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# SOIL EXPLORATION REPORT

## For

## M/s. TOWN AND CITY DEVELOPERS

*Ref: GEO – G - 021 - 2024-25*

*Date: 16.12.2023 &25.04.2024- 27.04.2024*

**PROJECT NAME:**

SOIL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF RESIDENTIAL ROW HOUSE BUILDING WITH G + 1 FLOOR OF PLOT AREA 50,525 SQ. FT., @ SF. NO. : 784/4B, 784/1F1 & 784/7, PERIYAR NAGAR, NEHRU NAGAR WEST, KALAPATTI, COIMBATORE DISTRICT – 641004.

**For TNCD LLP**

Designated Partner

**GEODESIGN INDIA PRIVATE LIMITED**

( An ISO 9001 : 2015 Certified Company )

Soil Investigations, SPT Test, DTH, Diamond core drilling, & Grouting works

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| S.NO. | CONTENTS | PAGE NO. |
|---|---|---|
| 1. | INTRODUCTION | 3 |
| | 1.1 PURPOSE AND SCOPE | 3 |
| | 1.2 THE SITE | 3 |
| 2. | FIELD INVESTIGATIONS | 3 |
| | 2.1 ROTARY BORING | 3 |
| | 2.2 STANDARD PENETRATION TEST | 4 |
| | 2.3 SAMPLING | 4 |
| 3. | LABORATORY TEST | 4 |
| 4. | FOUNDATION ANALYSIS | 5 |
| | 4.1 SOIL PROFILE | 5 |
| | 4.2 SAFE BEARING CAPACITY | 5 |
| | 4.3 SOIL STRATIGRAPHY | 5 - 6 |
| 5. | RECOMMENDATION | 7 |
| 6. | REFERENCES | 8 |
| 7. | ANNEXURE | |
| | 7.1 LOG OF BORINGS | 9 - 11 |
| | 7.2 LABORATORY TEST RESULTS | 12 - 14 |
| 8. | PHOTOS | 15 - 17 |
| 9. | ANNEXURE | |
| | 9.1 DESIGN OF PILE CARRYING CAPACITY | 18 - 21 |
| | 9.2 PERMIABILTY RESULTS | 22 |


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# 1. INTRODUCTION

## 1.1 PURPOSE AND SCOPE

Geo-technical site investigation work for "SOIL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF RESIDENTIAL ROW HOUSE BUILDING WITH G + 1 FLOOR OF PLOT AREA 50,525 SQ. FT., @ SF. NO. : 784/4B, 784/1F1 & 784/7, PERIYAR NAGAR, NEHRU NAGAR WEST, KALAPATTI, COIMBATORE DISTRICT – 641004." The primary purpose of our investigation is to obtain data to develop foundation design recommendations for the above work. At, first instance, Three point and Three Boreholes were excavated and bored at site. Client's representatives selected the locations of points and borings. To accomplish these purposes, the following tasks were performed:

1. Field and laboratory tests were conducted to evaluate the index and engineering properties of the soils.
2. Detailed soil borings were done up to stratum to explore the sub surface stratigraphy and obtain soil samples for testing. Field and laboratory tests were conducted to evaluate the index and engineering properties of the soils
3. Engineering analysis was performed to develop foundation design information for proposed structure.

## 1.2 THE SITE

"SOIL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF RESIDENTIAL ROW HOUSE BUILDING WITH G + 1 FLOOR OF PLOT AREA 50,525 SQ. FT., @ SF. NO. : 784/4B, 784/1F1 & 784/7, PERIYAR NAGAR, NEHRU NAGAR WEST, KALAPATTI, COIMBATORE DISTRICT – 641004."

# 2. FIELD INVESTIGATIONS

## 2.1. ROTARY BORING

Rotary drilling technique was adapted using Calyx machine in this field. In this method, boring is effected by the cutting action of a rotating bit that is kept in firm contact with the bottom of the hole. The bit is attached to the lower end of a hollow drill rod that is rotated by a suitable chuck. Drilling mud (usually Bentonite) is continuously forced down the hollow drill rods. The mud returning upwards though the annular space between the drill rods and the side of the hold bring the cutting to the surface.

## 2.2. STANDARD PENETRATION TEST

It is now most commonly used in site test. The test measures the penetration resistance of the split spoon sampler, when it is driven into the soil, at the bottom of a borehole in a standard manner. The N-value, which is the number of blow required to achieve 300mm penetration of the soil, indicates the relative density of sand or gravel, the consistency of other soil such as silts or clays and the strength of weak rocks. The test is described in IS 2131 - 1981. The split spoon sampler is attached to stiff drill rod and lowered to the bottom of the bore hole.

A standard blow consists of dropping a mass of 63.5kg free fall through 750 mm on to an anvil at the top of the rods and ensuing that this amount of dynamic energy is transferred to the sampler as much as possible.

The number of blows required to achieve each 150mm penetration is recorded for a fall penetration of 450mm. The initial 150mm penetration is referred to as seating drive and the blows required for this penetration are not considered as this zone is in disturbed soil. The next 300mm of penetration is referred to as the test drive and the number of blows required to achieve this fully is termed the penetration resistance or N-value.

## 2.3. SAMPLING

Soil samples were collected through Split spoon and rock core sample were collected through single tube core barrel.

## 3. LABORATORY TESTS

The operations to be performed in the laboratory depend upon the type of the nature of data required for the problem at hand. In case of cohesionless material, like sand, the laboratory tests are usually minimum and the design parameters are worked out from field test data such as form SPT- N value, Core resistance and plate load test data.

In the case of cohesive soils, the programme of laboratory testing can vary from carrying out simple tests such as unconfined tests to comprehensive study of soil behaviour using triaxial shear tests and consolidation tests.

Following laboratory tests are conducted.

For Cohesion & cohesionless soil

a) Specific gravity

b) Sieve analysis

c) Atterberg's limits

d) Natural moisture content.

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## 4. FOUNDATION ANALYSIS

### 4.1. Soil Profile

The profile of the area as observed in the points is given in the chart. The soil layer up to 10.00m depth SOFT DISINTEGRATED ROCK was obtained.

### 4.2. Safe Bearing Capacity

The bearing capacity of granular soil depends upon the unit weight and angle of internal friction of the soil. These two properties of granular soils are determined by standard penetration tests.

The allowable bearing pressure based on tolerable settlement has been established empirically by Terzaghi and Peck, 1948 and may be expressed by the equation.

Safe bearing capacity (SBC) = $3.5\ (N-3)\ \{(B+0.3)/2B\}^2$ X RW X FD +P

Where

N = Corrected N value N1

B = Width of Foundation = constant 1

RW = Water Correction = constant 0.5

FD = Depth of Factor = constant 1

P = Over Burden Pressure

### 4.3. SOIL STRATIGRAPHY

The soil stratigraphy is based on classification of soil samples recovered from the Pits, and our observations during Investigation. A generalized summary of the major soil strata is tabulated below:

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**POINT - 1 – DATE: 16.12.2023**

| STRATUM | FROM (m) | TO (m) | DESCRIPTION | SAFE BEARING CAPACITY (SBC) IN T/m2 |
|---|---|---|---|---|
| 1 | 0.00 | 0.60 | SILTY GRAVEL | **10.45 T/m$^2$ @ 1.20m**<br>**21.22 T/m$^2$ @ 1.80m**<br>**36.43 T/m$^2$ @ 2.40m**<br>**36.85 T/m$^2$ @ 3.00m** |
| 2 | 0.60 | 1.70 | POORLY GRADED GRAVEL | |
| 3 | 1.70 | 3.00 | SOFT DISINTEGRATED ROCK | |

**POINT - 2 – DATE: 16.12.2023**

| STRATUM | FROM (m) | TO (m) | DESCRIPTION | SAFE BEARING CAPACITY (SBC) IN T/m2 |
|---|---|---|---|---|
| 1 | 0.00 | 0.40 | FILLING SOIL | **6.01 T/m$^2$ @ 1.20m**<br>**13.09 T/m$^2$ @ 1.80m**<br>**17.20 T/m$^2$ @ 2.40m**<br>**36.85 T/m$^2$ @ 3.00m** |
| 2 | 0.40 | 2.10 | POORLY GRADED GRAVEL | |
| 3 | 2.10 | 3.45 | SOFT DISINTEGRATED ROCK | |

**POINT - 3 – DATE: 16.12.2023**

| STRATUM | FROM (m) | TO (m) | DESCRIPTION | SAFE BEARING CAPACITY (SBC) IN T/m$^2$ |
|---|---|---|---|---|
| 1 | 0.00 | 0.60 | FILLING SOIL | **4.53 T/m$^2$ @ 1.20m**<br>**14.56 T/m$^2$ @ 1.80m**<br>**36.43 T/m$^2$ @ 2.40m**<br>**36.85 T/m$^2$ @ 3.00m** |
| 2 | 0.60 | 1.70 | POORLY GRADED GRAVEL | |
| 3 | 1.70 | 3.20 | SOFT DISINTEGRATED ROCK | |

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## 5. RECOMMENDATION

For the site "SOIL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF RESIDENTIAL ROW HOUSE BUILDING WITH G + 1 FLOOR OF PLINTH AREA 4,700.153 SQ. M., @ SF. NO. : 784/4B, 784/1F1 & 784/7, PERIYAR NAGAR, NEHRU NAGAR WEST, KALAPATTI, COIMBATORE DISTRICT – 641004." standard penetration test was conducted and SBC was determined.

- In this site, up to 10.00m, SOFT DISINTEGRATED ROCK is obtained.

| BOREHOLE NO. / DEPTH | 1.20 m SBC in $T/m^2$ | 1.80 m SBC in $T/m^2$ | 2.40 m SBC in $T/m^2$ |
|---|---|---|---|
| 1 | 11.19 | 22.70 | 36.43 |
| 2 | 6.75 | 13.82 | 18.68 |
| 3 | 5.27 | 15.30 | 36.43 |

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| S.NO. | TITLE | ENGINEER'S NAME | SIGNATURE |
|---|---|---|---|
| 1 | Lab testing | Er.A.Kiruthika | |
| 2 | Report prepared by | Er.M.Ranjitha | |
| 3 | Corrected by | Er.A.Sindhuja | |
| 4 | Checked by | Er.V.Suganthi | |
| 5 | Approved by | Er.K.P.Vetriselvan | |

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## 6. REFERENCES


1. **IS: 1892-1979** – Indian Standard Code of Practice for Determination of Bearing Capacity Of Shallow Foundation

2. **IS: 1892-1979** - Indian Standard Code of Practice for Subsurface Investigation for Foundations

3. **IS: 2131-1981** - Indian Standard Method for Standard Penetration Test for Soils

4. **IS: 8009 (Part 1) - 1976** - Indian Standard Code of Practice for Calculation of Settlements of Foundations

5. **IS: 2720 (Part-2) - 1973** - Indian Standard Methods of Test for Soils, Determination of Water Content

6. **IS: 2720 (Part-4) - 1985** - Indian Standard Methods of Test for Soils, Grain Size Analysis

7. **IS: 2720 (Part-5) – 1985** - Indian Standard Method of Test for Soils, Determination of Liquid and Plastic Limit

8. **IS: 2720 (Part-3/Sec-1)1980** - Indian Standard Methods of Test for Soils, Determination of Specific Gravity.


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1

**Bore Log**

**Ref:** ***GEO – G – 021 – 2024 -2025***

**Name of Project:** "SOIL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF RESIDENTIAL ROW HOUSE BUILDING WITH G + 1 FLOOR OF PLOT AREA 50,525 SQ. FT., @ SF. NO. : 784/4B, 784/1F1 & 784/7, PERIYAR NAGAR, NEHRU NAGAR WEST, KALAPATTI, COIMBATORE DISTRICT – 641004."

**Soil Investigation done by:** GEODESIGN INDIA PRIVATE LIMITED Soil Exploration Consultant, Coimbatore-38

**Type of Drilling:** Rotary – Mud Circulation LOCATION : 1

G.W.T-Not met

Bore hole No. : 1

Date of commencement : 25.04.2024
Date of completion : 25.04.2024

| Depth below G.L | Soil Profile | Description of Soil | Thickness of layer (m) | Standard penetration test data: Depth at which test is conducted | N – Value- Depth of penetration: 15cm | 30cm | 45cm | For 30cm | Relative density / Consistency | Graphical representation of penetration resistance |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.30 | | **Silty Gravel** | **1.30** | 1.20 | 4 | 6 | 11 | 17 | Medium | |
| 2.10 | | **Poorly Graded Gravel** | **0.80** | 1.80 | 13 | 15 | 17 | 32 | Dense | |
| | | | | 2.40 | 50/5 | - | - | >50 | V.Dense | |
| | | | | 3.00 | >50 | - | - | >50 | V.Dense | |
| | | | | 4.50 | >50 | - | - | >50 | V.Dense | |
| | | **Soft Disintegrated Rock** | **7.90** | 6.00 | >50 | - | - | >50 | V.Dense | |
| | | | | 7.50 | >50 | - | - | >50 | V.Dense | |
| | | | | 9.00 | >50 | - | - | >50 | V.Dense | |
| **10.00m** | | End of Bore hole | | 10.00 | >50 | - | - | >50 | V.Dense | |

Graphical representation of penetration resistance: 0 20 40 60 80 100

Contd…2

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2

**Bore Log**

**Ref:** *GEO – G – 021 – 2024 -2025*

**Name of Project:** "SOIL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF RESIDENTIAL ROW HOUSE BUILDING WITH G + 1 FLOOR OF PLOT AREA 50,525 SQ. FT., @ SF. NO. : 784/4B, 784/1F1 & 784/7, PERIYAR NAGAR, NEHRU NAGAR WEST, KALAPATTI, COIMBATORE DISTRICT – 641004."

**Soil Investigation done by:** GEODESIGN INDIA PRIVATE LIMITED Soil Exploration Consultant, Coimbatore-38

**Type of Drilling:** Rotary – Mud Circulation LOCATION : 2

G.W.T-Not met

Bore hole No. : 2

Date of commencement : 26.04.2024
Date of completion : 26.04.2024

| Depth below G.L | Soil Profile | Description of Soil | Thickness of layer (m) | Standard penetration test data: Depth at which test is conducted | N – Value- Depth of penetration: 15cm | 30cm | 45cm | For 30cm | Relative density / Consistency | Graphical representation of penetration resistance |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | 0 20 40 60 80 100 |
| 0.90 | | **Silty Gravel** | **0.90** | | | | | | | |
| | | | | 1.20 | 3 | 5 | 6 | 11 | Medium | |
| | | **Poorly Graded Gravel** | **1.50** | 1.80 | 7 | 8 | 12 | 20 | Medium | |
| 2.40 | | | | 2.40 | 10 | 11 | 15 | 26 | Medium | |
| | | | | 3.00 | >50 | - | - | >50 | V.Dense | |
| | | | | 4.50 | >50 | - | - | >50 | V.Dense | |
| | | **Soft Disintegrated Rock** | **7.60** | 6.00 | >50 | - | - | >50 | V.Dense | |
| | | | | 7.50 | >50 | - | - | >50 | V.Dense | |
| | | | | 9.00 | >50 | - | - | >50 | V.Dense | |
| 10.00m | | End of Bore hole | | 10.00 | >50 | - | - | >50 | V.Dense | |

Contd…3

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3

## Bore Log

**Ref:** *GEO – G – 021 – 2024 -2025*

**Name of Project:** "SOIL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF RESIDENTIAL ROW HOUSE BUILDING WITH G + 1 FLOOR OF PLOT AREA 50,525 SQ. FT., @ SF. NO. : 784/4B, 784/1F1 & 784/7, PERIYAR NAGAR, NEHRU NAGAR WEST, KALAPATTI, COIMBATORE DISTRICT – 641004."

**Soil Investigation done by:** GEODESIGN INDIA PRIVATE LIMITED Soil Exploration Consultant, Coimbatore-38

**Type of Drilling:** Rotary – Mud Circulation LOCATION : 3

G.W.T-Not met

Bore hole No. : 3

Date of commencement : 27.04.2024
Date of completion : 27.04.2024

| Depth below G.L | Soil Profile | Description of Soil | Thickness of layer (m) | Standard penetration test data: Depth at which test is conducted | N – Value- Depth of penetration: 15cm | 30cm | 45cm | For 30cm | Relative density / Consistency | Graphical representation of penetration resistance |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | 0 20 40 60 80 100 |
| 1.70 | | **Filling Soil** | **1.70** | 1.20 | 4 | 4 | 5 | 9 | Loose | |
| 2.20 | | **Poorly Graded Gravel** | **0.50** | 1.80 | 6 | 10 | 12 | 22 | Dense | |
| | | **Soft Disintegrated Rock** | **7.80** | 2.40 | 50/11 | - | - | >50 | V.Dense | |
| | | | | 3.00 | 50/9 | - | - | >50 | V.Dense | |
| | | | | 4.50 | >50 | - | - | >50 | V.Dense | |
| | | | | 6.00 | >50 | - | - | >50 | V.Dense | |
| | | | | 7.50 | >50 | - | - | >50 | V.Dense | |
| | | | | 9.00 | >50 | - | - | >50 | V.Dense | |
| 10.00m | | End of Bore hole | | 10.00 | >50 | - | - | >50 | V.Dense | |

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INDIAN GEOTECHNICAL SOCIETY (LM-3564)

**Ref:** *GEO – G – 021 – 2024 -2025*

1

# SOIL TEST RESULTS

**Name of Project:** "SOIL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF RESIDENTIAL ROW HOUSE BUILDING WITH G + 1 FLOOR OF PLOT AREA 50,525 SQ. FT., @ SF. NO. : 784/4B, 784/1F1 & 784/7, PERIYAR NAGAR, NEHRU NAGAR WEST, KALAPATTI, COIMBATORE DISTRICT – 641004."

| GEODESIGN INDIA PRIVATE LIMITED Soil Exploration Consultant, Coimbatore-38 | BORE NUMBER - 1 | LOCATION : 1 | GROUND WATER LEVEL: Not met | COMMENCEMENT OF LAB TESTING 29.04.2024 | COMPLETION OF LAB TESTING 01.05.2024 |
|---|---|---|---|---|---|

| SOIL PROFILE AND DEPTH IN METRES | DEPTH OF SAMPLING (m) | IS SOIL CLASSIFICATION | NATURAL WET DENSITY (kN/m³) | NATURAL MOISTURE CONTENT % | INDEX TEST | | | SIEVE ANALYSIS % PASSING IS SIEVE ANALYSIS | | | | SPECIFIC GRAVITY | SHEAR TEST | | STANDARD PENETRATION TEST | | | | CONSOLIDATION TEST | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | LIQUID LIMIT (%) | PLASTIC LIMIT (%) | PLASTICITY INDEX (%) | % of GRAVEL | % of SAND | % of SILT | % of CLAY | | COHESION C (Ton / m²) | ANGLE OF INTERNAL FRICTION ⁰ | DEPTH OF TESTING (m) | OBSERVED N VALUE | CORRECTED N VALUE | SAFE BEARING CAPACITY (T/m²) | COMPRESSION INDEX $C_c$ | PRE-CONSOLIDATION PRESSURE (kg/cm²) | INITIAL VOIDS RATIO | CO-EFFECT OF CONSOLIDATION $C_v$ ( cm²/sec) |
| | | GM | 15.87 | 13.49 | - | - | - | 26 | 18 | 40 | 16 | 2.68 | - | 27 | 1.20 | 17 | 17 | 11.19 | | | | |
| | 1.30 | | | | | | | | | | | | | | 1.80 | 32 | 32 | 22.70 | - | - | - | - |
| | | GP | 18.21 | 11.36 | - | - | - | 44 | 32 | 24 | | 2.65 | - | 31 | 2.40 | >50 | 50 | 36.43 | | | | |
| | 2.10 | | | | | | | | | | | | | | 3.00 | >50 | 50 | 36.85 | - | - | - | - |
| | | | | | | | | | | | | | | | 4.50 | >50 | 50 | 37.90 | | | | |
| | | | | | | | | | | | | | | | 6.00 | >50 | 50 | 38.95 | | | | |
| | | SDR | - | - | - | - | - | - | - | - | - | - | - | - | 7.50 | >50 | 50 | 40.00 | - | - | - | - |
| | | | | | | | | | | | | | | | 9.00 | >50 | 50 | 41.05 | | | | |
| | 10.00 | | | | | | | | | | | | | | 10.00 | >50 | 50 | 41.75 | | | | |

*GM – SILTY GRAVEL, GP – POORLY GRADED GRAVEL, SDR – SOFT DISINTEGRATED ROCK.*

Contd…2

Ref: *GEO – G – 021 – 2024 -2025*

2

## SOIL TEST RESULTS

**Name of Project:** "SOIL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF RESIDENTIAL ROW HOUSE BUILDING WITH G + 1 FLOOR OF PLOT AREA 50,525 SQ. FT., @ SF. NO. : 784/4B, 784/1F1 & 784/7, PERIYAR NAGAR, NEHRU NAGAR WEST, KALAPATTI, COIMBATORE DISTRICT – 641004."

| GEODESIGN INDIA PRIVATE LIMITED Soil Exploration Consultant, Coimbatore-38 | | | | | BORE NUMBER - 2 | | | LOCATION : 2 | | | | GROUND WATER LEVEL: Not met | | COMMENCEMENT OF LAB TESTING 29.04.2024 | | | | COMPLETION OF LAB TESTING 01.05.2024 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | INDEX TEST | | | SIEVE ANALYSIS % PASSING IS SIEVE ANALYSIS | | | | | SHEAR TEST | STANDARD PENETRATION TEST | | | | CONSOLIDATION TEST | | | |
| SOIL PROFILE AND DEPTH IN METRES | DEPTH OF SAMPLING (m) | IS SOIL CLASSIFICATION | NATURAL WET DENSITY (kN/m³) | NATURAL MOISTURE CONTENT % | LIQUID LIMIT (%) | PLASTIC LIMIT (%) | PLASTICITY INDEX (%) | % of GRAVEL | % of SAND | % of SILT | % of CLAY | SPECIFIC GRAVITY | COHESION C (Ton / m²) | ANGLE OF INTERNAL FRICTION ⁰ | DEPTH OF TESTING (m) | OBSERVED N VALUE | CORRECTED N VALUE | SAFE BEARING CAPACITY (T/m²) | COMPRESSION INDEX $C_c$ | PRE-CONSOLIDATION PRESSURE (kg/cm²) | INITIAL VOIDS RATIO | CO-EFFECT OF CONSOLIDATION $C_v$ ( cm²/sec) |
| | 0.90 | GM | 18.19 | 14.23 | - | - | - | 30 | 22 | 36 | 12 | 2.71 | - | 29 | 1.20 | 11 | 11 | 6.75 | | | | |
| | | | | | | | | | | | | | | | 1.80 | 20 | 20 | 13.82 | - | - | - | - |
| | | GP | 17.42 | 12.95 | - | - | - | 46 | 28 | 26 | | 2.64 | - | 30 | 2.40 | 26 | 26 | 18.68 | | | | |
| | 2.40 | | | | | | | | | | | | | | 3.00 | >50 | 50 | 36.85 | - | - | - | - |
| | | | | | | | | | | | | | | | 4.50 | >50 | 50 | 37.90 | | | | |
| | | | | | | | | | | | | | | | 6.00 | >50 | 50 | 38.95 | | | | |
| | | SDR | - | - | - | - | - | - | - | - | - | - | - | - | 7.50 | >50 | 50 | 40.00 | - | - | - | - |
| | | | | | | | | | | | | | | | 9.00 | >50 | 50 | 41.05 | | | | |
| | 10.00 | | | | | | | | | | | | | | 10.00 | >50 | 50 | 41.75 | | | | |

*GM – SILTY GRAVEL, GP – POORLY GRADED GRAVEL, SDR – SOFT DISINTEGRATED ROCK.*

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Contd…3

## SOIL TEST RESULTS

**Name of Project:** "SOIL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF RESIDENTIAL ROW HOUSE BUILDING WITH G + 1 FLOOR OF PLOT AREA 50,525 SQ. FT., @ SF. NO. : 784/4B, 784/1F1 & 784/7, PERIYAR NAGAR, NEHRU NAGAR WEST, KALAPATTI, COIMBATORE DISTRICT – 641004."

| GEODESIGN INDIA PRIVATE LIMITED Soil Exploration Consultant, Coimbatore-38 | BORE NUMBER - 3 | LOCATION : 3 | GROUND WATER LEVEL: Not met | COMMENCEMENT OF LAB TESTING 29.04.2024 | COMPLETION OF LAB TESTING 01.05.2024 |
|---|---|---|---|---|---|

| SOIL PROFILE AND DEPTH IN METRES | DEPTH OF SAMPLING (m) | IS SOIL CLASSIFICATION | NATURAL WET DENSITY (kN/m³) | NATURAL MOISTURE CONTENT % | INDEX TEST | | | SIEVE ANALYSIS % PASSING IS SIEVE ANALYSIS | | | | SPECIFIC GRAVITY | SHEAR TEST | | STANDARD PENETRATION TEST | | | | CONSOLIDATION TEST | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | LIQUID LIMIT (%) | PLASTIC LIMIT (%) | PLASTICITY INDEX (%) | % of GRAVEL | % of SAND | % of SILT | % of CLAY | | COHESION C (Ton / m²) | ANGLE OF INTERNAL FRICTION ⁰ | DEPTH OF TESTING (m) | OBSERVED N VALUE | CORRECTED N VALUE | SAFE BEARING CAPACITY (T/m²) | COMPRESSION INDEX $C_c$ | PRE-CONSOLIDATION PRESSURE (kg/cm²) | INITIAL VOIDS RATIO | CO-EFFECT OF CONSOLIDATION $C_v$ ( cm²/sec) |
| | | FS | - | - | - | - | - | - | - | - | - | - | - | - | 1.20 | 9 | 9 | 5.27 | | | | |
| | 1.70 | | | | | | | | | | | | | | 1.80 | 22 | 22 | 15.30 | - | - | - | - |
| | | GP | 21.73 | 14.87 | - | - | - | 41 | 26 | 33 | | 2.67 | - | 30 | 2.40 | >50 | 50 | 36.43 | | | | |
| | 2.20 | | | | | | | | | | | | | | 3.00 | >50 | 50 | 36.85 | - | - | - | - |
| | | | | | | | | | | | | | | | 4.50 | >50 | 50 | 37.90 | | | | |
| | | | | | | | | | | | | | | | 6.00 | >50 | 50 | 38.95 | | | | |
| | | SDR | - | - | - | - | - | - | - | - | - | - | - | - | 7.50 | >50 | 50 | 40.00 | | | | |
| | | | | | | | | | | | | | | | 9.00 | >50 | 50 | 41.05 | - | - | - | - |
| | | | | | | | | | | | | | | | 10.00 | >50 | 50 | 41.75 | | | | |
| | 10.00 | | | | | | | | | | | | | | | | | | | | | |

*FS – FILLING SOIL, GP – POORLY GRADED GRAVEL, SDR – SOFT DISINTEGRATED ROCK.*

Geotechnical Engineer

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## 8. PHOTOS

**Trial Pit Location – 1**



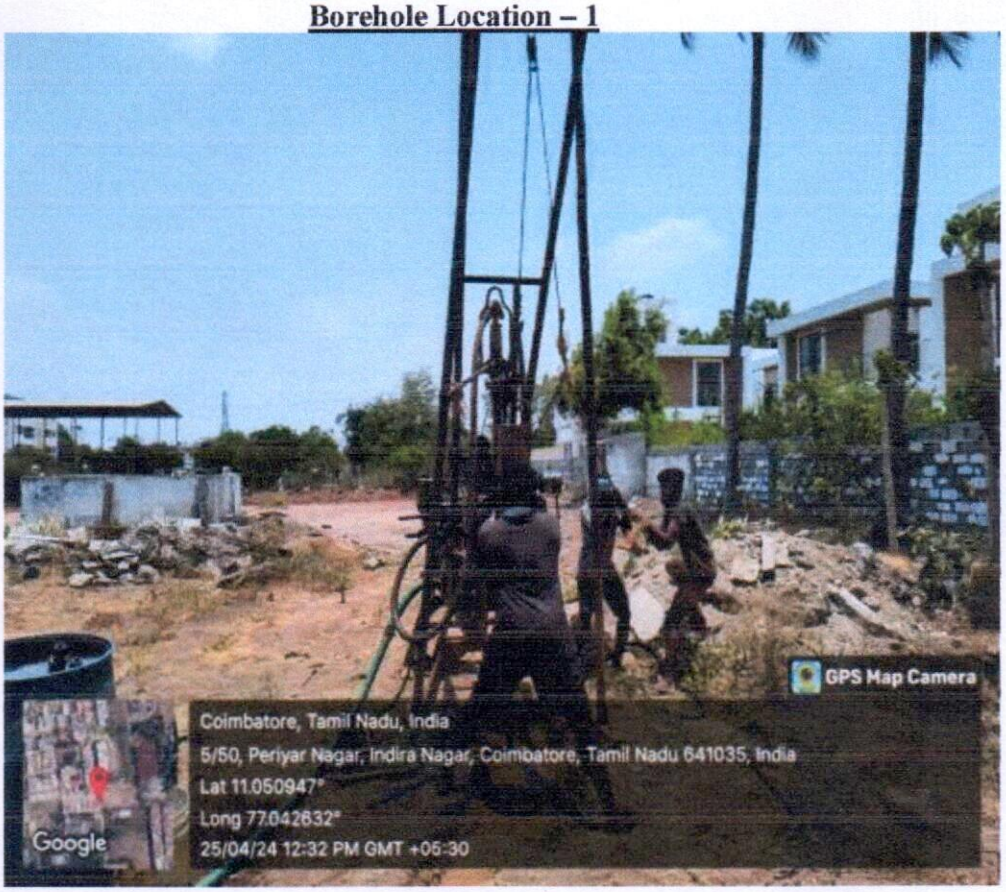
**Trial Pit Location – 2**



## Trial Pit Location – 3

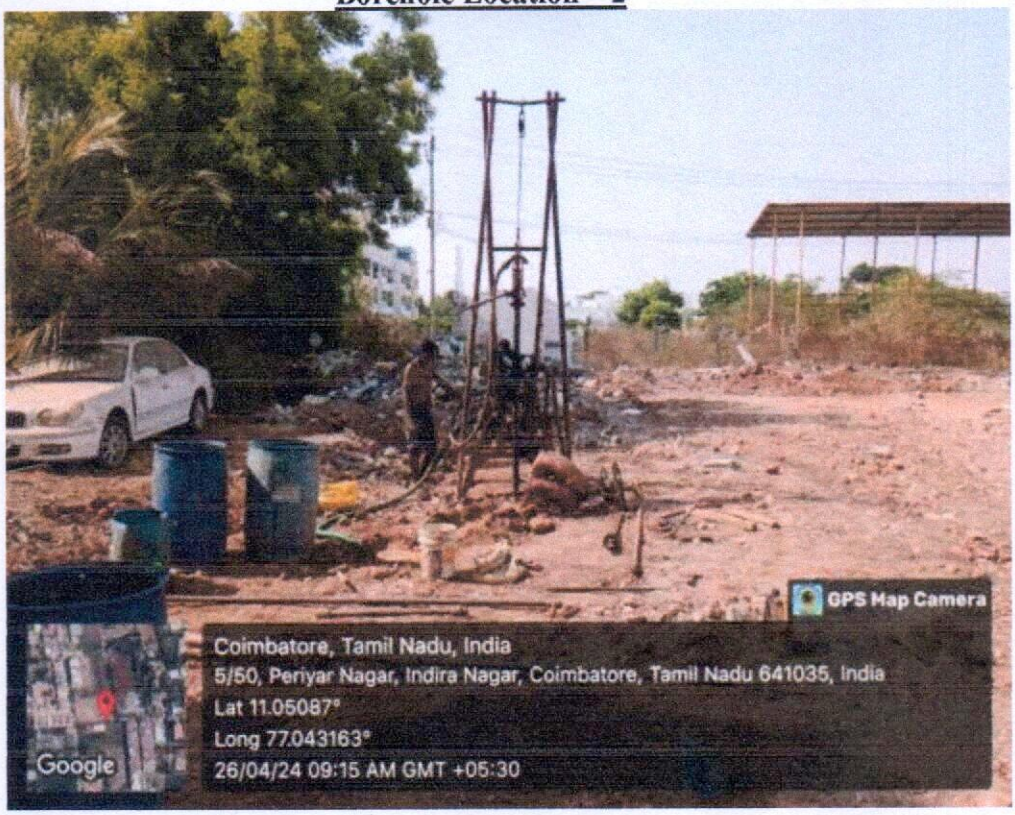


## Borehole Location – 1

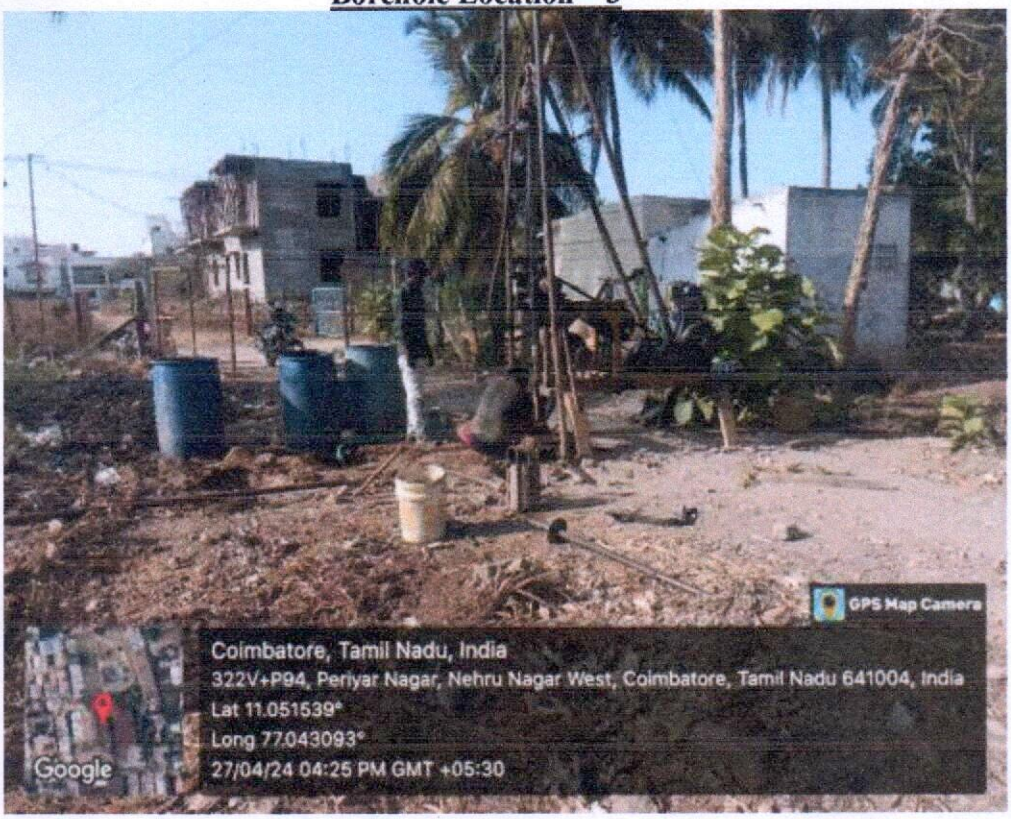



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## Borehole Location – 2




## Borehole Location – 3




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# 9. ANNEXURE

## 9.1 DESIGN OF PILE CARRYING CAPACITY

**DESIGN APPROACH FOR VERTICAL PILE CAPACITY:**

The vertical capacity pile is calculated based on IS: 2911 (Part 1/ Sec 1& 2) - 1979.

The ultimate capacity of piles ($Q_u$) depends on the sub-soil condition.

The ultimate capacity is calculated based on the following formulae:

**For Cohesionless Soil: Qu = Ap(0.5DγNγ + PDNq) + ∑KPDitanδAsi**

**For Cohesive Soil: Qu = ApNcCp + αCAs.**

| | | | |
|---|---|---|---|
| Type of Pile | = | Bored Pile | |
| Shape of the pile | = | Circular | |
| Diameter of pile (D) | = | 350 | mm |
| Water table from NGL for Design | = | 0 | m |
| Water table from NGL during Investigation | = | 0 | m |
| Unit wt of water ($\gamma_w$) | = | 10 | kN/m$^3$ |
| Depth interval | = | 0.1 | m |
| Factor of Safety | = | 2.5 | |
| Grade of Steel ($f_y$) | = | **Fe 500** | |
| Grade of Concrete ($f_{ck}$) | = | **M 30** | |
| Percentage of steel | = | 0.4 | % |
| Cross Sectional Area of Pile | = | 96211.28 | mm$^2$ |
| Reinforcement Area ($A_{sc}$) | = | 384.85 | mm$^2$ |
| Area of concrete ($A_c$) | = | 95826.43 | mm$^2$ |
| Volume of Concrete | = | 0.38 | m$^3$ |
| Stuctural capacity of Pile | = | 721.6 | kN |
| **Pile length for calculations =** | **=** | 5 | M |

| Pile length = 5 m | kN | kN/m$^2$ |
|---|---|---|
| Ultimate Tip Resistance | 440.06 | 2789.91575 |
| Ultimate Skin frictional Resistance for 5 m | 53.30 | 7.21 |
| Ultimate Skin frictional Resistance for 1 m | 1.496 | |
| Ultimate Skin frictional Resistance from 1 m to 5m | 51.80 | |
| Ultimate pile capacity | 491.86 | |
| Safe geotechnical pile capacity | 191.87 | |

| **Results:** | | | |
|---|---|---|---|

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| | | | |
|---|---|---|---|
| **Safe Vertical Capacity of Pile** | = | **191.87** | **kN** |
| **Safe Uplift capacity of Pile** | = | **18.69** | **kN** |
| **Safe Lateral Capacity of Pile** | = | **15.34** | **kN** |

**DESIGN APPROACH FOR VERTICAL PILE CAPACITY:**

The vertical capacity pile is calculated based on IS: 2911 (Part 1/ Sec 1& 2) - 1979.

The ultimate capacity of piles ($Q_u$) depends on the sub-soil condition.

The ultimate capacity is calculated based on the following formulae:

**For Cohesionless Soil: Qu = Ap(0.5DγNγ + PDNq) + ∑KPDitanδAsi**

**For Cohesive Soil: Qu = ApNcCp + αCAs.**

| | | | |
|---|---|---|---|
| Type of Pile | = | Bored Pile | |
| Shape of the pile | = | Circular | |
| Diameter of pile (D) | = | 450 | mm |
| Water table from NGL for Design | = | 0 | m |
| Water table from NGL during Investigation | = | 0 | m |
| Unit wt of water ($\gamma_w$) | = | 10 | kN/m$^3$ |
| Depth interval | = | 0.1 | m |
| Factor of Safety | = | 2.5 | |
| Grade of Steel ($f_y$) | = | **Fe 500** | |
| Grade of Concrete ($f_{ck}$) | = | **M 30** | |
| Percentage of steel | = | 0.4 | % |
| Cross Sectional Area of Pile | = | 159043.13 | mm$^2$ |
| Reinforcement Area ($A_{sc}$) | = | 636.17 | mm$^2$ |
| Area of concrete ($A_c$) | = | 158406.96 | mm$^2$ |
| Volume of Concrete | = | 0.64 | m$^3$ |
| Stuctural capacity of Pile | = | 1192.8 | kN |
| **Pile length for calculations =** | = | 5 | M |

| Pile length = 5 m | kN | kN/m$^2$ |
|---|---|---|
| Ultimate Tip Resistance | 734.88 | 2826.32025 |
| Ultimate Skin frictional Resistance for 5 m | 68.32 | 7.21 |
| Ultimate Skin frictional Resistance for 1 m | 1.9176 | |
| Ultimate Skin frictional Resistance from 1 m to 5m | 66.40 | |
| Ultimate pile capacity | 801.29 | |
| Safe geotechnical pile capacity | 312.45 | |

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| Results: | | | |
|---|---|---|---|
| **Safe Vertical Capacity of Pile** | = | **312.45** | **kN** |
| **Safe Uplift capacity of Pile** | = | **25.77** | **kN** |
| **Safe Lateral Capacity of Pile** | = | **24.99** | **kN** |

**DESIGN APPROACH FOR VERTICAL PILE CAPACITY:**

The vertical capacity pile is calculated based on IS: 2911 (Part 1/ Sec 1& 2) - 1979.

The ultimate capacity of piles ($Q_u$) depends on the sub-soil condition.

The ultimate capacity is calculated based on the following formulae:

**For Cohesionless Soil: Qu = Ap(0.5DγNγ + PDNq) + ∑KPDitanδAsi**

**For Cohesive Soil: Qu = ApNcCp + αCAs.**

| | | | |
|---|---|---|---|
| Type of Pile | = | Bored Pile | |
| Shape of the pile | = | Circular | |
| Diameter of pile (D) | = | 600 | mm |
| Water table from NGL for Design | = | 0 | m |
| Water table from NGL during Investigation | = | 0 | m |
| Unit wt of water ($\gamma_w$) | = | 10 | $kN/m^3$ |
| Depth interval | = | 0.1 | m |
| Factor of Safety | = | 2.5 | |
| Grade of Steel ($f_y$) | = | **Fe 500** | |
| Grade of Concrete ($f_{ck}$) | = | **M 30** | |
| Percentage of steel | = | 0.4 | % |
| Cross Sectional Area of Pile | = | 282743.34 | $mm^2$ |
| Reinforcement Area ($A_{sc}$) | = | 1130.97 | $mm^2$ |
| Area of concrete ($A_c$) | = | 281612.37 | $mm^2$ |
| Volume of Concrete | = | 1.13 | $m^3$ |
| Stuctural capacity of Pile | = | 2120.6 | kN |
| **Pile length for calculations =** | = | 5 | M |

| Pile length = 5 m | kN | $kN/m^2$ |
|---|---|---|
| Ultimate Tip Resistance | 1326.31 | 2880.927 |
| Ultimate Skin frictional Resistance for 5 m | 91.09 | 7.21 |
| Ultimate Skin frictional Resistance for 1 m | 2.5568 | |
| Ultimate Skin frictional Resistance from 1 m to 5m | 88.54 | |
| Ultimate pile capacity | 1414.85 | |
| Safe geotechnical pile capacity | 551.60 | |

| Results: | | | |
|---|---|---|---|
| Safe Vertical Capacity of Pile | = | 551.60 | kN |
| Safe Uplift capacity of Pile | = | 37.94 | kN |
| Safe Lateral Capacity of Pile | = | 44.12 | kN |

## PILE CARRYING CAPACITY

| S.No | DEPTH OF PILE IN 'm' | PILE DIAMETER IN 'mm' | VERTICAL PILE CAPACITY IN 'kN' | UPLIFT PILE CAPACITY IN 'kN' | LATERAL PILE CAPACITY IN 'kN' |
|---|---|---|---|---|---|
| 1 | 5.00 | 350 | 191.87 | 18.69 | 15.34 |
| 2 | 5.00 | 450 | 312.45 | 25.77 | 24.99 |
| 3 | 5.00 | 600 | 551.60 | 37.94 | 44.12 |

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## 9.2 LABORATORY PERMIABILTY RESULTS

| SL No | Depth | Borehole Location | Coefficient of Permeability (K in Cm/s) |
|---|---|---|---|
| 1 | 2.00m | 2 | 3.728 x 10-4 |
| 2 | 3.00m | 2 | 4.813 x 10-4 |
| 3 | 5.00m | 2 | 6.642 x 10-4 |

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