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SOIL EXPLORATION AND FOUNDATION REPORT

FOR THE PROPOSED BUILDING

AT

NO. 152

PURASAIWAKKAM HIGH ROAD

PURASAIWAKKAM

CHENNAI

PROJECT NO. TJE/001137/2018

T.J.ENGINEERS

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EXPLORATION REPORT

PROJECT NO. TJE/001137/2018

1. INTRODUCTION:

M/S RAINBOW FOUNDATIONS LTD., has proposed to construct a Three Basement + Stilt Floor + Seventeen Floors Building at No. 152, Purasaiwakkam High Road, Pursaiwakkam, Chennai-600 010. The soil investigation 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 three bore holes were bored up to maximum depth of 26.00m below existing ground level. The bore hole location is shown in Fig No.1 and bore log details

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are given in Fig No. 2,3&4. The bore holes were terminated in the Very Dense Sandy Gravel (Disintegrated Rock)/Soft Rock layer.

4.0. GEOTECHNICAL INVESTIGATIONS

4.1. Filed Investigations of Boreholes

Rotary drilling 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. 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 code 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 in neglected. The blows for last 30 cm penetration or refusal 'N' value of 100 whichever is earlier. Is taken as the 'N' 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 is given in Fig No. 2,3&4. 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 & Table-2a, 2b.

7.0. GROUND WATER TABLE

The ground water table was **encountered** at the **depth of 2.50m** below the existing ground level at the time of soil exploration.

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8.0. SUB SOIL PROFILE

From the visual identification from field test results, it is concluding that soil strata is not similar in BH-01, BH-02 and BH-03 location.

In BH-01 Location the soil strata is made-up of ten distinctive layers.

i. Filled Up Soil 0.00m to 1.80m

ii. Medium Stiff Sandy Silty Clay, 1.80m to 3.50m SPT's N= 5

iii. Medium Dense Silty Sand, 3.50m to 6.80m SPT's N= 15-23

iv. Very Loose Silty Clayey Sand, 6.80m to 9.00m SPT's N= 4

v. Medium Stiff Silty Clay, 9.00m to 11.00m SPT's N= 5

vi. Medium Dense to Very Dense Silty Clayey Sand, 11.00m to 20.00m SPT's N= 24-68

vii. Very Dense Clayey Silty Gravelly Sand,20.00m to 21.00m SPT's N= >100

viii. Very Dense Silty Clayey Sand, 21.00m to 23.80m SPT's N= 51

ix. Very Dense Silty Gravelly Clayey Sand, 23.80m to 25.00m SPT's N= >100

x. Very Dense Sandy Gravel, 25.00m to 26.00m SPT's N= >100

In BH-02 Location the soil strata is made-up of six distinctive layers.

i. Filled Up Soil 0.00m to 1.20m

ii. Medium Stiff Sandy Silty Clay, 1.20m to 2.80m SPT's N= 6

iii. Medium Dense Silty Sand, 2.80m to 6.70m SPT's N= 12-22

iv. Loose Silty Clayey Sand, 6.70m to 9.80m SPT's N= 5-7

v. Medium Dense to Dense Clayey Silty Sand, 9.80m to 18.80m SPT's N= 16-73

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vi. Very Dense Soft Rock, 18.80m to 23.00m SPT's N= >100

In BH-03 Location the soil strata is made-up of seven distinctive layers.

i. Filled Up Soil 0.00m to 1.90m

ii. Medium Stiff Sandy Silty Clay, 1.90m to 4.20m SPT's N= 8

iii. Very Soft to Medium Stiff Sandy Silty Clay, 4.20m to 8.00m SPT's N= 2-5

iv. Loose Clayey Silty Sand, 8.00m to 11.00m SPT's N= 5-6

v. Loose to Medium Dense Clayey Silty Sand, 11.00m to 14.20m SPT's N= 10-18

vi. Very Dense Clayey Silty Sand, 14.20m to 19.40m SPT's N= 51->100

vii. Very Dense Soft Rock, 19.40m to 23.00m SPT's N= >100

The soil profile details are presented in the Bore log, Fig. 2,3&4.

9.0. FOUNDATION ANALYSIS AND DESIGN

From the bore log data soil strata is not similar in all the three locations. From 0.00m to 1.20m-1.90m filled up soil is present. From 1.90m to 2.80m- 4.20m medium stiff Sandy Silty Clay layer is present, this layer has got swelling character.

In BH-01 and BH-02 location from 4.20m to 6.80m medium dense Silty Sand layer is present, but in BH-03 location very soft Sandy Silty Clay layer is present.

From 6.80m to 11.00m loose Silty Clayey Sand/ medium stiff Silty Clay layer is present. From 11.00m to 20.00m medium dense to very dense Silty Sand layer is present.

In BH-01 location, from 20.00 to 25.00m very dense Clayey Silty Gravelly Sand/Silty Clayey Sand layer is present, this layer is not present in other two locations. Below 25.00m very dense (Dis-integrated Rock) layer is seen.

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In BH-02 and BH-03 location below 20.00m soft rock having RQD-13% layer is seen. Diamond bit core barrel is used to drill this layer. The depth of soft Rock layer varies from 20.00m to 25.00m.

The layer up to 20.00m is the critical zone for open foundation system. The soil with in the critical zone for open foundation is loose to medium dense in consistency. For light loaded structure open foundation of **Isolated Footing** (or) **Continuous Strip Footing** (or) **Raft Foundation** can be adopted. The open foundation can be placed at the minimum depth of 2.50m below the existing ground level. Existing ground level is 1.00m higher than the road level. The SBC at different depth has been worked out and given below.

The proposed structure has got three Basement + Stilt floor + Seventeen floors, during the excavation for basement there is a possibility of bottom heave due to Elastic Movement of soil and Plastic inward movement of the surrounding soil. Therefore it is advisable to provide **Pile cum Raft foundation.**

The pile foundation can be Bored Cast in situ pile. The depth of soft Rock layer varies from 20.00m to 25.00m.The pile foundation should be terminated at the **depth of 24.00m to 27.00m** below existing ground level. The pile should be anchored into the very dense Soft Rock layer for minimum of 3.00m depth.

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9.1. COMPUTATION OF THE SAFE BEARING CAPACITY AT 2.50m DEPTH

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

$q_u = 1.2\ C\ Nc + \gamma\ D_f\ N_q$

The minimum observed N-Value is taken as 2 from Fig. 2,3&4.

The corresponding bearing capacity factors are,

$Nc = 5.7$

$N_q = 1$

Where,

C = Un drained shear strength = 1.34 t/m^2

γ = Unit weight of the soil = 1.50 t/m^3

γ' = Submerged unit weight of the soil = 0.50 t/m^3

D_f = Depth of footing = 2.50 m

D_f = Depth of water table = 2.50 m

Substitute all the above values in the formula,

$q_u = 1.2 \times 1.34 \times 5.7 + 1.50 \times 2.50 \times 1$

$= 9.165 + 3.75 = 12.915\ t/m^2$

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

Hence, safe bearing capacity $q_s = 12.915/2.50 = 5.166\ t/m^2$. Say 5.00 t/m^2.

Therefore, safe bearing capacity of the soil at 2.50m is 5.00 t/m^2

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9.1.2 COMPUTATION OF THE SAFE BEARING CAPACITY AT 8.00m DEPTH

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

$qu = (\gamma' Df + (\gamma - \gamma') Dw) \; Nq + 0.4 \; \gamma' \; B \; N\gamma$

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

The corresponding bearing capacity factors are,

$Nq = 6.68$

$N\gamma = 4.20$

Where,

γ = Bulk density = 1.50 t/m 3

γ' = Submerged density = 0.50 t/m 3

Df = Depth of footing = Considered minimum of 8.00 m.

Dw = Depth of water table = 2.50m

B = Breadth of the footing = Consider minimum of 1.00m.

Substitute all the above values in the formula,

$Qu = (0.50 \times 8.00 + (1.50 - 0.50) 2.50) \; 6.68 + 0.4 \times 0.50 \times 1.00 \times 4.20$

$= 43.42 + 0.84$

$= 44.26 \; t/m^2$

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

Hence, safe bearing capacity $q_s = 44.26 / 2.50 = 17.704 \; t/m^2$. Say $18.00 \; t/m^2$

Therefore, Safe Bearing Capacity of the soil at the depth of 8.00m is 18.00 t/m^2

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9.2. LOAD CARRYING CAPACITY OF THE CONVENTIONAL PILE-24.00m DEPTH

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

$$Qu = Qb + Qs$$

Qs = Ultimate unit skin friction on an individual layer

$$= Ks\ \sigma'vo \tan\delta\ \pi D L$$

Where

Ks = Co-efficient of horizontal soil stress = 0.471

$\sigma'vo$ = average efficient overburden pressure = 10.75 t/m^2

δ = angle of wall friction = 32

D = Dia meter of pile = 0.40m

L = Length of individual layer = 3.00m

= 0.471 x 10.75 x 0.624 x 3.14 x 0.40 x 3.00

= 11.904 t

$q_b = Nq\ \sigma'vo\ Ab$

where

Nq = Bearing Capacity Factor = 110

$\sigma'vo$ = effective overburden pressure at the toe = 11.50 t/m^2

Ab = Cross sectional area at the base

D = Dia of Pile = 0.40m

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$= 110 \times 11.50 \times 3.14 \times 0.40^2 / 4$

$= 158.884$ t

$\mathbf{Qu = Qb + Qs}$

$= 158.884 + 11.904 = 170.788$ t

Q safe $= Qu/F.S$

$= 170.788 / 2.5$

$= 68.315$ say 68.00 t

The safe load carrying capacity for six different diameter of piles for the **depth of 24.00m** for the worst case is worded out and given below.

Dia of Pile	Depth of Pile	Safe Load (Tones)
400mm	24.00m	68
450mm	24.00m	86
500mm	24.00m	105
600mm	24.00m	155
750mm	24.00m	232
900mm	24.00m	332

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).

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10.0. CONCLUSIONS

1. For light loaded structure open foundation of **Isolated Footing** (or) **Continuous Strip Footing** (or) **Raft Foundation** can be adopted.
2. The open foundation can be placed at the **minimum depth of 2.50m** below the existing ground level. Existing ground level is 1.00m higher than the road level. The proposed structure has got basement floor, SBC at different depth has been worked out and given below.

Sl.No.	Depth(m)	SBC (t/m^2)
1	2.50	5.00
2	3.00	5.50
3	5.00	6.00
4	7.00	6.50
5	8.00	18.00
6	9.00	19.50
7	10.00	20.50

3. The minimum width of footing should be maintained as 1.00m to avoid any punching shear failure and to achieve suggested SBC.
4. All the foundation should rest on 100 mm thick 1:4:8 concrete mat, over 100mm thick river sand layer.
5. The shallow foundation should rest on natural un disturbed layer.

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6. The **proposed structure has got Three Basement + Stilt Floor + Seventeen Floors**, during excavation there is a possibility of bottom heave due to Elastic Movement of soil and Plastic Inward Movement of the surrounding soil, therefore it is advisable to provide **Pile cum Raft foundation**.

7. The pile foundation can be Bored Cast in situ pile. The depth of soft Rock layer varies from 20.00m to 25.00m. The pile should be **anchored** into the very dense **Soft Rock layer for minimum of 3.00m depth**. The pile foundation could be terminated at the **depth of 24.00m to 27.00m** below existing ground level depending upon the depth of the soft rock at that particular pile location.

8. The load carrying capacity for six different diameter of pile for the minimum **depth of 24.00m** (for the worst case) is worded out and given below.

Dia of Pile	Depth of Pile	Safe Load (Tones)
400mm	24.00m	68
450mm	24.00m	86
500mm	24.00m	105
600mm	24.00m	155
750mm	24.00m	232
900mm	24.00m	332

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)

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9. 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.

10. The bore hole should be flushed properly before laying concrete.

11. The pile boring should be done with Percussion drilling or Hydraulic Rotary Drilling with DMC method. Tractor mount boring is not advisable.

12. The soil in shallow depth is loose Sandy and soft Clay proper precaution should be taken in deep excavation for basement, by providing proper shoring and dewatering.

13. For foundation design, **Stress due to any eccentricity, stress due to horizontal force** should be considered, and **stability** should be checked.

14. All suggested foundation recommendations and precautions should be adopted while undertaking the design aspects and construction activities.

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For T.J. Engineers

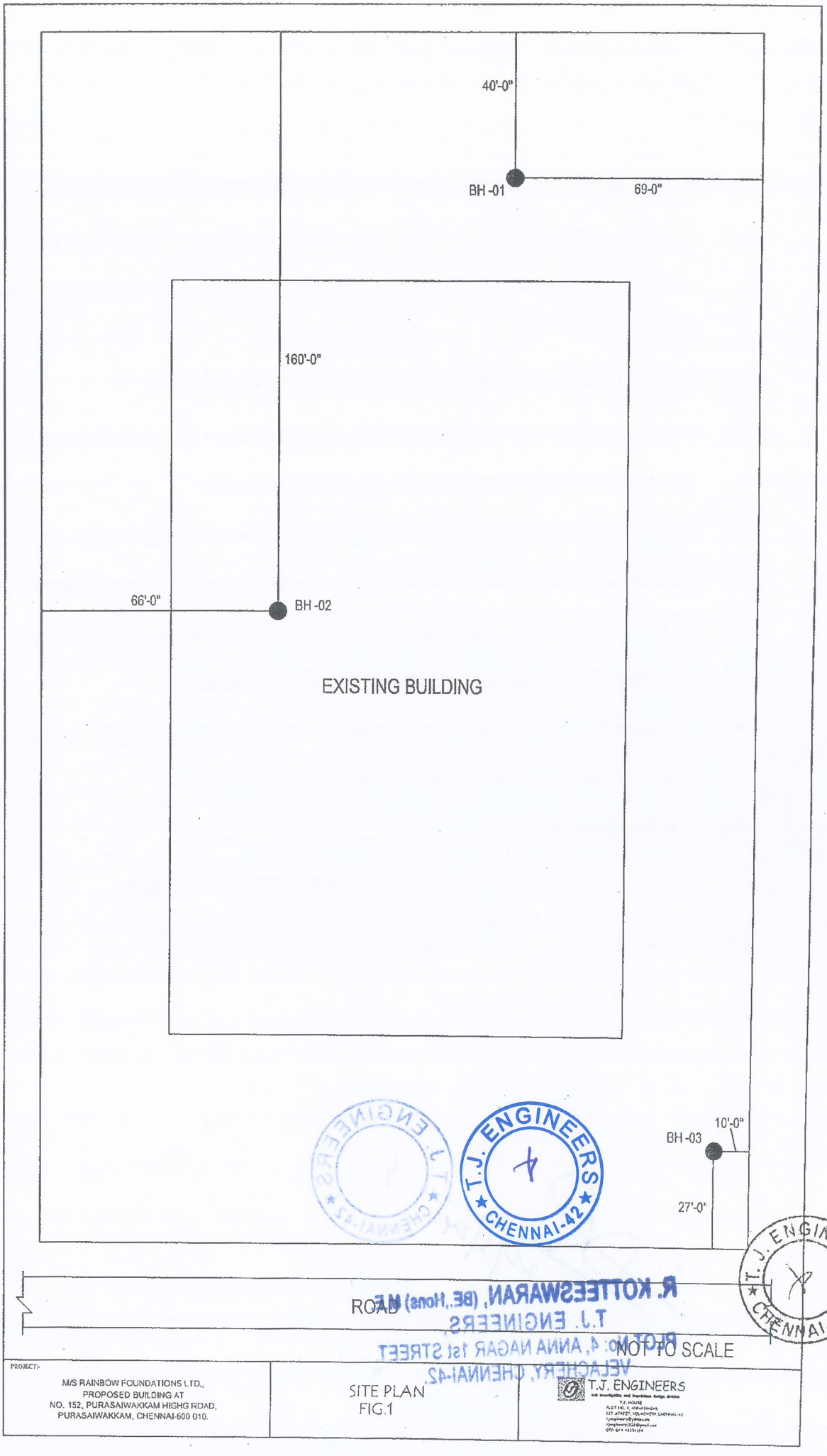
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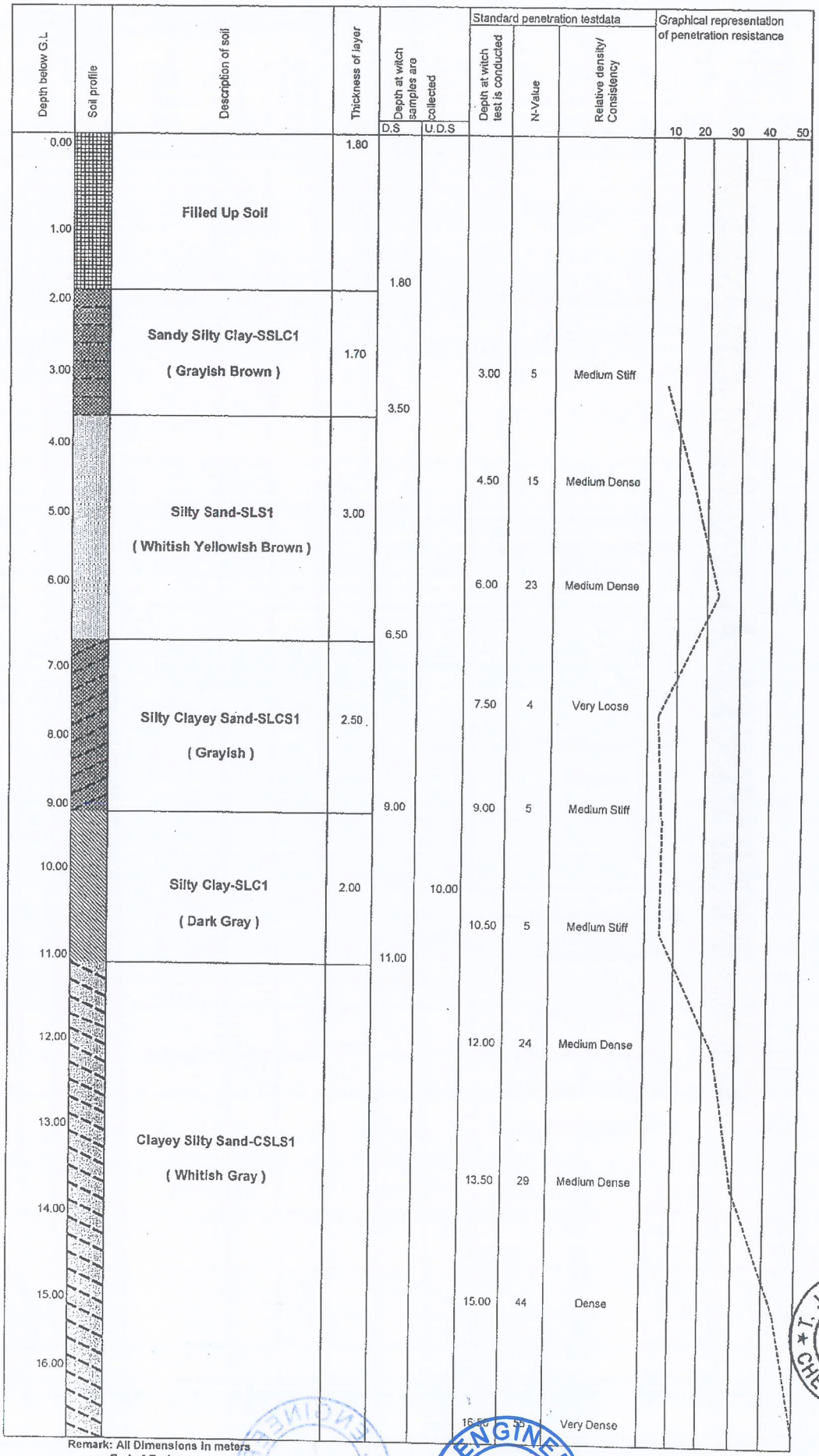
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40'-0"
BH -01
69-0"
160'-0"
66'-0"
BH -02
EXISTING BUILDING
BH -03
10'-0"
27'-0"
ROAD
NOT TO SCALE
PROJECT:-
M/S RAINBOW FOUNDATIONS LTD.,
PROPOSED BUILDING AT
NO. 152, PURASAIWAKKAM HIGHG ROAD,
PURASAIWAKKAM, CHENNAI-600 010.
SITE PLAN
FIG.1
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BORE LOG

PROJECT : Proposed Building at No. 152, Purasaiwakkam High Road, Purasaiwakkam, Chennai-600 010.
BORE HOLE NO : B.H:01
TYPE OF BORING : Rotary Drilling

DATE OF COMMENCEMENT: 19 - 09 - 2018
DATE OF COMPLETION : 20 - 09 - 2018
G.W.L : 2.50m



Remark: All Dimensions in meters
End of Boring

FIG: 2

cont....

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BORE LOG

PROJECT : Proposed Building at No. 152, Purasaiwakkam High Road, Pursaiwakkam, Chennai-600
BORE HOLE NO : B.H:01
TYPE OF BORING : Rotary Drilling

DATE OF COMMENCEMENT: 19 - 09 - 2018
DATE OF COMPLETION : 20 - 09 - 2018
G.W.L : 2.50m

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	10 20 30 40 50
17.00									
18.00		Clayey Silty Sand-CSLS1 (Whitish Gray)				18.00	68	Very Dense	
19.00									
20.00				20.00		20.00	>100	Very Dense	
		Silty Clayey Gravelly Sand-SLCGS1 (Whitish Gray)	1.00						
21.00				21.00					
22.00						22.00	51	Very Dense	
		Silty Clayey Sand-SLCS2 (Grayish)	2.80						
23.00									
				23.80					
24.00						24.00	>100	Very Dense	
		Silty Gravelly Clayey Sand-SLGCS1 (Yellowish Brown)	1.70						
25.00				25.50					
		Sandy Gravel-SG1							
26.00 →		(Disintegrated Rock)				26.00	>100	Very Dense	
		(Yellowish Brown Whitish Grayish)							
27.00									
28.00									
29.00									
30.00									

Remark: All Dimensions in meters
→ End of Boring

FIG: 2

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BORE LOG

PROJECT : Proposed Building at No. 152, Purasaiwakkam High Road, Pursaiwakkam, Chennai-600 010.
BORE HOLE NO : B.H:02
TYPE OF BORING : Rotary Drilling

DATE OF COMMENCEMENT: 20 - 09 - 2018
DATE OF COMPLETION : 22 - 09 - 2018
G.W.L : 2.50m

Depth below G.L	Soil profile	Description of soil	Thickness of layer	Depth at witch samples are collected D.S	Depth at witch samples are collected U.D.S	Standard penetration testdata: Depth at witch test is conducted	N-Value	Relative density/ Consistency
0.00		Filled Up Soil	1.20	1.20		1.50	6	Medium Stiff
2.00		Sandy Silty Clay-SSLC1 (Grayish Brown)		2.80		3.00	12	Medium Dense
3.00		Silty Sand-SLS1 (Whitish Yellowish Brown)	3.90			4.50	15	Medium Dense
6.00				6.70		6.00	22	Medium Dense
7.00		Silty Clayey Sand-SLCS1 (Grayish)	3.10			7.50	5	Loose
9.00				9.80		9.00	7	Loose
10.00		Clayey Silty Sand-CSLS1 (Whitish Gray)				10.50	16	Medium Dense
12.00						12.00	24	Medium Dense
13.00						13.50	37	Dense
14.00								
15.00						15.00	43	Dense
16.00						16.50	61	Very Dense

Graphical representation of penetration resistance: 10 20 30 40 50

Remark: All Dimensions in meters
→ End of Boring

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FIG: 3

cont....

BORE LOG

PROJECT : Proposed Building at No. 152, Purasaiwakkam High Road, Pursaiwakkam, Chennai-600
BORE HOLE NO : B.H:02
TYPE OF BORING : Rotary Drilling

DATE OF COMMENCEMENT: 20 - 09 - 2018
DATE OF COMPLETION : 22 - 09 - 2018
G.W.L : 2.50m

Depth below G.L	Soil profile	Description of soil	Thickness of layer	Depth at witch samples are collected D.S	Depth at witch samples are collected U.D.S	Standard penetration testdata: Depth at witch test is conducted	Standard penetration testdata: N-Value	Standard penetration testdata: Relative density/ Consistency	Graphical representation of penetration resistance
17.00									
		Clayey Silty Sand-CSLS1							
18.00		(Whitish Gray)				18.00	73	Very Dense	
				18.80					
19.00						19.00	>100	Very Dense	
20.00									
		Soft Rock							
21.00		(Grayish Yellowish Brown)				21.00			
22.00						22.00		Rock Core recovery 38%, RQD= 14%	
23.00 →						23.00			
24.00									
25.00									
26.00									
27.00									
28.00									
29.00									
30.00									

Remark: All Dimensions in meters
→ End of Boring

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FIG 3

BORE LOG

PROJECT : Proposed Building at No. 152, Purasaiwakkam High Road, Pursaiwakkam, Chennai-600 010.
BORE HOLE NO : B.H:03
TYPE OF BORING : Rotary Drilling

DATE OF COMMENCEMENT: 24 - 09 - 2018
DATE OF COMPLETION : 25 - 09 - 2018
G.W.L : 2.50m

Depth below G.L	Soil profile	Description of soil	Thickness of layer	Depth at witch samples are collected D.S	Depth at witch samples are collected U.D.S	Standard penetration testdata: Depth at witch test is conducted	N-Value	Relative density/ Consistency
0.00								
		Filled Up Soil	1.90					
1.00								
2.00				1.90				
		Sandy Silty Clay-SSLC1 (Grayish Brown)	2.30			3.00	8	Medium Stiff
3.00								
4.00				4.20				
						4.50	5	Medium Stiff
5.00								
6.00		Sandy Silty Clay-SSLC2 (Dark Gray)	3.80			6.00	2	Very Soft
7.00								
						7.50	2	Very Soft
8.00				8.00				
9.00						9.00	5	Loose
		Silty Clayey Sand-SLCS1 (Grayish)	3.00					
10.00						10.50	6	Loose
11.00				11.00				
12.00						12.00	10	Loose
		Silty Clayey Sand-SLCS2 (Grayish Brown)	3.20					
13.00						13.50	18	Medium Dense
14.00				14.20				
15.00		Clayey Silty Sand-CSLS2 (Whitish Brown Greenish Gray)	5.20			15.00	51	Very Dense
16.00								
						16.50	73	Very Dense

Graphical representation of penetration resistance: 10 20 30 40 50

Remark: All Dimensions in meters
End of Boring

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FIG: 4

cont....

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Project: Proposed Building at No. 152, Purasaiwakkam High Road, Purasaiwakkam, Chennai-600 010.

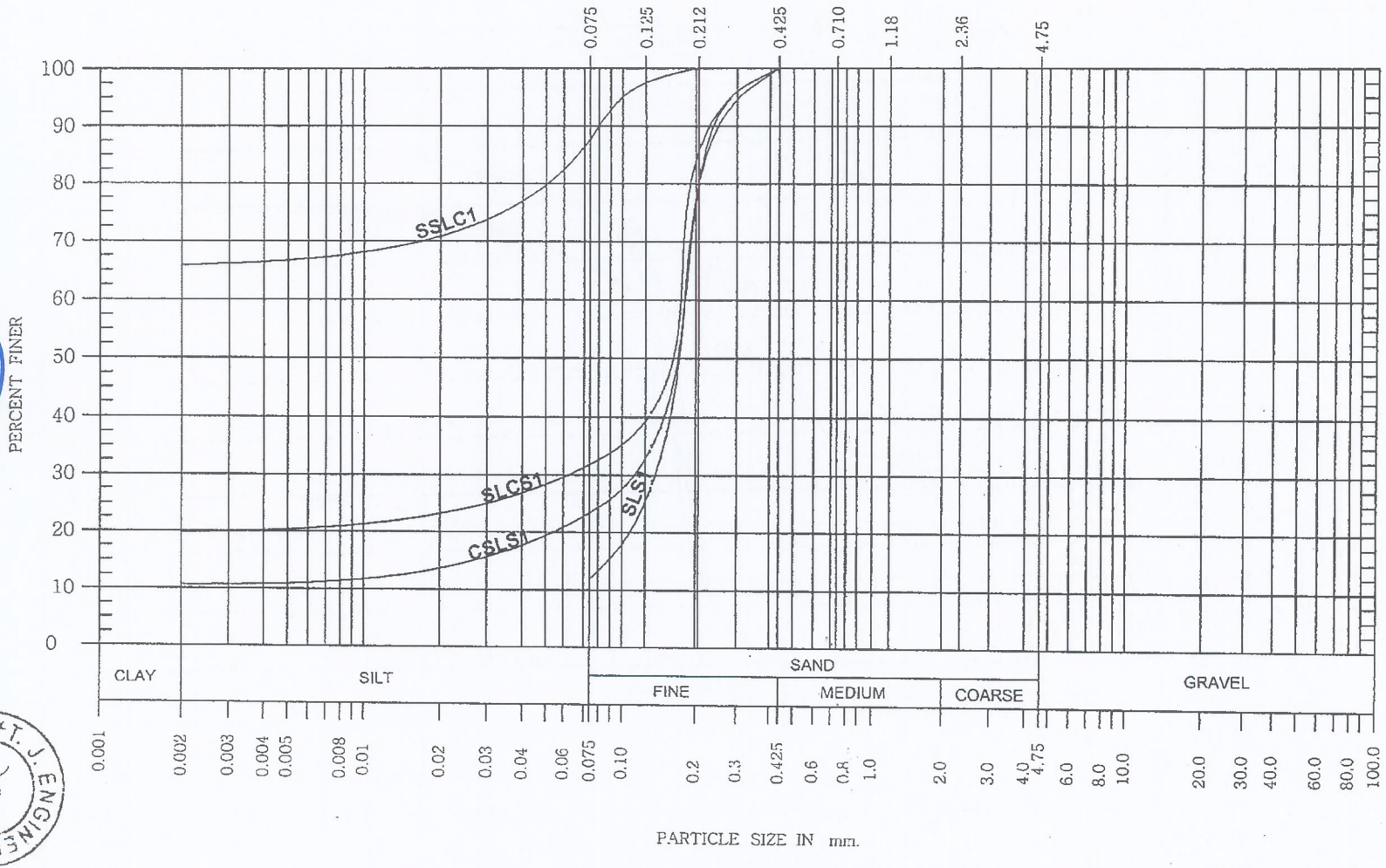


FIG. 6 GRAIN SIZE DISTRIBUTION CURVE-BH-02

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Project: Proposed Building at No. 152, Purasaiwakkam High Road, Purasaiwakkam, Chennai-600 010.

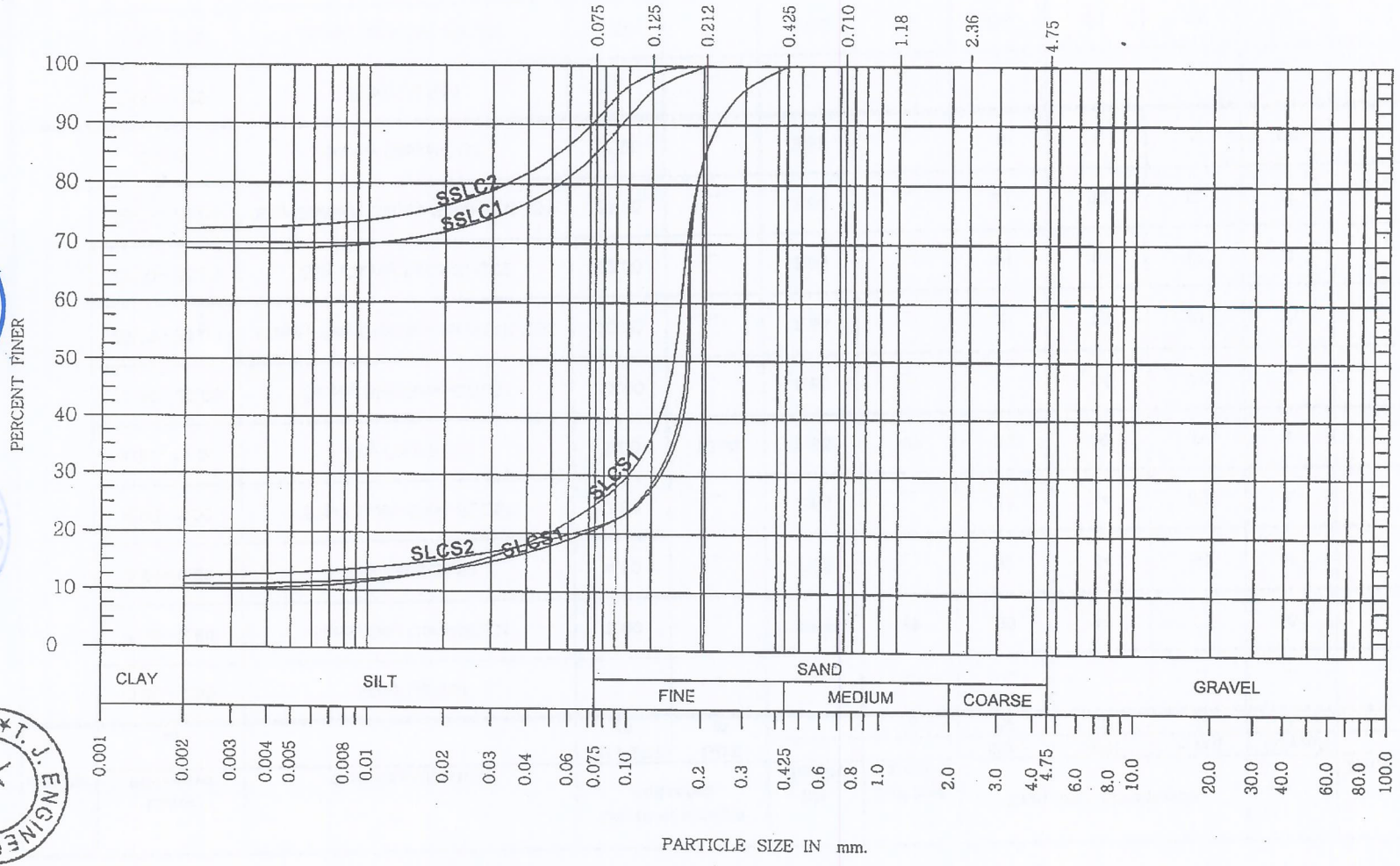


FIG. 7 GRAIN SIZE DISTRIBUTION CURVE-BH-03

LABORATARY TEST RESULTS

TABLE-1a

B.H No	Layer thickness	Soil classification	Depth of sample collected		SP. gravity	%of free swell	Grain size distribution				Remarks
			DS / SPT	UDS			Clay	Silt	Sand	Gravel	
	m		m	m		%	%	%	%	%	
1	0.00 - 1.80	Filled Up Soil	–	–	–	–	–	–	–	–	–
	1.80 - 3.50	Sandy Silty Clay-SSLC1	3.00	–	2.65	38	69	19	12	0	–
	3.50 - 6.80	Silty Sand-SLS1	4.50	–	2.63	–	0	14	86	0	–
	6.80 - 9.00	Silty Clayey Sand-SLCS1	7.50	–	2.64	–	18	14	68	0	–
	9.00 - 11.00	Silty Clay-SLC1	9.00	10.00	2.65	46	74	26	0	0	–
	11.00 - 20.00	Clayey Silty Sand-CSLS1	12.00	–	2.63	–	9	14	77	0	–
	20.00 - 21.00	Clayey Silty Gravelly Sand-CSLGS1	20.00	–	2.64	–	8	13	61	18	–
	21.00 - 23.80	Silty Clayey Sand-SLCS2	22.00	–	2.64	–	19	14	67	0	–
	23.80 - 25.00	Silty Gravelly Clayey Sand-SLGCS1	24.00	–	2.64	–	21	12	50	17	–
	25.00	Sandy Gravel-SG1	25.00	–	2.63	–	0	0	32	68	–
2	0.00 - 1.20	Filled Up Soil	–	–	–	–	–	–	–	–	–
	1.20 - 2.80	Sandy Silty Clay-SSLC1	1.50	–	2.65	36	66	21	13	0	–
	2.80 - 6.70	Silty Sand-SLS1	3.00	–	2.63	–	0	13	87	0	–
	6.70 - 9.80	Silty Clayey Sand-SLCS1	7.50	–	2.64	–	19	14	67	0	–
	9.80 - 18.80	Clayey Silty Sand-CSLS1	10.50	–	2.63	–	11	13	76	0	–
	18.80 - 23.00	Soft Rock	23.00	–	2.63	–	–	–	–	–	–

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LABORATARY 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 - 1.90	Filled Up Soil	–	–	–	–	–	–	–	–	–
	1.90 - 4.20	Sandy Silty Clay-SSLC1	3.00	–	2.65	38	68	19	13	0	–
	4.20 - 8.00	Sandy Silty Clay-SSLC2	6.00	–	2.65	47	73	19	8	0	–
	8.00 - 11.00	Silty Clayey Sand-SLCS1	9.00	–	2.64	–	12	9	79	0	–
	11.00 - 14.20	Silty Clayey Sand-SLCS2	12.00	–	2.64	–	13	9	78	0	–
	14.20 - 19.40	Clayey Silty Sand-CSLS1	15.00	–	2.63	–	10	15	75	0	–
	19.40 - 23.00	Soft Rock	23.00	–	2.63	–	–	–	–	–	–

LABORATARY TEST RESULTS

TABLE -2a

B.H No	Layer thickness m	Soil classification	Depth of sample collected DS / SPT m	Depth of sample collected UDS m	LL %	PL %	Bulk density t/m³	Consolidation Parameters e_o	Consolidation Parameters Cc	Shear Strength Parmeters Cu t/m²	Shear Strength Parmeters φ degree	Remarks
1	0.00 - 1.80	Filled Up Soil	–	–	–	–	–	–	–	–	–	–
	1.80 - 3.50	Sandy Silty Clay-SSLC1	3.00	–	61	22	1.50	–	–	3.32	–	–
	3.50 - 6.80	Silty Sand-SLS1	4.50	–	–	–	1.52	–	–	–	33	–
	6.80 - 9.00	Silty Clayey Sand-SLCS1	7.50	–	–	–	1.50	–	–	–	27	–
	9.00 - 11.00	Silty Clay-SLC1	9.00	10.00	64	25	1.50	1.8	0.34	3.35	–	–
	11.00 - 20.00	Clayey Silty Sand-CSLS1	12.00	–	–	–	1.52	–	–	–	35	–
	20.00 - 21.00	Clayey Silty Gravelly Sand-CSLGS1	20.00	–	–	–	1.58	–	–	–	37	–
	21.00 - 23.80	Silty Clayey Sand-SLCS2	22.00	–	–	–	1.57	–	–	–	34	–
	23.80 - 25.00	Silty Gravelly Clayey Sand-SLGCS1	24.00	–	–	–	1.58	–	–	–	38	–
	25.00	Sandy Gravel-SG1	25.00	–	–	–	1.62	–	–	–	40	–
2	0.00 - 1.20	Filled Up Soil	–	–	–	–	–	–	–	–	–	–
	1.20 - 2.80	Sandy Silty Clay-SSLC1	1.50	–	58	21	1.50	–	–	4.10	–	–
	2.80 - 6.70	Silty Sand-SLS1	3.00	–	–	–	1.52	–	–	–	33	–
	6.70 - 9.80	Silty Clayey Sand-SLCS1	7.50	–	–	–	1.50	–	–	–	28	–
	9.80 - 18.80	Clayey Silty Sand-CSLS1	10.50	–	–	–	1.54	–	–	–	35	–
	18.80 - 23.00	Soft Rock	23.00	–	–	–	1.59	–	–	–	41	–

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LABORATARY TEST RESULTS

TABLE -2b

B.H No	Layer thickness	Soil classification	Depth of sample collected		LL	PL	Bulk density	Consolidation Parameters		Shear Strength Parmeters		Remarks
			DS / SPT	UDS				e_o	Cc	Cu	Ø	
	m		m	m	%	%	t/m³			t/m²	degree	
3	0.00 - 1.90	Filled Up Soil	–	–	–	–	–	–	–	–	–	–
	1.90 - 4.20	Sandy Silty Clay-SSLC1	3.00	3.50	59	21	1.50	1.7	0.33	4.55	–	–
	4.20 - 8.00	Sandy Silty Clay-SSLC2	6.00	–	66	23	1.50	–	–	1.34	–	–
	8.00 - 11.00	Silty Clayey Sand-SLCS1	9.00	–	–	–	1.50	–	–	–	27	–
	11.00 - 14.20	Silty Clayey Sand-SLCS2	12.00	–	–	–	1.52	–	–	–	33	–
	14.20 - 19.40	Clayey Silty Sand-CSLS1	15.00	–	–	–	1.58	–	–	–	38	–
	19.40 - 23.00	Soft Rock	23.00	–	–	–	1.62	–	–	–	41	–

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