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# Report on
# The Geotechnical Investigation for the proposed construction of Residential Building in T.S. No: 23/48, Ward No: I (09), Block No.2 at Vivekananda Road, Central Zone, Coimbatore Corporation.

CLIENT:

**M/s. Dhiya Foundation Private Limited,**
P.N. Pudur,
Coimbatore.

**Project Code: 072422**
**02 August 2024**


**GEOCARE ENGINEERING CONSULTANCY**
***(An ISO 9001:2015 Certified Company)***
#17/25B, Annur Road,
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# GEOTECHNICAL INVESTIGATION BY MACHINE BORING METHOD

| | |
|---|---|
| **Client Name** | M/s. Dhiya Foundation Private Limited, |
| **Client Address** | No.22-1, P.R.R Nagar,<br>3rd Street,<br>P.N.Pudur Post,<br>Coimbatore – 641041. |
| **Project** | Proposed construction of Residential Building Stilt+5 floors ,15 Dwellings |
| **Site Address** | T.S.No.23/48, Ward No. I (09), Block No: 2,<br>Vivekananda Road, Central Zone,<br>Coimbatore Corporation. |
| **Date of field test** | 22nd and 23rd July 2024. |

| | |
|---|---|
| **Field test conducted by** | B. Naveenkumar, B.E |
| **Report Prepared by** | R. Suresh, B.E |
| **Report Verified by** | R. Sathishkumar, M.E (Geotech) /<br>S. Prabhavathi, M.E (Geotech) |
| **Report Approved by** | R. Sathishkumar, M.E (Geotech) |

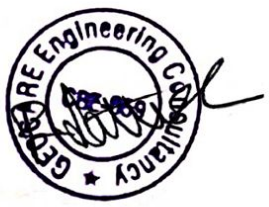
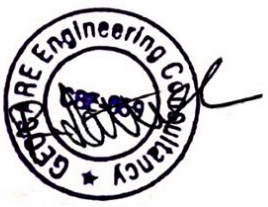


TABLE OF CONTENTS

1. INTRODUCTION ..... 4
2. OBJECTIVES AND SCOPE OF WORK ..... 4
2.1. OBJECTIVES ..... 4
2.2. SCOPE OF WORK ..... 4
2.2.1. FIELD (IN-SITU) INVESTIGATIONS ..... 4
2.2.2. LABORATORY TESTING ..... 5
2.3. REPORT ..... 5
3. PROJECT DETAILS ..... 5
3.1. THE SITE ..... 5
3.2. WEATHER CONDITION ..... 5
3.3. SEISMIC ZONE ..... 5
3.4. GEOLOGY OF COIMBATORE DISTRICT ..... 5
4. SCHEDULE OF INVESTIGATION ..... 6
4.1. FIELD INVESTIGATIONS ..... 6
4.2. STANDARD PENETRATION TESTS ..... 6
4.3. STANDING WATER LEVEL ..... 6
5. RESULTS AND DISCUSSION ..... 7
5.1. NET SAFE BEARING CAPACITY/ALLOWABLE BEARING PRESSURES ..... 9
6. CONCLUSION & RECOMMENDATIONS ..... 9
APPENDIX – I ..... 11
SITE LOCATION ..... 11
APPENDIX – II ..... 12
LABORATORY TEST RESULTS ..... 12
APPENDIX – III ..... 13
BORE LOGS ..... 13
APPENDIX – IV ..... 15
PHOTOGRAPHS SHOWING FIELD INVESTIGATION ..... 15
REFERENCES ..... 16



**TECHNICAL REPORT ON THE GEOTECHNICAL INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING IN T.S. N: 23/48, WARD NO: I (09), BLOCK NO: 2 AT VIVEKANANDA ROAD, CENTRAL ZONE, COIMBATORE CORPORATION.**

## 1. Introduction

The Management, M/s. Dhiya Foundation Private Limited, proposes to construct a Residential Building in T.S .No: 23/48, Ward No: I (09), Block No: 2 at Vivekananda Road, Central Zone, Coimbatore Corporation. In order to enable an adequate and economic design, the Geotechnical Investigation was assigned to M/s. GEOCARE Engineering Consultancy, Coimbatore in view to furnish the detailed technical information of the nature of subsoil strata for detail analysis and foundation designs.

## 2. Objectives and Scope of Work

### 2.1. Objectives

The object of the Geotechnical Investigation is to evaluate the following:

- To ascertain the subsoil strata.
- To record the ground water level if any.
- To determine the physical, and engineering properties of soil/rock samples.
- To evaluate the allowable bearing capacity of soil/rock.
- To recommend improvements to the weak soil strata, if any

### 2.2. Scope of Work

The scope of work includes the following field (In-situ) and laboratory tests.

#### 2.2.1. Field (In-Situ) Investigations

i) Boring 150mm dia/Nx size boreholes in all kinds of strata using rotary drilling by wash boring method as per IS –1892 –1979.

ii) Conducting field tests such as Standard Penetration Tests as per IS 2131- 1981 at various depths in the boreholes.

iii) Collection of undisturbed and disturbed soil samples at specified depths for determination of cohesion 'c' friction factor '$\phi$' and others index & engineering properties as per Indian Standards.

### 2.2.2. Laboratory Testing

The scope of laboratory testing is as follows:

i) Determination of Natural Moisture Content and Density as per IS 2720 - part 2.

ii) Grain size analysis as per IS 2720 - part 4.

iii) Determination of shear strength parameters as per IS 2720 – part 11 / 13.

### 2.3. Report

This report comprises of soil profile, recommendations regarding allowable bearing capacity, improvement in bearing capacity of soil.

## 3. Project Details

### 3.1. The Site

The site for the proposed construction of Residential Building is located at T.S .No: 23/48, Ward No: I (09), Block No: 2, Vivekananda Road, Central Zone, Coimbatore Corporation.

### 3.2. Weather Condition

The weather was cloudy and drizzling at the time of investigation.

### 3.3. Seismic Zone

The site for the proposed Residential Building at T.S .No: 23/48, Ward No: I (09), Block No: 2, Vivekananda Road, Central Zone, Coimbatore Corporation. which comes under seismic zone-III as per IS 1893 (Part-I)-2002.

### 3.4. Geology of Coimbatore District

About 60 per cent of the district is covered by red soils, of which red calcareous soil is predominant. They occupy most parts of Palladam, Coimbatore. Medium to deep red calcareous soils are found mainly in Pollachi and Udumalpet taluks. Parts of Palladam, Avinashi and Udumalpet taluks are occupied by red non-calcareous soils. The highlands in Coimbatore, Palladam and Avinashi taluks are mostly occupied by the black soils, which are dark gray to greyish brown in color. The Alluvial soils are found in small patches along the Noyyal River mainly in the upper reaches.

* Reference CWC Coimbatore District

## 4. Schedule of Investigation

### 4.1. Field Investigations

To study the subsoil strata at the proposed location 02 nos of 150mm dia/Nx size boreholes were bored by wash boring method using rotary calyx boring machine.

### 4.2. Standard Penetration Tests

Standard Penetration Test (SPT), which is conducted to determine penetration resistance was conducted in the boreholes using the procedure as described in IS: 2131. In this method, split spoon sampler (50.8mm OD and 35mm ID) is driven by dropping 63.5kg weight with a free fall of 75cm. The length of the sampler is 60cm. The sampler is first driven through 15cm as a "seating drive ". It is further driven through 30cm. The number of blows required for drilling the sampler for next 30 cm beyond seating drive is termed as "penetration resistance," N". Respective "N" values are presented in bore log sheets.

The SPT tests were conducted at regular intervals of 1.5m/change in strata in the boreholes.

The disturbed soil samples were collected in polythene bags and labeled.

The samples thus recovered were transported to the laboratory for testing purposes.

The depth at which SPT tests were conducted, disturbed sample taken at each location and boreholes terminated is as follows

**Table-1 Depth of SPT and UDS Samples**

| SL. No. | Borehole No. | Depth (m) | | |
|---|---|---|---|---|
| | | SPT Samples | UDS | Terminated |
| 1 | BH1 | 1.50, 3.0 | - | 8.0 |
| 2 | BH2 | 1.50, 3.0 | - | 80 |

### 4.3. Standing Water Level

Standing water level (SWL) is not observed in the boreholes during field investigation. Field investigation had been carried out on 22nd and 23rd July 2024.

## 5. Results and Discussion

### Sub Soil Stratification

The subsoil strata at BH1 & BH2 were are more or less similar and consists of Top Filled Soil up to a depth of about 0.40 - 0.60m below existing ground level (EGL), followed by Clay up to a depth of about 0.80 – 1.30m, Clayey Gravel up to a depth of about 1.40 – 2.80m, Dense Gravel (DG) / Very Soft Rock (VSR) up to a depth of about 6.0 – 6.50m and underlain by Soft Disintegrated Weathered Rock (SDR) at explored depth.

Stratum I : Top Filled Soil
Stratum II : Clay
Stratum III : Clayey Gravel
Stratum IV : DG / VSR
Stratum V : SDR

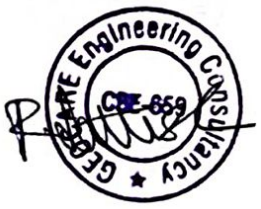
| BH No | Strata depth in m | | | | |
|---|---|---|---|---|---|
| | Stratum I | Stratum II | Stratum III | Stratum IV | Stratum V |
| BH1 | 0.0 – 0.60 | 0.60 – 1.30 | 1.30 – 2.80 | 2.80 – 6.0 | 6.0 – 8.0$^{E}$ and above |
| BH2 | 0.0 – 0.40 | 0.40 – 0.80 | 0.80 – 1.40 | 1.40 – 6.50 | 6.50 – 8.0$^{E}$and above |

E- Explored depth

### Design Parameters

The parameters required for the design of the foundation system for the proposed building are:

a) Type of foundation to be adopted
b) Depth at which the foundations have to be laid
c) Allowable bearing pressure on the soil at the foundation level




### Type of Foundation

The type of foundation for any structure depends upon the subsoil conditions, type of structure, as well as the loading intensity on the foundations.

The subsoil encountered at average founding levels is dense strata. Hence, Shallow Foundation can be adopted for the proposed building. The Shallow Foundations may be Isolated / Combined Footing depending upon the column loads, their spacing and configuration.

**Depth of Foundations**

The minimum depth of foundations depends upon the following factors:

a) Top loose zone, if any

b) Adequate depth of soil above founding level, to ensure mobilization of full safe bearing capacity

c) Adequate depth of soil strata below founding level of requisite strength to mobilize the safe bearing capacity

**Allowable Bearing Pressure**

The allowable bearing pressure on foundations of any structure is evaluated based on the following criteria:

a) Shear failure criterion using average soil data

b) Settlement criterion

The ground water table was not encountered in the borehole up to the investigated depth.

The Reduction Factor for Water Table R'w=1.0 has been applied. For calculation of overburden pressure, Bulk Density has been considered.

For calculations based on settlement criteria, the allowable total settlement has been taken as 25mm.The soil parameters considered for evaluation of net SBC/ allowable bearing pressure based on the test results on undisturbed soil samples collected at the site are as given below.

**Shear failure Criteria, c-$\phi$ soil**

**Design Parameters**

Cohesion c = 0.01 kg/cm$^2$

Angle of internal friction $\phi = 31^0$

Density of soil $\gamma_b$ = 1.70 g/cm$^3$

Factor of Safety = 3.0

**Consolidation settlement criteria**

Method: IS: 8009 (Part I approach), consolidation settlement criteria and normally consolidated soils.

Settlement has been computed for Minimum SBC value from shear approach. It is seen that settlements are within 25mm.

On the basis of the above analysis, the Net Allowable Bearing Pressures for 1.50m width of isolated footings, has been evaluated and is given below.

The strata available at the founding level will be generally DG / VSR.

### 5.1. Net Safe Bearing Capacity/Allowable Bearing Pressures

Recommendations are provided at depth of 2.0m, 3.0m, 3.50 & 4.0m below NGL considering shear failure and settlement.

**Table-2 Allowable Safe Bearing Capacity**

| Borehole No. | Depth below EGL (m) | Type of Strata | SBC (kN/m²) |
|---|---|---|---|
| | | | B=1.5m |
| BH1& BH2 | 2.0 | Clayey Gravel | 210 |
| | **3.0** | **DG / VSR** | **330** |
| | 3.5 | | 370 |
| | 4.0 | | 410 |

Site location is shown in Appendix-I. The index & engineering properties of soil samples at various depths in the boreholes are indicated in Appendix – II - Table 3. The Grain size distribution curves for the soil samples are shown in Fig. 2. Bore logs are shown in Appendix – III. Photographs showing field investigation are shown in Appendix – IV.

## 6. Conclusion & Recommendations

- The subsoil consists of Top Filled Soil followed by Clay, Clayey Gravel, DG / VSR and underlain by SDR at explored depth.
- Standing water level is not observed in the boreholes during field investigation.
- Based on the subsoil profile open foundation of **isolated/combined footing with tie beam** is recommended.
- The recommended depth of foundation is **3.0m** below EGL with an SBC of **330kN/m²** for a footing width of **1.50m**.
- Over excavation and loosening of strata at final founding level shall be avoided & if occurs, the same shall be replaced by lean concrete.

- Prior to laying PCC, all loose soil in the foundation shall be removed and the base should be thoroughly compacted.
- It is recommended that the back filling in the foundation should be carried out with proper compaction.
- Recommendations given are based on the assumption that same strata or harder strata extends below the explored depth.
- Interpretations are provided based on factual field &laboratory test results & shall be applicable for investigated locations. There is a possibility that strata variations could occur. If any variations indicate significant deviation from the findings of this report, the same shall be brought to our notice.

GEOCARE Engineering Consultancy CBE-659

**For GEOCARE Engineering Consultancy**

2/8/24

**Authorized Signatory**

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## APPENDIX – I

## SITE LOCATION



# APPENDIX – II

## LABORATORY TEST RESULTS

**Table 4 – Index and Engineering properties of soil samples:**

| BORE HOLE | SAMPLE TYPE | DEPTH (m) | NMC (%) | N-VALUE | GRAIN SIZE DISTRIBUTION (%) | | | | | SHEAR STRENGTH PARAMETER | | IS CLASSIFICATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | GRAVEL | SAND | | | SILT + CLAY | c (kg/cm²) | ø (Degrees) | |
| | | | | | | COARSE | MEDIUM | FINE | | | | |
| BH1 | SS | 1.5 | 10.1 | 34 | 38.8 | 12.7 | 15.5 | 8.9 | 24.1 | 0.01 | 31 | SG |
| BH1 | SS | 3.0 | 14.7 | >50 | 16.2 | 9.8 | 22.7 | 20.6 | 30.7 | | | SG |
| BH2 | SS | 1.5 | 11.1 | >50 | 31.1 | 9.8 | 23.7 | 22.6 | 12.9 | 0.01 | 31 | SG |
| BH2 | SS | 3.0 | 11.1 | >50 | 16.7 | 14.7 | 30.1 | 14.1 | 24.4 | | | SG |

SS – Split Spoon Sample, ST – Shelby Tube Sample, SG – Sand with Gravel

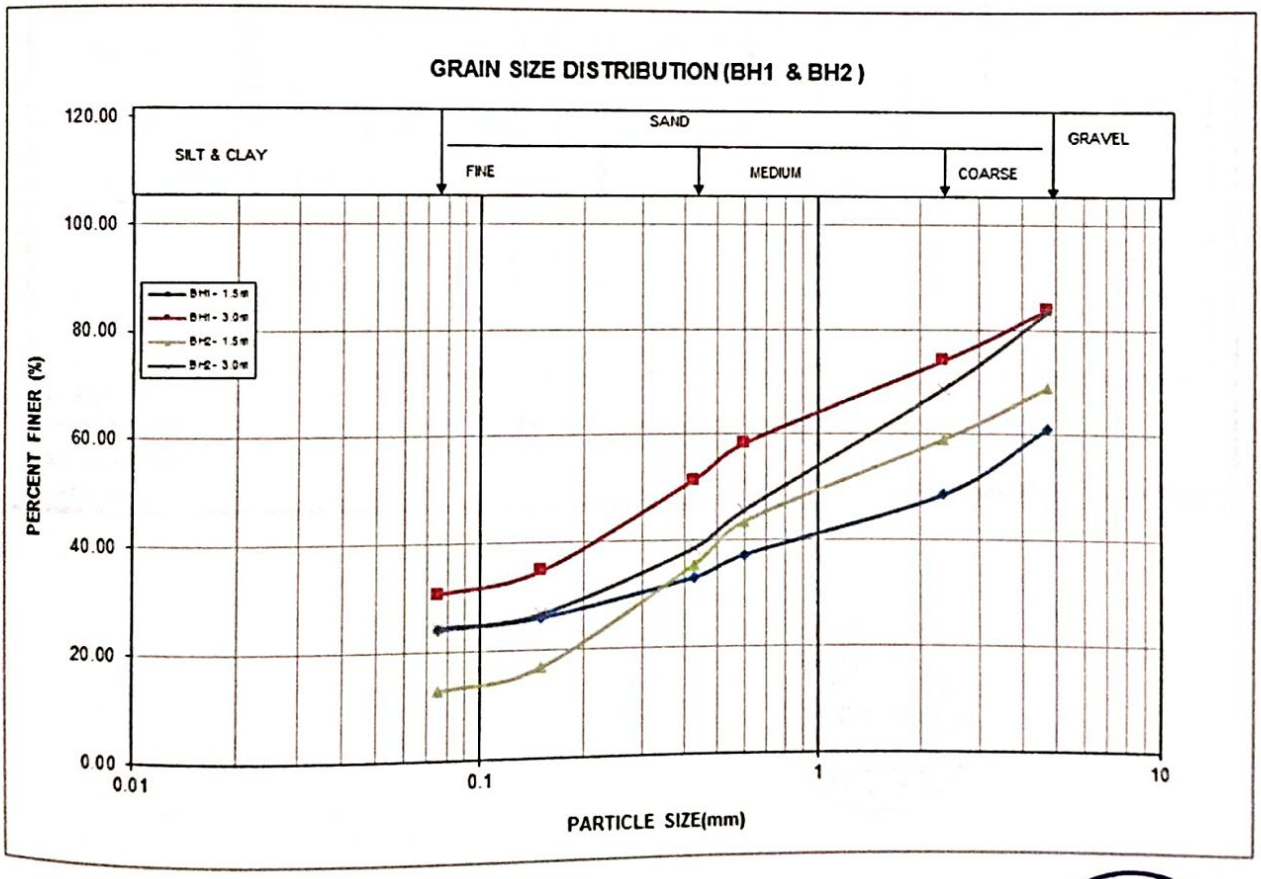



**Fig. 2 - Grain Size Distribution Curve**

## APPENDIX – III

## BORE LOGS

**GEOCARE ENGINEERING CONSULTANCY**
# 17/25B, Annur Road,
Karumathampatti, Coimbatore - 641 659.

**BORE LOG**

PROJECT : Geotechnical investigation of Residential Building

CLIENT : M/s. Dhiya Foundation Private Limited
BORE HOLE NO. : BH-01
LOCATION : P.N Pudur, Coimbatore.

TYPE OF BORING : Machine Boring
BORE HOLE DIA. : 100mm
GWT FROM G.L. :
CASING DEPTH :
DATE OF COMMENCEMENT : 22-07-2024
DATE OF COMPLETION : 22-07-2024

| SOIL DESCRIPTION | DEPTH BELOW GL (m) | STANDARD PENETRATION TEST N-VALUE | 10 | 20 | 30 | 40 | >50 | SAMPLE TYPE | ROCK DRILLING CR (%) | RQD (%) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Top Filled Soil | 1.00 | 34 (10,16,18) | | | | | | SS | | | |
| Clay | 2.00 | | | | | | | | | | |
| Clayey Gravel | 3.00 | >100 (50+R) | | | | | | SS | | | |
| DG / VSR | 4.00 | >100 (50+R) | | | | | | WS | | | |
| | 5.00 | | | | | | | | | | |
| | 6.00 | | | | | | | | | | |
| SDR | 7.00 | | | | | | | | | | |
| | 8.00 | | | | | | | | | | |
| | 9.00 | | | | | | | | | | |
| | 10.00 | | | | | | | | | | |

SS = SPLIT SPOON SAMPLE
ST = SHELBY TUBE SAMPLE
WS = WASH SAMPLE
R = REFUSAL

BH - 01 Terminated at 8.0m depth

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# 17/25B, Annur Road,
Karumathampatti, Coimbatore - 641 659.

## BORE LOG

PROJECT : Geotechnical investigation of Residential Building

CLIENT : M/s. Dhiya Foundation Private Limited

BORE HOLE NO. : BH-02

LOCATION : P.N Pudur, Coimbatore.

TYPE OF BORING : Machine Boring
BORE HOLE DIA. : 100mm
GWT FROM G.L. :
CASING DEPTH :
DATE OF COMMENCEMENT : 23-07-2024
DATE OF COMPLETION : 23-07-2024

| SOIL DESCRIPTION | DEPTH BELOW GL (m) | STANDARD PENETRATION TEST N-VALUE | 10 | 20 | 30 | 40 | >50 | SAMPLE TYPE | ROCK DRILLING CR(%) | ROCK DRILLING RQD(%) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Top Filled Soil | | | | | | | | | | | |
| Clay | 1.00 | >100 (50+R) | | | | | | SS | | | |
| Clayey Gravel | | | | | | | | | | | |
| | 2.00 | >100 (50+R) | | | | | | SS | | | |
| | 3.00 | | | | | | | | | | |
| | 4.00 | >100 (50+R) | | | | | | WS | | | |
| DG / VSR | 5.00 | | | | | | | | | | |
| | 6.00 | | | | | | | | | | |
| | 7.00 | | | | | | | | | | |
| SDR | 8.00 | | | | | | | | | | |
| | 9.00 | | | | | | | | | | |
| | 10.00 | | | | | | | | | | |

SS = SPLIT SPOON SAMPLE
ST = SHELBY TUBE SAMPLE
WS = WASH SAMPLE
R = REFUSAL

BH - 02 Terminated at 8.0m depth

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## APPENDIX – IV

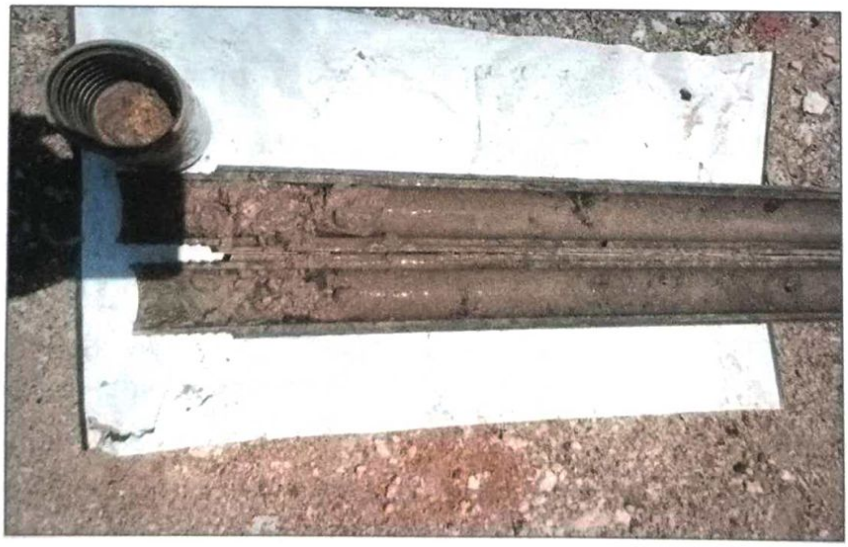
## PHOTOGRAPHS SHOWING FIELD INVESTIGATION



*Bore Hole - 01*



*Bore Hole - 02*



*Sample Collection 02*

## REFERENCES

## LIST OF IS CODES

### Field Investigation

1. IS: 1892 - 1979: Code of practice for sub surface investigations for foundations (First revision)
2. IS: 2131 - 1981: Method of Standard Penetration Tests for soils (First revision)
3. IS: 2132 - 1986: Code of practice for thin walled tube sampling of soils (Second revision)
4. Field Permeability test in Boreholes as per IS 5529 part – 1

### Laboratory Tests

5. IS: 2720 - 1983 (Part 1): Methods of test for soils: Preparation of dry soil samples for various tests (Second revision)
6. IS: 2720 - 1980 (Part 2): Method of test for soils: Determination of water content (Second revision) Amendment 1
7. IS: 2720 - 1985 (Part 4): Method of test for soils: Grain size analysis (Second revision)
8. IS: 2720-1981 Part 13: Method of tests for soils: Determination of shear strength parameters using Direct Shear apparatus.
9. Determination of Specific gravity as per IS 2720 part – 3.
10. Determination of Free swell Index as per IS 2720 part - 40.




### Foundation Construction

11. IS: 1080 - 1986: Code of practice for design and construction of shallow foundations on soils (other than raft, ring and shell) (Second revision)
12. IS: 1904 - 1986: Code of practice for design and construction of foundation in soils: General requirements (Third revision)
13. IS: 6403 - 1981: Code of practice for determination of bearing capacity of shallow foundations: First revision (Amendment 1)
14. IS: 8009 - 1976 (Part 1): Code of practice for calculation of settlements of foundations: Shallow foundations subject to symmetrical static vertical loads
    (Amendment 2)



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