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REPORT

ON

SOIL INVESTIGATION FOR CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING AT PANDAMANGALAM, TRICHY

Client

Mr. R. M. Alagappan,
Priyanka Towers,
T. S. No.27/28, Ward No: I,
Block No: 6, Zone. V,
Near Subramania Nagar,
Pandamangalam,
Trichy City Corporation.

By

Time

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TIME INSTITUTE FOR MATERIALS TESTING
NO. 25, SANJEEVI NAGAR,
TRICHY - CHENNAI BYEPASS ROAD,
TIRUCHIRAPPALLI,
TAMIL NADU - 620 002.
PH: 0431 2401326

AUGUST 2023

REPORT

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SUMMARY

Project	:	Construction of Residential Apartment Building at Pandamangalam, Trichy
Project Reference	:	Time /12/ Soil Test / August 2023
Owner	:	Mrs. AL. Meenal, Priyanka Towers, T. S. No.27/28, Ward no: L, Block No: 6, Zone. V, Near Subramania Nagar, Pandamangalam, Trichy City Corporation.
No. of Units	:	40 Units
Type of Structure	:	R.C.C. Framed construction
Location	:	Pandamangalam, Trichy
Scope	:	Geotechnical investigation for the entire area of construction
Test conducted	:	Two explanatory bore hole up to 6m depth was made and conducted standard penetration tests at every 1.5m depth. The undisturbed soil samples were collected at every 1.5m depth for laboratory test.

FINDINGS

Soil at shallow depth	:	Clay exist up to 2.4m depth
Hard stratum	:	No trace of rock exists up to 6m depth
Ground water table	:	Ground water table exists at 4.5m depth from ground level during soil investigation

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SUMMARY

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Project Reference	:	Time /12/ Soil Test / August 2023
Owner	:	Mrs. AL. Meenal, Priyanka Towers, T. S. No.27/28, Ward no: L, Block No: 6, Zone. V, Near Subramania Nagar, Pandamangalam, Trichy City Corporation.
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soil + agl

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Time Institute for Materials Testing
टाइम इन्स्टिट्यूट चीज़े शोध केलिए
Soil & Structural Consultant, Construction Materials Testing Lab
Quality is Excellence

August 09, 2023

To

Mrs. AL. Meenal,
Priyanka Towers,
T. S. No.27/28, Ward no: I,
Block no: 6, Zone. V,
Near Subramania Nagar,
Pandamangalam,
Trichy City Corporation.

REPORT ON SOIL INVESTIGATION

(Ref: TIME/12/ SOIL TEST/ AUGUST 2023)

Sub: Soil Investigation for construction of Residential Apartment Building at Pandamangalam, Trichy – reg.,

Ref: Based on letter dated: 04.08.2023

1.1 Introduction:

It is proposed to construct a **Residential Apartment Building at Pandamangalam, Trichy.** A detailed soil investigation was suggested for estimating the safe bearing capacity of the soil, so that suitable type of foundation can be decided for the proposed structure. Time Institute for Materials Testing (TIME) has been requested to undertake the soil investigation at the proposed site. The study was carried out by TIME between **05.08.2023 & 06.08.2023.** This report presents complete investigation data and discusses the results to recommend the bearing capacity values at different depths for the proposed structure.

Section 2 describes the soil profile and bore log details of two exploratory bore hole. Section 3 of this report gives the Grain size distribution curves and its analysis. Section 4 of this report presents the calculated safe Bearing capacity values of soil at various depths. Section 5 of this report reviews the test results and the recommended safe bearing capacity values for design of foundation. Section 6 of this report presents the Soil sample photos. Section 7 of this report presents site photo.

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Mob : + 91 94433 27936 Email : tmaterialstesting@yahoo.co.in, tmaterialstesting1@gmail.com Web: www.timeinstitute.net

1.2 Investigation Programme, Procedure and Data:

Investigation was carried out in two location at the site through exploratory bore hole. Soil samples were collected from bore hole at different depths for conducting laboratory test. Standard Penetration test was conducted at regular intervals and 'N' values were recorded. Undisturbed soil samples were collected and were preserved and transported to the laboratory for detailed identification tests. Based on the field and laboratory tests on the samples collected, the results are furnished in this report.

An exploratory bore hole was advanced from the existing ground level using truck mounted rotary drilling techniques supplemented by Betonies mud circulation. This drilling procedure with mud circulation is found most suitable for making exploratory bore hole. The mud circulation was employed through the drill rods and letting it out though the side jets provided in the cutting tool thus preventing any disturbance at the bore hole bottom. Mud circulation was used to stabilize the sides and the bottom of the bore hole, and then to bring the soil cuts to the surface. It is important to note that the mud jet is not used to cut the soils as in the case of wash boring technique. Use of drilling mud will also help in preventing the disturbance to the soil at the bore hole bottom during drilling operations. Diameter of the bore hole is about 150mm.

Bore hole was always kept full with the drilling mud so that a positive head is maintained in the bore hole thus preventing any disturbance to the soil within the test zone.

The field tests included Standard penetration test, Disturbed and undisturbed soil sampling, identification of different soil layers, Ground water table observation, complete logging of the bore hole, etc.

Laboratory investigation consisted of classification tests like grain size distribution analysis, determination of specific gravity etc. Unconfined Compression test and Direct shear was conducted on preserved soil samples. All the field and laboratory tests were conducted according to the procedures stipulated in relevant IS codes.

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1.3 Review of Field and Laboratory Results:

Sub soil Profile

The original ground level in the presently investigated area was plain terrain.

Bore Hole 1:

The soil below the existing ground level is clay. This layer is extended up to 2.4m depth. Sand with clay mixed exists from 2.4m to 2.9m depth. Clay exists from 2.9m to 5.2m depth. Sand exists from 5.2m to 5.7m depth. Below which clay exists from 5.7m to 6m depth from the existing ground level. The soil stratification and its variation under present investigation are available in bore log details. The 'N' value is progressively increasing towards depth, due to the soil stratification.

Bore Hole 2:

The soil below the existing ground level is clay. This layer is extended up to 4.8m depth. Below which sand exists from 4.8m to 6m depth from the existing ground level. The soil stratification and its variation under present investigation are available in bore log details. The 'N' value is progressively increasing towards depth, due to the soil stratification.

Ground Water Table

Ground water table exists at 4.5m depth from the ground level during the soil investigation.

Shear Strength

Standard Penetration test blow counts 'N' is measured at different levels in the bore hole. Mainly these 'N' values are used to assess the shear strength of different soil layers.

Cohesive layers: The classification of 'N' values in moderate to high plasticity medium clay deposits developed by Terzaghi is used for estimating the unconfined compression strength and untrained shear strength of clay and sandy clay layers. The consistency between the N values and the liquidity index values is reviewed while assigning undrained shear strength for soft to medium clay layers.

Non - Cohesive Layers: The sand layers towards depth are of residual type and suitable modifications are made to take care of the presence of plastic fines in the residual soil. Conventional method of estimating the angle of shearing resistance ϕ corresponding to the relative density and the grain size distribution as per the classification suggested by Peck and suitably modified by the R.K. Hough to account for the influence of grain size distribution is adopted here.

Laboratory Tests:

The Collected soil samples were tested as per relevant procedure in IS codes. The following parameters are evaluated.

1) **Natural Moisture Content**: This test is conducted in all disturbed samples to find the water content in soil samples as per **IS 2720 (Part 2): 1973**
2) **Specific Gravity:** This test is conducted in all disturbed soil samples to find specific gravity of soil as per **IS 2720 (Part 3): 1980**
3) **Density:** This test is conducted in all disturbed soil samples to find Bulk density and Dry density of soil as per **IS 2720 (Part 8): 1983**
4) **Sieve Analysis: This test is conducted to identify and classify the samples** as per **IS 2720 (Part 4) : 1985**
5) **Direct Shear Test:** This test conducted in coarse grained soil to fine the angle of shearing resistance of the soil as per **IS 2720 (Part 13):1986**

1.4 Recommended Safe bearing capacity values at different depths

Bore Hole	Depth (m)	Safe Bearing Capacity (t/m^2)
BH – 1	1.50	3.39
	3.00	3.39
	4.50	7.64
	6.00	5.94
BH – 2	1.50	2.54
	3.00	4.24
	4.50	13.59
	6.00	19.54

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1.5 Conclusions:

The scope of foundation is purely the decision of the structural engineer. However, the following suggestion are furnished for your reference.

1. There are two types of foundation as Open foundation and Deeper foundation.
2. Under Open foundation, there are four types like Isolated, Combined, Raft and Mat Foundation.
3. Under Deeper foundation, it is only Pile foundation.
4. Under which condition we can prefer Open foundation or Pile foundation?
5. In general, to have Open foundation for any type of loading via Light load /Heavy load symmetrically spaced columns or unsymmetrically spaced columns it is preferable to have SBC as $20t/m^2$ and above at 3m depth and it should continue to increase as proceed down, further it should not increase and decrease after 3m depth to satisfy the settlement criteria.
6. Based on the existing soil condition in this location all the above condition to provide Open foundation is not satisfied.
7. Hence it is Suggested to provide cast in situ friction Pile foundation.
8. The Pile load carrying capacity values like bearing resistance, Uplift force and Side Thrust for various diameter of Piles upto 6m depth are presented herewith for your reference.

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Recommended pile load capacity Values

Based on the variation of the existing soil profile and usage of M25 grade of concrete, the pile load capacity has been calculated and presented as below.

S. No.	Bore Hole no.	Pile Dia. (mm)	Depth (m)	Bearing Resistance (tonne)	Uplift Resistance (tonne)	Lateral thrust (tonne)
1	BH – 1 & BH - 2	400	6	13.8	10.4	2.1
		450		15.8	11.7	2.4
		500		17.9	13.1	2.7
		600		22.1	15.8	3.2

09th August 2023

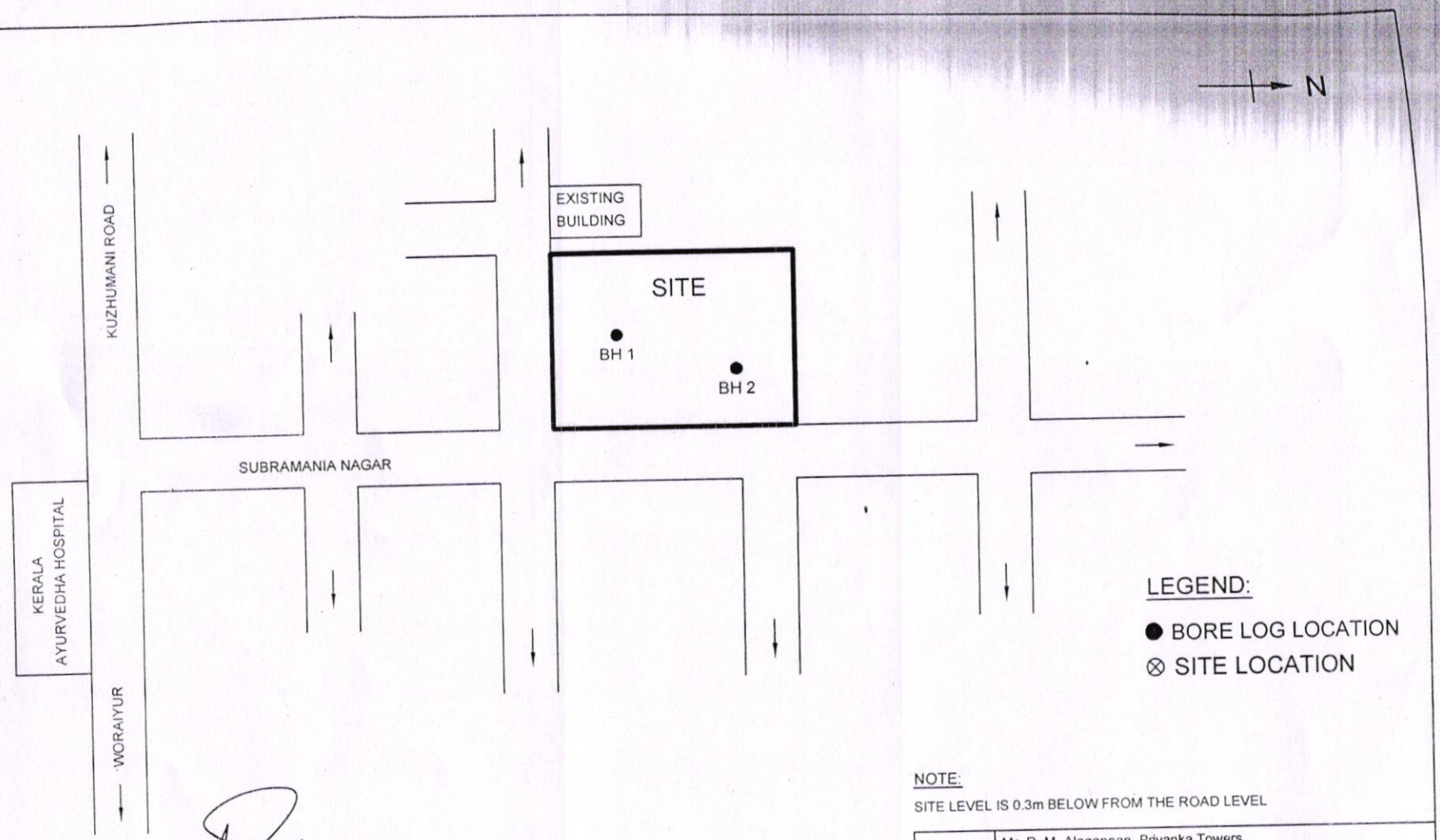
Time Institute for Materials Testing Tiruchirappalli-1

For Time Institute for Materials Testing

B. N. Krishnaswami

Dr. B.N. Krishnaswami.

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NOTE:

SITE LEVEL IS 0.3m BELOW FROM THE ROAD LEVEL

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SOIL CONSULTANT	TIME Institute for Materials Testing No 25, Sanjeevi Nagar, Trichy - Chennai Byepass road , Trichy - 620002. PHONE : 0431 - 2401326(OFF)	
DATE OF SURVEY	05.08.2023 & 06.08.2023	TITLE PLAN OF BORE HOLE AND SITE DETAILS AT PANDAMANGALAM, TRICHY
SCALE	NTS	DRG.NO DRAWING - 01 REV.

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SITE PLAN

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Annexure - B

SPECIFIC GRAVITY TEST
(As per IS 2720 (Part - 3) - 1980)

roject Name : **Soil investigation for construction of Residential Apartment Building at Pandamangalam, Trichy**

ore Hole No. : **1**

epth : **3m**

Trial	Bottle Wt (W1) gm	Bottle + Sample (W2) gm	Bottle + Sample + Water (W3) gm	Bottle + Water (W4) gm	Specific Gravity
1	32.6	92.2	117.6	80.8	2.614
2	32.6	91.8	117.4	80.8	2.619
3	32.6	91.3	117.0	80.8	2.609

Specific gravity of Fine Aggregate = 2.61

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Annexure - C

DENSITY CALCULATION

Project Name : **Soil investigation for construction of Residential Apartment Building at Pandamangalam, Trichy**

Bore Hole No. : **1**

Depth : **3m**

Sl. No.	Description	Reading
1	Weight of Empty Box (gm)	630.00
2	Weight of Box + Soil (gm)	792.50
3	Weight of Soil (gm)	162.50
4	Volume of Box (cm^3)	90.00
5	**Bulk Density (gm/cm^3)**	**1.81**
6	Weight of Container (gm)	23.70
7	Weight of Container + Wet Soil (gm)	45.10
8	Weight of Container + Dry Soil (gm)	41.50
9	Moisture Content (%)	20.22
10	**Dry Density (gm/cm^3)**	**1.50**

Result

Bulk Density of Soil = 1.81

Dry Density of Soil = 1.50

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Annexure - D

POROSITY & VOID RATIO

roject Name : **Soil investigation for construction of Residential Apartment Building at Pandamangalam, Trichy**

ore Hole No. : **1**

epth : **3m**

Sl. No.	Description	Reading
1	Dry Density γ_d (gm/cm^3)	1.50
2	Specific gravity (G_s)	2.61
	Porosity (%)	(1 – (γd/Gs))*100
		(1-(1.50/2.61)) x 100 = 42.52
3	**Porosity (%)**	**42**
	Void Ratio, (e)	η/(1-η)
		0.4252/(1-0.4252)
4	**Void Ratio**	**0.73**

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Annexure - E

FINENESS MODULUS TEST

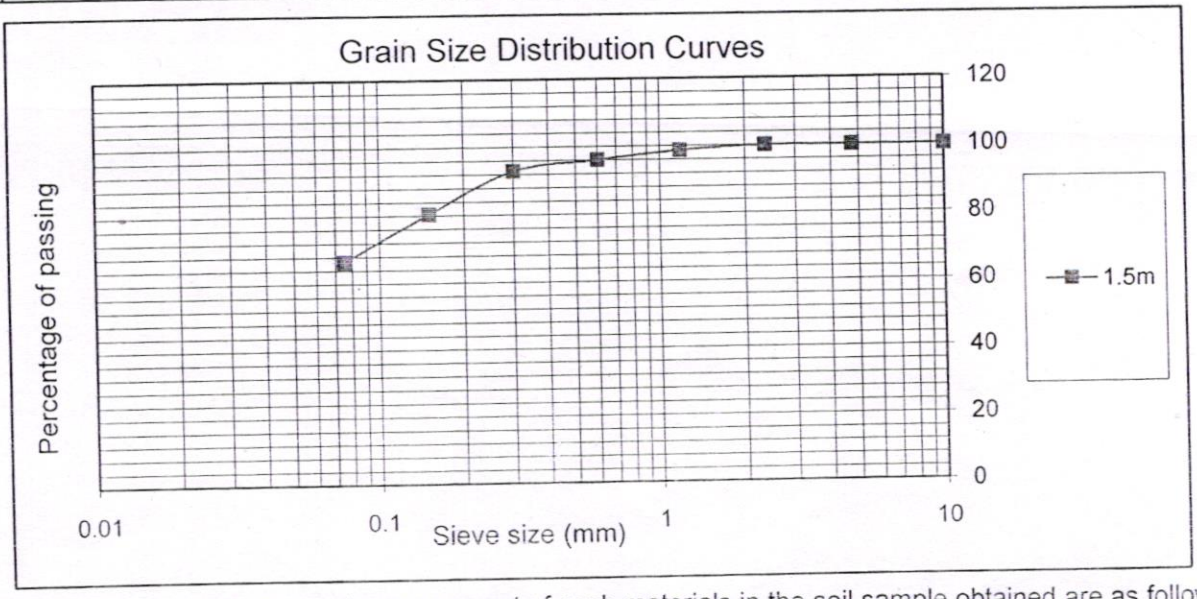
(As per IS 2720 (Part - 4) - 1985)

Project Name : **Soil investigation for construction of Residential Apartment Building at Pandamangalam, Trichy**

Bore Hole No. : **1**

Depth : **1.5m**

Sieve size (mm)	Weight retained	Cumulative Weight retained (gm)	Percentage cumulative weight retained (gm)	Percentage of passing
10	0	0.0	0.0	100.0
4.75	0	0.0	0.0	100.0
2.36	0	0.0	0.0	100.0
1.18	1.3	1.3	1.3	98.7
0.6	2.6	3.9	3.9	96.1
0.3	3.2	7.1	7.1	92.9
0.15	12.5	19.6	19.6	80.4
0.075	13.9	33.5	33.5	66.5
Pan	66.5	100.0	100.0	0.0



Based on Gradation Curve, the percentge component of each materials in the soil sample obtained are as follows (As per IS 1498 - 1970).

Gravel (%)	0
Coarse Sand (%)	1.3
Medium Sand (%)	5.8
Fine sand (%)	26.4
Silt & Clay (%)	66.5

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Annexure - F

Direct Shear Test (IS 2720 - Part 13 -1986)

Bore Hole	1
Depth (m)	6m
Date of Test	08.08.2023

L.C. Of Dial Gauge	0.002
Proving ring Constant	0.206996
Area of the specimen (cm^2)	36

Trial 1

Normal Stress: 0.5 kg/cm^2

Horizontal Gauge Reading	Proving Ring Reading	Shear Deformation	Shear Stress (kg/cm^2)
0	0	0.00	0.000
50	9	0.50	0.052
100	11	1.00	0.063
150	13	1.50	0.075
200	15	2.00	0.086
250	17	2.50	0.098
300	19	3.00	0.109
350	21	3.50	0.121
400	23	4.00	0.132

Trial 2

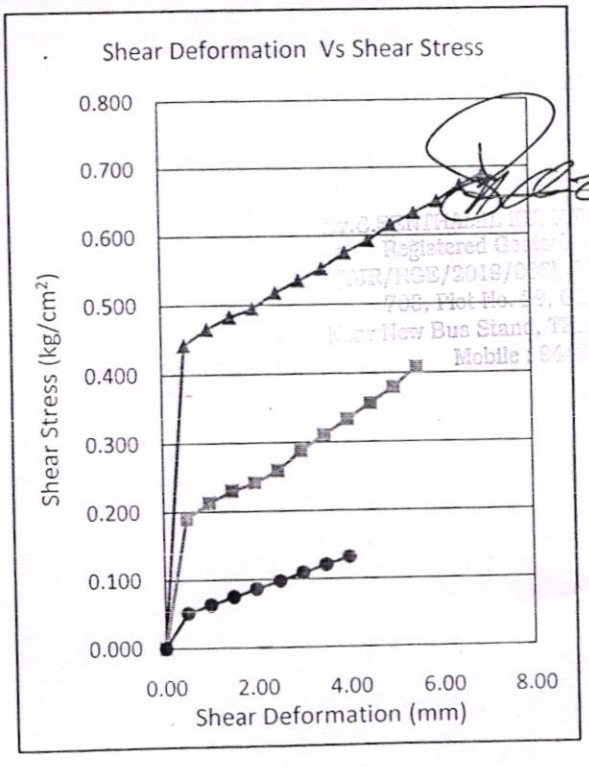
Normal Stress: 1 kg/cm^2

Horizontal Gauge Reading	Proving Ring Reading	Shear Deformation	Shear Stress (kg/cm^2)
0	0	0.00	0.000
50	33	0.50	0.190
100	37	1.00	0.213
150	40	1.50	0.230
200	42	2.00	0.241
250	45	2.50	0.259
300	50	3.00	0.287
350	54	3.50	0.310
400	58	4.00	0.333
450	62	4.50	0.356
500	66	5.00	0.379
550	71	5.50	0.408

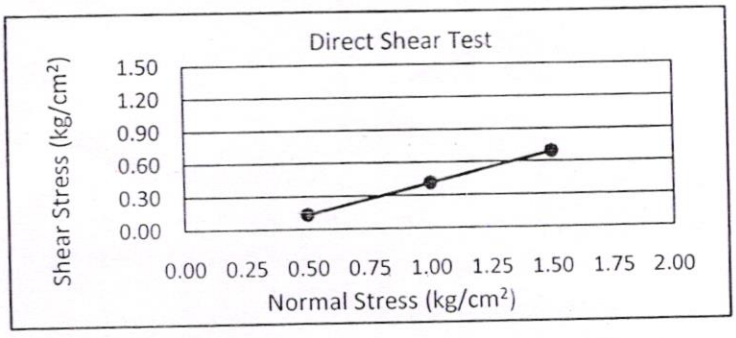
Trial 3

Normal Stress: 1.5 kg/cm^2

Horizontal Gauge Reading	Proving Ring Reading	Shear Deformation	Shear Stress (kg/cm^2)
0	0	0.00	0.000
50	77	0.50	0.443
100	81	1.00	0.466
150	84	1.50	0.483
200	86	2.00	0.494
250	90	2.50	0.517
300	93	3.00	0.535
350	96	3.50	0.552
400	100	4.00	0.575
450	103	4.50	0.592
500	107	5.00	0.615
550	110	5.50	0.632
600	113	6.00	0.650
650	117	6.50	0.673
700	120	7.00	0.690



Normal Stress (Kg/cm^2)	Proving Ring Reading at failure	Shear Stress (kg/cm^2)
0.50	23	0.132
1.00	71	0.408
1.50	120	0.690



$\emptyset$ = $\tan^{-1}$ (0.690 - 0.132)

Angle of Shearing Resistance ($\emptyset$) = 29.15 °

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Annexure - A

NATURAL MOISTURE CONTENT

(As per IS 2720 (Part - 2) - 1973)

roject Name : **Soil investigation for construction of Residential Apartment Building at Pandamangalam, Trichy**

ore Hole No. : **1**

epth : **3m**

Trial	Wt of container (W) gm	Wt of container +wet soil (W_1) gm	Wt of container + Dry soil (W_2) gm	Wt of Water ($W_3 = W_1-W_2$) gm	Wt of Dry Soil ($W_4 = W_2-W$) gm	Water Content (%) = (W_3-W_4)*100
1	23.70	45.10	41.50	3.6	17.8	20.22
2	22.50	50.80	46.00	4.8	23.5	20.43
3	19.80	52.60	47.10	5.5	27.3	20.15

Natural Moisture Content = 20.27

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