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# GEOMATRIX CONSULTANCY

(NABL accredited Laboratory as per ISO / IEC 17025-2017)

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# SOIL INVESTIGATION REPORT

SOIL INVESTIGATION WORKS AND LABORATORY TESTING SERVICES FOR THE CONSTRUCTION OF **RESIDENTIAL BUILDING AT TRICHY.**

| REPORT No: 139 / GRB / GMC / 24-25 | DATE : 25.10.2024 | REV : 0 |
|---|---|---|

**LOCATION** : **SURVEY NO : 136/1 PART, T.S.NO : 24/1 & 24/2,**
**NEW DOOR NO:23, WARD : AK,**
**CRAWFORD COLONY MAIN ROAD,**
**VILLAGE** : K.ABISHEKAPURAM
**TALUK** : TIRUCHIRAPPALLI WEST,
**DISTRICT** : TIRUCHIRAPPALLI

**CLIENT** : **DR.DANIEL NIXON AND OTHERS,**
NEW DOOR NO:23, T.S.NO : 24/1 & 24/2 , SURVEY NO : 136/1 PART, WARD : AK, K ABISHEKAPURAM VILLAGE , CRAWFORD COLONY MAIN ROAD , TIRUCHIRAPALLI WEST TALUK, TIRUCHIRAPPALLI - 620 012.

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✆ : (0452)-2905566, Mobile : 7598031360, 7708758598, 7871758599

**REPORT NO: 139 / GRB / GMC / 24 - 25 DATED: 25.10.2024**

**To**

**Dr.DANIEL NIXON AND OTHERS,**
New Door No:23, T.S.No : 24/1 & 24/2 , Survey No : 136/1 Part,
Ward : Ak, K Abishekapuram Village , Crawford Colony Main Road,
Tiruchirappalli West Taluk, Tiruchirappalli - 620 012.

Respected Sir / Madam,

**Sub**: Submission Soil investigation Report - Reg

**Name of work:** Conducting Sub soil investigation works for the Construction of **RESIDENTIAL BUILDING** at Trichy.

* * * * * * * * *

We appreciate the opportunity of service to you on this project and trust this reports meet your needs at this time. This report summarizes the result of our investigation and contains geotechnical recommendations for design and construction of this project.

Based on the result of our geotechnical investigation, we believe that the proposed project is feasible from a geotechnical point of concern, provided the recommendations in this report are incorporated in the design and implemented during earthwork and construction of the project.

If you have any queries regarding this report, please contact us. We look forward to being of further assistance as construction begins.

**No of Pages in this Report:**

Respectfully submitted

GEOMATRIX CONSULTANCY PVT LTD. MADURAI

Er.K.GANAPATHI,B.E.,M.E.(Soil Mech),F.I.E.,F.I.V., D.Litt.(USA)
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15. **REGISTERED GEOTECH ENGINEER CERTIFICATE COPY**



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# REPORT ON SUB-SOIL INVESTIGATION

## 1. INTRODUCTION:

**Dr. DANIEL NIXON AND OTHERS**, residing at New Door No:23, T.S.No : 24/1 & 24/2 , Survey No : 136/1 Part, Ward : Ak, K Abishekapuram Village, Crawford Colony Main Road, Tiruchirapalli West Taluk, Tiruchirapalli has proposed to construct a **RESIDENTIAL BUILDING** at Trichy. In order to get adequate data required for designing the foundations, they have conducted the sub-soil investigation and collect the samples to determine the foundation design parameters.

**M/S.GEOMATRIX CONSULTANCY,** Madurai, were entrusted with the work of conducting Sub-soil investigation, laboratory testing and preparing report with SBC Calculations and test results.

## 2. SCOPE OF WORK: The Scope of work includes the following:

- Making **three** boreholes of 150 mm dia using rotary driller to a depth of **15 m** or up to 1.00 m core drilling in hard rock whichever is met earlier.
- Conducting Standard penetration test as per **IS 2131-1981**(Reaffirmed 2002) at every **1.00 m** / **1.50m depth** intervals or change of soil strata and collecting disturbed / un disturbed soil samples.
- Conducting various laboratory tests on collected samples.
- Submitting recommendation for type and depth of foundation.
- Submitting report with SBC and settlement Calculations & laboratory test results in **two** hard copies.

## 3. LOCATION & DESCRIPTION OF STRUCTURE:

The proposed construction of **RESIDENTIAL BUILDING** located at **Survey No : 136/1 Part, T.S.No : 24/1 & 24/2, New Door No:23, Ward : Ak,** Crawford Colony Main Road, K.Abishekapuram Village in Tiruchirappalli West Taluk of Tiruchirappalli District. As per the details issued by the client, the proposed construction is a RCC structure has **Stilt + 9 floors with 18 Dwelling units** and the unit will be comprised reinforced concrete elements (Column, Beam, Slab & etc.).

## 4. SOIL INVESTIGATION:

The details of field investigation, tests carried out in the field & laboratory are presented as follows

### 4.1 FIELD SAMPLING:

**Three** boreholes of 150 mm dia were made using Rotary drilling machine in this site on **25.10.2024 - 27.10.2024.** SPT's was conducted at every 1.00 m / 1.50 m depth intervals and the disturbed and undisturbed samples were collected for identification and testing.

### 4.2 METHOD OF INVESTIGATION:

#### 4.2.1 EXPLORATORY BORE HOLE:

Exploratory borehole was advanced using rotary washing method so that minimum disturbance is attributed to the soil below the boring depth. Borehole was always kept filled with drilling mud to prevent any negative hydrostatic pressure within the borehole. Boring through the soil was performed using TC bit & diamond drill bit with side jets for drilling mud. Standard penetration tests, disturbed sampling, field identification of soil & rock samples, etc., was carried out in these bore holes.

#### 4.2.2 STANDARD PENETRATION TEST:

SPT was conducted at different depth in the borehole. SPT split spoon sampler of standard size was driven into the soil from borehole bottom using 63.5kg hammer falling from 75cm height. Blow counts for the penetration of every 15cm were recorded and the **N** is reported as the blow counts for 30cm penetration of the sampler leaving the first 15cm penetration as seating drive. SPT was conducted at a depth interval of 1.0m below the ground level.

#### 4.2.3 SAMPLING IN BORE HOLES:

Soil collected in the SPT sampler is preserved in polythene covers and transported to laboratory. One more polythene cover was provided to prevent the loss of moisture during the transit period. Rock samples also collected using double tubes core Barrel and preserving in wooden core boxes and transported to laboratory to conduct various tests.

## 5. DESCRIPTION OF GROUND WATER TABLE:

Ground water table was encounted at **1.40 m – 1.80 m** during investigation.

**6. LABORATORY TESTS:** The collected soil samples were tested in **ISO 17025: 2017, NABL** Quality control Certified Laboratory as per relevant procedure in IS codes. The laboratory-testing scheme is so designed to obtain the design parameters for the foundations. The following parameters are evaluated:

- **Natural Moisture Content:** This test is conducted in all disturbed samples to find the water content in the soil samples as per **IS 2720 (Part 2) : 1973**
- **Specific Gravity:** This test is conducted in all disturbed soil samples to find Specific gravity of Soil as per **IS 2720 (Part 3) : 1980**
- **Sieve Analysis:** These test conducted to identify and classify the samples as per **IS 2720 (Part 4) : 1985**
- **Liquid Limit:** This test conducted in fine-grained soils to find the liquid Limit of the soil as per **IS 2720 (Part 5) : 1985**
- **Plastic Limit:** This test conducted in fine-grained soil to find plastic limit of the soil as per **IS 2720 (Part 5) : 1985**
- **Direct Shear Test:** This test conducted in coarse-grained soil to find the angle of shearing resistance of the soil as per **IS 2720 (Part 13) : 1986**
- **Unconfined Compression Test:** This test conducted in fine-grained soil to find Cohesion of the soil as per **IS 2720 (Part 10): 1991.** All the test results are presented in **Tables 1 to 3.**

**7. DISCUSSION ON SOIL PROFILE:** Based on the field and Lab test results, it's concluded that,

In **BH-1** the sub soil profile consists of Brown coloured **Sand mixed with Clay** (0.00 – 1.00 m), Brown coloured **Sand mixed with Gravel** (1.00 – 2.11 m), **Soft Disintegrated Rock** (2.11 – 13.80 m), followed by **Hard Rock** (13.80 – 15.00 m). In **BH-2** the sub soil profile consists of Brown coloured **Sand mixed with Clay** (0.00 – 1.00 m), Brown coloured **Sand mixed with Gravel** (1.00 – 2.00 m), Brown coloured **Sand mixed with Clay** (2.00 – 3.03 m), **Soft Disintegrated Rock** (3.03 – 12.10 m), followed by **Hard Rock** (12.10 – 13.10 m).In **BH-3** the sub soil profile consists of Brown coloured **Sand mixed with Gravel** (0.00 – 1.00 m), Brown coloured **Gravel mixed with Sand** (1.00 – 2.00 m), Brown coloured **Sand mixed with Clay** (2.00 – 2.11 m), **Soft Disintegrated Rock** (2.11 – 12.60 m), followed by **Hard Rock** (12.60 – 13.60 m). The detailed Layer formations are presented in **Tables 1 to 3** and also in **Fig 2.**



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**8. ABSTRACT OF SBC CALCULATIONS:** The summary of safe bearing capacity calculated is presented as follows:

| BH No | Safe Bearing Capacity in kN / m2 at the depth of | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1.50 m | 1.80 m | 2.10 m | 2.40 m | 2.70 m | 3.00 m | 3.30 m | 3.60 m |
| 1 | 161.89 | 189.33 | 309.71 | 352.71 | 397.69 | 444.99 | 497.39 | 548.75 |
| 2 | 162.53 | 190.10 | 222.47 | 253.35 | 285.65 | 319.13 | 488.63 | 539.01 |
| 3 | 147.16 | 172.33 | 319.03 | 363.50 | 410.00 | 458.90 | 511.51 | 564.44 |
| **Recommended SBC in kN / m2** | **147.00** | **172.00** | **222.00** | **253.00** | **285.00** | **319.00** | **488.00** | **539.00** |

**9. RECOMMENDATIONS:** Based on the SBC and settlement calculations, site investigations the recommendations for foundation are as follows:

1) **ISOLATED COLUMN FOOTING** is recommended.
2) The recommended safe bearing capacities at every **0.30 m** interval from **1.50 m to 3.60 m** are presented above to design the foundation according to the load conditions and structural requirements.
3) For these Safe bearing capacity, the settlement also **within** the allowable limits ( The SBC and Settlement calculations are presented at the end of this report )
4) Due to presence of Sand in the top layers, there are chances for **Soil sliding** occurs during earthwork excavation, Hence **proper precautions** will be followed during execution of foundation.
5) The foundation concrete shall be laid in dry condition if meets the water table during the execution.
6) The excavated soil for foundation is **suitable** for back filling.

**Station :** Madurai.

**Date :** 29.10.2024.

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# LOCATION MAP

**LOCATION :**

**SURVEY NO : 136/1 PART, T.S.NO : 24/1 & 24/2, NEW DOOR NO:23, WARD : AK,**
**CRAWFORD COLONY MAIN ROAD,**
**VILLAGE : K.ABISHEKAPURAM**
**TALUK : TIRUCHIRAPALLI WEST,**
**DISTRICT : TIRUCHIRAPALLI**

**GPS COORDINATES**

**BH - 1 : N 10⁰ 46' 58.23", E 78⁰ 40' 42.90"**
**BH - 2 : N 10⁰ 47' 01.23", E 78⁰ 40' 40.75" &**
**BH - 3 : N 10⁰ 46' 58.50", E 78⁰ 40' 34.37"**

N

NOT TO SCALE

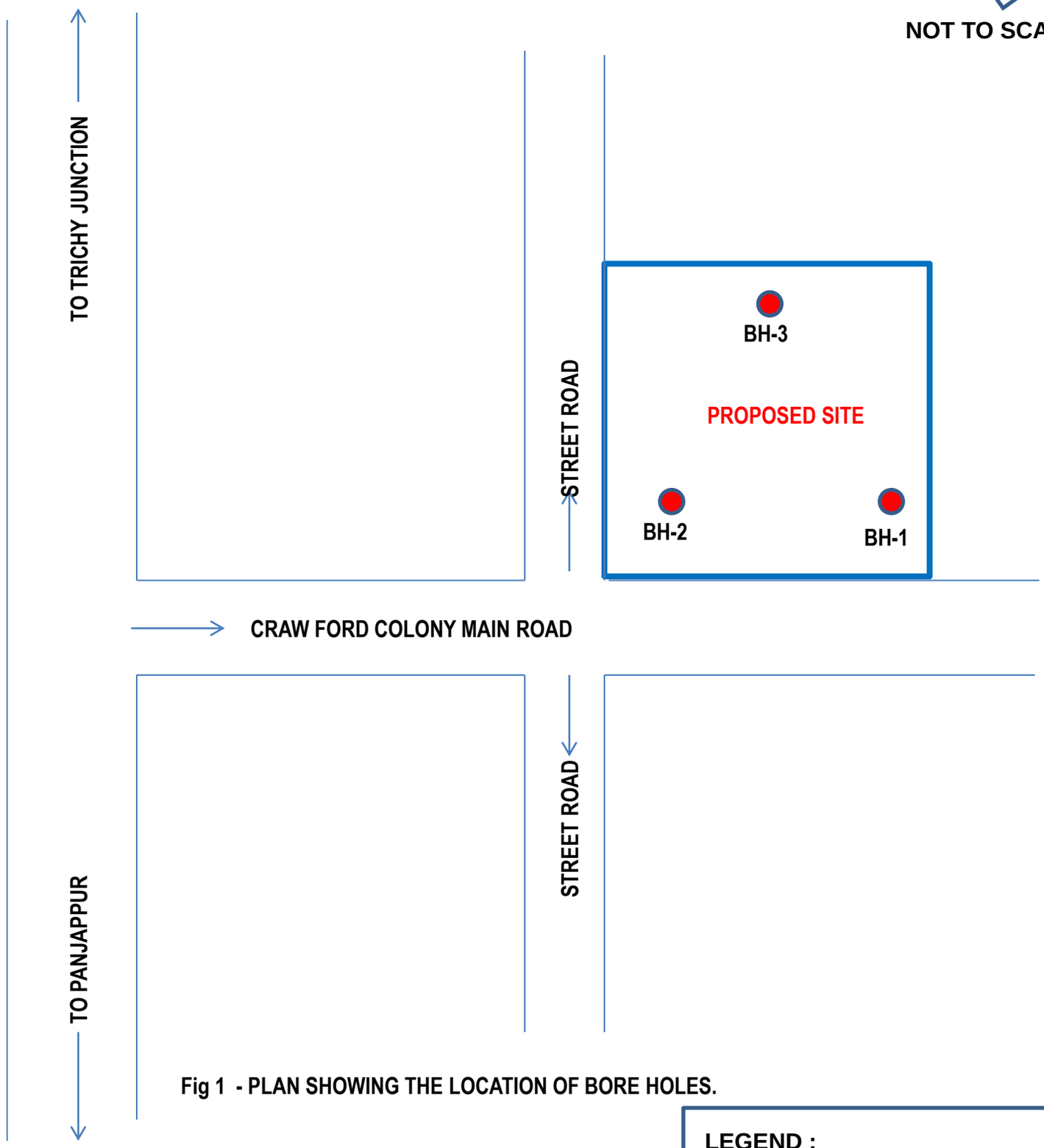



**Fig 1 - PLAN SHOWING THE LOCATION OF BORE HOLES.**

**LEGEND :**

● — BORE HOLE LOCATION

**PREPARED BY**


**GEOMATRIX CONSULTANCY**
**(An ISO- 17025 : 2017, NABL Certified Firm )**
**No.22, Thomas Street,**
**Narimedu, Madurai - 625 002.**


**TITLE OF PROJECT**

CONSTRUCTION OF **RESIDENTIAL BUILDING AT TRICHY.**


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**Geo-Tech Consultants & Engineers**

**Fig : 2A - VERTICAL SOIL PROFILE at BOREHOLE - 1 LOCATION**

**Name of Project:** Sub Soil Investigation for the Construction of RESIDENTIAL BUILDING at Trichy.

| | | | |
|---|---|---|---|
| **Report No** | 139 / GRB / 2024-25 Dt : 25.10.2024 | **Dia of Boring** | 150 mm |
| **Bore Hole No.** | 1 | **Total depth** | 15.00 m |
| **Type of Boring** | Rotary | **Depth of Water Table** | 1.40 m |
| **Started on** | 25.10.2024 | **Co - ordinates** | N 10° 46' 58.23" |
| **Ended on** | 25.10.2024 | | E 78° 40' 42.90" |

**BORELOG SHEET**

| Depth from Ground level | Soil Profiles | Description of Soil | Depth (m) | Type | 15 | 30 | 45 | N | Graphical Representation of SPT (N value) 0 10 20 30 40 50 60 70 80 90 100 | Type of Sample |
|---|---|---|---|---|---|---|---|---|---|---|
| -1.00 m | | Brown coloured **Sand mixed with Clay** | 1.00 | SPT | 13 cm for 50 blows | | | >100 | 100 | DS |
| -2.00 m | | Brown coloured **Sand mixed with Gravel** | 2.00 | SPT | 11 cm for 50 blows | | | >100 | 100 | DS |
| -2.11 m | | | 2.11 | | | | | | | |
| -3.00 m | | | 3.00 | SPT | 10 cm for 50 blows | | | >100 | 100 | WS |
| -4.00 m | | | 4.00 | SPT | SPT REBOUND (NO PENETRATION) | | | >100 | 100 | WS |
| -5.50 m | | | 5.50 | SPT | SPT REBOUND (NO PENETRATION) | | | >100 | 100 | WS |
| -7.00 m | | | 7.00 | SPT | SPT REBOUND (NO PENETRATION) | | | >100 | 100 | WS |
| -8.50 m | | **SOFT DISINTEGRATED ROCK ( CR = 0% & RQD= 0%)** | 8.50 | SPT | SPT REBOUND (NO PENETRATION) | | | >100 | 100 | WS |
| -10.00 m | | | 10.00 | SPT | SPT REBOUND (NO PENETRATION) | | | >100 | 100 | WS |
| -11.50 m | | | 11.50 | SPT | SPT REBOUND (NO PENETRATION) | | | >100 | 100 | WS |
| -13.50 m | | | 13.50 | SPT | SPT REBOUND (NO PENETRATION) | | | >100 | 100 | WS |
| -13.80 m | | | 13.80 | SPT | SPT REBOUND (NO PENETRATION) | | | >100 | 100 | WS |
| -15.00 m | | **HARD ROCK ( CR = 21 % & RQD = 11 %)** | 15.00 | SPT | SPT REBOUND (NO PENETRATION) | | | >100 | 100 | UDS |

DS - Disturbed soil sample

WS -Washing Sample

CR = Core Recovary

RQD = Rock Quality Designation

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**Fig : 2B- VERTICAL SOIL PROFILE at BOREHOLE - 2 LOCATION**

**Name of Project:** Sub Soil Investigation for the Construction of RESIDENTIAL BUILDING at Trichy.

| | | | |
|---|---|---|---|
| **Report No** | 139 / GRB / 2024-25 Dt : 25.10.2024 | **Dia of Boring** | 150 mm |
| **Bore Hole No.** | 2 | **Total depth** | 13.10 m |
| **Type of Boring** | Rotary | **Depth of Water Table** | 1.80 m |
| **Started on** | 26.10.2024 | **Co - ordinates** | N 10° 47' 01.23" |
| **Ended on** | 26.10.2024 | | E 78° 40' 40.75" |

**BORELOG SHEET**

| Depth from Ground level | Soil Profiles | Description of Soil | Depth (m) | Type | 15 | 30 | 45 | N | Graphical Representation of SPT (N value) 0 10 20 30 40 50 60 70 80 90 100 | Type of Sampl |
|---|---|---|---|---|---|---|---|---|---|---|
| -1.00 m | | Brown coloured **Sand mixed with Clay** | 1.00 | SPT | 5 cm for 50 blows | | | >100 | 100 | DS |
| -2.00 m | | Brown coloured **Sand mixed with Gravel** | 2.00 | SPT | 4 cm for 50 blows | | | >100 | 100 | DS |
| -3.00 m | | Brown coloured **Sand mixed with Clay** | 3.00 | SPT | 3 cm for 50 blows | | | >100 | 100 | DS |
| -3.03 m | | | 3.03 | | | | | | | |
| -4.00 m | | **SOFT DISINTEGRATED ROCK ( CR = 0% & RQD= 0%)** | 4.00 | SPT | SPT REBOUND (NO PENETRATION) | | | >100 | 100 | WS |
| -5.50 m | | | 5.50 | SPT | SPT REBOUND (NO PENETRATION) | | | >100 | 100 | WS |
| -7.00 m | | | 7.00 | SPT | SPT REBOUND (NO PENETRATION) | | | >100 | 100 | WS |
| -8.50 m | | | 8.50 | SPT | SPT REBOUND (NO PENETRATION) | | | >100 | 100 | WS |
| -10.00 m | | | 10.00 | SPT | SPT REBOUND (NO PENETRATION) | | | >100 | 100 | WS |
| -11.50 m | | | 11.50 | SPT | SPT REBOUND (NO PENETRATION) | | | >100 | 100 | WS |
| -12.10 m | | | 12.10 | SPT | SPT REBOUND (NO PENETRATION) | | | >100 | 100 | WS |
| -13.10 m | | **HARD ROCK ( CR = 63 % & RQD = 18 %)** | 13.10 | SPT | SPT REBOUND (NO PENETRATION) | | | >100 | 100 | UDS |

DS - Disturbed soil sample

WS -Washing Sample

CR = Core Recovary

RQD = Rock Quality Designation

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**Fig : 2C- VERTICAL SOIL PROFILE at BOREHOLE - 3 LOCATION**

**Name of Project:** Sub Soil Investigation for the Construction of RESIDENTIAL BUILDING at Trichy.

| | | | |
|---|---|---|---|
| **Report No** | 139 / GRB / 2024-25 Dt : 25.10.2024 | **Dia of Boring** | 150 mm |
| **Bore Hole No.** | 3 | **Total depth** | 13.60 m |
| **Type of Boring** | Rotary | **Depth of Water Table** | 1.70 m |
| **Started on** | 27.10.2024 | **Co - ordinates** | N $10^0$ 46' 58.50" |
| **Ended on** | 27.10.2024 | | E $78^0$ 40' 34.37" |

**BORELOG SHEET**

| Depth from Ground level | Soil Profiles | Description of Soil | Depth (m) | Type | 15 | 30 | 45 | N | Graphical Representation of SPT (N value) 0 10 20 30 40 50 60 70 80 90 100 | Type of Sample |
|---|---|---|---|---|---|---|---|---|---|---|
| -1.00 m | | Brown coloured **Sand mixed with Gravel** | 1.00 | SPT | 13 cm for 50 blows | | | >100 | 100 | DS |
| -2.00 m | | Brown coloured **Gravel mixed with Sand** | 2.00 | SPT | 11 cm for 50 blows | | | >100 | 100 | DS |
| -2.11 m | | Brown coloured **Sand mixed with Clay** | 2.11 | | | | | | | |
| -3.00 m | | | 3.00 | SPT | 2 cm for 50 blows | | | >100 | 100 | WS |
| -4.00 m | | | 4.00 | SPT | SPT REBOUND (NO PENETRATION) | | | >100 | 100 | WS |
| -5.50 m | | | 5.50 | SPT | SPT REBOUND (NO PENETRATION) | | | >100 | 100 | WS |
| -7.00 m | | **SOFT DISINTEGRATED ROCK ( CR = 0% & RQD= 0%)** | 7.00 | SPT | SPT REBOUND (NO PENETRATION) | | | >100 | 100 | WS |
| -8.50 m | | | 8.50 | SPT | SPT REBOUND (NO PENETRATION) | | | >100 | 100 | WS |
| -10.00 m | | | 10.00 | SPT | SPT REBOUND (NO PENETRATION) | | | >100 | 100 | WS |
| -11.50 m | | | 11.50 | SPT | SPT REBOUND (NO PENETRATION) | | | >100 | 100 | WS |
| -12.10 m | | | 12.10 | SPT | SPT REBOUND (NO PENETRATION) | | | >100 | 100 | WS |
| -13.10 m | | **HARD ROCK ( CR = 37 % & RQD = 37 %)** | 13.10 | SPT | SPT REBOUND (NO PENETRATION) | | | >100 | 100 | UDS |

DS - Disturbed soil sample

WS -Washing Sample

CR = Core Recovary

RQD = Rock Quality Designation

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## SUMMARY OF LAB TEST RESULTS

**Report No: 139 / GRB / 2024-25 Dt : 25.10.2024**

**Name of Project:** Sub Soil Investigation for the Construction of RESIDENTIAL BUILDING at Trichy.

**TABLE - 1**

**BH No : 1**

| Depth of soil (m) | | Soil Description | Type of sample collected | IS Classification | Grain Size Analysis (%) | | | | | NMC | Index Properties (%) | | | Bulk Density (KN/m$^3$) $\gamma_w$ | Dry Density (KN/m$^3$) $\gamma_d$ | Porosity ( % ) n | Voids ratio ( % ) e | Specific Gravity | Cohesion "C" in (Kg/cm$^2$) | Angle of friction (ø) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| From | To | | | | Gravel | Coarse Sand | Medium Sand | Fine Sand | Silt & Clay | | Liquid Limit ($W_L$) | Plastic Limit ($W_P$) | Plasticity Index ($I_P$) | | | | | | | |
| 0.00 | 1.00 | Brown coloured **Sand mixed with Clay** | DS | SC | 14.87 | 5.31 | 23.09 | 39.92 | 16.81 | 9 | NP | NP | NP | 17.84 | 16.37 | 0.38 | 0.62 | 2.65 | 0.00 | 33.00 |
| 1.00 | 2.00 | Brown coloured **Sand mixed with Gravel** | DS | SW | 45.83 | 27.88 | 19.41 | 3.80 | 3.08 | 14 | NP | NP | NP | 18.29 | 16.04 | 0.40 | 0.67 | 2.68 | 0.00 | 34.00 |
| 2.00 | 2.11 | Brown coloured **Sand mixed with Gravel** | DS | SW | 37.02 | 16.96 | 17.70 | 10.58 | 17.74 | 13 | NP | NP | NP | 18.35 | 16.24 | 0.39 | 0.63 | 2.65 | 0.00 | 34.00 |
| 2.11 | 3.00 | **Sand mixed with Gravel ( Pieces of Soft Disintegrated Rock )** | WS | SW | 41.58 | 46.86 | 8.64 | 2.92 | 0.00 | 10 | NP | NP | NP | 19.16 | 17.42 | 0.35 | 0.53 | 2.66 | 0.00 | 36.00 |
| 3.00 | 4.00 | **Sand mixed with Gravel ( Pieces of Soft Disintegrated Rock )** | WS | SW | 27.83 | 61.07 | 10.61 | 0.49 | 0.00 | 9 | NP | NP | NP | 19.23 | 17.64 | 0.34 | 0.52 | 2.68 | 0.00 | 36.00 |
| 4.00 | 5.50 | **Sand mixed with Gravel ( Pieces of Soft Disintegrated Rock )** | WS | SW | 18.38 | 69.40 | 11.55 | 0.67 | 0.00 | 3 | NP | NP | NP | 19.28 | 18.72 | 0.30 | 0.42 | 2.66 | 0.00 | 37.00 |
| 5.50 | 7.00 | **Sand ( Pieces of Soft Disintegrated Rock )** | WS | SP | 6.43 | 24.87 | 59.55 | 9.15 | 0.00 | 6 | NP | NP | NP | 19.35 | 18.25 | 0.32 | 0.46 | 2.67 | 0.00 | 37.00 |
| 7.00 | 8.50 | **Sand ( Pieces of Soft Disintegrated Rock )** | WS | SP | 8.56 | 31.21 | 49.73 | 10.50 | 0.00 | 5 | NP | NP | NP | 19.42 | 18.50 | 0.31 | 0.45 | 2.68 | 0.00 | 37.00 |
| 8.50 | 10.00 | **Sand ( Pieces of Soft Disintegrated Rock )** | WS | SP | 9.06 | 26.88 | 57.29 | 6.77 | 0.00 | 3 | NP | NP | NP | 19.47 | 18.90 | 0.29 | 0.41 | 2.66 | 0.00 | 37.00 |
| 10.00 | 11.50 | **Sand ( Pieces of Soft Disintegrated Rock )** | WS | SP | 1.22 | 26.16 | 62.65 | 9.97 | 0.00 | 6 | NP | NP | NP | 19.60 | 18.49 | 0.31 | 0.44 | 2.67 | 0.00 | 37.00 |
| 11.50 | 13.50 | **Sand ( Pieces of Soft Disintegrated Rock )** | WS | SP | 0.58 | 19.18 | 64.53 | 15.71 | 0.00 | 3 | NP | NP | NP | 19.63 | 19.06 | 0.29 | 0.41 | 2.69 | 0.00 | 37.00 |
| 13.50 | 13.80 | **Sand ( Pieces of Soft Disintegrated Rock )** | WS | SP | 3.55 | 24.27 | 59.73 | 12.45 | 0.00 | 8 | NP | NP | NP | 19.67 | 18.21 | 0.32 | 0.47 | 2.68 | 0.00 | 37.00 |
| 13.80 | 15.00 | **HARD ROCK** | UDS | **CR = 21 % & RQD = 11 %, Water absorbtion 1 %, Crushing Strength = 3800 KN / m2** | | | | | | | | | | 22.45 | 22.45 | 0.17 | 0.20 | 2.69 | 0.00 | 39.00 |

DS = Disturbed Sample
UDS = Un Disturbed Sample
NMC = Natural Moisture Content
CR = Core Recovery
NP = Non Plastic
RQD = Rock Quality Designati

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## SUMMARY OF LAB TEST RESULTS

**Report No: 139 / GRB / 2024-25 Dt : 25.10.2024**

**Name of Project:** Sub Soil Investigation for the Construction of RESIDENTIAL BUILDING at Trichy.

**TABLE - 2**

**BH No : 2**

| Depth of soil (m) | | Soil Description | Type of sample collected | IS Classification | Grain Size Analysis (%) | | | | | NMC | Index Properties (%) | | | Bulk Density (KN/m$^3$) $\gamma_w$ | Dry Density (KN/m$^3$) $\gamma_d$ | Porosity ( % ) n | Voids ratio ( % ) e | Specific Gravity | Cohesion "C" in (Kg/cm$^2$) | Angle of friction (ø) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| From | To | | | | Gravel | Coarse Sand | Medium Sand | Fine Sand | Silt & Clay | | Liquid Limit ($W_L$) | Plastic Limit ($W_P$) | Plasticity Index ($I_P$) | | | | | | | |
| 0.00 | 1.00 | Brown coloured **Sand mixed with Clay** | DS | SC | 8.16 | 4.55 | 19.40 | 28.15 | 39.74 | 19 | 25.63 | 15.24 | 10.39 | 17.69 | 14.87 | 0.43 | 0.77 | 2.63 | 0.24 | 19.00 |
| 1.00 | 2.00 | Brown coloured **Sand mixed with Gravel** | DS | SW | 14.97 | 30.09 | 37.41 | 7.72 | 9.81 | 16 | NP | NP | NP | 18.33 | 15.80 | 0.41 | 0.69 | 2.67 | 0.00 | 34.00 |
| 2.00 | 3.03 | Brown coloured **Sand mixed with Clay** | DS | SC | 0.80 | 26.71 | 51.69 | 9.82 | 10.98 | 17 | NP | NP | NP | 18.49 | 15.80 | 0.40 | 0.68 | 2.65 | 0.00 | 34.00 |
| 3.03 | 4.00 | **Sand mixed with Gravel ( Pieces of Soft Disintegrated Rock )** | WS | SW | 37.78 | 11.84 | 47.17 | 3.21 | 0.00 | 11 | NP | NP | NP | 19.05 | 17.16 | 0.36 | 0.56 | 2.67 | 0.00 | 36.00 |
| 4.00 | 5.50 | **Sand mixed with Gravel ( Pieces of Soft Disintegrated Rock )** | WS | SW | 13.51 | 16.00 | 59.05 | 11.44 | 0.00 | 10 | NP | NP | NP | 19.12 | 17.38 | 0.35 | 0.53 | 2.66 | 0.00 | 36.00 |
| 5.50 | 7.00 | **Sand mixed with Gravel ( Pieces of Soft Disintegrated Rock )** | WS | SW | 19.34 | 23.77 | 48.35 | 8.54 | 0.00 | 3 | NP | NP | NP | 19.18 | 18.62 | 0.31 | 0.44 | 2.68 | 0.00 | 36.00 |
| 7.00 | 8.50 | **Sand mixed with Gravel ( Pieces of Soft Disintegrated Rock )** | WS | SW | 18.28 | 28.35 | 49.09 | 4.28 | 0.00 | 9 | NP | NP | NP | 19.25 | 17.66 | 0.34 | 0.52 | 2.69 | 0.00 | 36.00 |
| 8.50 | 10.00 | **Sand ( Pieces of Soft Disintegrated Rock )** | WS | SP | 1.33 | 7.13 | 71.11 | 20.43 | 0.00 | 3 | NP | NP | NP | 19.30 | 18.74 | 0.30 | 0.43 | 2.68 | 0.00 | 36.00 |
| 10.00 | 11.50 | **Sand ( Pieces of Soft Disintegrated Rock )** | WS | SP | 1.11 | 0.58 | 55.33 | 42.98 | 0.00 | 7 | NP | NP | NP | 19.35 | 18.08 | 0.32 | 0.48 | 2.67 | 0.00 | 37.00 |
| 11.50 | 12.10 | **Sand ( Pieces of Soft Disintegrated Rock )** | WS | SP | 0.98 | 0.86 | 62.79 | 35.37 | 0.00 | 9 | NP | NP | NP | 19.41 | 17.81 | 0.33 | 0.49 | 2.66 | 0.00 | 37.00 |
| 12.10 | 13.10 | **HARD ROCK** | UDS | **CR = 63 % & RQD = 18 %, Water absorbtion 1 %, Crushing Strength = 4900 KN / m2** | | | | | | | | | | 22.97 | 22.97 | 0.14 | 0.17 | 2.68 | 0.00 | 40.00 |

DS = Disturbed Sample

UDS = Un Disturbed Sample

NMC = Natural Moisture Content

CR = Core Recovery

NP = Non Plastic

RQD = Rock Quality Designati

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## SUMMARY OF LAB TEST RESULTS

**Report No: 139 / GRB / 2024-25 Dt : 25.10.2024**

**Name of Project:** Sub Soil Investigation for the Construction of RESIDENTIAL BUILDING at Trichy.

**TABLE - 3**

**BH No : 3**

| Depth of soil (m) | | Soil Description | Type of sample collected | IS Classification | Grain Size Analysis (%) | | | | | NMC | Index Properties (%) | | | Bulk Density (KN/m$^3$) $\gamma_w$ | Dry Density (KN/m$^3$) $\gamma_d$ | Porosity ( % ) n | Voids ratio ( % ) e | Specific Gravity | Cohesion "C" in (Kg/cm$^2$) | Angle of friction (ø) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| From | To | | | | Gravel | Coarse Sand | Medium Sand | Fine Sand | Silt & Clay | | Liquid Limit ($W_L$) | Plastic Limit ($W_P$) | Plasticity Index ($I_P$) | | | | | | | |
| 0.00 | 1.00 | Brown coloured **Sand mixed with Gravel** | DS | SW | 25.56 | 5.58 | 29.72 | 24.28 | 14.86 | 8 | NP | NP | NP | 18.30 | 16.94 | 0.36 | 0.56 | 2.65 | 0.00 | 32.00 |
| 1.00 | 2.00 | Brown coloured **Gravel mixed with Sand** | DS | GW | 58.01 | 23.68 | 5.00 | 4.59 | 8.72 | 18 | NP | NP | NP | 18.65 | 15.81 | 0.41 | 0.69 | 2.67 | 0.00 | 33.00 |
| 2.00 | 2.11 | Brown coloured **Sand mixed with Clay** | DS | SC | 16.67 | 18.86 | 16.50 | 15.81 | 32.16 | 11 | 21.60 | 10.57 | 11.03 | 18.70 | 16.85 | 0.36 | 0.56 | 2.62 | 0.22 | 23.00 |
| 2.11 | 3.00 | **Gravel mixed with Sand ( Pieces of Soft Disintegrated Rock )** | WS | SW | 56.54 | 19.01 | 14.48 | 9.97 | 0.00 | 7 | NP | NP | NP | 19.48 | 18.21 | 0.32 | 0.47 | 2.68 | 0.00 | 36.00 |
| 3.00 | 4.00 | **Gravel mixed with Sand ( Pieces of Soft Disintegrated Rock )** | WS | SW | 55.20 | 23.64 | 17.12 | 4.04 | 0.00 | 3 | NP | NP | NP | 19.52 | 18.95 | 0.29 | 0.40 | 2.66 | 0.00 | 36.00 |
| 4.00 | 5.50 | **Sand mixed with Gravel ( Pieces of Soft Disintegrated Rock )** | WS | SW | 17.62 | 23.56 | 51.98 | 6.84 | 0.00 | 10 | NP | NP | NP | 19.56 | 17.78 | 0.33 | 0.50 | 2.67 | 0.00 | 36.00 |
| 5.50 | 7.00 | **Sand mixed with Gravel ( Pieces of Soft Disintegrated Rock )** | WS | SW | 27.02 | 30.58 | 38.24 | 4.16 | 0.00 | 6 | NP | NP | NP | 19.60 | 18.49 | 0.30 | 0.43 | 2.65 | 0.00 | 37.00 |
| 7.00 | 8.50 | **Sand ( Pieces of Soft Disintegrated Rock )** | WS | SW | 7.92 | 22.36 | 57.84 | 11.88 | 0.00 | 5 | NP | NP | NP | 19.62 | 18.69 | 0.30 | 0.43 | 2.68 | 0.00 | 37.00 |
| 8.50 | 10.00 | **Sand mixed with Gravel ( Pieces of Soft Disintegrated Rock )** | WS | SW | 18.10 | 30.33 | 48.90 | 2.67 | 0.00 | 11 | NP | NP | NP | 19.68 | 17.73 | 0.34 | 0.51 | 2.67 | 0.00 | 37.00 |
| 10.00 | 11.50 | **Sand mixed with Gravel ( Pieces of Soft Disintegrated Rock )** | WS | SW | 10.66 | 23.49 | 54.98 | 10.87 | 0.00 | 9 | NP | NP | NP | 19.74 | 18.11 | 0.32 | 0.47 | 2.66 | 0.00 | 37.00 |
| 11.50 | 12.60 | **Sand mixed with Gravel ( Pieces of Soft Disintegrated Rock )** | WS | SW | 13.60 | 25.90 | 46.00 | 14.50 | 0.00 | 5 | NP | NP | NP | 19.75 | 18.81 | 0.30 | 0.42 | 2.68 | 0.00 | 37.00 |
| 12.60 | 13.60 | **HARD ROCK** | UDS | **CR = 37 % & RQD = 37 %, Water absorbtion 1 %, Crushing Strength = 4200 KN / m2** | | | | | | | | | | 23.01 | 23.01 | 0.14 | 0.17 | 2.69 | 0.00 | 39.00 |

DS = Disturbed Sample
UDS = Un Disturbed Sample
NMC = Natural Moisture Content
CR = Core Recovery
NP = Non Plastic
RQD = Rock Quality Designation

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# NATURAL MOISTURE CONTENT TEST

**( Test method As per IS 2720 ( Part 2 ) - 1973)**

**Report No: 139 / GRB / 2024-25 Dt : 25.10.2024**

**ANNEXURE - A**

**Name of Project:** Sub Soil Investigation for the Construction of RESIDENTIAL BUILDING at Trichy.

| **BH. No** | **2** | | **2** | | **2** | |
|---|---|---|---|---|---|---|
| **Depth (m)** | **0.50 m** | | **1.00 m** | | **2.00 m** | |
| Wt of Tare (W) gm | 72.32 | 73.68 | 76.34 | 77.40 | 75.97 | 76.34 |
| Tare + Wet Soil ($W_1$) gm | 313.58 | 314.29 | 283.24 | 284.53 | 308.82 | 309.25 |
| Tare + Dry Soil ($W_2$) gm | 275.86 | 276.58 | 254.16 | 255.63 | 275.73 | 276.34 |
| Wt of Water ($W_3 = W_1 - W_2$) gm | 37.72 | 37.71 | 29.08 | 28.90 | 33.09 | 32.91 |
| Wt Dry Soil ($W_4 = W_2 - W$) gm | 203.54 | 202.90 | 177.82 | 178.23 | 199.76 | 200.00 |
| Water Content (%) = ($W_3 / W_4$)*100 | 18.53 | 18.59 | 16.35 | 16.22 | 16.56 | 16.46 |
| **Average Water Content (%)** | **19** | | **16** | | **17** | |

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Report No: 139 / GRB / 2024-25 Dt : 25.10.2024

## SPECIFIC GRAVITY TEST
**( Test method as per IS 2720 ( Part 3 ) - 1980)**

**ANNEXURE - B**

**Name of Project:** Sub Soil Investigation for the Construction of RESIDENTIAL BUILDING at Trichy.

| **BH. No** | **2** | | **2** | | **2** | |
|---|---|---|---|---|---|---|
| **Depth (m)** | **0.50 m** | | **1.00 m** | | **2.00 m** | |
| Bottle Number | 1 | 2 | 1 | 2 | 1 | 2 |
| Weight of empty Bottle ($w_1$) gm | 55.49 | 55.49 | 55.49 | 55.49 | 55.49 | 55.49 |
| Weight of bottle + Sample ($w_2$) gm | 77.42 | 78.62 | 77.54 | 78.25 | 76.43 | 77.35 |
| Weight of bottle + Sample + Water ($w_3$)gm | 163.40 | 164.12 | 163.59 | 164.02 | 162.84 | 163.42 |
| Weight of bottle + Water ($w_4$) gm | 149.80 | 149.80 | 149.80 | 149.80 | 149.80 | 149.80 |
| Specific Gravity = $(w_2 - w_1)/ (w_4 - w_1)-(w_3 - w_2)$ | 2.63 | 2.63 | 2.67 | 2.67 | 2.65 | 2.65 |
| **Average value for Specific Gravity** | **2.63** | | **2.67** | | **2.65** | |

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**Report No: 139 / GRB / 2024-25 Dt : 25.10.2024**

**ANNEXURE - C**

# GRAIN SIZE ANALYSIS TEST

**( Test method as per IS 2720 ( Part 4 ) - 1985)**

**Name of Project:** Sub Soil Investigation for the Construction of RESIDENTIAL BUILDING at Trichy.

**Weight of Soil taken for analysis** **Ws** : 100.00 g

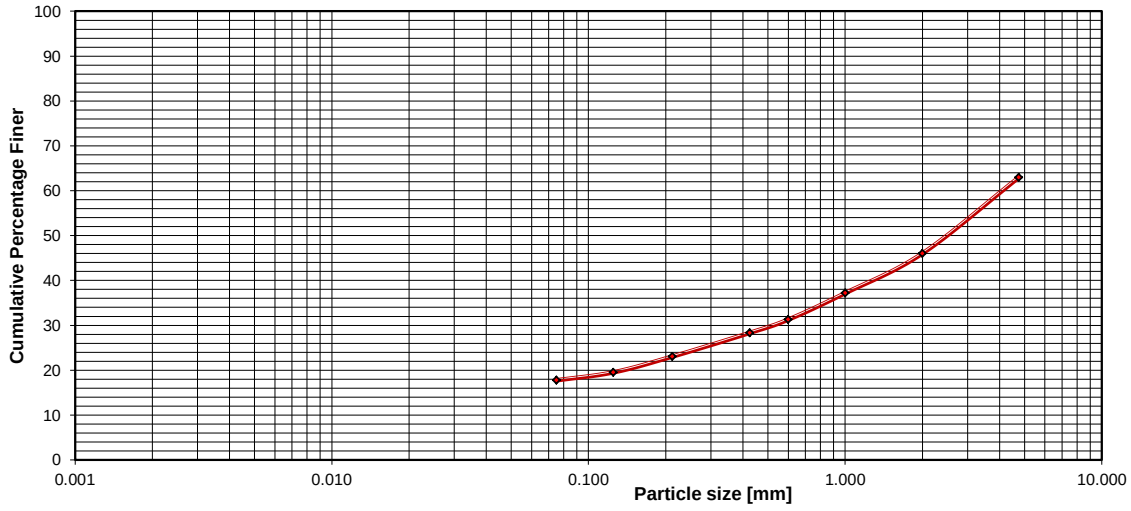
**Weight of Soil more than 0.075mm IS Sieve** : 82.26 g

| | |
|---|---|
| **Borehole No.** | **1** |
| **Depth (m)** | **2.00 m** |

| S.No. | Size of sieves | % Soil PSR % (1) | Cumulative % F % (2) | Average Sieve size (mm) (3) | Product of Columns (1) x (3) |
|---|---|---|---|---|---|
| 1 | 4.750 | 37.02 | 62.98 | 4.750 | 175.85 |
| 2 | 2.000 | 16.96 | 46.02 | 3.375 | 57.24 |
| 3 | 1.000 | 8.85 | 37.17 | 1.500 | 13.28 |
| 4 | 0.600 | 5.90 | 31.27 | 0.800 | 4.72 |
| 5 | 0.425 | 2.95 | 28.32 | 0.513 | 1.51 |
| 6 | 0.212 | 5.29 | 23.03 | 0.319 | 1.68 |
| 7 | 0.125 | 3.52 | 19.51 | 0.181 | 0.64 |
| 8 | 0.075 | 1.77 | 17.74 | 0.113 | 0.20 |
| 9 | passing 0.075 | | | | 255.113 |

Average Particle Diameter = 2.6574

| Clay | Silt | | | Sand | | | Gravel |
|---|---|---|---|---|---|---|---|
| | Fine | Medium | Coarse | Fine | Medium | Coarse | Fine |




**Soil description : Sand mixed with Gravel**

Based on Gradation Curve, the following sizes of Material (as per **IS 1498 - 1970**) are obtained

| Classification of soil | % |
|---|---|
| Gravel | 37.02 |
| Course Sand | 16.96 |
| Medium Sand | 17.70 |
| Fine Sand | 10.58 |
| Silt & Clay | 17.74 |


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**ANNEXURE - D**

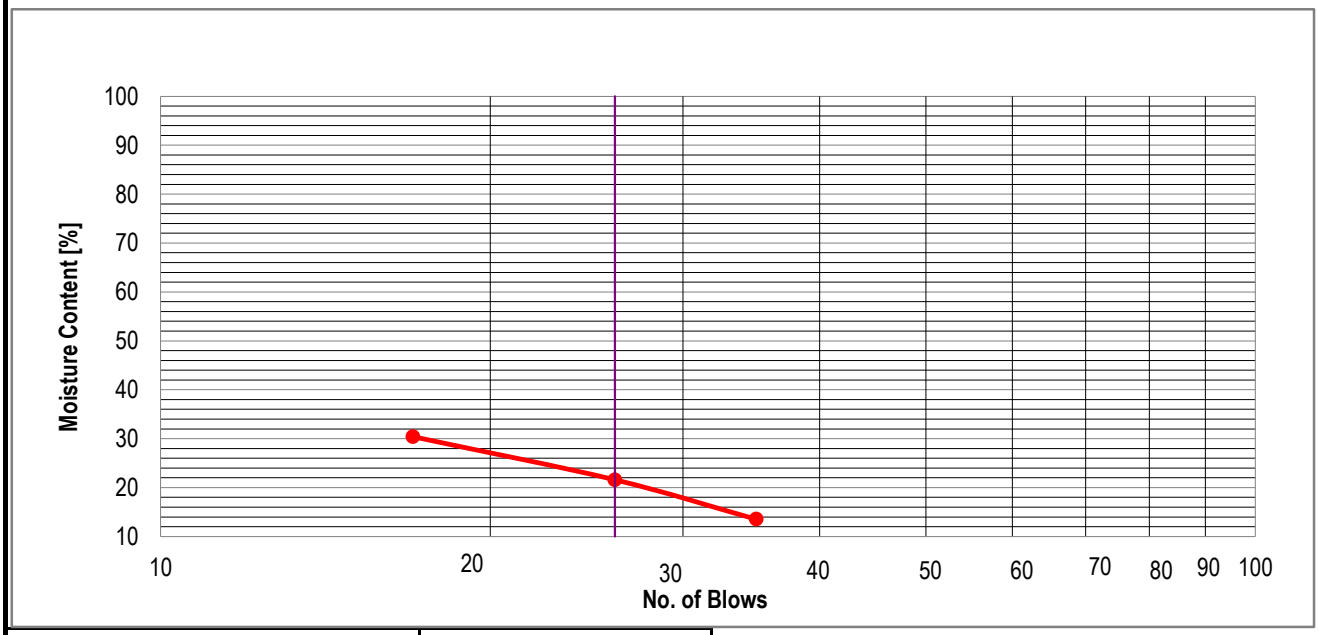
# LIQUID LIMIT & PLASTIC LIMIT TEST

( Test method As per IS 2720 ( Part 5 ) - 1985)

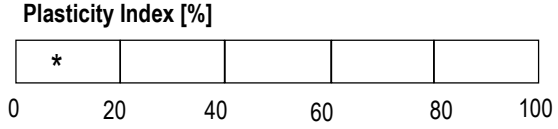
**Name of Project:** Sub Soil Investigation for the Construction of RESIDENTIAL BUILDING at Trichy.

| | |
|---|---|
| Report No | 139 / GRB / 2024-25 Dt : 25.10.2024 |
| Borehole No | 3 |
| Depth | 2.00 m |

| Description | | | Liquid Limit | | | Plastic Limit | |
|---|---|---|---|---|---|---|---|
| No. of Blows | N | | 17 | 26 | 35 | | |
| Weight of Wet Specimen + Container | WSC | g | 75.68 | 80.70 | 74.11 | 75.52 | 80.74 |
| Weight of Dry Specimen + Container | WDC | g | 73.29 | 78.86 | 73.00 | 74.64 | 79.82 |
| Weight of Container | WC | g | 65.43 | 70.34 | 64.79 | 66.55 | 70.86 |
| Weight of Water | WW | g | 2.39 | 1.84 | 1.11 | 0.88 | 0.92 |
| Weight of Dry Specimen | WD | g | 7.86 | 8.52 | 8.21 | 8.09 | 8.96 |
| Moisture Content | W | % | 30.41 | 21.60 | 13.52 | 10.88 | 10.27 |




| | | |
|---|---|---|
| Liquid Limit | $W_L$ : | 21.60 % |
| Plastic Limit | $W_P$ : | 10.57 % |
| Plasticity Index | $I_P$ : | 11.03 % |




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Report No: 139 / GRB / 2024-25 Dt : 25.10.2024

# DIRECT SHEAR TEST
( Test method As per IS 2720 ( Part 13 ) - 1986)

ANNEXURE - E

**Name of Project:** Sub Soil Investigation for the Construction of RESIDENTIAL BUILDING at Trichy.

| | |
|---|---|
| Borehole No | 3 |
| Depth (m) | 1.00 m |
| Date of Test | 30.10.2024 |

| | | |
|---|---|---|
| L.C of Dial gauge | : | 0.01 |
| Proving Ring Constant | : | 0.81421 |
| Area of the Specimen | : | 36 |

**Trail-1** — Normal Stress:0.5 kg/cm$^2$

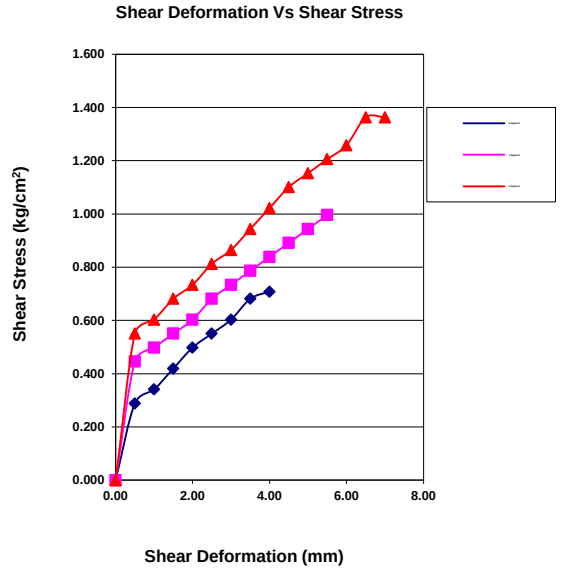
| Horizontal Gauge Reading | Proving Ring Reading | Shear deformation | Shear Stress (kg/Cm$^2$) |
|---|---|---|---|
| 0 | 0 | 0.00 | 0.000 |
| 50 | 12.74676 | 0.50 | 0.288 |
| 100 | 15.06436 | 1.00 | 0.341 |
| 150 | 18.54074 | 1.50 | 0.419 |
| 200 | 22.01713 | 2.00 | 0.498 |
| 250 | 24.33473 | 2.50 | 0.550 |
| 300 | 26.65232 | 3.00 | 0.603 |
| 350 | 30.12871 | 3.50 | 0.681 |
| 400 | 31.28751 | 4.00 | 0.708 |

**Trail-2** — Normal Stress:1.0 kg/cm$^2$

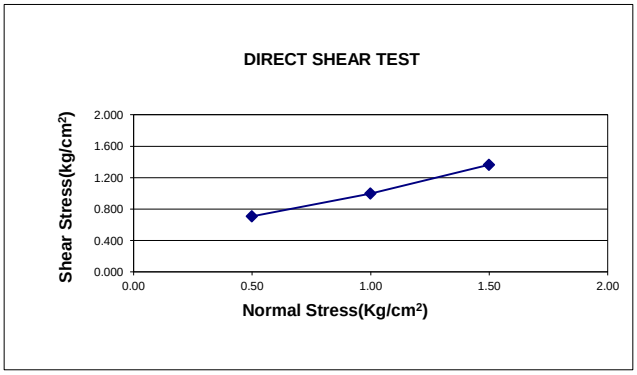
| Horizontal Gauge Reading | Proving Ring Reading | Shear deformation | Shear Stress (kg/Cm$^2$) |
|---|---|---|---|
| 0 | 0 | 0.00 | 0.000 |
| 50 | 19.69954 | 0.50 | 0.446 |
| 100 | 22.01713 | 1.00 | 0.498 |
| 150 | 24.33473 | 1.50 | 0.550 |
| 200 | 26.65232 | 2.00 | 0.603 |
| 250 | 30.12871 | 2.50 | 0.681 |
| 300 | 32.4463 | 3.00 | 0.734 |
| 350 | 34.7639 | 3.50 | 0.786 |
| 400 | 37.08149 | 4.00 | 0.839 |
| 450 | 39.39908 | 4.50 | 0.891 |
| 500 | 41.71668 | 5.00 | 0.944 |
| 550 | 44.03427 | 5.50 | 0.996 |

**Trail-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 | 24.3347 | 0.50 | 0.550 |
| 100 | 26.6523 | 1.00 | 0.603 |
| 150 | 30.1287 | 1.50 | 0.681 |
| 200 | 32.4463 | 2.00 | 0.734 |
| 250 | 35.9227 | 2.50 | 0.812 |
| 300 | 38.2403 | 3.00 | 0.865 |
| 350 | 41.7167 | 3.50 | 0.944 |
| 400 | 45.1931 | 4.00 | 1.022 |
| 450 | 48.6695 | 4.50 | 1.101 |
| 500 | 50.987 | 5.00 | 1.153 |
| 550 | 53.3046 | 5.50 | 1.206 |
| 600 | 55.6222 | 6.00 | 1.258 |
| 650 | 60.2574 | 6.50 | 1.363 |
| 700 | 60.2574 | 7.00 | 1.363 |




| Normal Stress (kg/cm$^2$) | Proving Ring reading at failure | Shear Stress (kg/cm$^2$) |
|---|---|---|
| 0.50 | 31.28750664 | 0.708 |
| 1.00 | 44.0342686 | 0.996 |
| 1.50 | 60.25742019 | 1.363 |




1. Angle of Shearing Resistance (Φ) = 33 Degrees
2. Cohesion (C) = 0.00 Kg/cm$^2$

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**GEOMATRIX CONSULTANCY**
Geo-Tech. Consultants & Engineers

Report No:139 / GRB / 2024-25 Dt : 25.10.2024

ANNEXURE - F

## DENSITY CALCULATIONS

**Name of Project:** Sub Soil Investigation for the Construction of RESIDENTIAL BUILDING at Trichy.

| | |
|---|---|
| Borehole No. | 1 |
| Depth (m) | 0.50 |

| Sl. No. | Description | Reading |
|---|---|---|
| 1 | Weight of Empty Box (gm) | 3,393.00 |
| 2 | Weight of Box + Soil (gm) | 3,553.60 |
| 3 | Weight of Soil (gm) | 160.60 |
| 4 | Volume of Box ($cm^3$) | 90.00 |
| 5 | Bulk Density (gm /$cm^3$) | 1.784 |
| 6 | Weight of Container (gm) | 42.58 |
| 7 | Weight of Container + Wet Soil (gm) | 61.70 |
| 8 | Weight of Container + Dry Soil (gm) | 59.77 |
| 9 | Moisture Content (%) | 11.23 |
| 10 | Dry Density (gm /$cm^3$) | 1.604 |

**RESULT**

1 WET DENSITY OF SOIL = 1.784 t / $m^3$

2 DRY DENSITY OF SOIL = 1.604 t / $m^3$

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Report No: 139 / GRB / 2024-25 Dt : 25.10.2024

ANNEXURE - G

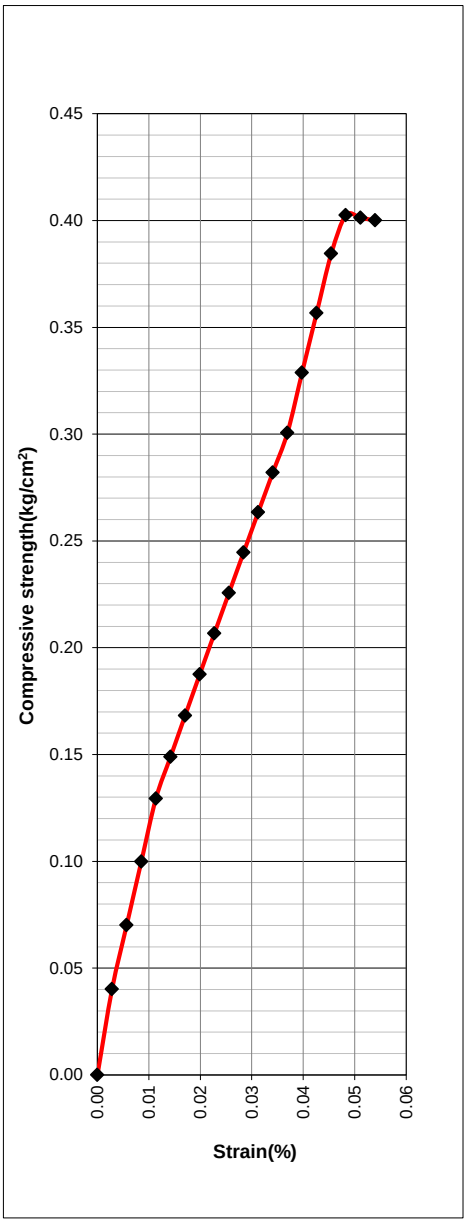
# UNCONFINED COMPRESSION TEST
( Test method as per IS 2720 ( Part 10 ) - 1995)

**Name of Project:** Sub Soil Investigation for the Construction of RESIDENTIAL BUILDING at Trichy.

| | |
|---|---|
| Diameter | 38 mm |
| Length | 88 mm |
| Constant | 0.31530 |

| | |
|---|---|
| Borehole No | 3 |
| Depth (m) | 2.00 m |
| Date of Test | 30.10.2024 |

| Deformation dial Reading | Axial deformation (mm) | Axial Strain (e) | Area ($cm^2$) | Proving Ring Readings | Axial force N (Kgf) | Compressive strength ($kg/cm^2$) |
|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| 0.00 | 0.00 | 0.00 | 11.35 | 0.00 | 0.000 | 0.00 |
| 25.00 | 0.25 | 0.00 | 11.38 | 1.45 | 0.457 | 0.04 |
| 50.00 | 0.50 | 0.01 | 11.41 | 2.54 | 0.800 | 0.07 |
| 75.00 | 0.75 | 0.01 | 11.45 | 3.62 | 1.143 | 0.10 |
| 100.00 | 1.00 | 0.01 | 11.48 | 4.71 | 1.486 | 0.13 |
| 125.00 | 1.25 | 0.01 | 11.51 | 5.44 | 1.714 | 0.15 |
| 150.00 | 1.50 | 0.02 | 11.55 | 6.16 | 1.943 | 0.17 |
| 175.00 | 1.75 | 0.02 | 11.58 | 6.89 | 2.171 | 0.19 |
| 200.00 | 2.00 | 0.02 | 11.61 | 7.61 | 2.400 | 0.21 |
| 225.00 | 2.25 | 0.03 | 11.65 | 8.34 | 2.629 | 0.23 |
| 250.00 | 2.50 | 0.03 | 11.68 | 9.06 | 2.857 | 0.24 |
| 275.00 | 2.75 | 0.03 | 11.72 | 9.79 | 3.086 | 0.26 |
| 300.00 | 3.00 | 0.03 | 11.75 | 10.51 | 3.314 | 0.28 |
| 325.00 | 3.25 | 0.04 | 11.79 | 11.24 | 3.543 | 0.30 |
| 350.00 | 3.50 | 0.04 | 11.82 | 12.32 | 3.886 | 0.33 |
| 375.00 | 3.75 | 0.04 | 11.86 | 13.41 | 4.228 | 0.36 |
| 400.00 | 4.00 | 0.05 | 11.89 | 14.50 | 4.571 | 0.38 |
| 425.00 | 4.25 | 0.05 | 11.93 | 15.22 | 4.800 | 0.40 |
| 450.00 | 4.50 | 0.05 | 11.96 | 15.22 | 4.800 | 0.40 |
| 475.00 | 4.75 | 0.05 | 12.00 | 15.22 | 4.800 | 0.40 |




| RESULTS | | | |
|---|---|---|---|
| qu | = | 0.402 | $kg/cm^2$ |
| Cohesion = C = | | 0.220 | $kg/cm^2$ |

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**GEOMATRIX CONSULTANCY**
**Geo-Tech. Consultants & Engineers**

**Name of Project:** Sub Soil Investigation for the Construction of RESIDENTIAL BUILDING at Trichy.

| Report No: 139 / GRB / 2024-25 | BH NO : 1 | CALCULATION -1 |
|---|---|---|

## SAFE BEARING CAPACITY CALCULATIONS on SHALLOW FOUNDATIONS

**TYPE OF FOOTING : SQUARE FOOTING**

| | | | |
|---|---|---|---|
| Length of footing | (Assumed Value ) | L = | **1.50** m |
| Breadth of footing | (Assumed Value ) | B = | **1.50** m |
| Foundation depth | | $D_f$ = | **3.60** m |
| Correction Factor for Water Table | | W' = | **0.50** |
| Unit weight of soil | | $\gamma_{soil}$ = | **1.923** $T/m^3$ |
| Cohension | | "C" = | **0.00** $T/m^2$ |
| Angle of shearing resistance(general shear) | φ = | | **36.00°** |
| Angle of shearing resistance(Local shear) | φ' = | | **25.77°** ( $Tan^{-1}$ (2/3 * tanφ) |
| Safety factor | | F = | **3.00** |
| Effective Surcharge of Soil above Footing Base | | q = | **3.32** $T/m^2$ |

Type of soil = **Soft Disintegrated Rock**

Mode of failure = **Combined (GSF & LSF) Shear Failure**

Ground Water Table level (Assumed for worst Case - at the Ground level) = **0** m From NGL

The Bearing Capacity Factors are Given by the following equations

**For GENERAL SHEAR FAILURE**

| | | |
|---|---|---|
| $Nq = \tan^2 ( 45° + Ø/2) (e^{\pi \tan Ø} )$ | = | 37.75 |
| $Nc = (Nq -1) \cot Ø$ | = | 50.59 |
| $N\gamma = 2 (Nq +1) \tan Ø$ | = | 56.31 |

**For LOCAL SHEAR FAILURE**

| | | |
|---|---|---|
| $N'q = \tan^2 ( 45° + Ø'/2) (e^{\pi \tan Ø'} )$ | = | 11.57 |
| $N'c = (Nq -1) \cot Ø'$ | = | 21.89 |
| $N'\gamma = 2 (Nq +1) \tan Ø'$ | = | 12.13 |

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**The Shape Factors**

| Shape of Footing | $S_c$ | $S_q$ | $S_\gamma$ |
|---|---|---|---|
| CONTINUOUS STRIP FOOTING | 1.0 | 1.0 | 1.0 |
| SQUARE FOOTING | 1.3 | 1.2 | 0.8 |
| RECTANGULAR FOOTING | 1+0.2B/L | 1+0.2B/L | 1-0.4B/L |

| SQUARE FOOTING | |
|---|---|
| $S_c$ = | 1.300 |
| $S_q$ = | 1.200 |
| $S_\gamma$ = | 0.800 |

**The Depth Factor**

| | | |
|---|---|---|
| $d_c$ = | 1 + 0.2 $D_f$ / B x tan ( 45° + Ø'/2) = | 1.942 |
| $d_q = d_\gamma$ = | 1 for Ø'<10° = | 1.000 |
| $d_q = d_\gamma$ = | 1+0.1$D_f$/Bxtan(45°+Ø'/2) for Ø'>10° = | 1.471 |

**The Inclination Factor**

$i_c = i_q$ = 1 - α /90 )^2 = 1.00

$i_\gamma$ = 1 - α / Ø)^2 1.00

α = Inclination of the load to the vertical in degress = **0**

Net Ultimate Bearing Capacity, **qd** = ( (cxNcxScxdcxic) + (qx(Nq -1)xSqxDqxIq) + (0.5xBxγxNγxSγxDγxIγxW')+ (2/3) (cxN'cxScxdcxic) + (qx(N'q -1)xSqxDqxIq) + (0.5xBxγxN'γxSγxDγxIγxW'))/"2

= **167.81** **T/sq.m**

**SAFE BEARING CAPACITY :**

SBC = qd / F.s = **55.94 T/sq.m** or **548.75 kN/m²**

**SETTLEMENT CALCULATIONS AS PER IS-8009-(part-1) 1998**

$Q_s$ = Pressure, $S_i$ = Immediate settlement I = Influence factor

B = width of foundation μ = Poisson's ratio $E_s$= Elastic Modulus

For,

**Soft Disintegrated Rock** $E_s$= 136200 kN/m²

(or) $E_s$= 13620.00 t/m²

$S_i$ = Immediate settlement = $I*Qs*B(1-\mu^2) / Es$

= 0.95*55.94*(1.5*(1-0.25^2))/13620

$S_i$= 0.0055 m

0.0055 x1000

Settlement = **5 mm** < **50 mm** **Hence SAFE**

The Max Allowable Differential Settlement for **Sand & Gravel is 50mm** and for **Silt & Clay is 75mm.**

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**GEOMATRIX CONSULTANCY**
Geo-Tech. Consultants & Engineers

**Name of Project:** Sub Soil Investigation for the Construction of RESIDENTIAL BUILDING at Trichy.

| Report No: 139 / GRB / 2024-25 | BH NO : 2 | CALCULATION -2 |
|---|---|---|

## SAFE BEARING CAPACITY CALCULATIONS on SHALLOW FOUNDATIONS

**TYPE OF FOOTING : SQUARE FOOTING**

| | | | |
|---|---|---|---|
| Length of footing | (Assumed Value ) | L = | **1.50** m |
| Breadth of footing | (Assumed Value ) | B = | **1.50** m |
| Foundation depth | | $D_f$ = | **3.60** m |
| Correction Factor for Water Table | | W' = | **0.50** |
| Unit weight of soil | | $\gamma_{soil}$ = | **1.905** $T/m^3$ |
| Cohension | | "C" = | **0.00** $T/m^2$ |
| Angle of shearing resistance(general shear) | φ = | | **36.00°** |
| Angle of shearing resistance(Local shear) | φ' = | | **25.77°** ( $Tan^{-1}$ (2/3 * tanφ) |
| Safety factor | | F = | **3.00** |
| Effective Surcharge of Soil above Footing Base | | q = | **3.26** $T/m^2$ |

Type of soil = **Soft Disintegrated Rock**

Mode of failure = **Combined (GSF & LSF) Shear Failure**

Ground Water Table level (Assumed for worst Case - at the Ground level) = **0** m From NGL

The Bearing Capacity Factors are Given by the following equations

**For GENERAL SHEAR FAILURE**

| | | |
|---|---|---|
| $Nq = \tan^2 (45° + Ø/2) (e^{\pi \tan Ø})$ | = | 37.75 |
| $Nc = (Nq - 1) \cot Ø$ | = | 50.59 |
| $N\gamma = 2 (Nq + 1) \tan Ø$ | = | 56.31 |

**For LOCAL SHEAR FAILURE**

| | | |
|---|---|---|
| $N'q = \tan^2 (45° + Ø'/2) (e^{\pi \tan Ø'})$ | = | 11.57 |
| $N'c = (Nq - 1) \cot Ø'$ | = | 21.89 |
| $N'\gamma = 2 (Nq + 1) \tan Ø'$ | = | 12.13 |

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**The Shape Factors**

| Shape of Footing | $S_c$ | $S_q$ | $S_\gamma$ |
|---|---|---|---|
| CONTINUOUS STRIP FOOTING | 1.0 | 1.0 | 1.0 |
| SQUARE FOOTING | 1.3 | 1.2 | 0.8 |
| RECTANGULAR FOOTING | 1+0.2B/L | 1+0.2B/L | 1-0.4B/L |

| SQUARE FOOTING | |
|---|---|
| $S_c$ = | 1.300 |
| $S_q$ = | 1.200 |
| $S_\gamma$ = | 0.800 |

**The Depth Factor**

| | | |
|---|---|---|
| $d_c$ = | 1 + 0.2 $D_f$ / B x tan ( 45° + Ø'/2) = | 1.942 |
| $d_q = d_\gamma$ = | 1 for Ø'<10° = | 1.000 |
| $d_q = d_\gamma$ = | 1+0.1$D_f$/Bxtan(45°+Ø'/2) for Ø'>10° = | 1.471 |

**The Inclination Factor**

$i_c = i_q$ = 1 - α /90 )^2 = 1.00

$i_\gamma$ = 1 - α / Ø)^2 1.00

α = Inclination of the load to the vertical in degress = **0**

Net Ultimate Bearing Capacity, **qd** = ( (cxNcxScxdcxic) + (qx(Nq -1)xSqxDqxIq) + (0.5xBxγxNγxSγxDγxIγxW')+ (2/3) (cxN'cxScxdcxic) + (qx(N'q -1)xSqxDqxIq) + (0.5xBxγxN'γxSγxDγxIγxW'))/"2

= **164.84** **T/sq.m**

**SAFE BEARING CAPACITY :**

SBC = qd / F.s = **54.95 T/sq.m** or **539.01 kN/m²**

**SETTLEMENT CALCULATIONS AS PER IS-8009-(part-1) 1998**

$Q_s$ = Pressure, $S_i$ = Immediate settlement I = Influence factor

B = width of foundation μ = Poisson's ratio $E_s$= Elastic Modulus

For,

**Soft Disintegrated Rock** $E_s$= 136200 kN/m²

(or) $E_s$= 13620.00 t/m²

$S_i$ = Immediate settlement = $I*Qs*B(1-\mu^2) / Es$

= 0.95*54.95*(1.5*(1-0.25^2))/13620

$S_i$= 0.0054 m

0.0054 x1000

Settlement = **5 mm** < **50 mm** **Hence SAFE**

The Max Allowable Differential Settlement for **Sand & Gravel is 50mm** and for **Silt & Clay is 75mm.**

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**Name of Project:** Sub Soil Investigation for the Construction of RESIDENTIAL BUILDING at Trichy.

| Report No: 139 / GRB / 2024-25 | BH NO : 3 | CALCULATION -3 |
|---|---|---|

## SAFE BEARING CAPACITY CALCULATIONS on SHALLOW FOUNDATIONS

**TYPE OF FOOTING : SQUARE FOOTING**

| | | | |
|---|---|---|---|
| Length of footing | (Assumed Value ) | L = | **1.50** m |
| Breadth of footing | (Assumed Value ) | B = | **1.50** m |
| Foundation depth | | $D_f$ = | **3.60** m |
| Correction Factor for Water Table | | W' = | **0.50** |
| Unit weight of soil | | $\gamma_{soil}$ = | **1.952** $T/m^3$ |
| Cohension | | "C" = | **0.00** $T/m^2$ |
| Angle of shearing resistance(general shear) | φ = | | **36.00°** |
| Angle of shearing resistance(Local shear) | φ' = | | **25.77°** ( $Tan^{-1}$ (2/3 * tanφ) |
| Safety factor | | F = | **3.00** |
| Effective Surcharge of Soil above Footing Base | | q = | **3.43** $T/m^2$ |

Type of soil = **Soft Disintegrated Rock**

Mode of failure = **Combined (GSF & LSF) Shear Failure**

Ground Water Table level (Assumed for worst Case - at the Ground level) = **0** m From NGL

The Bearing Capacity Factors are Given by the following equations

**For GENERAL SHEAR FAILURE**

| | | |
|---|---|---|
| $Nq = \tan^2 ( 45° + Ø/2) (e^{\pi \tan Ø} )$ | = | 37.75 |
| $Nc = (Nq -1) \cot Ø$ | = | 50.59 |
| $N\gamma = 2 (Nq +1) \tan Ø$ | = | 56.31 |

**For LOCAL SHEAR FAILURE**

| | | |
|---|---|---|
| $N'q = \tan^2 ( 45° + Ø'/2) (e^{\pi \tan Ø'} )$ | = | 11.57 |
| $N'c = (Nq -1) \cot Ø'$ | = | 21.89 |
| $N'\gamma = 2 (Nq +1) \tan Ø'$ | = | 12.13 |

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**The Shape Factors**

| Shape of Footing | $S_c$ | $S_q$ | $S_\gamma$ |
|---|---|---|---|
| CONTINUOUS STRIP FOOTING | 1.0 | 1.0 | 1.0 |
| SQUARE FOOTING | 1.3 | 1.2 | 0.8 |
| RECTANGULAR FOOTING | 1+0.2B/L | 1+0.2B/L | 1-0.4B/L |

| SQUARE FOOTING | |
|---|---|
| $S_c$ = | 1.300 |
| $S_q$ = | 1.200 |
| $S_\gamma$ = | 0.800 |

**The Depth Factor**

| | | |
|---|---|---|
| $d_c$ = | 1 + 0.2 $D_f$ / B x tan ( 45° + Ø'/2) = | 1.942 |
| $d_q = d_\gamma$ = | 1 for Ø'<10° = | 1.000 |
| $d_q = d_\gamma$ = | 1+0.1$D_f$/Bxtan(45°+Ø'/2) for Ø'>10° = | 1.471 |

**The Inclination Factor**

$i_c = i_q$ = 1 - α /90 )^2 = 1.00

$i_\gamma$ = 1 - α / Ø)^2 1.00

α = Inclination of the load to the vertical in degress = **0**

Net Ultimate Bearing Capacity, **qd** = ( (cxNcxScxdcxic) + (qx(Nq -1)xSqxDqxIq) + (0.5xBxγxNγxSγxDγxIγxW')+ (2/3) (cxN'cxScxdcxic) + (qx(N'q -1)xSqxDqxIq) + (0.5xBxγxN'γxSγxDγxIγxW'))/"2

= **172.61** **T/sq.m**

**SAFE BEARING CAPACITY :**

SBC = qd / F.s = **57.54 T/sq.m** or **564.44 kN/m²**

**SETTLEMENT CALCULATIONS AS PER IS-8009-(part-1) 1998**

$Q_s$ = Pressure, $S_i$ = Immediate settlement I = Influence factor

B = width of foundation μ = Poisson's ratio $E_s$= Elastic Modulus

For,

**Soft Disintegrated Rock** $E_s$= 136200 kN/m²

(or) $E_s$= 13620.00 t/m²

$S_i$ = Immediate settlement = $I*Qs*B(1-\mu^2) / Es$

= 0.95*57.54*(1.5*(1-0.25^2))/13620

$S_i$= 0.0056 m

0.0056 x1000

Settlement = **6 mm** < **50 mm** **Hence SAFE**

The Max Allowable Differential Settlement for **Sand & Gravel is 50mm** and for **Silt & Clay is 75mm.**

GEOMATRIX CONSULTANCY PVT LTD. MADURAI

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Construction of RESIDENTIAL BUILDING at Trichy.

## BOREHOLE - 1 SITE PHOTOS:









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## BOREHOLE - 2 SITE PHOTOS:









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## BOREHOLE - 3 SITE PHOTOS:









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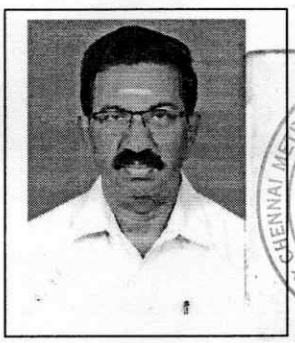
**CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY**
'ThalamuthuNatarajan Building', No.1, Gandhi Irwin Road,
Egmore, Chennai-600 008.

# PROFESSIONAL REGISTRATION CERTIFICATE

This is to certify that the **Thiru. K. GANAPATHI** has enrolled as **Registered Geo-Technical Engineer (RGTE)** with Chennai Metropolitan Development Authority (CMDA) who has the qualification of **M.E.,(Soil Mechanics & Foundation Engg.).,** and experience in the relevant field for **6 years**.

He has been given the Registration No.**GTE/2019/04/022 Renewed** on **23.04.2024.** He shall be required to comply with the duties and responsibilities prescribed by the Government of Tamil Nadu in Part-V, "Registration of Professionals", Tamil Nadu Combined Development and Building Rules, 2019 approved vide G.O.(Ms) No.18 MAWS (MA1) Dept. dated 04.02.2019.

This Registration is valid upto **22.04.2029**.



CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
CHENNAI-600 008.

29/4/24.

**(A. MEGANATHAN)**
**Superintendent**

GEOMATRIX CONSULTANCY PVT LTD. MADURAI

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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.