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SOIL EXPLORATION AND FOUNDATION REPORT

FOR THE PROPOSED BUILDING

AT

NO. R 215

T.N.H.B. ROAD

KAKKALUR ERIE SCHEME (POST)

THIRUVALLUR DISTRICT

CHENNAI

T.J.ENGINEERS

SOIL EXPLORATION AND FOUNDATION DESIGN DIVISION
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EXPLORATION REPORT

1.INTRODUCTION:

1.1.Object and Scope of Investigation:

Mr. **R. RAJI** has been proposed to construct a Building at No. R215, T.N.E.B. Road, Kakkalu Erie Scheme, Kakkalur (Post) Thiruvallaur District, Chennai. 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 most suitable type of foundation system for the proposed structure.

For this purpose two bore holes were bored up to maximum depth of 22.00m. 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 holes were terminated in the Very Dense Cemented Sand layer.

The work comprised of mobilization and conducting standard penetration test in the field and collecting disturbed and undisturbed samples for testing in the laboratory. This report presents the analysis of test results and foundation recommendations made based on the analysis.

1.2. Field and Laboratory Tests:

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 1.50 m. 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 samples were collected from all the layers for visual observation, classification tests and

strength characteristics of the soil layers. The laboratory test results are given in the table-1&2.

2.0. GROUND WATER

The ground water level was encountered at the depth of 2.00m below the existing ground level at the time of soil investigation.

3.0. PROFILE OF THE SOIL:

From the above Field and Laboratory tests, the soil profile of the area as observed in borehole is given graphically in Fig. 2&3. And also Summarized below.

Bore Hole No.	**Depth (m)**	**Soil description**	**Relative Density**	**Remarks**
B.No.1 &2	0.00 - 5.50	Sandy Clay (Grayish Yellowish Brown)	Very Stiff	-
	5.50 – 10.00	Clayey Silty Sand (Grayish Whitish Brown)	Medium Dense	-
	10.00 – 12.00	Silty Clay (Dark Gray)	Stiff	-
	12.00 – 19.00	Sandy Silty Clay (Grayish)	Very Stiff	-

	19.00 – 22.00	Clayey Sand (Grayish Yellowish Brown)	Very Dense	-

4.0. FOUNDATION ANALYSIS

From the bore log data there is Sandy Clay layer available up to 5.50m, this layer has got swelling character. From 5.50m to 10.00m there is a medium dense Clayey silty Sand layer available, From 10.00m to 12.00m there is a Stiff silty Clay layer available, From 12.00m to 19.00m there is a Very Stiff Silty Clay layer available, below 19.00m there is a hard Cemented Sand layer available.

For light loaded structure open foundation can be adopted. The foundation can be **Isolated Footing** or **Continues Footing** or **Raft foundation.** The foundation can be placed at the **minimum depth of 2.10m** below the existing ground level. The existing ground level considered the level of the ground at the time of soil investigation.

For heavy loaded structure, if the SBC is not sufficient for the expected loading intensity, structure very sensitive for differential settlement, structure with long cantilever span, long span with un symmetrical column position pile foundation can be adopted. The pile foundation can be Bored Cast in-situ Pile or Driven pile. The pile foundation can be terminated at the depth of 22.00m below the existing ground level.

4.1. COMPUTATION OF THE SAFE BEARING CAPACITY

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

$$\mathbf{q_u = 1.20\ C_u\ N_c + \gamma' D_f\ N_q}$$

The minimum observed N-Value is taken as 15 from Fig. 2&3. The corresponding bearing capacity factors are,

$N_c = 5.70$

$N_q = 1$

Where,

C_u = Undrained Shear strength = 6.94 t/m^2

γ = Bulk density = 1.50 t/m^3

γ' = Submerged density = 0.50 t/m^3

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

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

Substitute all the above values in the formula,

q_u = 1.20 x 6.94 x 5.70 + 0.5 x 2.10 x 1.00

= 47.47 + 1.05 = 48.52 t/m^2

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

Hence, safe bearing capacity q_s = 48.52 / 2.50 = 19.41 t/m^2.

Therefore, Safe Bearing Capacity of the soil at the depth of 2.10m is 19.00 t/m^2

4.2. 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.

$$\mathbf{Qu = Qb + Qs}$$

Qs = Untimate 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 efficient overburden pressure = 9.75 t/m^2

δ = angle or wall friction = 32

D = Dia meter of pile = 0.40m

L = Length of individual layer = 3.00m

= 0.471 x 9.75 x 0.624 x 3.14 x 0.40 x3.00

= 10.80 t

q_b = Nq σ'_{vo} Ab

where

Nq = Bearing Capacity Factor = 125

σ'_{vo} = effective overburden pressure at the toe = 10.50 t/m^2

Ab = Cross sectional area at the base

D = Dia of Pile = 0.40m

= 125 x 10.50 x 3.14 x 0.40^2 /4

= 164.85 t

Qu = Qb + Qs

= 164.85 + 10.80 = 175.65 t

Q safe = Qu/F.S= 175.65 t/2.5= 70.26 say 70 t

The safe load carrying capacity for five different diameter of piles for the depth of 22.00m are worked and are given below.

Dia of Pile	Depth of Pile	Safe Load (Tones)
400mm	**22.00m**	**70**
450mm	**22.00m**	**88**
500mm	**22.00m**	**108**
600mm	**22.00m**	**155**
750mm	**22.00m**	**240**

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).

5.0. CONCLUSIONS

1. Soil in the shallow depth is fair to adopt open foundation system for light loaded structure.
2. The foundation can be **Isolated Footing (or) Continues 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 (existing ground level considered as the ground level at the time of soil investigation).
4. The **Safe Bearing Capacity** of the soil at the minimum **depth of 2.10m** is **19.00 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 soil.
7. All the foundation should rest on 100 mm thick 1:4:8 concrete mat.
8. All the foundation trench should be compacted by sprinkling of water and ramming before laying PCC.
9. Since the soil in the shallow depth is clayey and having swelling character , If Isolated footing provided it is advisable to provide **Continues Plinth Beam** connecting columns on both direction, **6" thick belt** at G.F floor level, **Continues sill slab** and **Continues lintel beam.**
10. For heavy loaded structure if the SBC is not sufficient for the expected loading intensity, structure Sensitive for differential settlement, Long span with un symmetrical column position and with long cantilever span, Pile foundation can be adopted. The pile foundation can be terminated at the depth of 22.00m. The

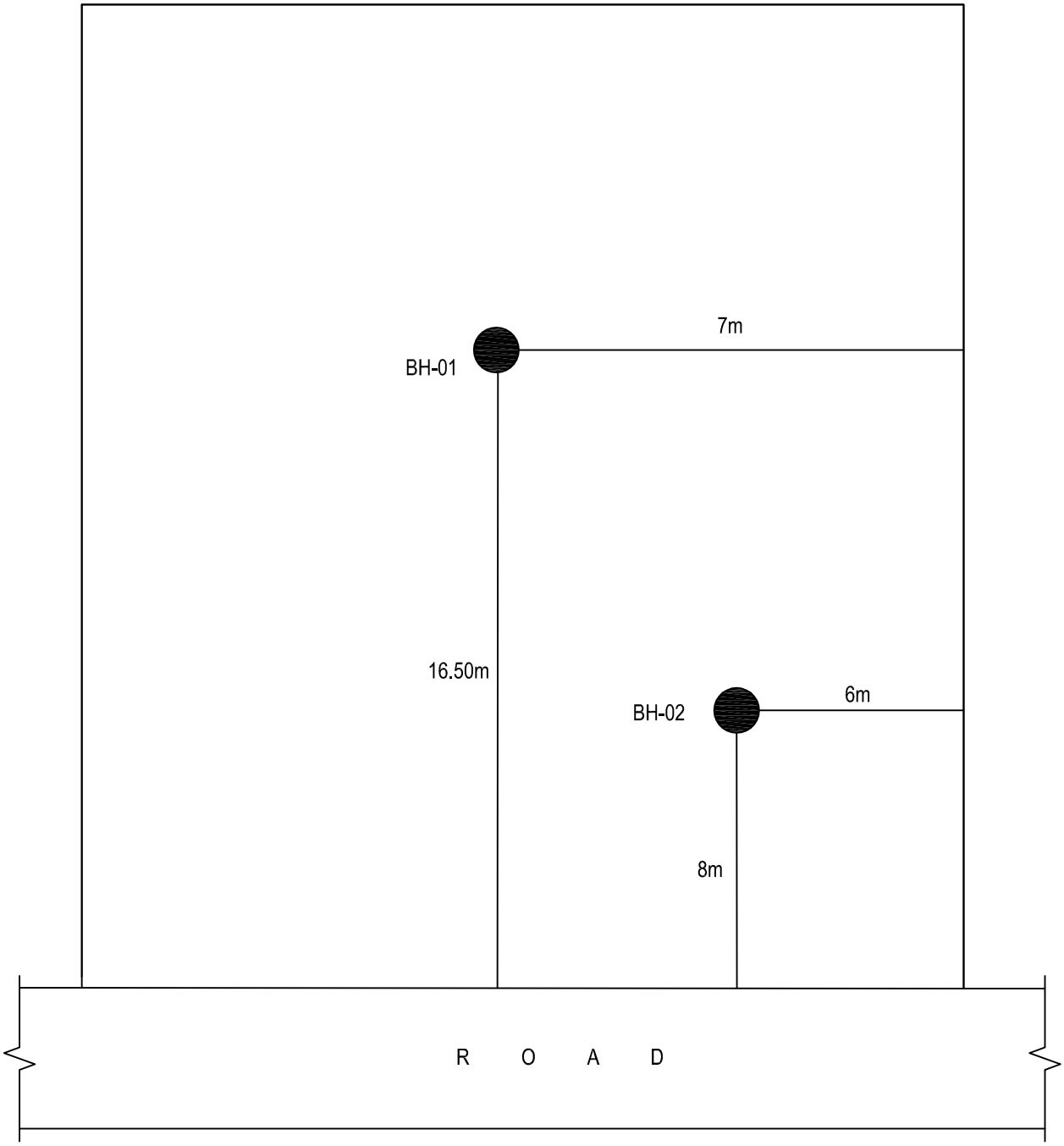
pile foundation can be Bored Cast in situ pile or Driven Pile. The load carrying capacity for four different diameter of pile has been worked out and given below.

Dia of Pile	Depth of Pile	Safe Load (Tones)
400mm	**22.00m**	**70**
450mm	**22.00m**	**88**
500mm	**22.00m**	**108**
600mm	**22.00m**	**155**
750mm	**22.00m**	**240**

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).

11. The pile should be **anchored** in to the very dense **Cemented Sand layer** for **minimum of 3.00m**. The depth of pile may vary slightly according to site condition.
12. If pile foundation provided proper precaution should be adopted while boring, against sliding of borehole, by providing temporary or permanent casing pipe or circulating proper dense bentonite slurry. The bore hole should be flushed properly before concreting. Pile Concreting should be done as soon as possible boring operation is over.
13. The bore hole should be flushed properly before laying concrete.
14. All suggested foundation recommendations and precautions should be adopted while undertaking the design aspects and construction activities.

For T.J. Engineers
15-03 -2013



NOT TO SCALE

CLIENT:-	PROJECT:-		
Mr. Mr. R. RAJI CHENNAI.	PROPOSED BUILDING AT NO. R215, T.N.E.B. ROAD, KAKKALU ERIE SCHEME, KAKKALUR (POST) THIRUVALLAUR DISTRICT, CHENNAI.	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

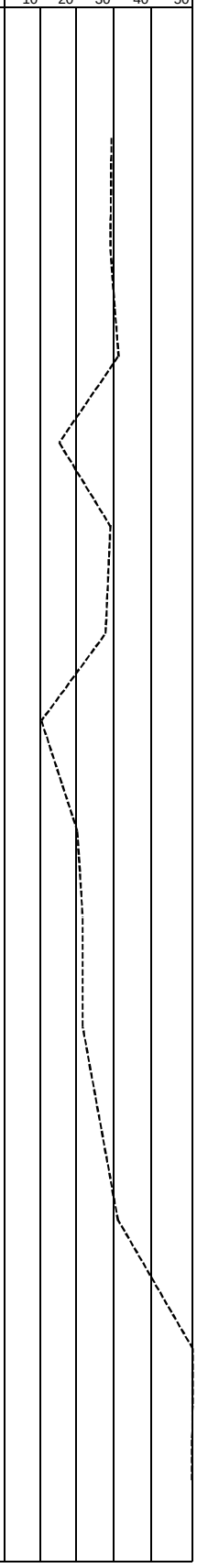
BORE LOG

PROJECT : **Proposed Building at Thiruvallur, Chennai**
BORE HOLE NO : **B.H:1**
TYPE OF BORING : **Rotary Drilling**

DATE OF COMMENCEMENT: **08 - 03 - 2013**
DATE OF COMPLETION : **08 - 03 - 2013**
G.W.L : **2.00m**

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	N-Value	Relative density/ Consistency
0.00								
1.00								
						1.50	29	Very Stiff
2.00		**Sandy Clay**						
		(Grayish to Yellowish Brown)						
3.00						3.00	29	Very Stiff
4.00								
						4.50	32	Very Stiff
5.00			5.50	5.50				
6.00						6.00	15	Medium Dense
7.00		**Clayey Silty Sand**	4.50			7.50	29	Medium Dense
8.00		**(Grayish Whitish Brown)**						
9.00						9.00	28	Medium Dense
10.00				10.00				
						10.50	10	Stiff
11.00		**Silty Clay**	2.00					
		(Dark Gray)						
12.00				12.00		12.00	20	Very Stiff
13.00								
						13.50	22	Very Stiff
14.00								
15.00		**Sand Silty Clay**	7.00			15.00	21	Very Stiff
16.00		**(Grayish)**						
17.00								
18.00						18.00	31	Hard
19.00				19.00				
20.00		**Clayey Sand**				20.00	>100	Very Dense
		(Cemented Sand)						
21.00		**(Grayish to Yellowish Brown)**						
22.00						22.00	>100	Very Dense
23.00								

Graphical representation of penetration resistance



Remark: All Dimensions in meters

→ **End of Boring**

FIG: 2

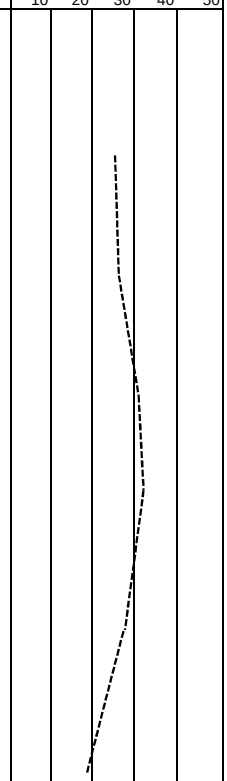
BORE LOG

PROJECT : **Proposed Building at Thiruvallur, Chennai**
BORE HOLE NO : **B.H:2**
TYPE OF BORING : **Rotary Drilling**

DATE OF COMMENCEMENT: **09 - 03 - 2013**
DATE OF COMPLETION : **09 - 03 - 2013**
G.W.L : **2.00m**

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	N-Value	Relative density/ Consistency
0.00								
1.00								
2.00		**Sandy Clay**	5.50			1.50	26	Very Stiff
3.00		**(Grayish Brown)**				3.00	27	Very Stiff
4.00								
5.00						4.50	31	Very Stiff
				5.50				
6.00						6.00	32	Dense
7.00		**Clayey Silty Sand**	4.00					
8.00		**(Grayish Yellowish Brown)**				9.00	27	Medium Dense
9.00								
				9.50				
10.00 →		**Sand Silty Clay**				10.00	19	Very Stiff
11.00		**(Grayish)**						
12.00								
13.00								
14.00								
15.00								
16.00								
17.00								
18.00								
19.00								
20.00								
21.00								
22.00								

Graphical representation of penetration resistance



Remark: All Dimensions in meters

→ **End of Boring**

FIG: 3

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 - 5.50	Sandy Clay	1.50	_	2.65	57	47	15	38	0	_
	5.50 - 10.00	Clayey Silty Sand	6.00	_	2.64	_	15	23	62	0	_
	10.00 - 12.00	Silty Clay	10.50	_	2.65	_	53	35	12	0	_
	12.00 - 19.00	Sandy Silty Clay	12.00	_	2.65	_	47	34	19	0	_
	19.00 - 22.00	Clayey Sand	22.00	_	2.64	_	17	20	63	0	_
2	0.00 - 5.50	Sandy Clay	1.50	_	2.65	57	45	16	39	0	_
	5.50 - 9.50	Clayey Silty Sand	6.00	_	2.64	_	17	25	58	0	_
	9.50 - 10.00	Sandy Silty Clay	10.00	_	2.65	_	54	32	14	0	_

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	Ø	
	m		m	m	%	%	t/m^3			t/m^2	degree	
1	0.00 - 5.50	Sandy Clay	1.50	_	58	19	_	_	_	6.94	_	_
	5.50 - 10.00	Clayey Silty Sand	6.00	_	_	_	1.5	_	_	_	_	_
	10.00 - 12.00	Silty Clay	10.50	_	_	_	1.5	_	_	_	33	_
	12.00 - 19.00	Sandy Silty Clay	12.00	_	_	_	1.5	_	_	5.7	_	_
	19.00 - 22.00	Clayey Sand	22.00	_	_	_	1.5	_	_	_	40	_
2	0.00 - 5.50	Sandy Clay	1.50	_	57	18	_	_	_	7.25	_	_
	5.50 - 9.50	Clayey Silty Sand	6.00	_	_	_	1.5	_	_	_	35	_
	9.50 - 10.00	Sandy Silty Clay	10.00	_	_	_	1.5	_	_	10.82	_	_



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