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SOIL EXPLORATION AND FOUNDATION REPORT

FOR THE PROPOSED BUILDING

AT

PLOT NO. 48 (PART), 69 (PART) & 70 (PART)

OLD DOOR NO. 8 & 27, NEW DOOR NO. 27

GRAND SOUTHERN TRUNK ROAD, PALLAVARAM

CHENNAI-600 044, COMPRISED IN T.S. NO. 73, BLOCK NO. 21

WARD-E OF ZAMIN PALLAVARAM VILLAGE

PALLAVARAM TALUK, CHENGALPATTU DISTRICT

AND WITHIN THE LIMITS IF PALLAVARAM MUNICIPALITY

PROJECT NO. TJE/003100/2024

T.J.ENGINEERS

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EXPLORATION REPORT

PROJECT NO. TJE/003100/2024

1.INTRODUCTION:

M/S VIGNESH PROPERTEES has proposed to construct a Basement Floor + Ground Floor + Eight Floors Building at Plot No. 48 (Part), 69 (Part) & 70 (Part), Old Door No. 8 & 27, New Door No. 27, Grand Southern Trunk Road, Pallavaram, Chennai-600 044, Comprised in T.S. No. 73, Block No. 21, Ward-E of Zamin Pallavaram Village, Pallavaram Taluk, Chengalpattu District and within the Limits if Pallavaram Municipality. 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 1.00m depth interval or as required.
- Collection of soil sample from bore hole.
- Preparation of geotechnical investigation Report.

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3.0. LOCATION & NUMBER OF BORE HOLES

For this purpose two bore holes were bored up to maximum depth of 8.00m 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. The bore hole was 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. 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

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polythene bags for testing in the laboratory. The SPT values obtained at every 1.00m 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-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 is given in Fig-2&3. 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.

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7.0. GROUND WATER TABLE

The ground water table was encountered at the **depth of 3.00m**, below the existing ground level at the time of soil exploration. It was noticed from the existing well at the site.

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 location.

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

i. Filled Up Soil 0.00m to 0.80m

ii. Medium Dense to Very Dense Silty Clayey Gravelly Sand, 0.80m to 4.80m

SPT's N= 14-51

iii. Very Dense Silty Clayey Gravelly Sand, 4.80m to 7.00m

SPT's N= >100

iv. Very Dense Sandy Gravel, 7.00m to 8.00m SPT's N = >100

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

i. Filled Up Soil 0.00m to 0.90m

ii. Medium Dense Clayey Silty Gravelly Sand, 0.90m to 1.80m

SPT's N= 14

iii. Very Dense Silty Clayey Gravelly Sandy, 1.80m to 5.50m

SPT's N= >100

iv. Very Dense Sandy Gravel, 5.50m to 8.00m SPT's N = >100

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

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9.0. FOUNDATION ANALYSIS

From the bore log data at the top from 0.00m to 0.90m Filled Up Soil layer is present. From 0.90m to 5.50m/7.00m medium dense to very dense Silty Clayey Gravelly Sand/Clayey Silty Gravelly Sand layer is present. Below 5.50m/7.00m very dense Sandy Gravel (Disintegrated Rock) layer is seen, this layer is fair to rest pile foundation for heavy loaded structure.

The layer up to 4.80m is the critical zone for open foundation system, with in the critical zone medium dense to very dense Sandy layer is present. 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 2.00m 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 + Ground Floor + Eight Floors, the Safe Bearing Capacity (SBC) at different depths have 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 cum Raft foundation**. The pile foundation can be Bored Cast in situ pile. The pile foundation should be terminated at the minimum depth 8.00m. The pile should be anchored into the very dense Sandy Gravel layer for minimum of 1.00m depth.

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9.1. COMPUTATION OF THE SAFE BEARING CAPACITY AT 2.00m DEPTH

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

$qu = \gamma\ Df\ Nq + 0.4\ \gamma'\ B\ N\gamma$

The observed N-Value is taken as 22 from Fig. 2&3.

The corresponding bearing capacity factors are,

$Nq = 21.25$

$N\gamma = 20.10$

Where,

γ = Bulk density = 1.50 t/m 3

γ' = Submerged density = 0.50 t/m 3

Df = Depth of footing = Considered minimum of 2.00 m.

Dw = Depth of water table = 3.00m

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

Substitute all the above values in the formula,

Qu = 1.50 x 2.00 x 21.25 + 0.40 x 0.50 x 1.00 x 20.10

= 63.75 + 4.02

= 67.77 t/m ^{2}

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

Hence, safe bearing capacity q s = 67.77 / 2.50 = 27.108 t/m ^{2}. Say 27.00 t/m ^{2}.

Therefore, Safe Bearing Capacity of the soil at the depth of 2.00m is 27.00 t/m ^{2}

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9.2. COMPUTATION OF THE SAFE BEARING CAPACITY AT 4.00m 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 22 from Fig. 2&3.

The corresponding bearing capacity factors are,

$Nq = 21.25$

$N\gamma = 20.10$

Where,

γ = Bulk density = 1.50 t/m 3

γ' = Submerged density = 0.50 t/m 3 .

Df = Depth of footing = Considered minimum of 4.00 m.

Dw = Depth of water table = 3.00m

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

Substitute all the above values in the formula,

Qu = (0.50 x 4.00 + (1.50- 0.50)3.00) 21.25 + 0.4 x 0.50 x 1.00 x 20.10

= 106.25 + 4.02

= 110.27 t/m ^{2}

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

Hence, safe bearing capacity q s = 110.27 / 2.50 = 44.108 t/m ^{2}.

Therefore, Safe Bearing Capacity of the soil at the depth of 4.00m is 44.00 t/m ^{2}

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9.3. SETTLEMENT ANALYSIS FOR THE INTENSITY OF 44.00 t/m ^{2}

LAYER -1, SILTY CLAYEY 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
= 2.80m

C = $1.5q_c/ \sigma'_0$

q_c = Static cone resistance
= $440t/m^2$

C = 1.5x440/4.70
= 140.425

σ'_0 =The original effective over burden pressure at the centre of the layer
= 4.70 t/m^2

$\Delta\sigma$ = The stress increases at the centre of the layer due to foundation loads (or) pressure
= 2.27 t/m^2

S_1 = (2.80 /140.425) x Log_e (4.70 +2.27/4.70)
= 0.0199x 10^{-3} x 0.394
= 7.841 x 10^{-3}m
= 7.841mm

TOTAL SETTLEMENT

= 7.841mm < 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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9.4. LOAD CARRYING CAPACITY OF THE CONVENTIONAL PILE

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

σ'_{vo} = average effective overburden pressure = 3.375 t/m^2

δ = angle of wall friction = 32

D = Dia meter of pile = 0.40m

L = Length of individual layer = 0.50m

= 0.471 x 3.375 x 0.624 x 3.14 x 0.40 x 0.50

= 0.622 t

$q_b = Nq\sigma'_{vo}Ab$

where

Nq = Bearing Capacity Factor =145

σ'_{vo} = effective overburden pressure at the toe = 3.50 t/m^2

Ab = Cross sectional area at the base

D = Dia of Pile = 0.40m

= 145 x 3.50 x 3.14 x 0.40^2 /4

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= 63.742 t

Qu = Qb + Qs

= 63.742 + 0.622 = 64.364 t

Q safe = Qu/F.S = 64.364/2.5 = 25.745 say 26.00 t

The safe load carrying capacity for five different diameter of piles for the **depth of 8.00m** are worked and are given below.

Dia of Pile	Depth of Pile	Safe Load (Tones)
400mm	8.00m	26
450mm	8.00m	33
500mm	8.00m	40
600mm	8.00m	58
750mm	8.00m	90

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. 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) **Continuous Strip Footing** (or) **Raft Foundation** can be adopted.
3. The open foundation can be placed at the minimum depth of 2.00m below the existing ground level. The existing ground level was same as the road level at the time of soil investigation.
4. The proposed structure has got Basement Floor + Ground Floor + Eight Floors, the Safe Bearing Capacity (SBC) at different depths have been worked out and given below.

Sl.No.	DEPTH (m)	SBC (t/m^2)
1.	2.00	27.00
2.	3.00	39.00
3.	4.00	44.00

5. The minimum width of footing should be maintained as 1.00m to avoid any punching shear failure and to achieve suggested SBC.
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. The shallow foundation should rest on natural undisturbed stratum, proper shoring should be done for the earth work excavation.

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8. **For heavy loaded structure,** if the SBC is not sufficient for the expected loading intensity it is advisable to provide deep foundation of **Pile cum Raft foundation**. The pile foundation can be Bored Cast in situ pile. The pile should be terminated at the minimum **depth of 8.00m (Including Anchorage depth)** below existing ground level.

9. The load carrying capacity for five different diameter of pile for the **minimum depth of 8.00m** are worked out and given below.

Dia of Pile	Depth of Pile	Safe Load (Tones)
400mm	**8.00m**	**26**
450mm	**8.00m**	**33**
500mm	**8.00m**	**40**
600mm	**8.00m**	**58**
750mm	**8.00m**	**90**

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. The pile should be anchored into the very dense Sandy Gravel (Disintegrated Rock) layer for minimum of 0.50m depth.

11. 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.

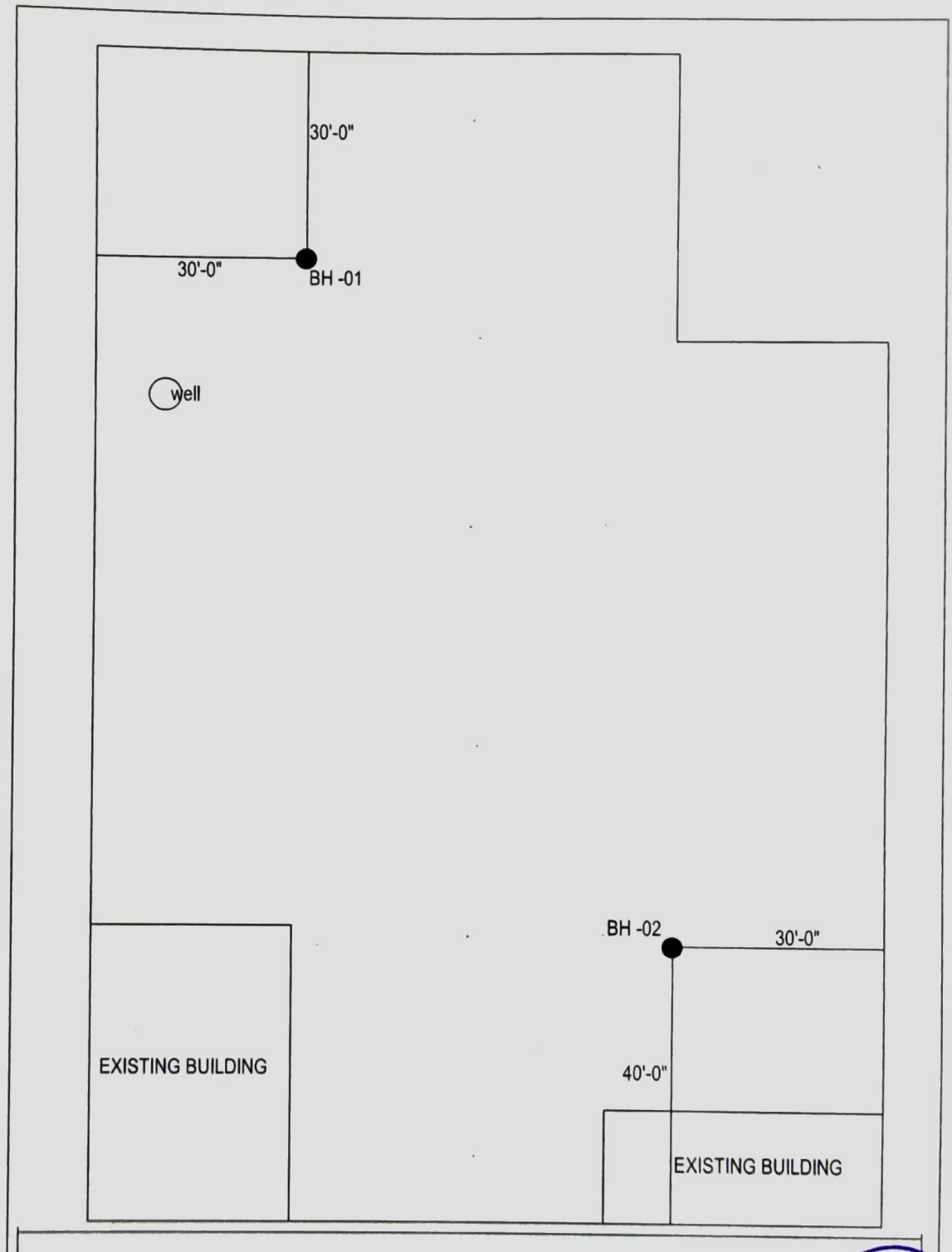
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12. The bore hole should be flushed properly before laying concrete. It has to be ensured by comparing the depth of pile bore hole and Tremie Pipe. The depth of Tremie Pipe lowered can be 300mm less than borehole depth. If the gap between bore hole bottom and Tremie Pipe bottom is more than 300mm, there is a possibility of slush deposit in the bore hole.
13. The pile boring should be done with **Percussion drilling or Hydraulic Rotary Drilling with DMC method.**
14. For foundation design, **Stress due to any eccentricity, stress due to horizontal force** should be considered, and **stability** should be checked.
15. All suggested foundation recommendations and precautions should be adopted while undertaking the design aspects and construction activities.

For T.J. Engineers

23– 01 - 2024

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



SITE PLAN
FIG.1

NOT TO SCALE

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CLIENT:-	PROJECT:-	
M/S VIGNESH PROPERTEES CHENNAI.	PROPOSED BUILDING AT PLOT NO. 48 (PART), 69 (PART) & 70 (PART), OLD DOOR NO. 8 & 27, NEW DOOR NO. 27, GRAND SOUTHERN TRUNK ROAD, PALLAVARAM, CHENNAI-600 044. COMPRISED IN T.S. NO. 73, BLOCK NO. 21, WARD-E OF ZAMIN PALLAVARAM VILLAGE, PALLAVARAM TALUK, CHENGALPATTU DISTRICT AND WITHIN THE LIMITS IF PALLAVARAM MUNICIPALITY.	T.J. ENGINEERS soil investigation and foundation design division T.J. HOUSE PLOT NO. 9, ANNA NAGAR, 1ST STREET, VELACHERY, CHENNAI 42. tjengineers@yahoo.com tjengineers1998@gmail.com OFF: 044-42334194

BORE LOG

PROJECT : Proposed Building at Plot No. 48 (Part), 69 (Part) & 70 (Part), Old Door No. 8 & 27, New Door No. 27, Grand Southern Trunk Road, Pallavaram, Chennai-600 044, Comprised in T.S. No. 73, Block No. 21, Ward-E of Zamin Pallavaram Village, Pallavaram Taluk, Chengalpattu District and within the Limits if Pallavaram Municipality.

BORE HOLE NO : B.H:01

TYPE OF BORING : Rotary Drilling

DATE OF COMMENCEMENT : 13 - 01 - 2024

DATE OF COMPLETION : 13 - 01 - 2024

G.W.L : 3.00m (Well)

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
0.00		Filled Up Soil	0.80	0.80					
1.00		Silty Clayey Gravelly Sand-SLCGS1 (Reddish Brown)	4.00			1.00	14	Medium Dense	
2.00						2.00	22	Medium Dense	
3.00						3.00	40	Dense	
4.00				4.80		4.00	51	Very Dense	
5.00		Silty Clayey Gravelly Sand-SLCGS2 (Gray Yellowish Brown)	2.20			5.00	>100	Very Dense	
6.00						6.00	>100	Very Dense	
7.00		Sandy Gravel-SG1 (Disintegrated Rock) (Grayish Brown)		7.00		7.00	>100	Very Dense	
8.00	→					8.00	>100	Very Dense	
9.00									
10.00									

Remark: All Dimensions in meters

→ End of Boring

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FIG: 2

BORE LOG

PROJECT : Proposed Building at Plot No. 48 (Part), 69 (Part) & 70 (Part), Old Door No. 6 & 27, New Door No. 27, Grand Southern Trunk Road, Pallavaram, Chennai-600 044, Comprised in T.S. No. 73, Block No. 21, Ward-E of Zamin Pallavaram Village, Pallavaram Taluk, Chengalpattu District and within the Limits if Pallavaram Municipality.

DATE OF COMMENCEMENT : 14 - 01 - 2024
DATE OF COMPLETION : 14 - 01 - 2024
G.W.L : 3.00m (Well)

BORE HOLE NO : B.H:02
TYPE OF BORING : Rotary Drilling

Depth below G.L	Soil profile	Description of soil	Thickness of layer	Depth at which samples are collected D.S	Depth at which samples are collected U.D.S	Standard penetration test data: Depth at which test is conducted	N-Value	Relative density/ Consistency	Graphical representation of penetration resistance
0.00		Filled Up Soil	0.90	0.90		1.00	18	Medium Dense	
1.00		Clayey Silty Gravelly Sand-CSLGS1 (Reddish Brown)	0.90	1.80		2.00	>100	Very Dense	
2.00		Silty Clayey Gravelly Sand-SLCGS1 (Gray Yellowish Brown)	3.70			3.00	>100	Very Dense	
3.00						4.00	>100	Very Dense	
4.00						5.00	>100	Very Dense	
5.00				5.50		6.00	>100	Very Dense	
6.00		Sandy Gravel-SG1 (Disintegrated Rock) (Whtiish Yellowish Brown)				7.00	>100	Very Dense	
7.00						8.00	>100	Very Dense	
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: 3

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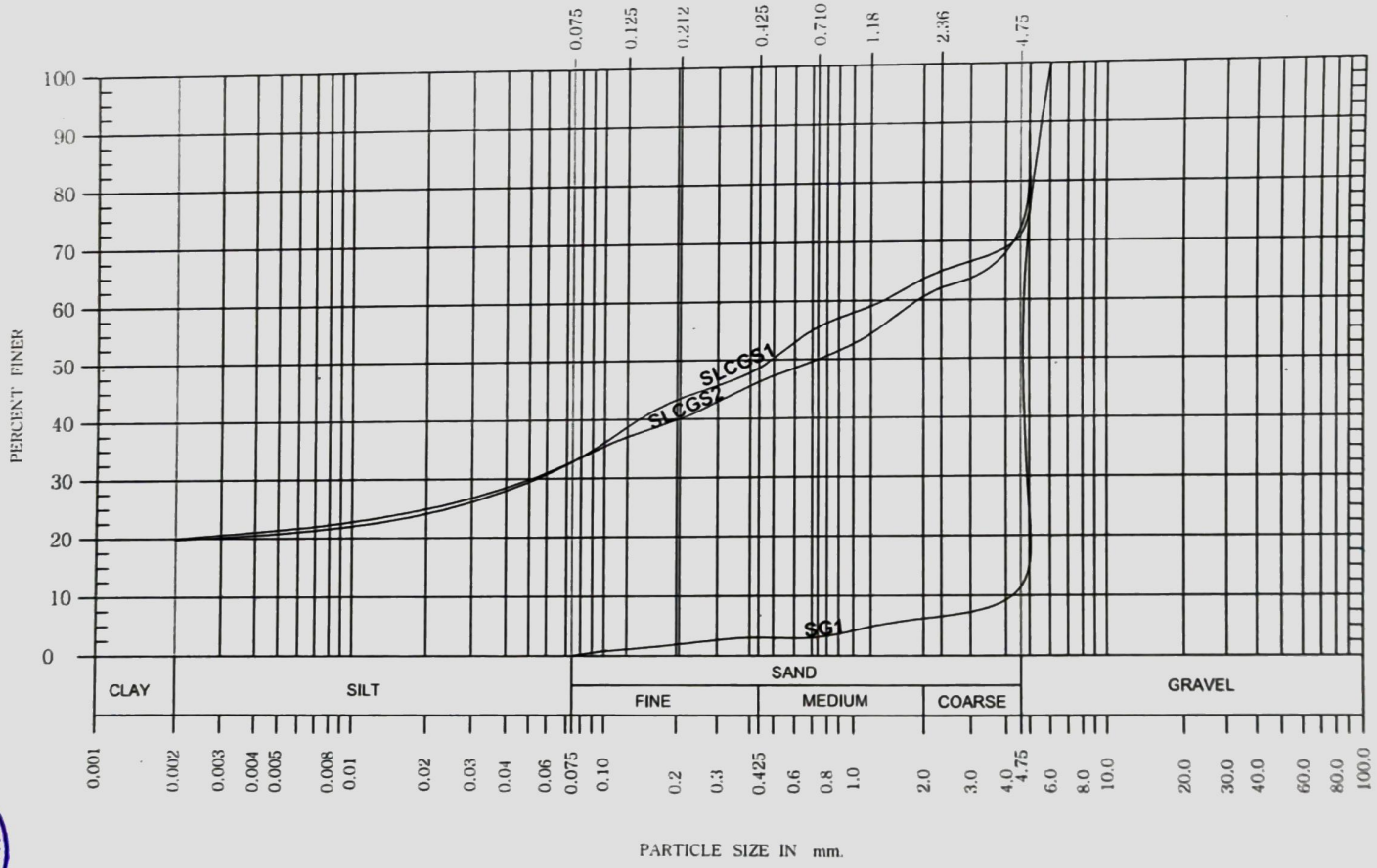


FIG. 4 GRAIN SIZE DISTRIBUTION CURVE-BH-01

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soil exploration & foundation design

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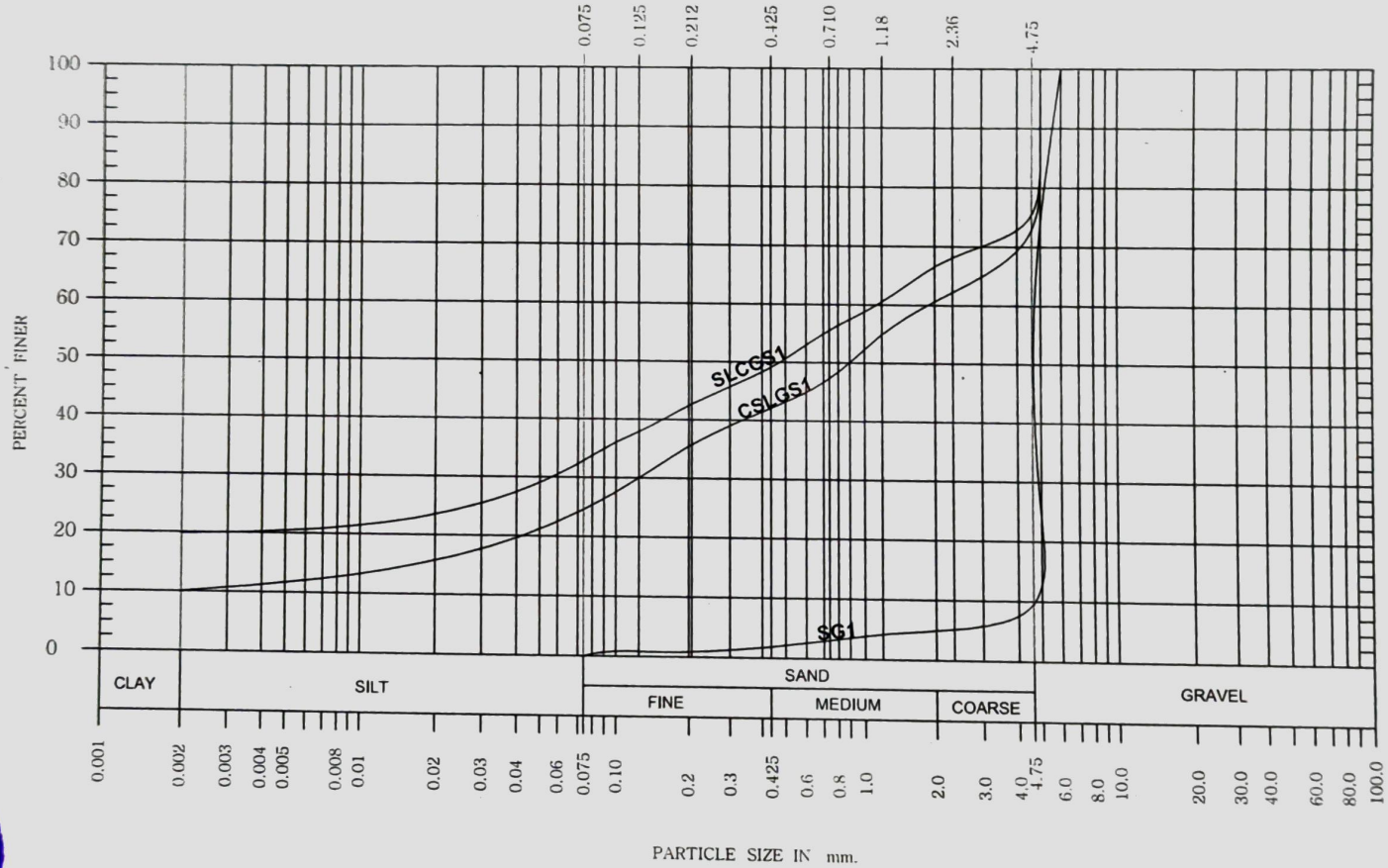


FIG. 5 GRAIN SIZE DISTRIBUTION CURVE-BH-02

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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
	m		DS / SPT m	UDS m			Clay	Silt	Sand	Gravel	
						%	%	%	%	%	
1	0.00 - 0.80	Filled Up Soil	–	–	–	–	–	–	–	–	–
	0.80 - 4.80	Silty Clayey Gravelly Sand-SLCGS1	1.00	–	2.65	–	19	14	38	29	–
	4.80 - 7.00	Silty Clayey Gravelly Sand-SLCGS2	2.00	–	2.64	–	20	13	40	27	–
	7.00 - 8.00	Sandy Gravel-SG-1	8.00	–	2.63	–	0	0	12	88	–
2	0.00 - 0.90	Filled Up Soil	–	–	–	–	–	–	–	–	–
	0.90 - 1.80	Clayey Silty Gravelly Sand-CSLGS1	1.00	–	2.65	–	10	16	48	26	–
	1.80 - 5.50	Silty Clayey Gravelly Sand-SLCGS1	2.00	–	2.64	–	19	14	42	25	–
	5.50 - 8.00	Sandy Gravel-SG-1	8.00	–	2.63	–	0	0	9	91	–

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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/m³			t/m²	degree	
1	0.00 - 0.80	Filled Up Soil	–	–	–	–	–	–	–	–	–	–
	0.80 - 4.80	Silty Clayey Gravelly Sand-SLCGS1	1.00	–	–	–	1.50	–	–	–	32	–
	4.80 - 7.00	Silty Clayey Gravelly Sand-SLCGS2	2.00	–	–	–	1.58	–	–	–	38	–
	7.00 - 8.00	Sandy Gravel-SG-1	8.00	–	–	–	1.62	–	–	–	41	–
2	0.00 - 0.90	Filled Up Soil	–	–	–	–	–	–	–	–	–	–
	0.90 - 1.80	Clayey Silty Gravelly Sand-CSLGS1	1.00	–	–	–	1.52	–	–	–	33	–
	1.80 - 5.50	Silty Clayey Gravelly Sand-SLCGS1	2.00	–	–	–	1.58	–	–	–	39	–
	5.50 - 8.00	Sandy Gravel-SG-1	8.00	–	–	–	1.62	–	–	–	42	–

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THE LANDLENS SUITE

Eight ways to know a piece of land before you pay for it.

This report covers one part of the picture. These cover the rest, drawn from the same government records, for any property in Tamil Nadu.

LandLens One
Ask anything about a property and get an answer grounded in live government records, with the sources shown.
/landlens/one

Verify My Land
Every record check run on one property and returned as a single report.
/landlens/verify-my-land

Legal Opinion
An advocate's written opinion on the title, built on the records we pull for it.
/landlens

One Map
Every layer on one map: the parcel, its boundary, zoning, water bodies and what sits around it.
/landlens/one/map

PriceMap
What land actually changed hands for around this plot, taken from the registered deeds.
/landlens/pricemap

Build Scope
What you are allowed to build here: floor space, height, coverage and setbacks.
/landlens/build-scope

Property Tracker
Watch a property and hear about it when something new is registered against it.
/landlens/property-tracker

Deal Room
Run the transaction in one place: documents, stamping, signatures and the parties.
/landlens/deal-room

FREE TOOLS · NO ACCOUNT NEEDED

Twenty-four checks you can run yourself, at no cost.

Records and verification

The registers themselves, read for you.

- Encumbrance Certificate
- Patta and Chitta
- Field Measurement Sketch
- EC Analyzer
- Bank charge check
- Court case search
- Seller background check
- Approval check by survey

Value and duty

What it is worth and what it costs to register.

- Guideline value by street
- Guideline value by survey
- Stamp duty and registration fees
- Capital gains
- Floor space index
- Area unit converter

Zoning and land use

What the plan says can happen on this land.

- Land use zone finder
- CMDA land use check
- Coastal regulation zone
- Master plan check
- Water bodies finder
- Airport height clearance

Registers and directories

Who holds it, and which office keeps the record.

- Find your registering office
- Temple property check
- Waqf property check
- RERA register

Every free tool
/tools

Services we run for you
/services

The LandLens suite
/landlens/one

Verified RealEstate™

Every claim in this document traces back to a government record.

- Legal opinions, due diligence and title verification
- Building plan, layout and sub-division approvals
- Completion and occupancy certificates, regularisation
- Escrow, negotiation and NRI property management
- Land survey, soil testing, architecture and construction

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Prepared from the registers named on the page each finding sits on. Where a register could not be read, this document says so in its place rather than leaving the gap to be read as a clean result.