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SOIL EXPLORATION AND FOUNDATION REPORT

FOR THE PROPOSED BUILDING

AT

NO. 510

MINT STREET

KONDITHOPE

CHENNAI

PROJECT NO. TJE/001877/2021



T.J.ENGINEERS

SOIL EXPLORATION AND FOUNDATION DESIGN DIVISION

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EXPLORATION REPORT

PROJECT NO. TJE/001877/2021

1.INTRODUCTION:

M/S SREE FOUNDATION has proposed to construct a Basement Floor + Ground Floor + Five Floors Building at No. 510, Mint Street, Kondithope, Chennai-600 079. The work was entrusted to T.J. Engineers by the promoter. The location is shown in Fig No.1. The object of the soil exploration work done is to determine the soil properties of the proposed area and to arrive at a most suitable type of foundation system for the proposed structure.

2.0 SCOPE OF WORK

The Scope of Work includes the following

Boreholes

- ❖ Drilling of borehole at the proposed borehole locations as per the direction of the client.
- ❖ Collection of disturbed and undisturbed soil samples and carrying out the relevant laboratory test on soils.
- ❖ Conducting of standard penetration test (SPT) within the borehole at every 1.50m depth interval or as required.
- ❖ Collection of soil sample from bore hole.
- ❖ Preparation of geotechnical investigation Report.

3.0. LOCATION & NUMBER OF BORE HOLES

For this purpose six bore holes were bored up to maximum depth of 30.00m below existing ground level. The bore hole location is shown in Fig No.1 and bore log details are given in Fig No. 2,3,4,5,6&7. The bore holes were terminated in the Very Hard Sandy Silty Clay (Cemented Clay) layer.

4.0. GEOTECHNICAL INVESTIGATIONS

4.1. Filed Investigations of Boreholes

Rotary drilling boring technique was adopted for boring in this area. The Standard penetration tests were conducted at change of layers and at specified intervals, commencing the test at 1.50m below the existing ground level. The relative density of different soil layers obtained from the N-Values are given in the Fig No. 2,3,4,5,6&7. Disturbed and un disturbed samples were collected from all the layers for visual observation, classification tests and strength characteristics of the soil layers.

Standard Penetration Test (SPT)

Standard Penetration Tests were conducted using a split spoon sampler, as per relevant codal provision (IS: 2131 – 1981). The SPT is generally conducted in sandy and completely weathered rock strata till 45 cm penetration with number of blows recorded for every 15 cm penetration. The number of blows required for first 15 cm is neglected. The blows for last 30 cm penetration or refusal 'N' value of 100 whichever is earlier is taken as the 'N' value. In the clayey strata, when driving of sampling tube is not possible, SPT was conducted to know the consistency of the soil strata and to retrieve the disturbed soil sample. The soil samples obtained in the split spoon sampler are carefully packed in polythene bags for testing in the laboratory. The SPT values obtained at every 1.50m interval are given in the bore logs.

4.2. Grain Size Analysis

Combined sieve and hydrometer analyses were conducted on the various samples collected. The results are given in Table-1a, 1b. Based on the proportion of the different soil constituents, the soil is classified.

4.3. Laboratory Tests for Borehole samples

The following laboratory tests were conducted on collected Soil Samples.

- I. Moisture Content as per IS: 2720 (Part 2)
- II. Specific Gravity as per IS: 2720 (Part 2)
- III. Sieve Analysis as per IS: 2720 (Part 4)
- IV. Hydrometer Analysis as per IS: 2720 (Part 4)
- V. Liquid Limit as per IS: 2720 (Part 5)
- VI. Plastic Limit as per IS: 2720 (Part 5)
- VII. Swelling Index as per IS: 2720 (Part 40)

5.0. BORE LOG DATA

The Summary of bore hole log data for BH-01, BH-02, BH-03, BH-04, BH-05, BH-06 & BH-07 is given in Fig-2,3,4,5,6&7. Bore hole location is given in Fig.1.

6.0. LABORATORY TEST RESULTS

The laboratory test results of boreholes samples are presented in Table-1a, 1b and Table-2a, 2b.

7.0. GROUND WATER TABLE

The ground water table was encountered at the **depth of 4.00m**, below the existing ground level at the time of soil exploration.

8.0. SUB SOIL PROFILE

From the visual identification from field test results, it is concluding that the sub soil is basically made-up of eight distinctive layers.

- i. Filled Up Soil 0.00m to 1.40m
- ii. Loose to Dense Silty Sand, 1.40m to 5.50m SPT's N= 6-35

iii. Medium Dense to Very Dense Silty Sand, 5.50m to 10.00m	SPT's	N= 22-68
iv. Very Dense Silty Sand, 10.00m to 14.10m	SPT's	N= 53->100
v. Soft to Medium Stiff Sandy Silty Clay, 14.10m to 17.20m	SPT's	N= 3-7
vi. Dense Silty Clayey Sand, 17.20m to 20.50m	SPT's	N= 30-48
vii. Dense to Very Dense Silty Clayey Sand, 20.50m to 26.00m	SPT's	N= 30-52
viii. Very Hard Sandy Silty Clay (Cemented Clay), 26.00m to 30.00m	SPT's	N=>100

The soil profile details are presented in the Bore Logs, in Fig. 2,3,4,5,6&7.

9.0 FOUNDATION ANALYSIS

From the bore log data at the top from 0.00m to 1.40m filled up soil is present. From 1.40m to 5.50m loose to dense Silty Sand layer is present. From 5.50m to 14.10m medium dense to very dense Silty Sand layer is present. From 14.10m to 17.20m soft to medium stiff Sandy Silty Clay layer is present, this layer has got swelling character. From 17.20m to 20.50m dense Silty Clayey Sand layer is present. From 20.50m to 26.00m dense to very dense Clayey Silty Sand layer is present. Below 26.00m very hard Sandy Silty Clay (Cemented Clay) layer is seen, this layer is fair to rest pile foundation for heavy loaded structure.

The soil up to 17.20m is the critical zone for open foundation system, with in the critical zone loose to dense Sandy layer and Soft to Medium Stiff Clay layer is present and the Clay layer has got swelling character. The soil in the shallow depth is fair to adopt open foundation for light loaded structure. The open foundation of Isolated Footing or Continues Strip Raft Footing or Raft Foundation can be adopted. The proposed structure has got Basement + Ground Floor + Five Floors, total Raft foundation can be adopted.

The open foundation can be placed at the minimum **depth of 2.10m** below the existing ground level. The existing ground level was same as the road level at the time of soil investigation. The proposed structure has got basement floor, SBC at different depth has been worked out and given below.

For heavy loaded structure, if the SBC is not sufficient for the expected loading intensity, it is advisable to **provide deep foundation of pile foundations**. The pile foundation can be **Bored Cast in situ pile**. The pile foundation should be terminated at

the minimum **depth of 30.00m** below existing ground level. The pile should be anchored into the very hard cemented Clay layer for minimum of 4.00m depth.

9.1. COMPUTATION OF THE GROSS SAFE BEARING CAPACITY OF RAFT FOUNDATION AT 2.10m DEPTH

Based on the standard penetration test value the ultimate bearing capacity (q_u) could be calculated from the following formula.

$$q_u = \gamma D_f N_q + 0.4 \gamma' B N_\gamma$$

The observed N-Value is taken as 11 from Fig. 2,3,4,5,6&7.

The corresponding bearing capacity factors are,

$$N_q = 14.10$$

$$N_\gamma = 10.34$$

Where,

$$\gamma = \text{Bulk density} = 1.50 \text{ t/m}^3$$

$$\gamma' = \text{Submerged density} = 0.50 \text{ t/m}^3$$

$$D_f = \text{Depth of footing} = \text{Considered minimum of 2.10 m.}$$

$$D_w = \text{Depth of water table} = 4.00$$

$$B = \text{Breadth of the footing} = \text{Consider minimum of 1.00m.}$$

Substitute all the above values in the formula,

$$\begin{aligned} Q_u &= 1.50 \times 2.10 \times 14.10 + 0.4 \times 0.50 \times 1.00 \times 10.34 \\ &= 44.415 + 2.068 \\ &= 46.483 \text{ t/m}^2 \end{aligned}$$

Safe bearing capacity could be considered with a factor of safety of 2.5

$$\text{Hence, safe bearing capacity } q_s = 46.483 / 2.50 = 18.593 \text{ t/m}^2. \text{ Say } 18.50 \text{ t/m}^2$$

Therefore, Safe Bearing Capacity of the soil at the depth of 2.10m is 18.50 t/m²

9.2. SETTLEMENT ANALYSIS FOR THE LOADING INTENSITY OF 34.00 t/m²

LAYER -1, SILTY SAND

The Settlement of the Sand layer can be calculated using the following formula.

$$S_1 = (H/C) \text{Log}_e (\sigma'_0 + \Delta\sigma / \sigma'_0)$$

Where

H = The thickness of the compressible clay layer

$$= 12.00\text{m}$$

$$C = 1.5q_c / \sigma'_0$$

q_c = Static cone resistance

$$= 220 \text{ t/m}^2$$

$$C = 1.5 \times 220 / 8.05$$

$$= 40.993$$

σ'₀ = The original effective over burden pressure at the centre of the clay layer

$$= 8.05 \text{ t/m}^2$$

Δσ = The stress increases at the centre of the clay layer due to foundation loads (or) pressure

$$= 0.41 \text{ t/m}^2$$

$$S_1 = (12.00 / 40.993) \times \text{Log}_e (8.05 + 0.41 / 8.05)$$

$$= 0.292 \times 10^{-3} \times 0.049$$

$$= 0.01450\text{m} \times 10^{-3}$$

$$= 14.50\text{mm}$$

LAYER -2, SANDY SILTY CLAY

The Consolidation Settlement of the Clay layer can be calculated using the following formula.

$$S_2 = (C_c / 1 + e_0) H \log_{10} (\sigma'_0 + \Delta\sigma / \sigma'_0)$$

Where

C_c = Coefficient of compression index
= 0.36

e_0 = The initial void ratio
= 1.90

H = The thickness of the compressible clay layer
= 3.10m

σ'_0 = The original effective over burden pressure at the centre of the clay layer
= 11.825 t/m²

$\Delta\sigma$ = The stress increases at the centre of the clay layer due to foundation loads
(or) pressure
= 0.122 t/m²

S_2 = $(0.36 / 1 + 1.90) 3.10 \log_{10} (11.825 + 0.122 / 11.825)$
= $0.124 \times 3.10 \times 4.457$
= $1.713 \text{m} \times 10^{-3}$
= 1.713mm

TOTAL SETTLEMENT

$$\begin{aligned} &= S_1 + S_2 \\ &= 14.50 + 1.713 \\ &= \mathbf{16.213\text{mm} < 50\text{mm}} \end{aligned}$$

The maximum allowable settlement as per IS: 1904-1986 for R.C.C structure with Isolated footing foundation is 50mm- 75mm. **The settlement is within the permissible limit. Hence it is Safe**

9.3. LOAD CARRYING CAPACITY OF THE PILE

Based on the standard penetration test value the ultimate load carrying capacity (q_u) could be calculated from the following formula.

$$Q_u = Q_b + Q_s$$

$$Q_s = \text{Ultimate unit skin friction of an individual layer}$$

$$= \alpha C_u (\pi D L)$$

Where

$$\alpha = \text{Adhesion factor} = 0.40$$

$$C_u = \text{Un drained shear strength} = 50.25 \text{ t/m}^2$$

$$D = \text{Diameter of pile} = 0.40 \text{ m}$$

$$L = \text{Length of pile in individual layer} = 4.00 \text{ m}$$

$$Q_s = 0.40 \times 50.25 \times 3.14 \times 0.40 \times 4.00$$

$$Q_s = 100.982 \text{ t}$$

$$Q_b = \text{Ultimate Base resistance}$$

$$Q_b = N_c C_u A_b$$

where

$$N_q = \text{Bearing Capacity Factor} = 9$$

$$C_u = \text{Un drained shear strength} = 50.25 \text{ t/m}^2$$

$$D = \text{Diameter of pile} = 0.40 \text{ m}$$

$$A_b = \text{Cross sectional area at the base} = (\pi D^2 / 4)$$

$$Q_b = 9 \times 50.25 \times 3.14 \times 0.40^2 / 4$$

$$= 56.802 \text{ t}$$

$$Q_u = 56.802 + 100.982$$

$$= 157.784 \text{ t}$$

$$Q_{\text{safe}} = Q_u / \text{F.S}$$

$$= 157.784 / 2.50$$

$$Q_{\text{safe}} = 63.113 \text{ say } 63.00 \text{ t}$$

The load carrying capacity for five different diameter of piles for the depth of **28.00m** are worked and are given below.

Dia of Pile	Depth of Pile	Safe Load (Tones)
400mm	28.00m	63
450mm	28.00m	74
500mm	28.00m	86
600mm	28.00m	112
750mm	28.00m	156

The above safe loads are provisional and shall be confirmed by conducting pile load test as per the guide line laid down in IS: 2911 (Part: IV).

10.0. CONCLUSIONS

1. The soil in the shallow depth is fair to adopt open foundation system for light loaded structure.
2. For light loaded structure, open foundation of **Isolated Footing** or **Continues Strip Raft Footing** or **Raft Foundation** can be adopted. The proposed structure has got Basement + Ground Floor + Five Floors, total Raft foundation can be adopted.
3. The open foundation can be placed at the minimum **depth of 2.10m** below the existing ground level. The existing ground level was same as the road level at the time of soil investigation. The proposed structure has got basement floor, Safe Bearing Capacity (SBC) at different depth has been worked out and given below.

Sl. No.	Depth (m)	S.B.C (t/m ²)
1	2.10m	18.50
2	2.50m	22.00
3	3.00m	26.00
4	3.50m	30.00
5	4.00m	34.00

4. The shallow foundation should rest on **natural un disturbed** layer.
5. The soil in the shallow depth is sandy soil, proper shoring should be done for the basement floor excavation.
6. All the foundation should rest on 100 mm thick 1:4:8 concrete mat, over 100mm thick river sand or M Sand layer.
7. **For heavy loaded structure**, if the SBC is not sufficient for the expected loading intensity and horizontal force, it is advisable to provide deep foundation of pile foundations. The pile foundation can be Bored Cast in situ pile. The pile foundation

should be terminated at the minimum **depth of 30.00m** below existing ground level. The pile should be **anchored** into the hard Cemented Clay layer **for minimum of 4.00m depth**. The load carrying capacity of pile for five different diameters, for **30.00m depth** has been worked out and given below.

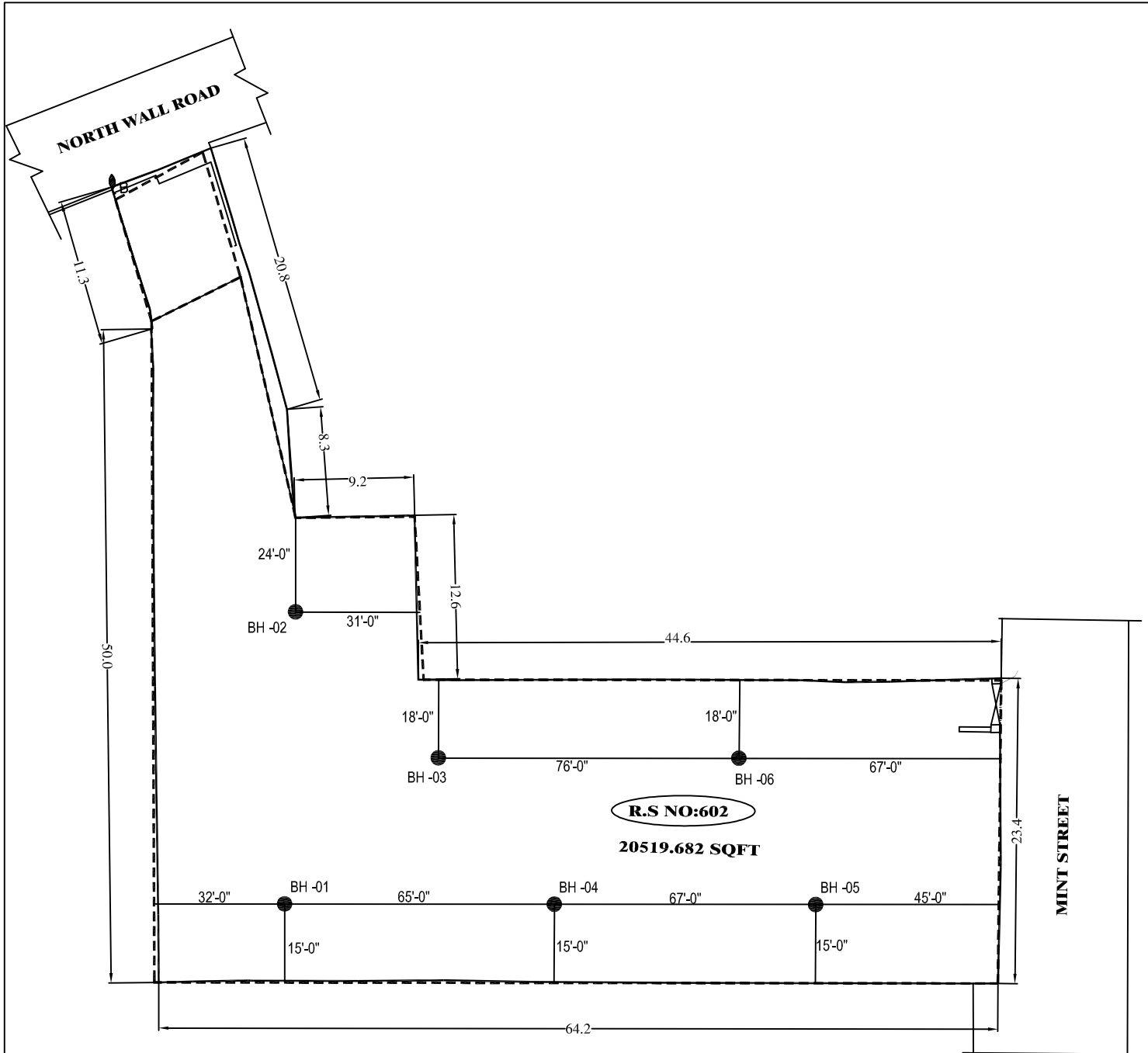
Dia of Pile	Depth of Pile	Safe Load (Tones)
400mm	30.00m	63
450mm	30.00m	74
500mm	30.00m	86
600mm	30.00m	112
750mm	30.00m	156

The above safe loads are provisional and shall be confirmed by conducting pile load test as per the guide line laid down in IS: 2911 (Part: IV)

8. Proper precaution should be taken while boring the pile against sliding of bore hole, by maintaining the proper dense bentonite slurry or providing temporary casing or permanent casing and pile concreting should be done as soon as boring is over.
9. The bore hole should be flushed properly before laying concrete.
10. The pile boring should be done with **Percussion drilling** or **Hydraulic Rotary Drilling** with DMC method.
11. For foundation design, Stress due to any eccentricity, stress due to horizontal force should be considered, and stability should be checked.
12. All suggested foundation recommendations and precautions should be adopted while undertaking the design aspects and construction activities.

For T.J. Engineers

09 - 04 – 2021

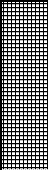


CLIENT:- M/S SREE FOUNDATION NO.11, EKAMBAESWARAR, AGRAHARAM STREET PARK TOWN, CHENNAI – 600 003	PROJECT:- PROPOSED BUILDING AT NO. 510, MINT STREET, KONDITHOPE, CHENNAI-600 079.	SITE PLAN FIG.1	 T.J. ENGINEERS soil investigation and foundation design division T.J. HOUSE PLOT NO. 4, ANNA NAGAR, 1ST STREET, VELACHERY, CHENNAI-42, tjengineers@yahoo.com tjengineers1998@gmail.com OFF: 044-42334194
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BORE LOG

PROJECT : Proposed Building at No. 510, Mint Street, Kondithope, Chennai-600 079.
BORE HOLE NO : B.H:01
TYPE OF BORING : Rotary Drilling

DATE OF COMMENCEMENT: 11 - 03 - 2021
DATE OF COMPLETION : 12 - 03 - 2021
G.W.L : 4.00m

Depth below G.L	Soil profile	Description of soil	Thickness of layer	Depth at which samples are collected		Standard penetration test data			Graphical representation of penetration resistance				
				D.S	U.D.S	Depth at which test is conducted	N-Value	Relative density/ Consistency					
									10	20	30	40	50
0.00		Filled Up Soil	1.10										
1.00													
1.10													
2.00		Silty Sand-SLS1 (Grayish Brown)	2.40			1.50	6	Loose					
3.00						3.00	10	Loose					
3.50													
4.00						4.50	27	Medium Dense					
5.00		Silty Sand-SLS2 (Whitish Brown)	6.50			6.00	33	Dense					
6.00													
7.00						7.50	48	Dense					
8.00													
9.00						9.00	55	Very Dense					
10.00													
10.00						10.50	63	Very Dense					
11.00													
12.00		Silty Sand-SLS3 (Whitish Yellowish Brown)	4.00			12.00	>100	Very Dense					
13.00													
13.50						13.50	60	Very Dense					
14.00													
14.00		Sandy Silty Clay-SSLC1 (Dark Gray)	3.00			15.00	6	Medium Stiff					
15.00													
16.00						16.50	3	Soft					
16.50													

Remark: All Dimensions in meters
➡ End of Boring

BORE LOG

PROJECT : Proposed Building at No. 510, Mint Street, Kondithope, Chennai-600 079.
BORE HOLE NO : B.H:01
TYPE OF BORING : Rotary Drilling

DATE OF COMMENCEMENT: 11 - 03 - 2021
DATE OF COMPLETION : 12 - 03 - 2021
G.W.L : 4.00m

Depth below G.L	Soil profile	Description of soil	Thickness of layer	Depth at which samples are collected		Standard penetration test data			Graphical representation of penetration resistance				
				D.S	U.D.S	Depth at which test is conducted	N-Value	Relative density/ Consistency	10	20	30	40	50
17.00													
18.00		Silty Clayey Sand-SLCS1 (Grayish Brown)	3.50			18.00	35	Dense					
19.00													
20.00						20.00	48	Dense					
21.00		Clayey Silty Sand-CSLS1 (Yellowish Whitish Gray)	5.50										
22.00						21.50	36	Dense					
23.00						23.00	45	Dense					
24.00													
25.00						25.00	52	Very Dense					
26.00		Sandy Silty Clay-SSLC2 (Cemented Clay) (Whitish Gray Yellowish Brown)											
27.00						26.50	>100	Very Hard					
28.00						28.00	>100	Very Hard					
29.00													
30.00						30.00	>100	Very Hard					
31.00													

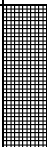
Remark: All Dimensions in meters
→ End of Boring

FIG: 2

BORE LOG

PROJECT : Proposed Building at No. 510, Mint Street, Kondithope, Chennai-600 079.
BORE HOLE NO : B.H:02
TYPE OF BORING : Rotary Drilling

DATE OF COMMENCEMENT: 12 - 03 - 2021
DATE OF COMPLETION : 13 - 03 - 2021
G.W.L : 4.00m

Depth below G.L	Soil profile	Description of soil	Thickness of layer	Depth at which samples are collected		Standard penetration test data			Graphical representation of penetration resistance				
				D.S	U.D.S	Depth at which test is conducted	N-Value	Relative density/ Consistency					
0.00		Filled Up Soil	1.00						10	20	30	40	50
1.00													
2.00		Silty Sand-SLS1 (Grayish Brown)	3.00			1.50	8	Loose					
3.00						3.00	12	Medium Dense					
4.00						4.50	24	Medium Dense					
5.00						6.00	31	Dense					
6.00		Silty Sand-SLS2 (Yellowish Whitish Brown)	10.10			7.50	43	Dense					
7.00						9.00	49	Dense					
8.00						10.50	57	Very Dense					
9.00						12.00	>100	Very Dense					
10.00						13.50	53	Very Dense					
11.00													
12.00		Sandy Silty Clay-SSLC1 (Dark Gray)	3.10			15.00	7	Medium Stiff					
13.00													
14.00						16.50	4	Soft					
15.00													
16.00													

Remark: All Dimensions in meters
→ End of Boring

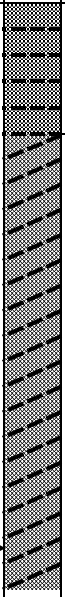
FIG: 3

cont....

BORE LOG

PROJECT : Proposed Building at No. 510, Mint Street, Kondithope, Chennai-600 079.
BORE HOLE NO : B.H:02
TYPE OF BORING : Rotary Drilling

DATE OF COMMENCEMENT: 12 - 03 - 2021
DATE OF COMPLETION : 13 - 03 - 2021
G.W.L : 4.00m

Depth below G.L	Soil profile	Description of soil	Thickness of layer	Depth at which samples are collected		Standard penetration test data			Graphical representation of penetration resistance				
				D.S	U.D.S	Depth at which test is conducted	N-Value	Relative density/Consistency					
17.00		Silty Clayey Sand-SLCS1 (Grayish Brown)		17.20		18.00	30	Dense					
18.00													
19.00													
20.00						20.00	46	Dense					
21.00													
22.00													
23.00													
24.00													
25.00													
26.00													
27.00													
28.00													
29.00													
30.00													
31.00													

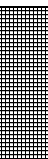
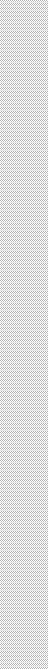
Remark: All Dimensions in meters
→ End of Boring

FIG: 3

BORE LOG

PROJECT : Proposed Building at No. 510, Mint Street, Kondithope, Chennai-600 079.
BORE HOLE NO : B.H:03
TYPE OF BORING : Rotary Drilling

DATE OF COMMENCEMENT: 13 - 03 - 2021
DATE OF COMPLETION : 13 - 03 - 2021
G.W.L : 4.00m

Depth below G.L	Soil profile	Description of soil	Thickness of layer	Depth at witch samples are collected		Standard penetration testdata			Graphical representation of penetration resistance						
				D.S	U.D.S	Depth at witch test is conducted	N-Value	Relative density/ Consistency							
0.00		Filled Up Soil	1.10												
1.00															
2.00		Silty Sand-SLS1 (Grayish Whitish Brown)	2.90			1.50	14	Medium Dense							
3.00								3.00	22	Medium Dense					
4.00															
5.00		Silty Sand-SLS2 (Whitish Brown)				4.50	35	Dense							
6.00								6.00	42	Dense					
7.00															
8.00								7.50	50	Very Dense					
9.00															
10.00								9.00	58	Very Dense					
10.50								10.50	66	Very Dense					
11.00															
12.00															
13.00															
14.00															
15.00															
16.00															

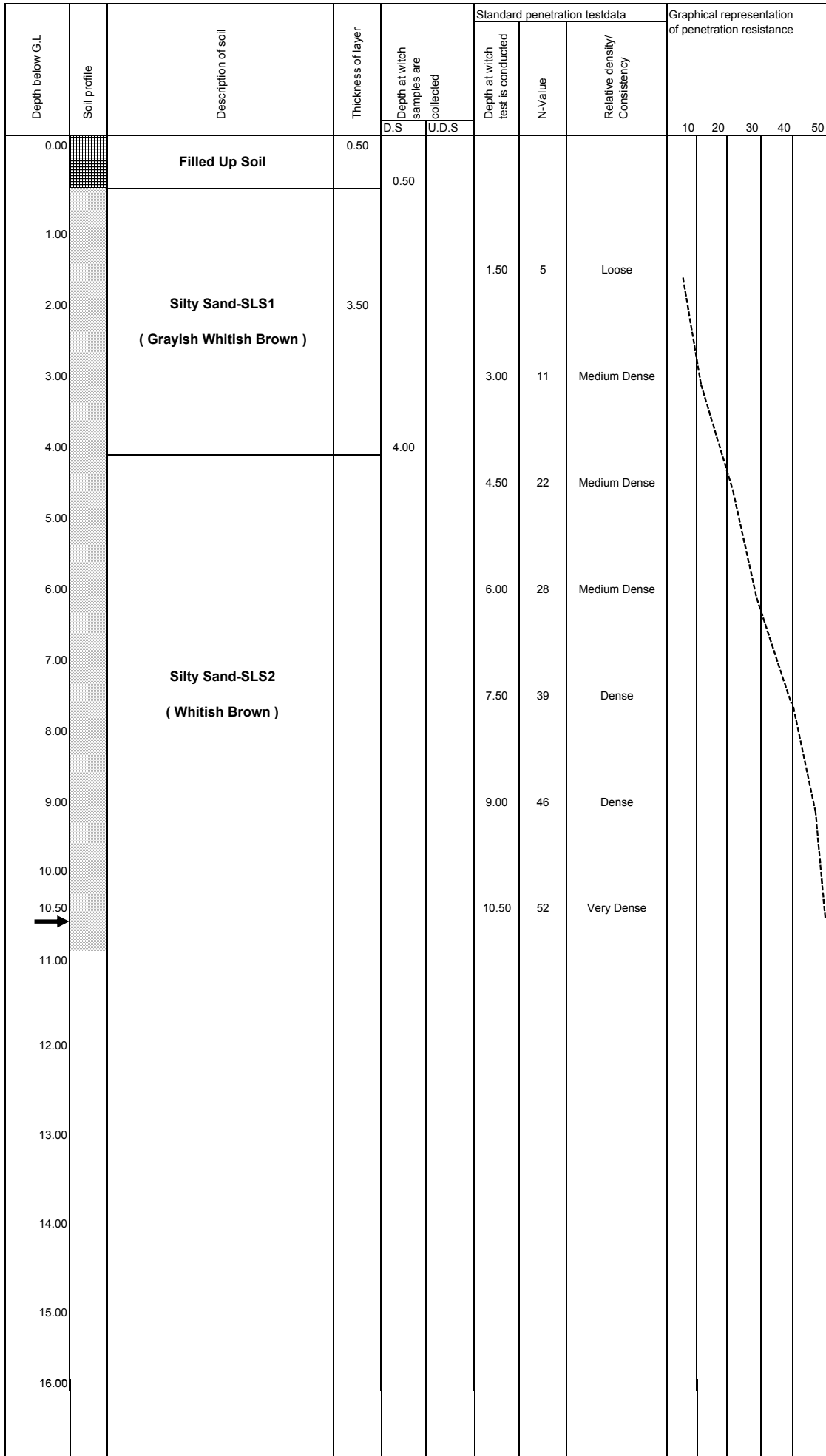
Remark: All Dimensions in meters
→ End of Boring

FIG: 4

BORE LOG

PROJECT : Proposed Building at No. 510, Mint Street, Kondithope, Chennai-600 079.
BORE HOLE NO : B.H:04
TYPE OF BORING : Rotary Drilling

DATE OF COMMENCEMENT: 13 - 03 - 2021
DATE OF COMPLETION : 13 - 03 - 2021
G.W.L : 4.00m



Remark: All Dimensions in meters
→ End of Boring

FIG: 5

BORE LOG

PROJECT : Proposed Building at No. 510, Mint Street, Kondithope, Chennai-600 079.
BORE HOLE NO : B.H:05
TYPE OF BORING : Rotary Drilling

DATE OF COMMENCEMENT: 13 - 03 - 2021
DATE OF COMPLETION : 14 - 03 - 2021
G.W.L : 4.00m

Depth below G.L	Soil profile	Description of soil	Thickness of layer	Depth at which samples are collected		Standard penetration test data			Graphical representation of penetration resistance				
				D.S	U.D.S	Depth at which test is conducted	N-Value	Relative density/ Consistency					
0.00		Filled Up Soil	1.20										
1.00													
1.20				1.20		1.50	16	Medium Dense					
2.00													
3.00						3.00	24	Medium Dense					
4.00						4.50	35	Dense					
5.00				5.50		6.00	45	Dense					
6.00													
7.00						7.50	55	Very Dense					
8.00													
9.00						9.00	58	Very Dense					
10.00													
10.50						10.50	65	Very Dense					
11.00													
12.00													
13.00													
14.00													
15.00													
16.00													

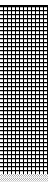
Remark: All Dimensions in meters
 End of Boring

FIG: 6

BORE LOG

PROJECT : Proposed Building at No. 510, Mint Street, Kondithope, Chennai-600 079.
BORE HOLE NO : B.H:06
TYPE OF BORING : Rotary Drilling

DATE OF COMMENCEMENT: 15 - 03 - 2021
DATE OF COMPLETION : 15 - 03 - 2021
G.W.L : 4.00m

Depth below G.L	Soil profile	Description of soil	Thickness of layer	Depth at which samples are collected		Standard penetration test data			Graphical representation of penetration resistance				
				D.S	U.D.S	Depth at which test is conducted	N-Value	Relative density/ Consistency	10	20	30	40	50
0.00		Filled Up Soil	1.40										
1.00													
1.40				1.40		1.50	18	Medium Dense					
2.00													
3.00		Silty Sand-SLS1 (Grayish Whitish Brown)	3.60			3.00	23	Medium Dense					
4.00						4.50	28	Medium Dense					
5.00				5.00									
6.00						6.00	35	Dense					
7.00		Silty Sand-SLS2 (Whitish Brown)				7.50	47	Dense					
8.00													
9.00						9.00	60	Very Dense					
10.00													
10.50						10.50	68	Very Dense					
11.00													
12.00													
13.00													
14.00													
15.00													
16.00													

Remark: All Dimensions in meters
→ End of Boring

FIG: 7

Project: Proposed Building at No. 510, Mint Street, Kondithope, Chennai-600 079.

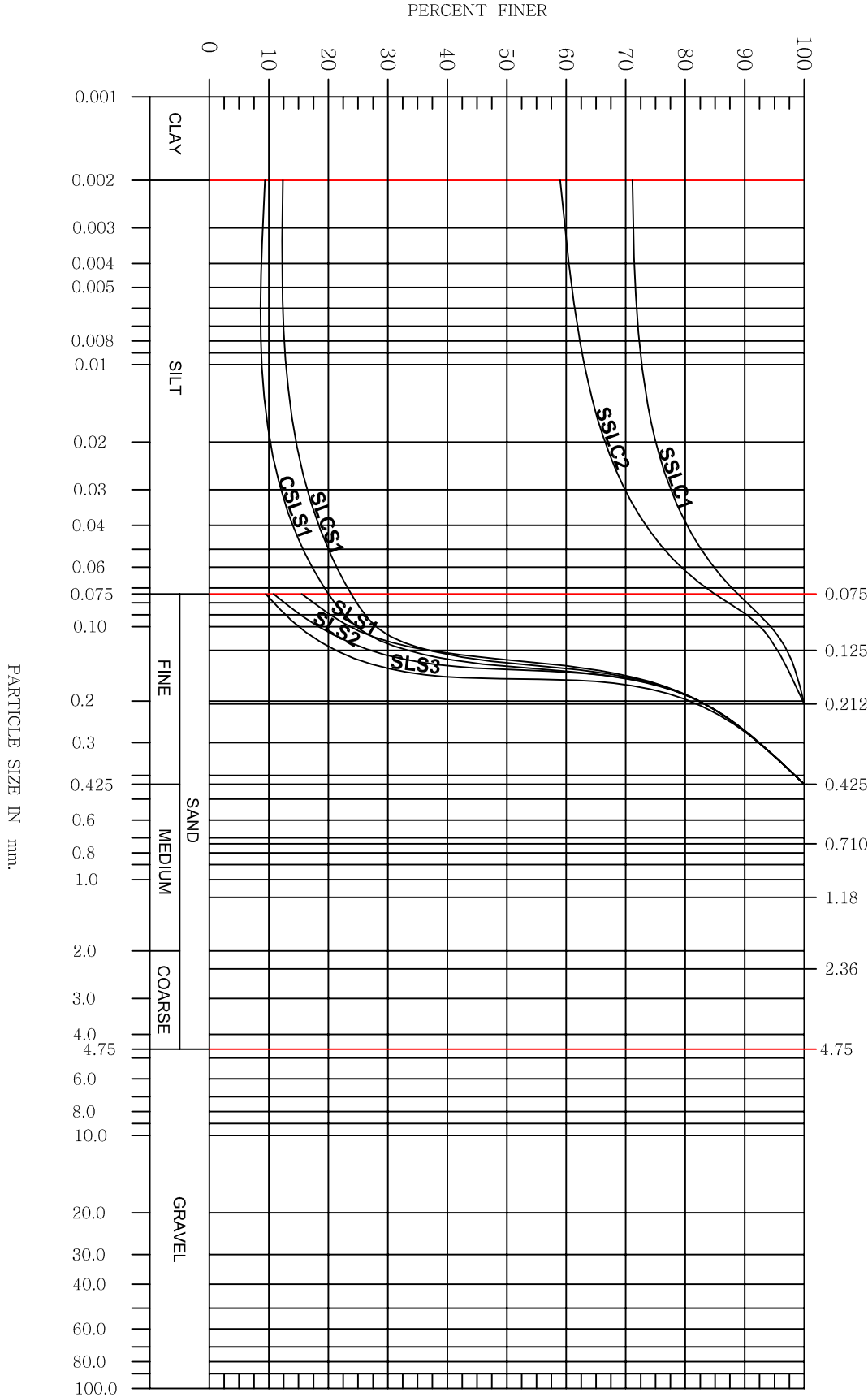
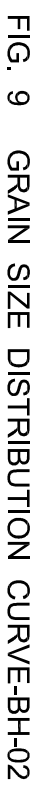


FIG. 8 GRAIN SIZE DISTRIBUTION CURVE-BH-01



Project: Proposed Building at No. 510, Mint Street, Kondithope, Chennai-600 079.

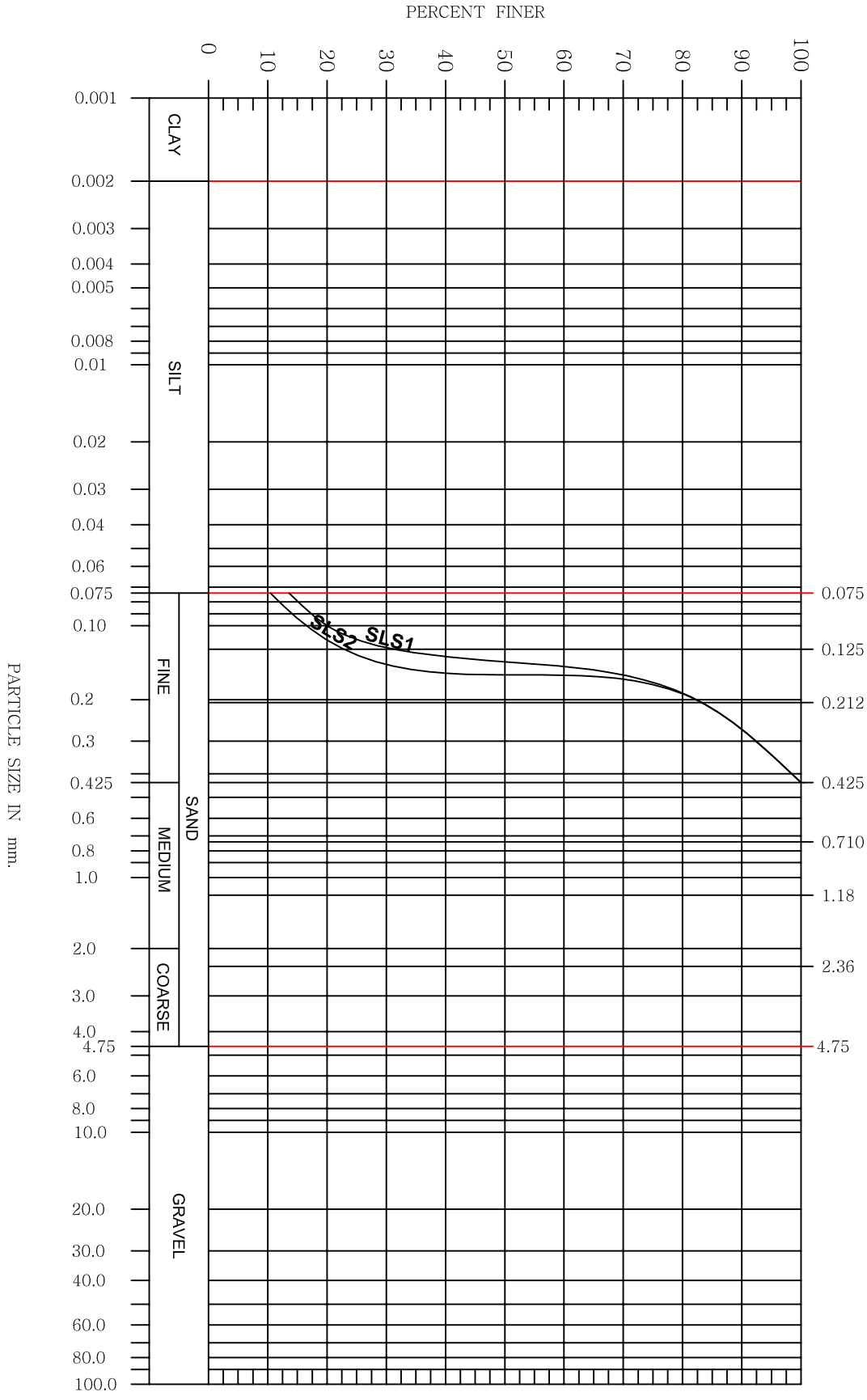


FIG. 10 GRAIN SIZE DISTRIBUTION CURVE-BH-03

Project: Proposed Building at No. 510, Mint Street, Kondithope, Chennai-600 079.

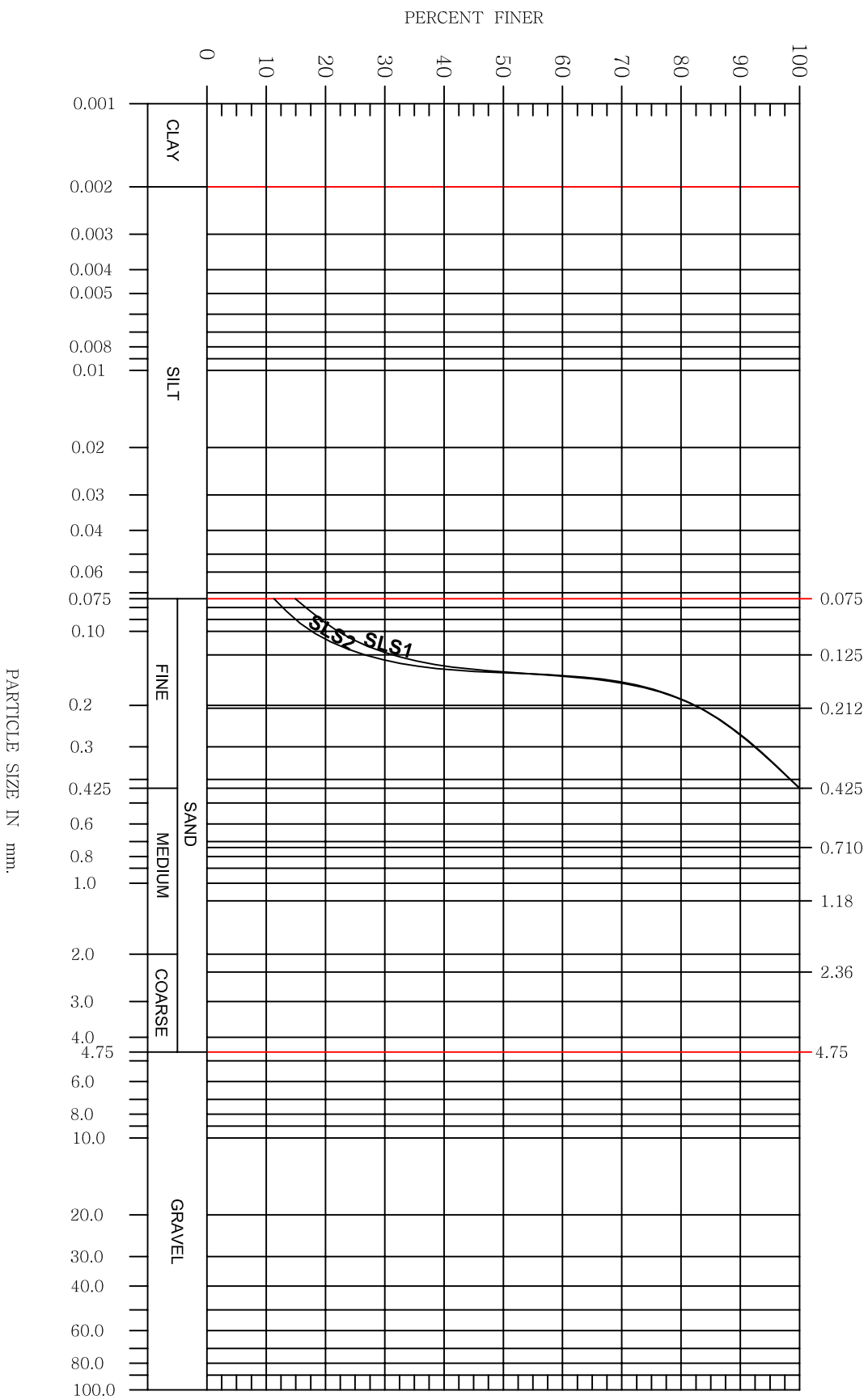


FIG. 11 GRAIN SIZE DISTRIBUTION CURVE-BH-04

Project: Proposed Building at No. 510, Mint Street, Kondithope, Chennai-600 079.

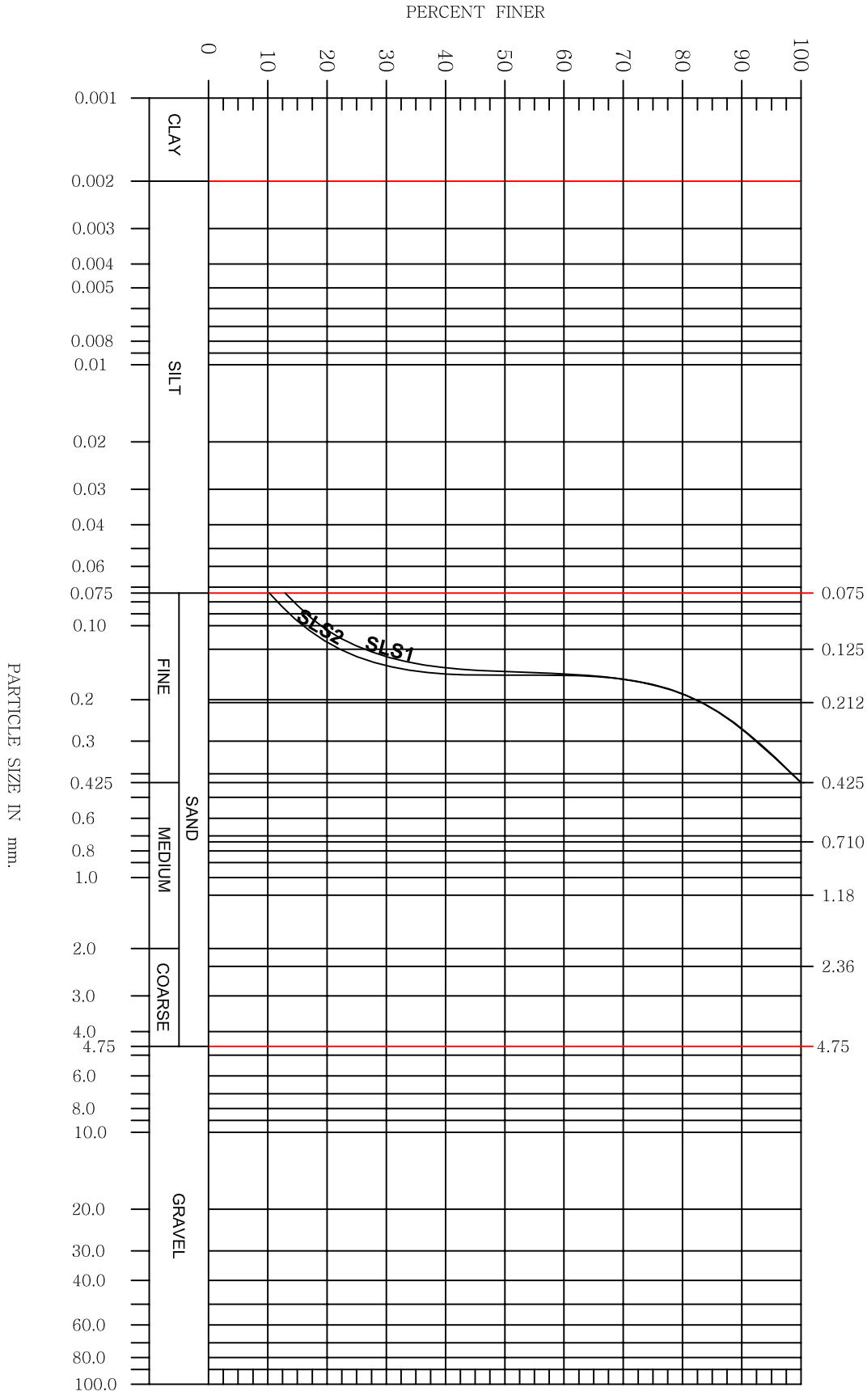


FIG. 12 GRAIN SIZE DISTRIBUTION CURVE-BH-05

Project: Proposed Building at No. 510, Mint Street, Kondithope, Chennai-600 079.

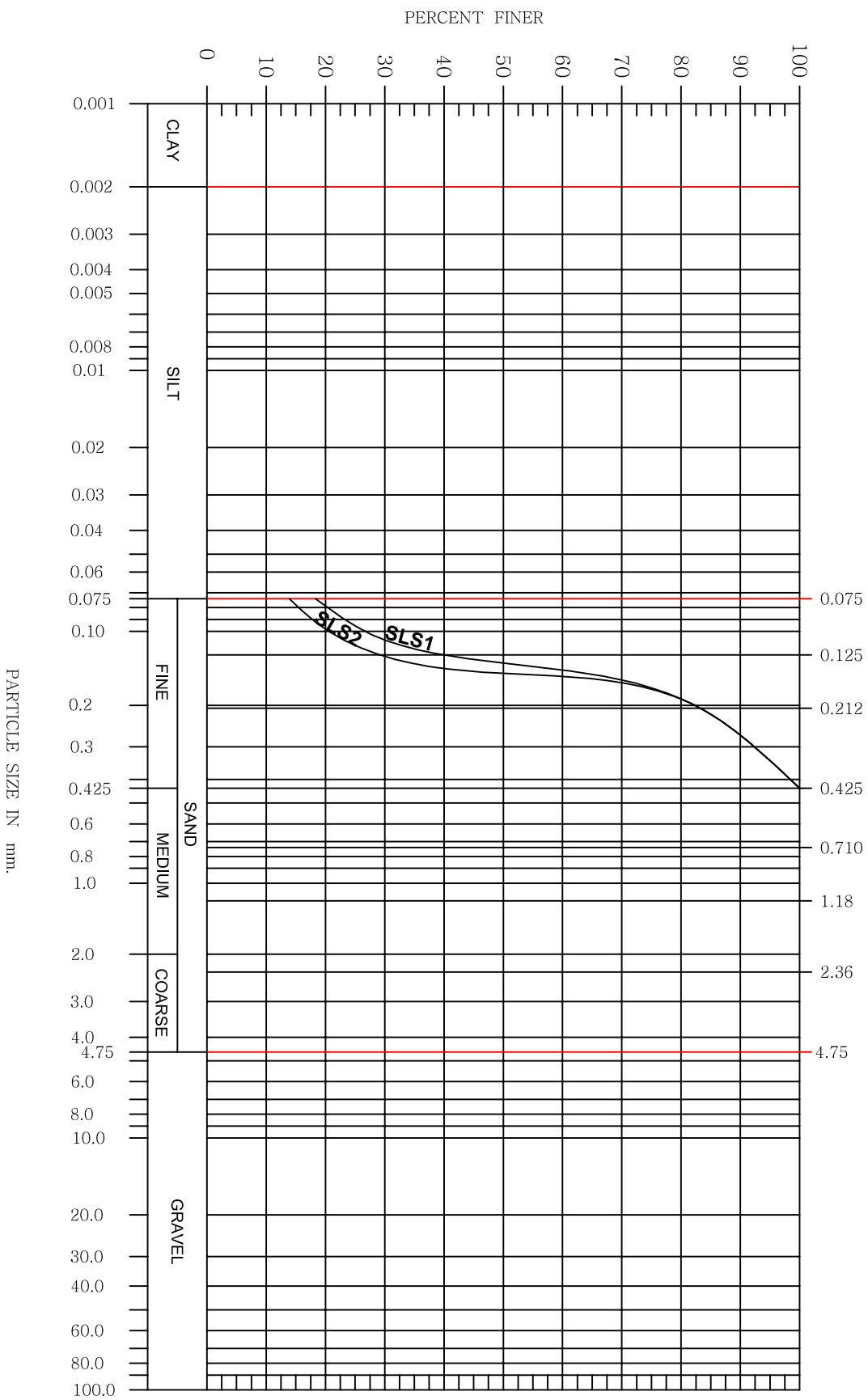


FIG. 13 GRAIN SIZE DISTRIBUTION CURVE-BH-06

LABORATORY TEST RESULTS

TABLE - 1a

B. H No	Layer thickness	Soil classification	Depth of sample collected		SP. gravity	%of free swell	Grain size distribution				Remarks		
	m		DS / SPT m	UDS m					Clay	Silt		Sand	Gravel
									%	%		%	%
1	0.00 - 1.10	Filled Up Soil	—	—	—	—	—	—	—	—	—		
	1.10 - 3.50	Silty Sand-SLS1	1.50	—	2.64	—	0	16	84	0	—		
	3.50 - 10.00	Silty Sand-SLS2	4.50	—	2.64	—	0	12	88	0	—		
	10.00 - 14.00	Silty Sand-SLS3	10.50	—	2.64	—	0	9	91	0	—		
	14.00 - 17.00	Sandy Silty Clay-SSLC1	15.00	—	2.67	39	72	16	12	0	—		
	17.00 - 20.50	Silty Clayey Sand-SLCS1	18.00	—	2.66	—	13	11	76	0	—		
	20.50 - 26.00	Clayey Silty Sand-CSLS1	21.50	—	2.65	—	9	11	80	0	—		
	26.00 - 30.00	Sandy Silty Clay-SSLC2 (Cemented Clay)	30.00	—	2.67	29	58	28	14	0	—		
2	0.00 - 1.00	Filled Up Soil	—	—	—	—	—	—	—	—	—		
	1.00 - 4.00	Silty Sand-SLS1	1.50	—	2.64	—	0	15	85	0	—		
	4.00 - 14.10	Silty Sand-SLS2	4.50	—	2.64	—	0	13	87	0	—		
	14.10 - 17.20	Sandy Silty Clay-SSLC1	15.00	—	2.67	38	71	18	11	0	—		
	17.20 - 20.00	Silty Clayey Sand-SLCS1	20.00	—	2.65	—	14	12	74	0	—		

LABORATORY TEST RESULTS
TABLE - 1b

B . H No	Layer thickness	Soil classification	Depth of sample collected		SP. gravity	%of free swell	Grain size distribution				Remarks		
	m		DS / SPT m	UDS m					Clay	Silt		Sand	Gravel
									%	%		%	%
3	0.00 - 1.10	Filled Up Soil	—	—	—	—	—	—	—	—	—		
	1.10 - 4.00	Silty Sand-SLS1	1.50	—	2.64	—	0	14	86	0	—		
	4.00 - 10.50	Silty Sand-SLS2	10.50	—	2.64	—	0	11	89	0	—		
4	0.00 - 0.50	Filled Up Soil	—	—	—	—	—	—	—	—	—		
	0.50 - 4.00	Silty Sand-SLS1	1.50	—	2.64	—	0	15	85	0	—		
	4.00 - 10.50	Silty Sand-SLS2	10.50	—	2.64	—	0	12	88	0	—		
5	0.00 - 1.20	Filled Up Soil	—	—	—	—	—	—	—	—	—		
	1.20 - 5.50	Silty Sand-SLS1	1.50	—	2.64	—	0	13	87	0	—		
	5.50 - 10.50	Silty Sand-SLS2	10.50	—	2.64	—	0	11	89	0	—		
6	0.00 - 1.40	Filled Up Soil	—	—	—	—	—	—	—	—	—		
	1.40 - 5.00	Silty Sand-SLS1	1.50	—	2.64	—	0	17	83	0	—		
	5.00 - 10.50	Silty Sand-SLS2	10.50	—	2.64	—	0	14	86	0	—		

LABORATORY TEST RESULTS

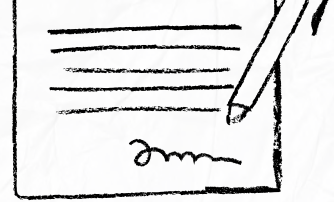
TABLE - 2a

B. H No	Layer thickness	Soil classification	Depth of sample collected		LL %	PL %	Bulk density t/m ³	Consolidation Parameters		Shear Strength Parameters		Remarks
	m		DS / SPT m	UDS m				e _o	C _c	Cu t/m ²	∅ degree	
1	0.00 - 1.10	Filled Up Soil	—	—	—	—	—	—	—	—	—	—
	1.10 - 3.50	Silty Sand-SLS1	1.50	—	—	—	1.50	—	—	—	31	—
	3.50 - 10.00	Silty Sand-SLS2	4.50	—	—	—	1.52	—	—	—	33	—
	10.00 - 14.00	Silty Sand-SLS3	10.50	—	—	—	1.57	—	—	—	36	—
	14.00 - 17.00	Sandy Silty Clay-SSLC1	15.00	—	69	25	1.50	1.90	0.36	2.68	—	—
	17.00 - 20.50	Silty Clayey Sand-SLCS1	18.00	—	—	—	1.54	—	—	—	34	—
	20.50 - 26.00	Clayey Silty Sand-CSLS1	21.50	—	—	—	1.56	—	—	—	37	—
	26.00 - 30.00	Sandy Silty Clay-SSLC2 (Cemented Clay)	30.00	—	56	19	1.54	—	—	50.25	—	—
2	0.00 - 1.00	Filled Up Soil	—	—	—	—	—	—	—	—	—	—
	1.00 - 4.00	Silty Sand-SLS1	3.00	—	—	—	1.50	—	—	—	31	—
	4.00 - 14.10	Silty Sand-SLS2	4.50	—	—	—	1.56	—	—	—	35	—
	14.10 - 17.20	Sandy Silty Clay-SSLC1	15.00	—	70	26	1.50	1.80	0.35	3.35	—	—
	17.20 - 20.00	Silty Clayey Sand-SLCS1	20.00	—	—	—	1.57	—	—	—	34	—

LABORATORY TEST RESULTS

TABLE -2b

B . H No	Layer thickness	Soil classification	Depth of sample collected		LL %	PL %	Bulk density t/m ³	Consolidation Parameters		Shear Strength Parameters		Remarks
	m		DS / SPT m	UDS m				e _o	C _c	Cu t/m ²	∅ degree	
3	0.00 - 1.10	Filled Up Soil	—	—	—	—	—	—	—	—	—	—
	1.10 - 4.00	Silty Sand-SLS1	1.50	—	—	—	1.52	—	—	—	33	—
	4.00 - 10.50	Silty Sand-SLS2	10.50	—	—	—	1.56	—	—	—	37	—
4	0.00 - 0.50	Filled Up Soil	—	—	—	—	—	—	—	—	—	—
	0.50 - 4.00	Silty Sand-SLS1	1.50	—	—	—	1.50	—	—	—	31	—
	4.00 - 10.50	Silty Sand-SLS2	10.50	—	—	—	1.57	—	—	—	38	—
5	0.00 - 1.20	Filled Up Soil	—	—	—	—	—	—	—	—	—	—
	1.20 - 5.50	Silty Sand-SLS1	1.50	—	—	—	1.53	—	—	—	33	—
	5.50 - 10.50	Silty Sand-SLS2	10.50	—	—	—	1.57	—	—	—	38	—
6	0.00 - 1.40	Filled Up Soil	—	—	—	—	—	—	—	—	—	—
	1.40 - 5.00	Silty Sand-SLS1	1.50	—	—	—	1.53	—	—	—	33	—
	5.00 - 10.50	Silty Sand-SLS2	10.50	—	—	—	1.58	—	—	—	39	—



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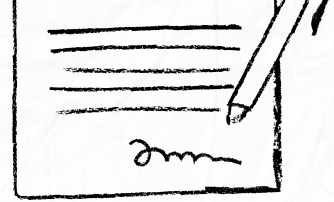
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