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SOIL EXPLORATION AND FOUNDATION REPORT

FOR THE PROPOSED BUILDING

AT

M/S DAC DEVELOPERS PRIVATE LIMITED,

CHENNAI ARE ASSOCIATED IN THE CONSTRUCTION OF PROPOSED RESIDENTIAL BUILDING AT S.NO: 41/4, 41/5 IN POTHERI VILLAGE, CHENGALPET TALUK, CHENGALPET DISTRICT, CHENGALPET-603 203.

PROJECT NO. TJE/002982/2023

T.J.ENGINEERS

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CONTENTS OF THE REPORT

1.0 INTRODUCTION

2.0 SCOPE OF WORK

3.0 LOCATION AND NUMBER OF BORE HOLES

4.0 GEO TECHNICAL INVESTIGATION

- 4-1. Field Investigation of Bore Holes
- 4.2. Grain Size Analysis
- 4-3. Laboratory Test for Bore Hole Sample

5.0 BORE HOLE DATA

6.0 LABORATORY TEST RESULTS

7.0 GROUND WATER TABLE

8.0 SUB SOIL PROFILE

9.0 FOUNDATION ANALYSIS AND DESIGN

- 9.1. Computation of Safe Bearing Capacity of the soil at 2.10m depth
- 9.2. Settlement Analysis

10.0 CONCLUSIONS

11.0 TABLES AND FIGURES

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EXPLORATION REPORT

PROJECT NO. TJE/002982/2023

1.INTRODUCTION:

M/S DAC DEVELOPERS PRIVATE LIMITED has proposed to construct a Stilt Floor + Five Floors Building at Survey No. 41/4, 41/5 in Potheri Village, Chengalpet Taluk, Chengalpet District, Chengalpet-603 203. 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 1.00m 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 5.00m 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) 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 1.00m 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 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 in 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 1.00m interval are given in the bore logs.

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4.2. Grain Size Analysis

Combined sieve and hydrometer analyses were conducted on the various samples collected. The results are given in Table-1. 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-1 and Table-2.

7.0. GROUND WATER TABLE

The ground water table was **encountered at the depth of 1.00m** below the existing ground level at the time of soil exploration.

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8.0. SUB SOIL PROFILE

From the visual identification and from the field test results, it is concluding that soil strata is made-up of four distinctive layers.

i. Sandy Silty Clay, 0.00m to 0.50m

ii. Medium Dense Silty Clayey Gravelly Sand, 0.50m to 1.90m

SPT's N = 18-28

iii. Very Dense Clayey Silty Gravelly Sand, 1.90m to 3.00m

SPT's N = >100

iv. Very Dense Sandy Gravel, 3.00m to 5.00m SPT's N = >100

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

9.0 FOUNDATION ANALYSIS

From the bore log data at the from 0.00m to 0.50m Sandy Silty Clay layer is present, this layer has got swelling character. From 0.50m to 1.90m medium dense Silty Clayey Gravelly Sand layer is present. From 1.90m to 3.00m very dense Clayey Silty Gravelly Sand layer is present. Below 3.00m very dense Sandy Gravel-(Dis-integrated Rock) layer is seen.

The soil in the shallow depth is fair to adopt open foundation system. For the proposed structure the foundation can be **Isolated Footing or Continuous Strip Footing or Raft Foundation.** The foundation can be placed at the minimum **depth of 2.10m** below the exiting ground level (Ground level at the time of soil investigation). The existing ground level was same as the road level at the time of soil investigation.

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9.1. COMPUTATION OF THE SAFE BEARING CAPACITY AT 2.10m 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 >50 from Fig. 2,3&4.

The corresponding bearing capacity factors are,

$Nq = 33.84$

$N\gamma = 33.32$

Where,

γ = Bulk density = 1.50 t/m 3

γ' = Submerged density = 0.50 t/m 3

Df = Depth of footing = Considered minimum of 2.10 m.

Dw = Depth of water table = 1.00m

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

Substitute all the above values in the formula,

Qu = (0.50x 2.10 + (1.50- 0.50)1.00) 33.84 + 0.4 x 0.50 x 1.00 x 33.32

= 69.372 + 6.664

= 76.036 t/m ^{2}

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

Hence, safe bearing capacity q s = 76.036 / 2.50 = 30.414 t/m ^{2}. Say 30.50 t/m ^{2}.

Therefore, Safe Bearing Capacity of the soil at the depth of 2.10m is 30.50 t/m ^{2}

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9.2. SETTLEMENT ANALYSIS FOR THE INTENSITY OF 30.50 t/m ^{2}

LAYER -1, Silty Clayey Gravelly Sand/Clayey Silty Gravelly 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 layer
= 0.90m

C = $1.5q_c/ \sigma'_0$

q_c = Static cone resistance
= $1000t/m^2$

C = 1.5x1000/2.275
= 659.34

σ'_0 =The original effective over burden pressure at the centre of the layer
= $2.275\ t/m^2$

$\Delta\sigma$ = The stress increases at the centre of the layer due to foundation loads (or) pressure
= $2.42\ t/m^2$

S_1 = $(0.90 /659.34) \times \text{Log}_e (2.275 +2.42/2.275)$
= $0.00136 \times 10^{-3} \times 0.7241$
= 0.000984×10^{-3}m
= 0.984mm

TOTAL SETTLEMENT

= **0.984mm < 50mm**

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

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10.0. CONCLUSIONS

1. Soil in the shallow depth is fair to adopt open foundation system.
2. The foundation can be **Isolated Footing** or **Continuous Strip Footing (Inverted T Beam)** or **Raft Foundation.**
3. The **foundation** can be placed at the **minimum depth** of **2.10m** below existing ground level, the existing ground level was same as the road level at the time of soil investigation.
4. The **Safe Bearing Capacity** (SBC) of the soil at **2.10m depth is 30.50 t/m^2.**
5. The **minimum width** of footing should be maintained as **1.00m** to avoid any punching shear failure and to achieve suggested SBC.
6. The shallow foundation should rest on **natural un disturbed strata.**
7. All the foundation should rest on 100 mm thick 1:4:8 concrete mat, over 100mm thick river sand or M sand layer. The foundation bed should be well compacted by ramming before laying sand layer.
8. If isolated footing provided, it is advisable to provide **plinth beam** connecting all column on both direction, **continuous belt beam** at floor level, **continuous sill slab**, **continuous lintel beam**.
9. All suggested foundation recommendations and precautions should be adopted while undertaking the design aspects and construction activities.

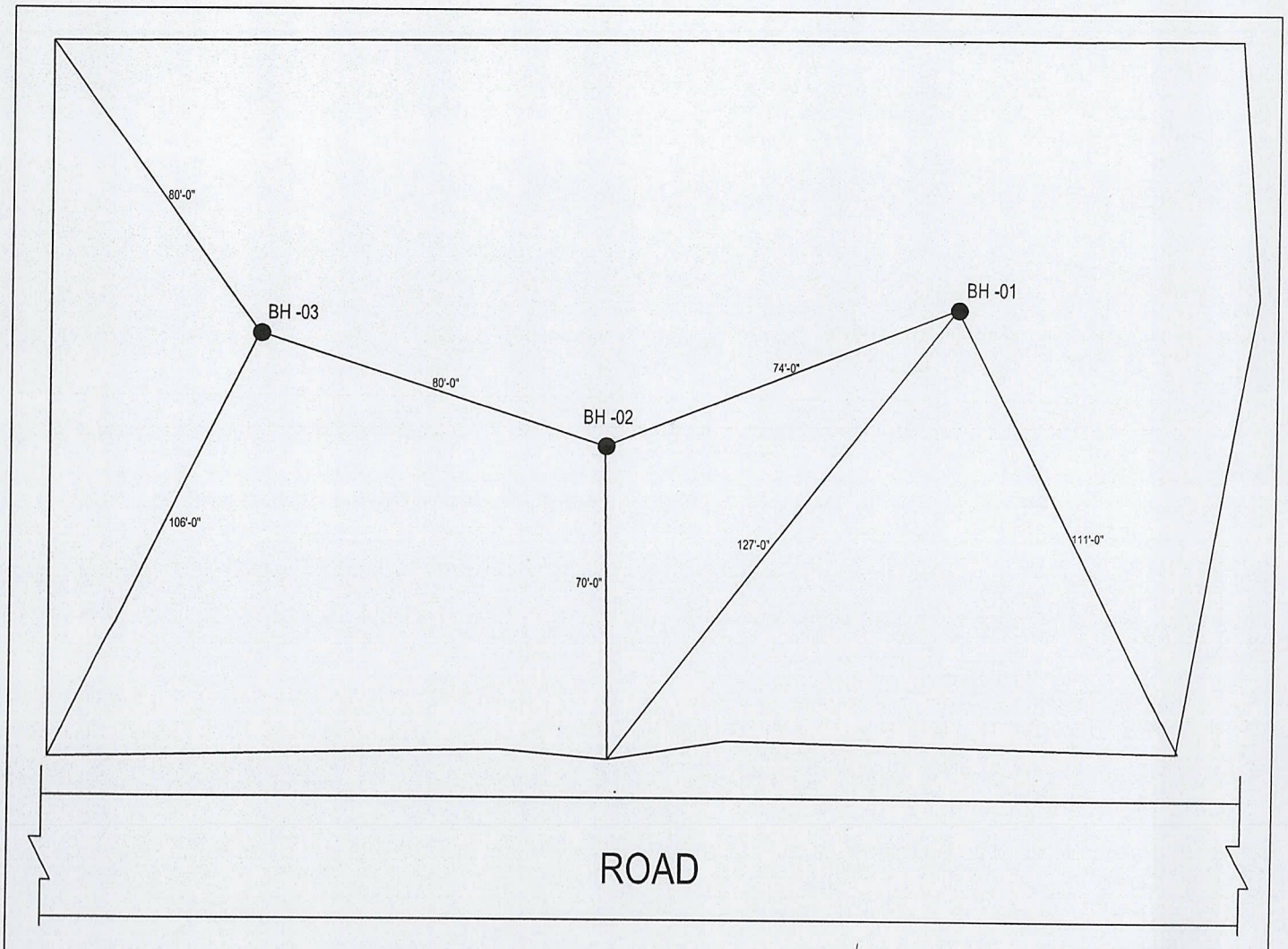
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For T.J. Engineers

20 - 10 -2023

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DTCP Reg. No: CGLRGN/RGTE/2019/07/010

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NOT TO SCALE

CLIENT:-	PROJECT:-		
M/S DAC DEVELOPERS PRIVATE LIMITED CHENNAI.	PROPOSED BUILDING AT SURVEY NO. 41/4, 41/5 IN POTHERI VILLAGE, CHENGALPET TALUK, CHENGALPET DISTRICT, CHENGALPET-603 203.	SITE PLAN FIG.1	T.J. ENGINEERS soil investigation and foundation design division

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BORE LOG

PROJECT : **Proposed Building at Survey No. 41/4, 41/5 in Potheri Village, Chengalpet Taluk, Chengalpet District, Chengalpet-603 203.**

BORE HOLE NO : **B.H:01**

TYPE OF BORING : **Rotary Drilling**

DATE OF COMMENCEMENT: **13 - 10 - 2023**

DATE OF COMPLETION : **13 - 10 - 2023**

G.W.L : **1.00m**

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
0.00		**Sandy Silty Clay-SSLC1 (Brown)**	0.50	0.50					
1.00		**Silty Clayey Gravelly Sand-SLCGS1 (Gray Yellowish Brown)**	1.40	1.90		1.00	22	Medium Dense	
2.00		**Clayey Silty Gravelly Sand-CSLGS1 (Brown)**	1.10	3.00		2.00	>100	Very Dense	
3.00		**Sandy Gravel-SG1 (Disintegrated Rock) (Gray Brown)**				3.00	>100	Very Dense	
4.00						4.00	>100	Very Dense	
5.00						5.00	>100	Very Dense	
6.00									
7.00									
8.00									
9.00									
10.00									

Graphical representation of penetration resistance: 10 20 30 40 50

Remark: All Dimensions in meters

End of Boring

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FIG: 2

BORE LOG

PROJECT : Proposed Building at Survey No. 41/4, 41/5 in Potheri Village, Chengalpet Taluk, Chengalpet District, Chengalpet-603 203.

BORE HOLE NO : B.H:02

TYPE OF BORING : Rotary Drilling

DATE OF COMMENCEMENT: 13 - 10 - 2023

DATE OF COMPLETION : 14 - 10 - 2023

G.W.L : 1.00m

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
0.00		Sandy Silty Clay-SSLC1 (Brown)	0.40	0.40					
1.00		Silty Clayey Gravelly Sand-SLCGS1 (Reddish Gray Yellowish Brown)	1.20	1.60		1.00	28	Medium Dense	
2.00		Clayey Silty Gravelly Sand-CSLGS1 (Brown)	0.90	2.50		2.00	>100	Very Dense	
3.00		Sandy Gravel-SG1 (Disintegrated Rock) (Gray Brown)				3.00	>100	Very Dense	
4.00						4.00	>100	Very Dense	
5.00 →						5.00	>100	Very Dense	
6.00									
7.00									
8.00									
9.00									
10.00									

Graphical representation of penetration resistance: 10 20 30 40 50

Remark: All Dimensions in meters

→ End of Boring

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FIG: 3

BORE LOG

PROJECT : **Proposed Building at Survey No. 41/4, 41/5 in Potheri Village, Chengalpet Taluk, Chengalpet District, Chengalpet-603 203.**

BORE HOLE NO : **B.H:03**

TYPE OF BORING : **Rotary Drilling**

DATE OF COMMENCEMENT: **14 - 10 - 2023**

DATE OF COMPLETION : **14 - 10 - 2023**

G.W.L : **1.00m**

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
0.00		**Sandy Silty Clay-SSLC1 (Brown)**	0.50	0.50					
1.00		**Silty Clayey Gravelly Sand-SLCGS1 (Gray Yellowish Brown)**	1.30	1.80		1.00	18	Medium Dense	
2.00		**Clayey Silty Gravelly Sand-CSLGS1 (Brown)**	1.20			2.00	>100	Very Dense	
3.00		**Sandy Gravel-SG1 (Disintegrated Rock) (Gray Brown)**		3.00		3.00	>100	Very Dense	
4.00						4.00	>100	Very Dense	
5.00						5.00	>100	Very Dense	
6.00									
7.00									
8.00									
9.00									
10.00									

Graphical representation of penetration resistance: 10 20 30 40 50

Remark: All Dimensions in meters

End of Boring

FIG: 4

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Project: Proposed Building at Survey No. 41/4, 41/5 in Potheri Village, Chengalpet Taluk, Chengalpet District, Chengalpet-603 203.

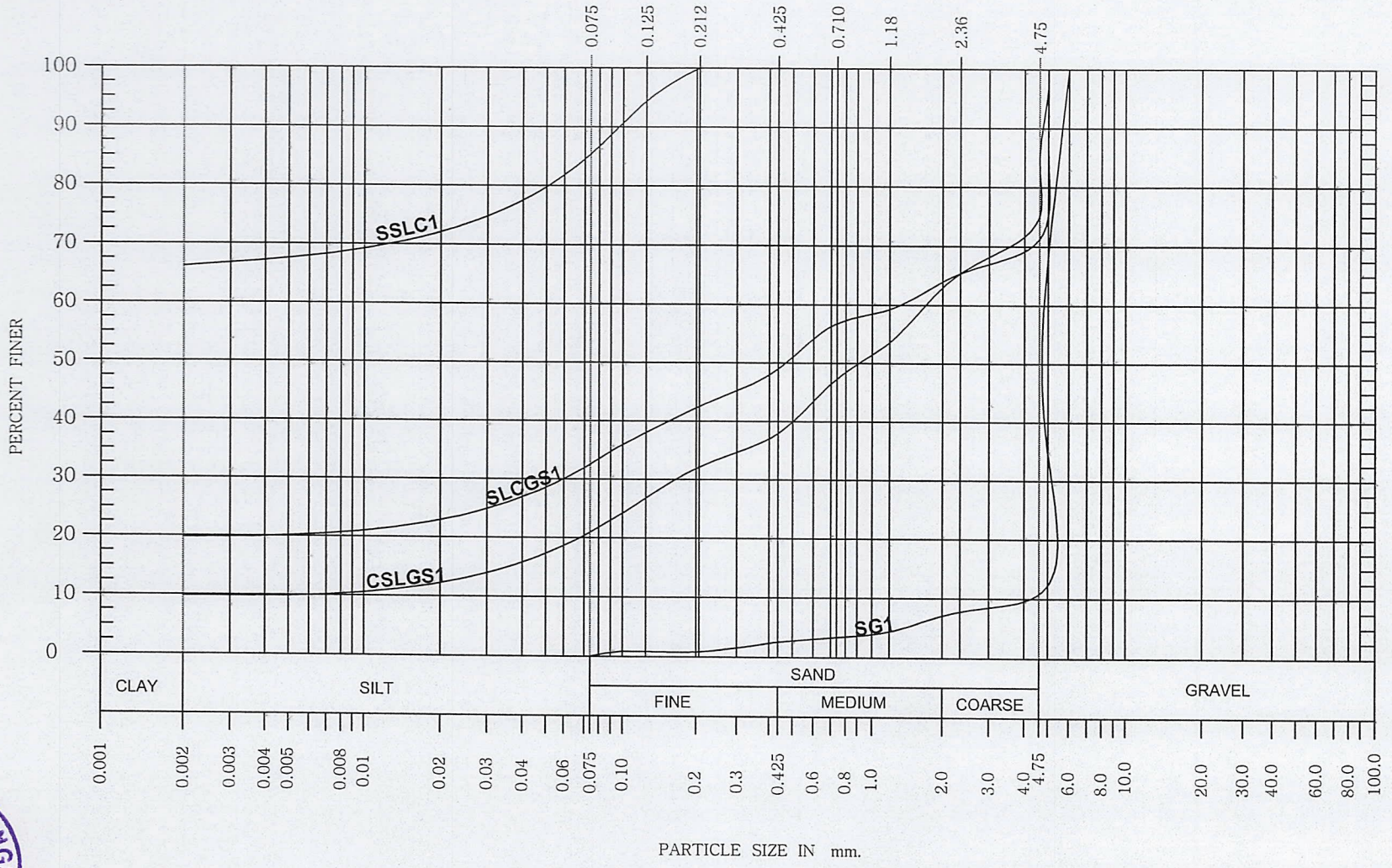


FIG. 5 GRAIN SIZE DISTRIBUTION CURVE-BH-01

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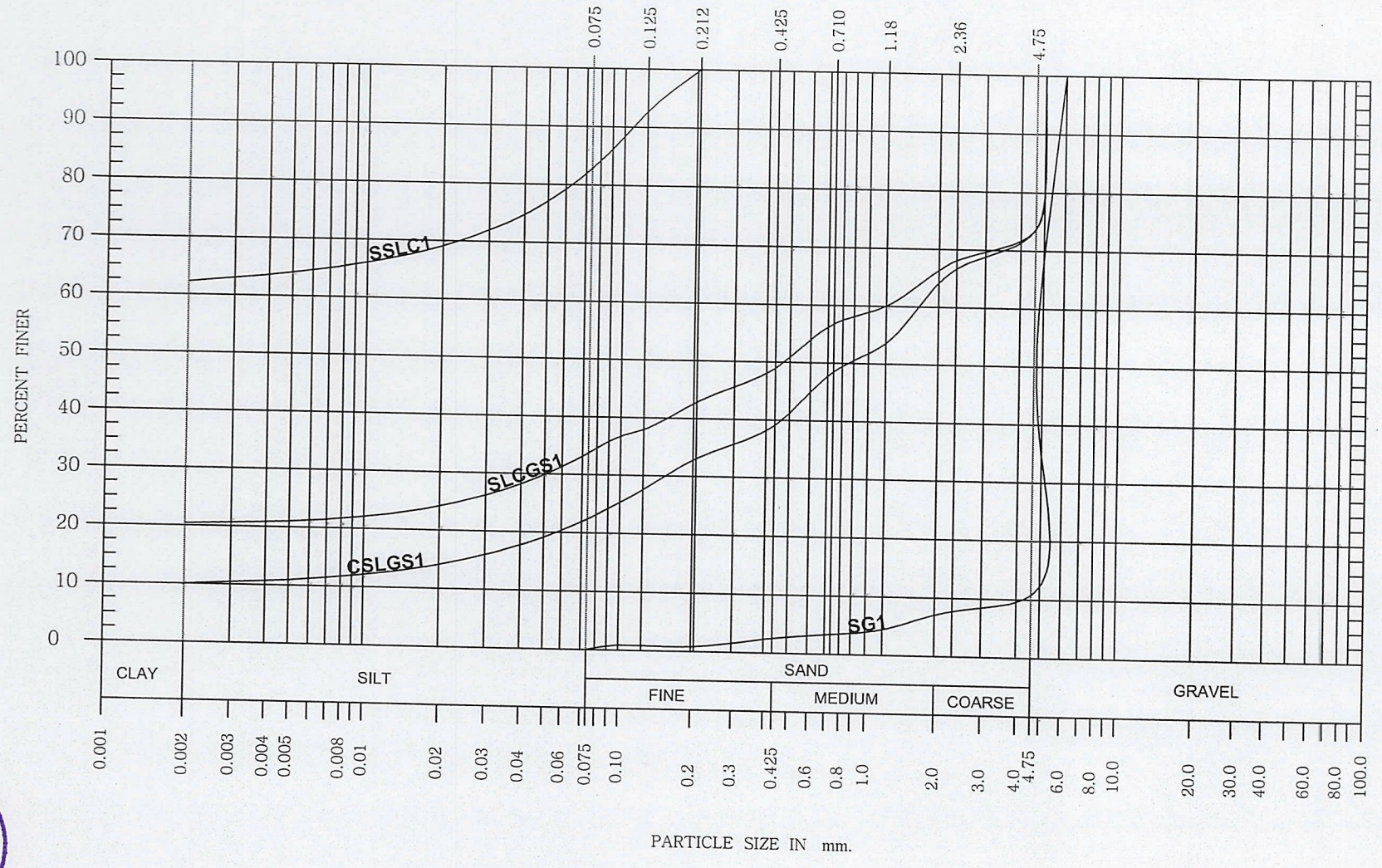


FIG. 6 GRAIN SIZE DISTRIBUTION CURVE-BH-02

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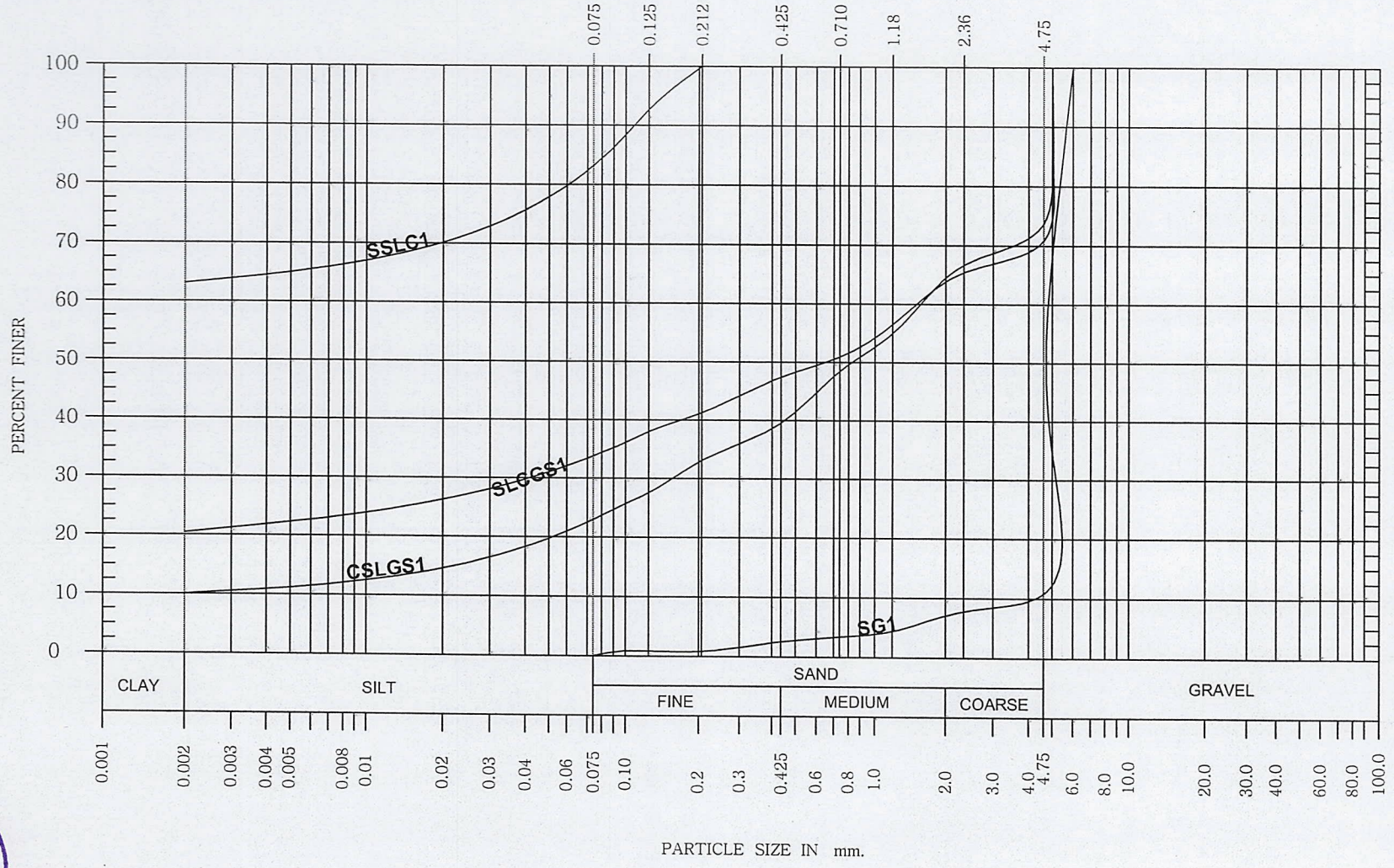


FIG. 7 GRAIN SIZE DISTRIBUTION CURVE-BH-03

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LABORATARY TEST RESULTS

TABLE-1

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 - 0.50	Sandy Silty Clay-SSLC1	0.50	_	2.66	34	66	20	14	0	_
	0.50 - 1.90	Silty Clayey Gravelly Sand-SLCGS1	1.00	_	2.64	_	19	14	39	28	_
	1.90 - 3.00	Clayey Silty Gravelly Sand-CSLGS1	2.00	_	2.64	_	9	13	54	24	_
	3.00 - 5.00	Sandy Gravel-SG1	5.00	_	2.63	_	0	0	11	89	_
2	0.00 - 0.40	Sandy Silty Clay-SSLC1	0.40	_	2.66	32	63	21	16	0	_
	0.40 - 1.60	Silty Clayey Gravelly Sand-SLCGS1	1.00	_	2.64	_	21	13	40	26	_
	1.60 - 2.50	Clayey Silty Gravelly Sand-CSLGS1	2.00	_	2.64	_	10	13	51	26	_
	2.50 - 5.00	Sandy Gravel-SG1	5.00	_	2.63	_	0	0	9	91	_
3	0.00 - 0.50	Sandy Silty Clay-SSLC1	0.50	_	2.66	33	64	20	16	0	_
	0.50 - 1.80	Silty Clayey Gravelly Sand-SLCGS1	1.00	_	2.64	_	21	13	37	29	_
	1.80 - 3.00	Clayey Silty Gravelly Sand-CSLGS1	2.00	_	2.64	_	10	14	50	26	_
	3.00 - 5.00	Sandy Gravel-SG1	5.00	_	2.63	_	0	0	14	86	_

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LABORATARY TEST RESULTS

TABLE -2

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	∅	
	m		m	m	%	%	t/m^3			t/m^2	degree	
1	0.00 - 0.50	Sandy Silty Clay-SSLC1	0.50	–	65	26	–	–	–	–	–	–
	0.50 - 1.90	Silty Clayey Gravelly Sand-SLCGS1	1.00	–	–	–	1.52	–	–	–	33	–
	1.90 - 3.00	Clayey Silty Gravelly Sand-CSLGS1	2.00	–	–	–	1.59	–	–	–	37	–
	3.00 - 5.00	Sandy Gravel-SG1	5.00	–	–	–	1.62	–	–	–	41	–
2	0.00 - 0.40	Sandy Silty Clay-SSLC1	0.40	–	62	24	–	–	–	–	–	–
	0.40 - 1.60	Silty Clayey Gravelly Sand-SLCGS1	1.00	–	–	–	1.53	–	–	–	34	–
	1.60 - 2.50	Clayey Silty Gravelly Sand-CSLGS1	2.00	–	–	–	1.58	–	–	–	37	–
	2.50 - 5.00	Sandy Gravel-SG1	5.00	–	–	–	1.61	–	–	–	41	–
3	0.00 - 0.50	Sandy Silty Clay-SSLC1	0.50	–	62	24	–	–	–	–	–	–
	0.50 - 1.80	Silty Clayey Gravelly Sand-SLCGS1	1.00	–	–	–	1.52	–	–	–	33	–
	1.80 - 3.00	Clayey Silty Gravelly Sand-CSLGS1	2.00	–	–	–	1.58	–	–	–	38	–
	3.00 - 5.00	Sandy Gravel-SG1	5.00	–	–	–	1.62	–	–	–	42	–

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