50%	SP-SM
4.0	15	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	1	48	44	7	0	-	-	-	-	-	M.Dense	<50%	SP-SM
5.0	7	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	2	48	40	10	0	-	-	-	-	-	Loose	<50%	SP-SM
6.5	9	SS	23	42	17	25	0.76	14	55	Stiff	Above	CI	-	-	-	-	80	20	-	-	-	-	-	FG>50%	FG>50%	FG>50%
8.0	6	SS	25	39	16	23	0.61	14	48	M.Stiff	Above	CI	-	-	-	-	82	18	-	-	-	-	-	FG>50%	FG>50%	FG>50%
9.5	5	SS	23	40	16	24	0.71	14	50	M.Stiff	Above	CI	-	-	-	-	78	22	-	-	-	-	-	FG>50%	FG>50%	FG>50%
11.0	7	SS	32	58	22	36	0.72	13	58	M.Stiff	Above	CH	-	-	-	-	75	25	-	-	-	-	-	FG>50%	FG>50%	FG>50%
12.5	35	SS	15	39	17	22	1.09	13	40	Hard	Above	CI	-	-	-	-	83	17	-	-	-	-	-	FG>50%	FG>50%	FG>50%
14.0	32	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	1	33	50	16	0	-	-	-	-	-	Dense	<50%	SM
15.5	21	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	2	30	55	13	0	-	-	-	-	-	M.Dense	<50%	SM
17.0	16	SS	20	61	22	39	1.05	12	80	V.Stiff	Above	CH	-	-	-	-	72	28	-	-	-	-	-	FG>50%	FG>50%	FG>50%
18.5	13	SS	22	39	17	22	0.77	12	75	Stiff	Above	CI	-	-	-	-	74	26	-	-	-	-	-	FG>50%	FG>50%	FG>50%
20.0	23	SS	16	41	18	23	1.09	14	88	CG>50%	Above	-	0	1	7	48	35	9	-	-	-	-	-	M.Dense	<50%	SC
22.0	14	SS	16	37	15	22	0.95	14	52	CG>50%	Above	-	0	1	2	58	34	5	-	-	-	-	-	M.Dense	<50%	SC
24.0	41	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	2	15	65	18	0	-	-	-	-	-	Dense	<50%	SM
26.0	41	SS	24	80	32	48	1.17	10	85	Hard	Above	CH	-	-	-	-	68	32	-	-	-	-	-	FG>50%	FG>50%	FG>50%
28.0	64	SS	22	75	28	47	1.13	11	72	Hard	Above	CH	-	-	-	-	70	30	-	-	-	-	-	FG>50%	FG>50%	FG>50%
30.0	>100	SS	20	66	28	38	1.21	12	60	Hard	Above	CH	-	-	-	-	72	28	-	-	-	-	-	FG>50%	FG>50%	FG>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 Frees Well Index
C_U = Uniformity Coefficient
C_C = Coefficient of Curvature
IP=LL-PL

LAB IN-CHARGE	M.PRAVEEN
REVIEWED BY	JALEEL YASIN

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

Depth of Sample below E.G.L. (m)	SPT-Value	Type of Sample	Sub Soil Classification																								
			Fine Grained (FG)										Coarse Grained (CG)												IS-Notation	
			NMC(%)	LL (%)	PL (%)	I_P	Ic	SL (%)	FS (%)	Consistancy	Position With Respect to A-Aline	IS:Notation	Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)	D_{10} (mm)	D_{30}(mm)	D_{60} (mm)	$C_U=D_{60}/D_{10}$	$C_c=D_{30}^2/(D_{10}xD_{60})$	Relative Density	Gravel	Sand
1.0	9	SS	20	36	16	20	0.80	16	38	Stiff	Above	CI	-	-	-	-	82	18	-	-	-	-	-	FG>50%	FG>50%	FG>50%
2.0	10	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	1	33	38	28	0	-	-	-	-	-	Loose	<50%	SM
3.0	14	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	1	52	28	19	0	-	-	-	-	-	M.Dense	<50%	SM
4.0	15	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	4	48	28	20	0	-	-	-	-	-	M.Dense	<50%	SM
5.0	3	SS	34	40	17	23	0.26	14	49	Soft	Above	CI	-	-	-	-	76	24	-	-	-	-	-	FG>50%	FG>50%	FG>50%
6.5	5	SS	28	45	17	28	0.61	15	45	M.Stiff	Above	CI	-	-	-	-	75	25	-	-	-	-	-	FG>50%	FG>50%	FG>50%
8.0	9	SS	18	42	16	26	0.92	14	60	CG>50%	Above	-	0	1	4	55	35	5	-	-	-	-	-	Loose	<50%	SC
9.5	20	SS	15	40	16	24	1.04	15	42	CG>50%	Above	-	0	2	2	58	34	4	-	-	-	-	-	M.Dense	<50%	SC
11.0	12	SS	24	59	20	39	0.90	16	45	Stiff	Above	CH	-	-	-	-	72	28	-	-	-	-	-	FG>50%	FG>50%	FG>50%
12.5	6	SS	25	41	17	24	0.67	16	40	M.Stiff	Above	CI	-	-	-	-	78	22	-	-	-	-	-	FG>50%	FG>50%	FG>50%
14.0	6	SS	26	36	18	18	0.56	16	38	M.Stiff	Above	CI	-	-	-	-	84	16	-	-	-	-	-	FG>50%	FG>50%	FG>50%
15.5	19	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	1	3	65	31	0	-	-	-	-	-	M.Dense	<50%	SM
17.0	6	SS	38	65	23	42	0.64	12	75	M.Stiff	Above	CH	-	-	-	-	70	30	-	-	-	-	-	FG>50%	FG>50%	FG>50%
18.5	5	SS	29	47	18	29	0.62	13	58	M.Stiff	Above	CI	-	-	-	-	75	25	-	-	-	-	-	FG>50%	FG>50%	FG>50%
20.0	8	SS	23	46	17	29	0.79	15	45	CG>50%	Above	-	0	0	1	58	35	6	-	-	-	-	-	Loose	<50%	SC
22.0	22	SS	15	39	16	23	1.04	16	40	CG>50%	Above	-	0	0	3	58	34	5	-	-	-	-	-	M.Dense	<50%	SC
24.0	26	SS	16	42	17	25	1.04	15	48	V.Stiff	Above	CI	-	-	-	-	78	22	-	-	-	-	-	FG>50%	FG>50%	FG>50%
26.0	40	SS	15	41	17	24	1.08	14	55	Hard	Above	CI	-	-	-	-	78	22	-	-	-	-	-	FG>50%	FG>50%	FG>50%
28.0	60	SS	14	66	28	38	1.37	12	68	Hard	Above	CH	-	-	-	-	70	30	-	-	-	-	-	FG>50%	FG>50%	FG>50%
30.0	>100	SS	13	58	26	32	1.41	12	65	Hard	Above	CH	-	-	-	-	72	28	-	-	-	-	-	FG>50%	FG>50%	FG>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 Frees Well Index
C_U = Uniformity Coefficient
C_C = Coefficient of Curvature
IP=LL-PL

LAB IN-CHARGE	M.PRAVEEN
REVIEWED BY	JALEEL YASIN

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

Depth of Sample below E.G.L. (m)	SPT-Value	Type of Sample	Sub Soil Classification																								
			Fine Grained (FG)										Coarse Grained (CG)												IS-Notation	
			NMC(%)	LL (%)	PL (%)	I_P	Ic	SL (%)	FS (%)	Consistancy	Position With Respect to A-Aline	IS:Notation	Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)	D_{10} (mm)	D_{30}(mm)	D_{60} (mm)	$C_U=D_{60}/D_{10}$	$C_c=D_{30}^2/(D_{10}xD_{60})$	Relative Density	Gravel	Sand
1.0	12	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	1	33	38	28	0	-	-	-	-	-	M.Dense	<50%	SM
2.0	11	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	1	37	32	30	0	-	-	-	-	-	M.Dense	<50%	SM
3.0	12	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	3	45	32	20	0	-	-	-	-	-	M.Dense	<50%	SM
4.0	13	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	2	48	29	21	0	-	-	-	-	-	M.Dense	<50%	SM
5.0	7	SS	23	40	17	23	0.74	15	48	M.Stiff	Above	CI	-	-	-	-	76	24	-	-	-	-	-	FG>50%	FG>50%	FG>50%
6.5	5	SS	22	38	16	22	0.73	15	42	M.Stiff	Above	CI	-	-	-	-	78	22	-	-	-	-	-	FG>50%	FG>50%	FG>50%
8.0	7	SS	25	39	17	22	0.64	14	60	M.Stiff	Above	CI	-	-	-	-	80	20	-	-	-	-	-	FG>50%	FG>50%	FG>50%
9.5	10	SS	18	37	16	21	0.90	15	42	Stiff	Above	CI	-	-	-	-	82	18	-	-	-	-	-	FG>50%	FG>50%	FG>50%
11.0	10	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	1	3	65	31	0	-	-	-	-	-	Loose	<50%	SM
12.5	9	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	2	2	69	27	0	-	-	-	-	-	Loose	<50%	SM
14.0	18	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	1	2	70	27	0	-	-	-	-	-	M.Dense	<50%	SM
15.5	7	SS	42	62	23	39	0.51	12	70	M.Stiff	Above	CH	-	-	-	-	70	30	-	-	-	-	-	FG>50%	FG>50%	FG>50%
17.0	9	SS	25	58	22	36	0.92	12	75	Stiff	Above	CH	-	-	-	-	72	28	-	-	-	-	-	FG>50%	FG>50%	FG>50%
18.5	8	SS	24	45	19	26	0.81	13	55	Stiff	Above	CI	-	-	-	-	75	25	-	-	-	-	-	FG>50%	FG>50%	FG>50%
20.0	10	SS	22	40	18	22	0.82	14	47	Stiff	Above	CI	-	-	-	-	78	22	-	-	-	-	-	FG>50%	FG>50%	FG>50%
22.0	23	SS	15	37	16	21	1.05	16	38	CG>50%	Above	-	0	1	3	55	35	6	-	-	-	-	-	M.Dense	<50%	SC
24.0	29	SS	15	40	16	24	1.04	15	45	V.Stiff	Above	CI	-	-	-	-	74	26	-	-	-	-	-	FG>50%	FG>50%	FG>50%
26.0	42	SS	14	45	17	28	1.11	14	52	Hard	Above	CI	-	-	-	-	78	22	-	-	-	-	-	FG>50%	FG>50%	FG>50%
28.0	55	SS	12	63	28	35	1.46	13	58	Hard	Above	CH	-	-	-	-	72	28	-	-	-	-	-	FG>50%	FG>50%	FG>50%
30.0	>100	SS	12	59	27	32	1.47	13	52	Hard	Above	CH	-	-	-	-	73	27	-	-	-	-	-	FG>50%	FG>50%	FG>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 Frees Well Index
C_U = Uniformity Coefficient
C_C = Coefficient of Curvature
IP=LL-PL

LAB IN-CHARGE	M.PRAVEEN
REVIEWED BY	JALEEL YASIN

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

Depth of Sample below E.G.L. (m)	SPT-Value	Type of Sample	Sub Soil Classification																								
			Fine Grained (FG)										Coarse Grained (CG)												IS-Notation	
			NMC(%)	LL (%)	PL (%)	I_P	Ic	SL (%)	FS (%)	Consistancy	Position With Respect to A-Aline	IS:Notation	Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)	D_{10} (mm)	D_{30}(mm)	D_{60} (mm)	$C_U=D_{60}/D_{10}$	$C_c=D_{30}^2/(D_{10}xD_{60})$	Relative Density	Gravel	Sand
1.0	12	SS	-	-	-	-	-	-	-	CG>50%	-	-	1	2	45	25	27	0	-	-	-	-	-	M.Dense	<50%	SM
2.0	12	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	2	35	39	24	0	-	-	-	-	-	M.Dense	<50%	SM
3.0	13	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	0	48	28	24	0	-	-	-	-	-	M.Dense	<50%	SM
4.0	14	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	0	45	28	27	0	-	-	-	-	-	M.Dense	<50%	SM
5.0	7	SS	25	39	18	21	0.67	13	45	M.Stiff	Above	CI	-	-	-	-	78	22	-	-	-	-	-	FG>50%	FG>50%	FG>50%
6.5	6	SS	26	38	17	21	0.57	14	52	M.Stiff	Above	CI	-	-	-	-	77	23	-	-	-	-	-	FG>50%	FG>50%	FG>50%
8.0	7	SS	27	45	19	26	0.69	14	50	M.Stiff	Above	CI	-	-	-	-	75	25	-	-	-	-	-	FG>50%	FG>50%	FG>50%
9.5	9	SS	22	38	17	21	0.76	16	38	Stiff	Above	CI	-	-	-	-	80	20	-	-	-	-	-	FG>50%	FG>50%	FG>50%
11.0	5	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	1	4	68	27	0	-	-	-	-	-	Loose	<50%	SM
12.5	20	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	1	4	72	23	0	-	-	-	-	-	M.Dense	<50%	SM
14.0	23	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	0	3	68	29	0	-	-	-	-	-	M.Dense	<50%	SM
15.5	5	SS	29	44	20	24	0.63	14	58	M.Stiff	Above	CI	-	-	-	-	76	24	-	-	-	-	-	FG>50%	FG>50%	FG>50%
17.0	5	SS	35	65	23	42	0.71	12	75	M.Stiff	Above	CH	-	-	-	-	71	29	-	-	-	-	-	FG>50%	FG>50%	FG>50%
18.5	5	SS	30	42	20	22	0.55	13	69	M.Stiff	Above	CI	-	-	-	-	77	23	-	-	-	-	-	FG>50%	FG>50%	FG>50%
20.0	9	SS	22	39	18	21	0.81	14	48	Stiff	Above	CI	-	-	-	-	80	20	-	-	-	-	-	FG>50%	FG>50%	FG>50%
22.0	11	SS	20	39	17	22	0.86	16	35	Stiff	Above	CI	-	-	-	-	82	18	-	-	-	-	-	FG>50%	FG>50%	FG>50%
24.0	11	SS	22	46	18	28	0.86	14	52	Stiff	Above	CI	-	-	-	-	75	25	-	-	-	-	-	FG>50%	FG>50%	FG>50%
26.0	46	SS	17	45	18	27	1.04	14	49	Hard	Above	CI	-	-	-	-	75	25	-	-	-	-	-	FG>50%	FG>50%	FG>50%
28.0	34	SS	16	69	28	41	1.29	13	69	Hard	Above	CH	-	-	-	-	72	28	-	-	-	-	-	FG>50%	FG>50%	FG>50%
30.0	>100	SS	16	62	26	36	1.28	13	65	Hard	Above	CH	-	-	-	-	70	30	-	-	-	-	-	FG>50%	FG>50%	FG>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 Frees 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	Ic	SL (%)	FS (%)	Consistancy	Position With Respect to A-Aline	IS:Notation	Gravel (%)	Coarse (%)	Medium (%)	Fine (%)	Silt (%)	Clay (%)	D_{10} (mm)	D_{30}(mm)	D_{60} (mm)	$C_U=D_{60}/D_{10}$	$C_c=D_{30}^2/(D_{10}xD_{60})$	Relative Density	Gravel	Sand
1.0	6	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	0	22	60	18	0	-	-	-	-	-	Loose	<50%	SM
2.0	10	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	1	42	45	12	0	-	-	-	-	-	Loose	<50%	SP-SM
3.0	13	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	2	40	48	10	0	-	-	-	-	-	M.Dense	<50%	SP-SM
4.0	15	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	1	48	43	8	0	-	-	-	-	-	M.Dense	<50%	SP-SM
5.0	14	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	2	35	48	15	0	-	-	-	-	-	M.Dense	<50%	SM
6.5	5	SS	29	48	18	30	0.63	15	55	M.Stiff	Above	CI	-	-	-	-	74	26	-	-	-	-	-	FG>50%	FG>50%	FG>50%
8.0	5	SS	25	45	18	27	0.74	15	58	M.Stiff	Above	CI	-	-	-	-	75	25	-	-	-	-	-	FG>50%	FG>50%	FG>50%
9.5	5	SS	27	47	17	30	0.67	14	50	M.Stiff	Above	CI	-	-	-	-	76	24	-	-	-	-	-	FG>50%	FG>50%	FG>50%
11.0	6	SS	40	69	25	44	0.66	12	65	M.Stiff	Above	CH	-	-	-	-	72	28	-	-	-	-	-	FG>50%	FG>50%	FG>50%
12.5	5	SS	25	37	16	21	0.57	15	41	M.Stiff	Above	CI	-	-	-	-	80	20	-	-	-	-	-	FG>50%	FG>50%	FG>50%
14.0	5	SS	24	35	16	19	0.58	15	38	M.Stiff	Above	CL	-	-	-	-	82	18	-	-	-	-	-	FG>50%	FG>50%	FG>50%
15.5	18	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	1	7	67	25	0	-	-	-	-	-	M.Dense	<50%	SM
17.0	20	SS	-	-	-	-	-	-	-	CG>50%	-	-	0	2	25	60	13	0	-	-	-	-	-	M.Dense	<50%	SM
18.5	7	SS	24	41	17	24	0.71	15	48	M.Stiff	Above	CI	-	-	-	-	76	24	-	-	-	-	-	FG>50%	FG>50%	FG>50%
20.0	9	SS	22	39	17	22	0.77	14	52	Stiff	Above	CI	-	-	-	-	81	19	-	-	-	-	-	FG>50%	FG>50%	FG>50%
22.0	16	SS	15	38	16	22	1.05	15	50	CG>50%	Above	-	0	0	2	55	35	8	-	-	-	-	-	M.Dense	<50%	SC
24.0	18	SS	16	44	17	27	1.04	14	60	V.Stiff	Above	CI	-	-	-	-	75	25	-	-	-	-	-	FG>50%	FG>50%	FG>50%
26.0	54	SS	15	49	18	31	1.10	14	65	Hard	Above	CI	-	-	-	-	74	26	-	-	-	-	-	FG>50%	FG>50%	FG>50%
28.0	60	SS	18	71	29	42	1.26	11	70	Hard	Above	CH	-	-	-	-	70	30	-	-	-	-	-	FG>50%	FG>50%	FG>50%
30.0	>100	SS	18	68	28	40	1.25	12	71	Hard	Above	CH	-	-	-	-	71	29	-	-	-	-	-	FG>50%	FG>50%	FG>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 Frees Well Index
C_U = Uniformity Coefficient
C_C = Coefficient of Curvature
IP=LL-PL

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Table-2.7 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	1.7	7.33	220	325	2.0	7.40	211	305
2	BH-03	2.4	7.33	225	333	2.0	7.40	210	309
3	BH-05	2.4	7.33	229	336	3.0	7.40	208	307

CHAPTER-3

SUB-SURFACE STRATIFICATION

3.0 Preamble:

The sub surface stratification at borehole location, with respect to Foundation/Geotechnical Engineering Application are derived based on the visual identification, laboratory classification tests and field insitu strength tests. Further, the strength parameters are estimated based on the in-situ strength test results as per the following correlations.

3.1 Design Sub Soil Profile:

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

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

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

REFERENCE BORE HOLE-BH:					**01**	**Ref R.L. of G.L. (m):**			**0.00**		
Layer No.	**Layer Thk. (m)**			**Type of Strata**	**Colour**	**Ave. Design SPT**	**Relative Density**	**Consistency**	**(γ) kN/m^3**	**Shear Parameters**	
	Top. R.L.	**Bot. R.L.**	**Thickness**							**(C_u) kPa**	**(ϕ) Deg.**
1	0.00	0.30	0.30	Filled up soil Concrete and waste material	Brown	-	-	-	-	-	-
2	0.30	3.00	2.70	Silty Sand	Brown	9	Loose	-	14.5	-	29.8
3	3.00	6.00	3.00	Silty Sand	Brown	14	Medium Dense	-	17	-	31.2
4	6.00	12.50	6.50	Silty Clay	Black	7	-	Medium Stiff	16	47	-
5	12.50	14.50	2.00	Silty Clay	Black	15	-	Stiff	20	100	-
6	14.50	15.50	1.00	Silty Sand	Black	16	Medium Dense	-	18	-	31.8
7	15.50	19.50	4.00	Silty Clay	Black	7	-	Medium Stiff	16	47	-
8	19.50	24.00	4.50	Clayey Silty Sand	Black	19	Medium Dense	-	18	-	32.7
9	24.00	26.00	2.00	Silty Sand	Brownish	39	Dense	-	19.5	-	38.48
10	26.00	30.00	4.00	Compacted Clay	Brownish	>100	-	Hard	22	400	-

REFERENCE BORE HOLE-BH:					02	Ref R.L. of G.L. (m):			0.00		
Layer No.	Layer Thk. (m)			Type of Strata	Colour	Ave. Design SPT	Relative Density	Consistency	(γ) kN/m^3	Shear Parameters	
	Top. R.L.	Bot. R.L.	Thickness							(C_u) kPa	(ϕ) Deg.
1	0.00	0.30	0.30	Filled up soil Concrete and waste material	Brown	-	-	-	-	-	-
2	0.30	3.00	2.70	Silty Sand	Brown	9	Loose	-	14.5	-	29.8
3	3.00	5.00	2.00	Silty Sand	Brown	14	Medium Dense	-	17	-	31.2
4	5.00	7.50	2.50	Clayey Silty Sand	Black	8	Loose	-	14.5	-	29.6
5	7.50	12.50	5.00	Silty Clay	Black	6	-	Medium Stiff	15.5	40	-
6	12.50	17.00	4.50	Silty Sand	Black	27	Medium Dense	-	19	-	35.1
7	17.00	19.50	2.50	Silty Clay	Black	7	-	Medium Stiff	16	47	-
8	19.50	24.00	4.50	Clayey Silty Sand	Black	19	Medium Dense	-	18	-	32.7
9	24.00	26.00	2.00	Silty Sand	Brownish	41	Dense	-	20	-	38.98
10	26.00	28.00	2.00	Silty Clay	Brownish	41	-	Hard	21	273	-
11	28.00	30.00	2.00	Compacted Clay	Brownish	>100	-	Hard	22	400	-

REFERENCE BORE HOLE-BH:					03	Ref R.L. of G.L. (m):			0.00		
Layer No.	Layer Thk. (m)			Type of Strata	Colour	Ave. Design SPT	Relative Density	Consistency	(γ) kN/m^3	Shear Parameters	
	Top. R.L.	Bot. R.L.	Thickness							(C_u) kPa	(ϕ) Deg.
1	0.00	0.30	0.30	Filled up soil Concrete and waste material	Brown	-	-	-	-	-	-
2	0.30	2.00	1.70	Silty Clay	Brown	9	-	Stiff	17	60	-
3	2.00	5.00	3.00	Silty Sand	Brown	13	Medium Dense	-	16.5	-	30.9
4	5.00	8.00	3.00	Silty Clay	Black	4	-	Soft	14.5	27	-
5	8.00	9.50	1.50	Clayey Silty Sand	Black	9	Loose	-	14.5	-	29.8
6	9.50	10.00	0.50	Clayey Silty Sand	Black	20	Medium Dense	-	18	-	33
7	10.00	12.50	2.50	Silty Clay	Black	12	-	Stiff	18.5	80	-
8	12.50	15.50	3.00	Silty Clay	Black	6	-	Medium Stiff	15.5	40	-
9	15.50	17.00	1.50	Silty Sand	Brownish	19	Medium Dense	-	18	-	32.7
10	17.00	20.00	3.00	Silty Clay	Brownish	6	-	Medium Stiff	15.5	40	-
11	20.00	24.00	4.00	Clayey Silty Sand	Brownish	22	Medium Dense	-	18.5	-	33.6
12	24.00	28.00	4.00	Silty Clay	Brownish	22	-	Very Stiff	20.5	147	-
13	28.00	30.00	2.00	Compacted Clay	Brownish	>100	-	Hard	22	400	-

REFERENCE BORE HOLE-BH:					04	Ref R.L. of G.L. (m):			0.00		
Layer No.	Layer Thk. (m)			Type of Strata	Colour	Ave. Design SPT	Relative Density	Consistency	(γ) kN/m^3	Shear Parameters	
	Top. R.L.	Bot. R.L.	Thickness							(C_u) kPa	(ϕ) Deg.
1	0.00	0.30	0.30	Filled up soil Concrete and waste material	Brown	-	-	-	-	-	-
2	0.30	5.00	4.70	Silty Sand	Brown	12	Medium Dense	-	16	-	30.6
3	5.00	10.00	5.00	Silty Clay	Brown	7	-	Medium Stiff	16	47	-
4	10.00	14.00	4.00	Silty Clay	Black	4	-	Soft	14.5	27	-
5	14.00	9.50	4.50	Clayey Silty Sand	Black	9	Loose	-	14.5	-	29.8
6	9.50	10.00	0.50	Silty Sand	Black	10	Loose	-	15	-	30
7	10.00	12.50	2.50	Silty Sand	Black	10	Loose	-	15	-	30
8	12.50	14.00	1.50	Silty Clay	Black	6	-	Medium Stiff	15.5	40	-
9	14.00	15.50	1.50	Silty Sand	Brownish	9	Loose	-	14.5	-	29.8
10	15.50	20.00	4.50	Silty Clay	Brownish	9	-	Stiff	17	60	-
11	20.00	24.00	4.00	Clayey Silty Sand	Brownish	23	Medium Dense	-	18.5	-	33.9
12	24.00	28.00	4.00	Silty Clay	Brownish	22	-	Very Stiff	20.5	147	-
13	28.00	30.00	2.00	Compacted Clay	Brownish	>100	-	Hard	22	400	-

REFERENCE BORE HOLE-BH:					05	Ref R.L. of G.L. (m):			0.00		
Layer No.	Layer Thk. (m)			Type of Strata	Colour	Ave. Design SPT	Relative Density	Consistency	(γ) kN/m^3	Shear Parameters	
	Top. R.L.	Bot. R.L.	Thickness							(C_u) kPa	(ϕ) Deg.
1	0.00	0.30	0.30	Filled up soil Concrete and waste material	Brown	-	-	-	-	-	-
2	0.30	5.00	4.70	Silty Sand	Brown	13	Medium Dense	-	16.5	-	30.9
3	5.00	10.00	5.00	Silty Clay	Brown	7	-	Medium Stiff	16	47	-
4	10.00	12.50	2.50	Silty Sand	Black	5	Loose	-	14	-	20.37
5	12.50	15.50	3.00	Silty Sand	Black	5	Loose	-	14	-	20.37
6	15.50	20.00	4.50	Silty Clay	Black	20	-	Very Stiff	20	133	-
7	20.00	26.00	6.00	Silty Clay	Black	11	-	Stiff	18	73	-
8	26.00	28.00	2.00	Silty Clay	Black	46	-	Hard	21	307	-
9	28.00	30.00	2.00	Compacted Clay	Brownish	>100	-	Hard	22	400	-

REFERENCE BORE HOLE-BH:					06	Ref R.L. of G.L. (m):			0.00		
Layer No.	Layer Thk. (m)			Type of Strata	Colour	Ave. Design SPT	Relative Density	Consistency	(γ) kN/m^3	Shear Parameters	
	Top. R.L.	Bot. R.L.	Thickness							(C_u) kPa	(ϕ) Deg.
1	0.00	0.30	0.30	Filled up soil Concrete and waste material	Brown	-	-	-	-	-	-
2	0.30	2.00	1.70	Silty Sand	Brown	6	Loose	-	14.5	-	29.2
3	2.00	6.50	4.50	Silty Clay	Brown	13	-	Stiff	19	87	-
4	6.50	15.50	9.00	Silty Sand	Black	6	Loose	-	14.5	-	29.2
5	15.50	18.00	2.50	Silty Sand	Black	19	Medium Dense	-	18	-	32.7
6	18.00	20.00	2.00	Silty Clay	Black	7	-	Medium Stiff	16	47	-
7	20.00	24.00	4.00	Clayey Silty Sand	Black	16	Medium Dense	-	18	-	31.8
8	24.00	28.00	4.00	Silty Clay	Black	36	-	Hard	21	240	-
9	28.00	30.00	2.00	Compacted Clay	Brownish	>100	-	Hard	22	400	-

FOUNDATION SYSTEM

CHAPTER-4

FOUNDATION SYSTEM

4.0 Preamble:

In the design of foundation system, the stress-strain compatibility of the super structure, sub structure and the bearing strata should be satisfied both individually and as a combined system. In view of this, the following data are needed for the design of foundation system, defined in terms of the type of sub structure and the bearing strata characteristics.

- The super structure characteristics along with the loading pattern on the sub structure
- The sub soil characteristics that define the required substructure configuration for a safe transfer of super-structural loads to the bearing strata

Considering the above aspects of the foundation design, the suitable type of foundation system is presented below.

4.1 Proposed Structures

An understanding of the proposed construction and the order of loads on the foundations is needed for choosing the appropriate foundation system.

In the present case, the proposed structure is configured with stilt plus five upper floors, and is meant for residential use. For this kind of structure, the column loads could vary between 1500kN to 2500kN. The above mentioned loads have no bearing on the design of either sub or super structures and are mentioned just to provide an insight to choose an appropriate foundation system with respect to subsoil conditions.

4.2 Foundation System

For the kind of proposed structure and the sub soil conditions, it is not possible to adopt any kind of open foundation system from both shear and settlement considerations. Hence, it is advisable to adopt deep pile foundation system.

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

Table:- 4.1 Recommended Safe Load Carrying Capacities of Bored Cast-in Situ Piles								
Sl.No	Reference Bore hole No.	Length of Pile below E.G.L	Assumed Length of Cut-Off Below E.G.L	Length of Pile below Cut-off	Dia.of Pile in (mm)	SAFE LOAD CARRYING CAPACITY (kN)		
						Vertical Load Carrying Capacity	Pull Out Capacity	Lateral Load Carrying Capacity
1	BH-01	26.0	1.0	25.00	500	1200	800	35
2					600	1500	1000	45
3					750	1900	1200	65
4					900	2400	1400	90

RECOMMENDATIONS

CHAPTER-5

RECOMMENDATIONS

5.0 Recommendation for Bored Cast Insitu Pile Foundation:

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

5.1 Construction method statement of pile foundation:

- For the bored cast in situ piles, a guide casing of 2 to 3.0m length can be adopted
- The mud used shall be made out of sodium bentonite with minimum frees swell index of more than 300% and liquid limit more than 100%. The silt content in bentonite shall not more than 5%.
- The mud was prepared using sodium bentonite with a density of 1.10 to 1.15 g/cc.

5.2 General Recommendation:

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

FOR GEO ENGINEERING CONSULTANTS, CHENNAI

AUTHORIZED SIGNATORY

ANNEXURE

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

Type of Pile	Bored	Diameter of Pile			Length of Pile below G.L. (m)	26	As Per IS:2911-(P-I,S-2)-2010	
Reference Bore Hole	BH-01		600	mm	Surcharge Pressure	0	kPa	

Layer No.	Layer Thk. (m) Top. R.L.	Bot. R.L.	Thickness	Type of Strata	Ave. SPT	(γ) kN/m^3 of Layer	Ave. upto Layer	Shear Parameters (C_u) kPa	(ϕ) Deg.	Effective Overburden Pressure (kPa) At top of Layer	At Bot. of Layer	At Mid. of Layer	Adhesion Factor (α)	Earth Pressure Coefficient (k)	Skin Friction (Q_f) kN		
1	0	1	1	Cut-Off Level													
2	1	3	2.0	Sand	9	14.5	14.5	-	29.8	0.0	9.0	4.5	-	1.0	qf	2	9.7
3	3	6	3.0	Sand	14	17.0	15.8	-	31.2	9.0	30.0	19.5	-	1.1	qf	3	70.8
4	6	12.5	6.5	Clay	7	16.0	16.5	47	-	30.0	69.0	49.5	0.9	-	qf	4	518.3
5	12.5	14.5	2.0	Clay	15	20.0	18.0	100	-	69.0	89.0	79.0	0.4	-	qf	5	162.1
6	14.5	15.5	1.0	Sand	16	18.0	19.0	-	31.8	89.0	97.0	93.0	-	1.1	qf	6	118.6
7	15.5	17	1.5	Clay	7	16.0	17.0	47	-	97.0	106.0	101.5	0.9	-	qf	7	119.6
8	17	19.5	2.5	Clay	15	20.0	18.0	100	-	106.0	131.0	118.5	0.4	-	qf	8	202.6
9	19.5	22	2.5	Sand	19	18.0	19.0	-	32.7	131.0	151.0	141.0	-	1.1	qf	9	484.9
10	22	26	4.0	Sand	40	20.0	19.0	-	38.8	151.0	191.0	171.0	-	1.4	qf	10	1493.2

Summation of Positive Skin Resitance (kN) Q_f= 3179.87

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

Computation of End Bearing Resistance

		SPT	ϕ	C_u	N_q	N_c			
Bearing Stratum	Clay	40	-	267	-	9	Eff.Ht.of Overburden	9	m
							Effective Overburden Pressure	66.75	kN/m^2

End Bearing Resistance (kN) Q_p= 679.43

Ultimate Load Carrying Capacity (Q_{ult})	**$Q_u=Q_f-Q_f+Q_p$ (kN)**	3859.30
Safe Load Carrying Capacity (Q_{safe})	**Q_A-safe=Q_u/2.5 (kN)**	1543.72
Allowable Safe Pull out Capacity	**$Q_{A\text{-}pull}$: Qf/3 (kN)**	1059.96

Skin Resistance in Clay Layer is π*d*T_l*C_u*α

Skin Resistance in Sand Layer is π*d*T_l*q_l*K*Tan(ϕ)

End Bearing Resistance in Clay Layer is π*d^2/4*C_u*N_c

End Bearing Resistance in Sand Layer is π*d^2/4*Q*N_q

Where

Note: End Bearing is Sandy Clay/Silty Clay Formation it is model as Clay corresponding Cu value taken as 267 kPa.

Cu=Undrained Shear Strength of Clay

K=Coef. Earth Pressure at Rest

d=Dia. Of Pile

ϕ=Angle of Shearing Resistance

q_l=Effecitve Overburden Pressure at middle of Layer

α=Adhession Factor

N_c=Bearing Capacity Factor = 9

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

T_l=Thickness of Layer

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

LATERAL LOAD CARRYING CAPACITY OF BORED CAST- SITU PILES

Reference Bore Hole : BH-01

1 Geometrical Data

Type of Pile Head Considered		Fixed	
Diameter of Pile (d)	:	0.60	m
Free standing Length of Pile (e)	:	0	m
Length of Pile below E.G.L (Le)	:	26.0	m
Cut-Off Level From E.G.L	:	1.0	
Length of Pile below Cut-Off Level (Le)	:	25.0	m
Grade of Concrete (M)	:	25	MN/m^2
Young's Modulus of Concrete (E)	:	25000000	kN/m^2
Momemnt of Inertia (I)	:	0.006362	m^4

2 Determination of Depth of Fixity

Type of Soil Strata	:	sand	
Ground Water Condition	:	Submerged	
Average SPT "N" Value	:	9	
T=(EI/nh)1/5			
(n can be read as η in the above and below equation in case of Sand)			
nh=	:	1200	kN/m^3
In Case of Sand	:	-	kN/m^2
T=	:	2.66	
L1/T	:	0.00	
Lf/T	:	2.20	
Depth of Fixity below Cut off (z_f)	:	5.85	m

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

Allowable Lateral Deflection (Y)	:	0.005	m
Lateral Load Carrying Capacity (H)= Y*12EI/(e+zf)^3	:	47.75	kN
Recommended Design Lateral Load carrying Capacity	:	**47**	**kN**
Fixed End Moment,M_F=H(e+z_f)/2		140	
Reduction Factor (L_1/T)	:	0.83	m
Actual Moment (Fixed End Moment/Reduction Factor),M_F		**116**	kN-m

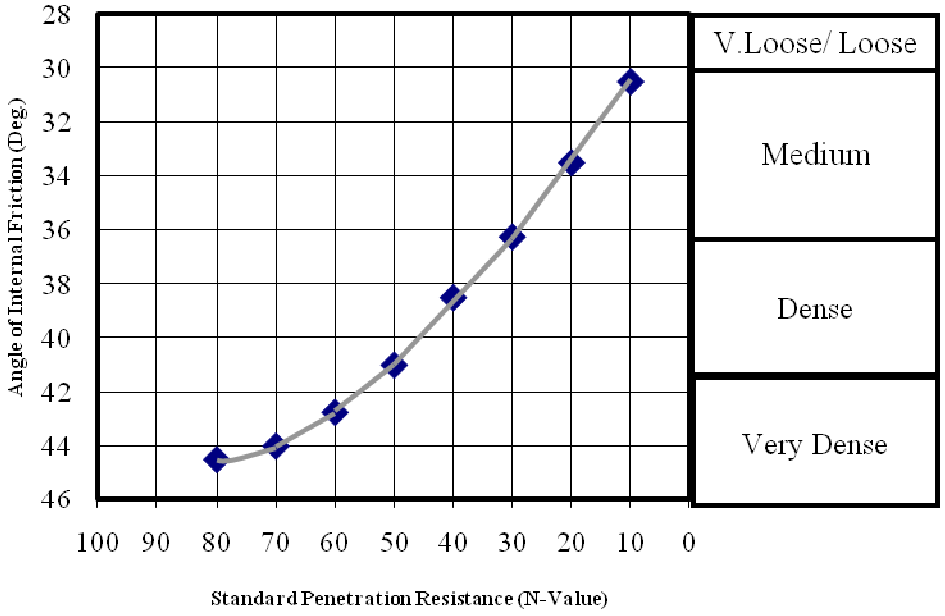


FIG. A1 Relation Ship between Angle of Internal Friction & N-value (Reproduced from IS:6403-1981)

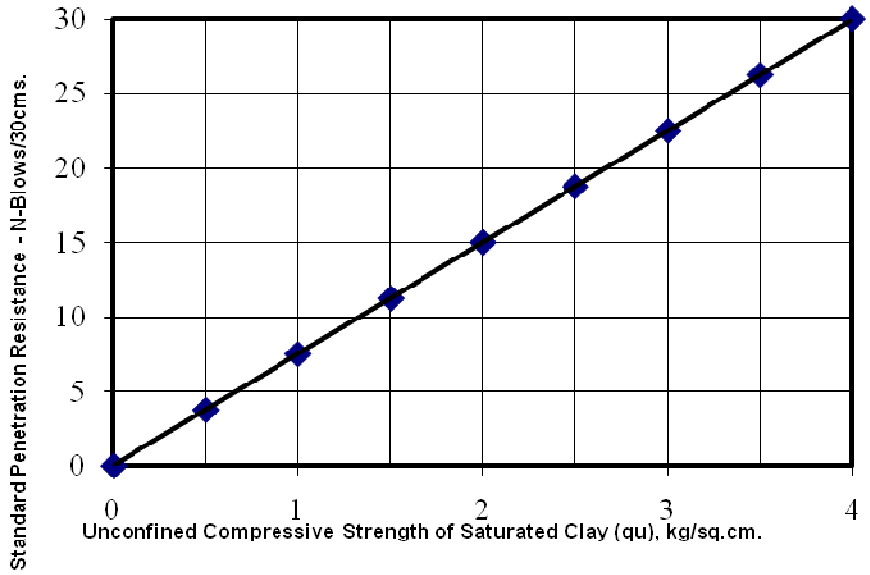


FIG. A2 : Relationship between UCC & SPT-Value (N) of Saturated Clay (AfterTerzhagi & Peck, 1948)



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Property Valuation & Cost Estimation

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

Ownership, Compliance & Legal Verification

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

Zoning & Land Use Analysis

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

Property Documentation & Workflow Tools

Forms & Templates, Document Generator, Document Translation, Dictionary

Vastu & Property Management Tools

Home Vastu Shastra, Plot Vastu Shastra, Property Management

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