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Project :

RESIDENTIAL COMMERCIAL BUILDING AT PORUR, CHENNAI

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GEOTECHNICAL INVESTIGATION REPORT

for Commercial Building at Porur, Chennai

EXECUTIVE SUMMARY

Dr. Hemanth Raj, Chennai is proposing to construct a commercial building at Arcot Road, Sapthagiri Nagar, Porur, Chennai - 600 116.

The site for the proposed commercial building is situated at Plot No.: 7 on the southern side of Arcot road in Sapthagiri Nagar, Porur, Chennai - 600 116. The site measures approximately 18.28m x 40.08m. The site is having boundary wall on all the sides and is fairly level in topography. Vegetation in the form of trees and grass were observed within the site during the period of field investigations.

The proposed commercial building consists of an open stilt floor at ground level and three upper floors.

Geotechnical investigations have been undertaken at the site as per the scope of investigations, stipulated by the client, which consisted of conducting 2 boreholes down to refusal/rock strata (where N>100) and further drilling in refusal/rock strata by a minimum 3m was to be carried out.

The results of borehole investigations indicate the presence of filled-up strata (at the location of borehole no 1 only) down to 2m depth below which virgin soil was encountered. The virgin soil encountered is Brown silty sand down to 11.8/12m depth underlain by Grey sandy silty clay down to the depths of refusal strata encountered at 22/22.5m depth below existing ground level. The refusal strata is in the form of completely weathered rock (Charnockite Based) down to the maximum investigated depth of 25/25.5m below existing ground level.

The soil strata encountered from ground level down to 11.8/12m depth below existing ground level is in a medium dense state and beyond 11.8/12m depth is in a soft state down refusal strata encountered at depths varying between 21m & 21.5m below existing ground level.

Ground water table was encountered at 4.5m depth in the boreholes during the period of field

investigations.

In view of the observed subsoil conditions, the proposed residential building can be supported on *Shallow Foundation - Isolated/Strip Footings laid at a minimum depth of 2m below the existing ground level with an allowable bearing pressure of 11t/m² (1.1kg/cm²) for widths of foundation ≥1.5m.*

The excavated soil can be used for backfilling purposes.

The foundation surface should be watered for at least 24 hours. The top slush should then be removed and the surface compacted heavily. If any loose pockets are observed, the same shall be filled with brickbats/ gravel and compacted well. Foundations can subsequently be placed over such a prepared surface.

Stiff Tie-beams connecting the columns in both directions may be provided which will render additional rigidity to the structure.

REPORT ON GEOTECHNICAL INVESTIGATION FOR COMMERCIAL BUILDING AT PORUR, CHENNAI

1.0 INTRODUCTION

1.1 Overview

1.1.1 Dr. Hemanth Raj, Chennai is proposing to construct a commercial building at Arcot Road, Sapthagiri Nagar, Porur, Chennai - 600 116.

1.1.2 The geotechnical investigations have been carried to ascertain the soil conditions for the design of foundations of the proposed commercial building.

1.2 Authority

A detailed geotechnical investigations programme has been conducted as per the authorisation by Dr. Hemanth Raj, Chennai vide our oral Work Order No. NCC/OWO/DH/086A/C/2023.

2.0 PROJECT DETAILS

2.1 Site Location

The site for the proposed commercial building is situated at Plot No.: 7 on the southern side of Arcot road in Sapthagiri Nagar, Porur, Chennai - 600 116.

2.2 Site Layout and Topography

2.2.1 The site measures approximately 18.28m x 40.08m. The site is having boundary wall on all the sides and is fairly level in topography. Vegetation in the form of trees and grass were observed within the site during the period of field investigations.

2.2.2 The colour of the exposed soil surface is Brown.

2.3 The Structure

As per information provided by the client, the proposed commercial building consists of an open stilt floor at ground level and three upper floors.

2.4 Seismic Zone

Site for the proposed commercial building is situated in Porur, Chennai which falls under Seismic Zone III as per IS 1893 (Part 1) - 2016.

2.5 Geographical Information

2.5.1 The site for the proposed commercial building is located at:

a) Latitude : 13°02'

b) Longitude : 80°10'

3.0 OBJECT OF INVESTIGATIONS

3.1 For designing the foundation system of the proposed commercial building, the following data are required:

a) Type of foundation system.

b) Depth below the ground level at which the foundation system is to be laid.

c) Allowable bearing pressure on the foundations levels.

3.2 To determine above factors, the following information would be required:

a) The subsoil profile indicating thicknesses of the various soil strata, to a depth down to the influence zone below the foundations.

b) Engineering properties of the soil strata at various levels.

c) Physical characteristics of the soil strata.

d) Variation of the strength of the strata with depth.

3.3 For evaluating the above parameters, field investigations and laboratory investigations on the soil samples collected during the field investigations, have been carried out.

3.4 The results from these investigations have been analysed to provide the recommendations for the design of foundations.

4.0 SCOPE OF INVESTIGATIONS

4.1 Scope of investigations as given in the work order consisted of:

a) Conducting 2 boreholes down to refusal/rock strata (where N>100); and further drilling in refusal/rock strata by a minimum of 3m, as required by the client.

b) Conducting standard penetration tests at 1.5m intervals.

c) Recovering undisturbed soil samples from various levels of the subsoil strata.

d) Recording ground water table levels, if met with.

e) Conducting relevant laboratory tests on soil samples recovered.

f) Preparation and submission of a technical report containing the details of the tests carried out, their analysis and recommendations regarding the foundation system to be adopted. Two copies of the report are to be submitted.

5.0 FIELD INVESTIGATIONS

5.1 General Details

5.1.1 The locations of the boreholes were shown at site by the client's representative. A Schematic site plan showing the boreholes locations marked by the client is given in fig. 1.

5.1.2 Weather was clear during the period of field investigations which were carried out in the fourth week of February 2023.

5.2 Boreholes

5.2.1 The boreholes were progressed by mechanically operated rotary core drill method.

5.2.2 Refusal strata (i.e. N-value > 100) in the form of grey completely weathered rock was encountered at 22/22.5m depth below existing ground level. The drilling in refusal/rock strata was conducted using NX size core barrel fitted with diamond bits.

5.2.3 The boreholes were terminated after drilling a minimum of 3m in refusal/rock strata

(where N-value is >100) as per the stipulated scope of work.

5.2.4 The depth at which ground water table was encountered in the boreholes during the field investigations, depths at which refusal strata was encountered and termination depths of the boreholes, are given below:

BH. No.	Depth of Water Table Below EGL (m)	Depth of Refusal/ Rock Strata Below EGL (m)	Termination Depth Below EGL (m)
1	4.5	22.5	25.5
2	4.5	22	25

5.2.5 Ground water table was encountered at 4.5m depth in the boreholes during the period of field investigations.

5.2.6 Standard Penetration Tests were conducted in soil strata at 1.5m depth intervals.

5.2.7 Disturbed soil samples recovered from split spoon sampler were packed in polythene bags, labelled and retained for identification purposes.

5.2.8 Undisturbed soil samples were recovered by thin walled tubes conforming to IS 2132. These tubes had an area ratio of less than 10%. The diameter of soil samples were 50mm and length 45cm.

6.0 LABORATORY INVESTIGATIONS

6.1 The soil samples brought to the laboratory were subjected to various tests to determine the following properties

a) Type of soil and its gradation

b) Consistency limits

c) Natural density

d) Natural water content

e) Shear strength properties

6.2 In order to determine the above properties listed in 6.2, the following tests were conducted.

a) Sieve analysis on the coarse grained soil fraction

b) Hydrometer analysis on the fine grained soil fraction

c) Liquid and plastic limits

d) Natural Density and Water Content tests

e) Triaxial compression tests

f) Free Swell Index tests

7.0 RESULTS AND ANALYSIS

7.1 Presentation of Results

7.1.1 The results of borehole investigations and of the laboratory investigations conducted on the soil samples collected from the boreholes have been presented in the form of soil profile tables in Table Nos. 1 & 2.

7.1.2 The soil profile tables indicate the following:

a) Standard Penetration Test Values (i.e. N- values observed) at various depths

b) Soil description identifying the type of soil

c) Grain size analysis indicating composition of subsoil

d) Consistency limits

e) In-situ bulk density and Water content

f) Triaxial compression test results

7.2 Analysis of Soil Profile

7.2.1 A perusal of the data presented in the soil profile tables indicate the presence of the following soil strata.

a) Stratum - I : Filled-Up (Building materials)

b) Stratum - II : Brown silty sand

c) Stratum - III : Grey sandy silty clay

d) Stratum - IV : Refusal strata - Grey completely weathered rock (Charnockite Based)

7.2.2 The thicknesses in each borehole of each strata described in 7.2.1 is given in the table below:

BH. No.	Depth (m) : from - to			
	Stratum - I	Stratum - II	Stratum - III	Stratum - IV
1	0.0 - 2	2 - 12	12 - 22.5	22.5 - 25.5
5	-	0.0 - 11.8	11.8 - 22	22 - 25

7.2.3 The above results show that :

a) Stratum - I consisting of Filled-up strata (Building materials) strata has been encountered down to the depth of 2m below existing ground level only at the location of borehole BH1.

b) Stratum - II (Brown silty sand) consisting significant percentages of sand and varying percentages of silt, has been encountered from ground level/2m to 11.8/12m below existing ground level.

c) Stratum - III consisting of Grey sandy silty clay having significant percentages of clay and varying percentages of silt and sand, has been encountered from 11.8/12m to 22/22.5m depth below existing ground level.

d) Stratum - IV comprising of Refusal strata (grey completely weathered rock - Charnockite based) was encountered from 22/22.5m down to termination depths of 25/25.5m below existing ground level.

7.3 Soil Composition

7.3.1 The grain size distribution of the soil samples at various depths, as determined in the laboratory have been presented in the form of grain size analysis curves in figs. 3a to 3d.

7.3.2 The variations in the grain size distribution - strata wise across the boreholes are as follows:

a) Stratum - II : Brown silty sand

BH No.	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
1	0	92 - 98	2 - 8	0
2	0	93 - 97	3 - 7	0

b) Stratum - III : Grey sandy silty clay

BH No.	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
1	0	10 - 15	34 - 38	47 - 54
2	0	11 - 23	36 - 39	45 - 52

7.3.3 The above results indicate that :

a) Stratum - II consists of about of 2 - 8% silt and 92 - 98% of sand.

b) Stratum - III consists of about 10 - 23% of sand 34 - 39% of silt and 45 - 54 % of clay.

7.4 In-situ Density and Water Content

7.4.1 The in-situ bulk densities, water contents and dry densities obtained from undisturbed soil samples are tabulated below.

BH No.	Depth (m)	In-situ Bulk Density (g/cm^3)	Water Content (%)	Dry Density (g/cm^3)
1	3	1.86	6.2	1.75
	13.5	1.81	25.7	1.44

BH No.	Depth (m)	In-situ Bulk Density (g/cm³)	Water Content (%)	Dry Density (g/cm³)
	21	1.82	25.7	1.45
	2	1.83	7.1	1.71
	3.5	1.85	6.6	1.74
2	12.5	1.80	23.1	1.46
	17	1.82	25.7	1.45
	18.5	1.83	25.2	1.46

7.4.2 The dry densities indicate that the sub soil is in a soft state. Undisturbed soil samples could not be collected below 4.5m depth as the samples were cohesionless and sampling was done below ground water table level and beyond 11.8/12m depth the samples wire is a soft state and sampling was done below ground water table level.

7.5 Consistency Limits

7.5.1 The Consistency Limits determined for the soil in Stratum - II (Brown silty sand) indicate that the soil in this strata is non plastic in nature.

7.5.2 The Consistency Limits determined for the soil in Stratum - III (Grey sandy silty clay) indicate that the liquid limit varies between 57% to 66%, plastic limit varies between 20% to 28% and plasticity index varies between 37% to 38%.

7.5.3 The Consistency Limits determined indicate that the soil in

a) Stratum - II (Brown silty sand) is non plastic in nature.

b) Stratum - III (Grey sandy silty clay) is high plastic in nature.

7.6 Standard Penetration Tests

7.6.1 Standard Penetration Test values (N-values observed) are presented in the soil profile table nos.1 & 2.

7.6.2 Standard Penetration Test values (N-values observed) have also been presented in form

of plots of N-values vs depth in fig. 4.

7.6.3 The soil strata encountered from ground level down to 11.8/12m depth below existing ground level is in a medium dense state with N-values ranging between 8 & 14 and beyond 11.8/12m depth is in a soft state with N-values ranging between 4 & 7 down refusal strata encountered at depths varying between 21m & 21.5m below existing ground level.

7.7 Triaxial Test Results

7.7.1 The cohesion 'c' obtained from triaxial test is negligible and the angle of shearing resistance ϕ of the soil varies between 30° & 32°.

7.8 Free Swell Index

7.8.1 The free swell index of the soil samples collected at various depths are given below:

BH. No.	Free Swell Index (%) at Depth (m)			
	1.5	2	3	3.5
1	-	1.1	-	0.8
2	1.7	-	1.2	-

7.8.2 The above results indicate that the soil strata is low swelling in nature. Hence, the excavated soil can be used for backfilling purposes.

7.9 Compiled Soil Profile

7.9.1 An overview of the results and their analysis has been presented in the form of a compiled soil (fig. 2).

7.9.2 The above figure shows the various strata encountered and their thicknesses in each of the boreholes and also gives the soil composition and the observed N-values at various depths along with the depth at which undisturbed soil samples were collected.

8.0 *DESIGN CRITERIA*

8.1 Design Parameters

8.1.1 The parameters required for the design of foundation system for the proposed structure 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

8.1.2 On the basis of the analysis of the results of investigations, the required design parameters have been arrived at and are given in the following sections.

8.2 Type of Foundations

8.2.1 The type of foundation depends on the following:

a) Subsoil conditions

b) Type of structure

c) Configuration at loading points

d) Loading intensity on each sub-structure/structural element.

8.2.2 As per information provided by the client, the proposed commercial building consists of an open stilt floor at ground level and three upper floors.

8.2.3 The results of the investigations have shown that the subsoil encountered from ground level down to 11.8/12m depth below existing ground level is in a medium dense state and beyond 11.8/12m depth is in a soft state down refusal strata encountered at depths varying between 21m & 21.5m below existing ground level.

8.2.4 In view of the above, *Shallow Foundations - Isolated /Strip Footings* can be adopted for the proposed commercial building.

8.3 Depth of Foundations

8.3.1 The depth at which shallow foundations should be laid will be governed by the following criteria.

a) Top filled up strata/loose soil, if any

b) There should be sufficient thickness of soil above the footing/foundations so that the bearing capacity of the soil can be fully mobilised.

c) Soil below the level of footings/foundations should have the requisite strength to support the anticipated bearing pressures on the foundations without allowing the settlement of footings/foundations to exceed the acceptable limits.

d) Requirements of the type of structure (commercial building consisting of an open stilt floor at ground level and three upper floors).

8.3.2 The results of the investigations have shown the soil strata encountered from ground level down to 11.8/12m depth below existing ground level is in a medium dense state and beyond 11.8/12m depth is in a soft state down refusal strata encountered at depths varying between 21m & 21.5m below existing ground level..

8.3.3 In view of the above factors, shallow foundations of the proposed commercial building can be made to rest at a minimum depth of *2m below the existing ground level*. The soil available at the founding level will be Brown silty sand.

8.4 Allowable Bearing Pressure

8.4.1 Allowable bearing pressure has been evaluated by:

a) Shear failure criteria based on the average soil data

b) Settlement criteria based on the SPT values (N-values)

c) Settlement criteria based on deformation modulus

8.4.2 An allowable settlement of 50mm has been considered to evaluate the allowable bearing

pressure for Isolated/Strip Footings.

8.4.3 A water table correction factor of 0.5 has been considered.

8.4.4 On the basis of the above analysis, *net allowable bearing pressure of 11t/m²* can be adopted for foundations laid at 2m depth below existing ground level for widths of foundations *≥1.5m.*

9.0 RECOMMENDATIONS

9.1 Type of Foundations

Shallow Foundations - Isolated/Strip Footings

9.2 Depth of Foundations

Minimum 2m below the existing ground level

9.3 Net Allowable Bearing Pressure

Net allowable bearing pressure of 11t/m² for widths of foundations ≥1.5m for an allowable settlement of 50mm.

9.4 Notes

9.4.1 The recommendations given in this report have been arrived at on the basis of design parameters which have been judiciously adopted by giving due consideration to the results of field and laboratory investigations as well as NAGADI's experience of over four decades in working in various types of soil and rock conditions all over India.

9.4.2 The entire report should be studied before adopting the recommendations given in the report.

9.5 Construction Advisories

9.5.1 The soil of each strata has been described with name, colour etc. During excavation, any variations observed in the nature and condition of the soil from those given in this Report should be noted and appropriate action should be taken.

9.5.2 The excavated soil can be used for backfilling purposes.

9.5.3 The foundation surface should be watered for at least 24 hours. The top slush should then be removed and the surface compacted heavily. If any loose pockets are observed, the same shall be filled with brickbats/ gravel and compacted well. Foundations can subsequently be placed over such a prepared surface.

9.5.4 Stiff Tie-beams connecting the columns in both directions may be provided which will render additional rigidity to the structure.

9.6 Appendices

9.6.1 The typical analysis of the Allowable Bearing Pressure has been given in Appendix-A of this report.

9.6.2 The List of IS codes referred for providing the recommendations and that which might be required to implement the same have been given in Appendix-B of this report.

10.0 LIMITATIONS

This Geotechnical investigation has been carried out at locations in the site chosen by the client as representing the entire site. The recommendations provided in this Report are hence valid only for those test locations. However, if there is any change in the subsoil conditions and properties at places between or beyond the chosen test locations, Nagadi may be contacted for further actions. Fresh investigations will have to be carried out at such locations.

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ANALYSIS FOR ALLOWABLE BEARING PRESSURE

Data

(i) Soil Properties :

c (kg/cm^2) = Nil $\phi = 30°$ γ (g/cm^3) = 1.85

(ii) Depth of Foundation, D (m) = 2

(iii) Allowable Settlement, s (mm) = 50

Shear Failure Criterion (Ref. IS : 6403)

$N_c = 25.38$ $N_q = 14.63$ $N_\gamma = 17.01$ $R_w = 0.50$ $R_w' = 0.50$

$$q_s = \frac{1}{3}\left(c \cdot N_c + \gamma . D \cdot N_q \cdot R_w + 0.5 \cdot \gamma \cdot B \cdot N_\gamma \cdot R'_w\right) - \gamma . D . R_w$$

B (m)	1.5	≤3
q_s (t/m^2)	11.1	15.0

Settlement Criterion (Ref. IS : 8009)

(i) From N Values

B (m)	1.5	≤3
H (m)	3	6
N_{av}	12	14
q_a (t/m^2)	11.2	11.5

*(ii) From Triaxial Compression Tests** : $q_a = \dfrac{s \cdot E}{0.7 \cdot H}$

B (m)	1.5	≤3
H (m)	3	6
E (kg/cm^2)	90	100
q_a (t/m^2)	21.4	11.9

ADOPT	**B (m)**	**1.5**	**≤3**
	q (t/m^2)	**11**	**11**

Note : *q_s and q_a are NET VALUES, Weight of backfill etc. need not be added to the loading except in case of filling above original G.L.*

LIST OF IS CODES

Field Investigation

1. IS : 1498 - 1970 : Classification and identification of soils for general engineering purposes (First Revision) (Amendment 2)
2. IS : 1892 - 1979 : Code of practice for sub surface investigations for foundations (First revision)
3. IS : 2131 - 1981 : Method of Standard Penetration Tests for soils (First revision)
4. IS : 2132 - 1986 : Code of practice for thin walled tube sampling of soils (Second revision)

Laboratory Tests

1. IS : 2720 - 1983 (Part 1) : Methods of test for soils: Preparation of dry soil samples for various tests (Second revision)
2. IS : 2720 - 1980 (Part 2) : Method of test for soils: Determination of water content (Second revision) Amendment 1
3. IS : 2720 - 1980 (Part 3/Sec 1) : Method of test for soils : Determination of Specific Gravity : Fine grained soils. (First revision)
4. IS : 2720 - 1980 (Part 3/Sec 2) : Method of test for soils : Determination of Specific Gravity : Fine, Medium & Coarse grained soils. (First revision).
5. IS : 2720 - 1985 (Part 4) : Method of test for soils : Grain size analysis (Second revision)
6. IS : 2720 - 1985 (Part 5) : Method of test for soils : Determination of liquid and plastic limit (Second revision)
7. IS : 2720 - 1977 (Part 40) : Methods of tests for soils: Determination of free swell index of soils.

Foundation Construction

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

SOIL PROFILE

Project: Commercial Building at Arcot Road, Porur, Chennai - 600 116

B.H. Location: | Water Table: 4.5m | Term. Depth : 25.5m | B.H. No. : 1

N - Value#	Depth (m)	Soil Description	Grain Size Analysis				Atterberg Limits		In-situ properties		Triaxial Test		
			Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid (%)	Plastic (%)	Density* (g/cm³)	Water Cont (%)	Type	c (kg/cm²)	ϕ (°)
	0.0	Ground level											
	1.3	Filled up (Building materials)											
11	2.0	Brown silty sand	0	96	4	0	-	NP					
	3.0	Brown silty sand							1.86	6.2	DS	-	28
13	3.5	Brown silty sand	0	97	3	0	-	NP					
	4.5	Brown silty sand							Sample slipped				
11	5.0	Brown silty sand	0	94	6	0	-	NP					
	6.0	Brown silty sand							Sample slipped				
14	6.5	Brown silty sand	0	95	5	0	-	NP					
	7.5	Brown silty sand							Sample slipped				
10	8.0	Brown silty sand	0	96	4	0	-	NP					
	9.0	Brown silty sand							Sample slipped				
11	9.5	Brown silty sand	0	98	2	0	-	NP					
	10.5	Brown silty sand							Sample slipped				
11	11.0	Brown silty sand	0	92	8	0	-	NP					
	12.0	Change of strata							Soft sample				
6	12.5	Grey sandy silty clay	0	15	35	50	58	25	1.81	25.7	Soft sample		
	13.5	Grey sandy silty clay											

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Sheet No. :1

SOIL PROFILE

Project: Commercial Building at Arcot Road, Porur, Chennai - 600 116

B.H. Location: | Water Table: 4.5m | Term. Depth : 25.5m | B.H. No. : 1

N - Value#	Depth (m)	Soil Description	Grain Size Analysis				Atterberg Limits		In-situ properties		Triaxial Test		
			Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid (%)	Plastic (%)	Density* (g/cm³)	Water Cont (%)	Type	c (kg/cm²)	ϕ (°)
4	14.0	Grey sandy silty clay	0	13	36	51	59	25					
	15.0	Grey sandy silty clay							1.81	25.7	Soft sample		
4	15.5	Grey sandy silty clay	0	11	37	52	62	25					
	16.5	Grey sandy silty clay									Soft sample		
4	17.0	Grey sandy silty clay	0	15	38	47	57	26					
	18.0	Grey sandy silty clay									Soft sample		
6	18.5	Grey sandy silty clay	0	10	36	54	66	23					
	19.5	Grey sandy silty clay									Soft sample		
5	20.0	Grey sandy silty clay	0	14	34	52	60	26					
	21.0	Grey sandy silty clay							1.82	25.7	Soft sample		
6	21.5	Grey sandy silty clay	0	15	37	48	58	24					
		Change of strata											
>100 (50/8cm)	22.5	Grey completely Weathered Rock (Charnockite based)											
>100 (35/Nil)	24.0	Grey completely Weathered Rock (Charnockite based)											
>100 (35/Nil)	25.5	Grey completely Weathered Rock (Charnockite based)											

*-Natural Bulk Density # -N Values (Observed)

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Job No. : G(C)9787A

Sheet No.2

SOIL PROFILE

Project: Commercial Building at Arcot Road, Porur, Chennai - 600 116

B.H. Location:

Water Table: 4.5m

Term. Depth : 25.0m

B.H. No. : 2

N - Value#	Depth (m)	Soil Description	Grain Size Analysis				Atterberg Limits		In-situ properties		Triaxial Test		
			Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid (%)	Plastic (%)	Density* (g/cm³)	Water Cont (%)	Type	c (kg/cm²)	ϕ (°)
	0.0	Ground level											
8	1.5	Brown silty sand	0	95	5	0	-	NP					
	2.0	Brown silty sand							1.83	7.1	DS	-	30
10	3.0	Brown silty sand	0	96	4	0	-	NP					
	3.5	Brown silty sand							1.85	6.6	DS	-	32
12	4.5	Brown silty sand	0	94	6	0	-	NP					
	5.0	Brown silty sand							Sample slipped				
8	6.0	Brown silty sand	0	95	5	0	-	NP					
	6.5	Brown silty sand							Sample slipped				
11	7.5	Brown silty sand	0	94	6	0	-	NP					
	8.0	Brown silty sand							Sample slipped				
10	9.0	Brown silty sand	0	97	3	0	-	NP					
	9.5	Brown silty sand							Sample slipped				
11	10.5	Brown silty sand	0	93	7	0	-	NP					
	11.0	Brown silty sand							Soft sample				
	11.8	Change of strata											
6	12.0	Grey sandy silty clay	0	23	36	41	50	20					
	12.5	Grey sandy silty clay							1.80	23.1	Soft sample		

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Job No. : G(C)9787A

Sheet No. :3

SOIL PROFILE

Project: Commercial Building at Arcot Road, Porur, Chennai - 600 116

B.H. Location: | Water Table: 4.5m | Term. Depth : 25.0m | B.H. No. : 1

N - Value#	Depth (m)	Soil Description	Grain Size Analysis				Atterberg Limits		In-situ properties		Triaxial Test		
			Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid (%)	Plastic (%)	Density* (g/cm³)	Water Cont (%)	Type	c (kg/cm²)	ϕ (°)
4	13.5	Grey sandy silty clay	0	16	39	45	54	23	Soft sample				
	14.0	Grey sandy silty clay											
5	15.0	Grey sandy silty clay	0	13	39	48	59	24	Soft sample				
	15.5	Grey sandy silty clay											
6	16.5	Grey sandy silty clay	0	11	37	52	63	26	1.82	25.1	Soft sample		
	17.0	Grey sandy silty clay											
7	18.0	Grey sandy silty clay	0	15	38	47	58	23	1.83	25.2	Soft sample		
	18.5	Grey sandy silty clay											
5	19.5	Grey sandy silty clay	0	12	38	50	60	25	Soft sample				
	20.0	Grey sandy silty clay											
6	21.0	Grey sandy silty clay	0	14	37	49	59	25					
		Change of strata											
>100 (50/10cm)	22.0	Grey completely Weathered Rock (Charnockite based)											
>100 (35/Nil)	23.5	Grey completely Weathered Rock (Charnockite based)											
>100 (35/Nil)	25.0	Grey completely Weathered Rock (Charnockite based)											

*-Natural Bulk Density # -N Values (Observed)

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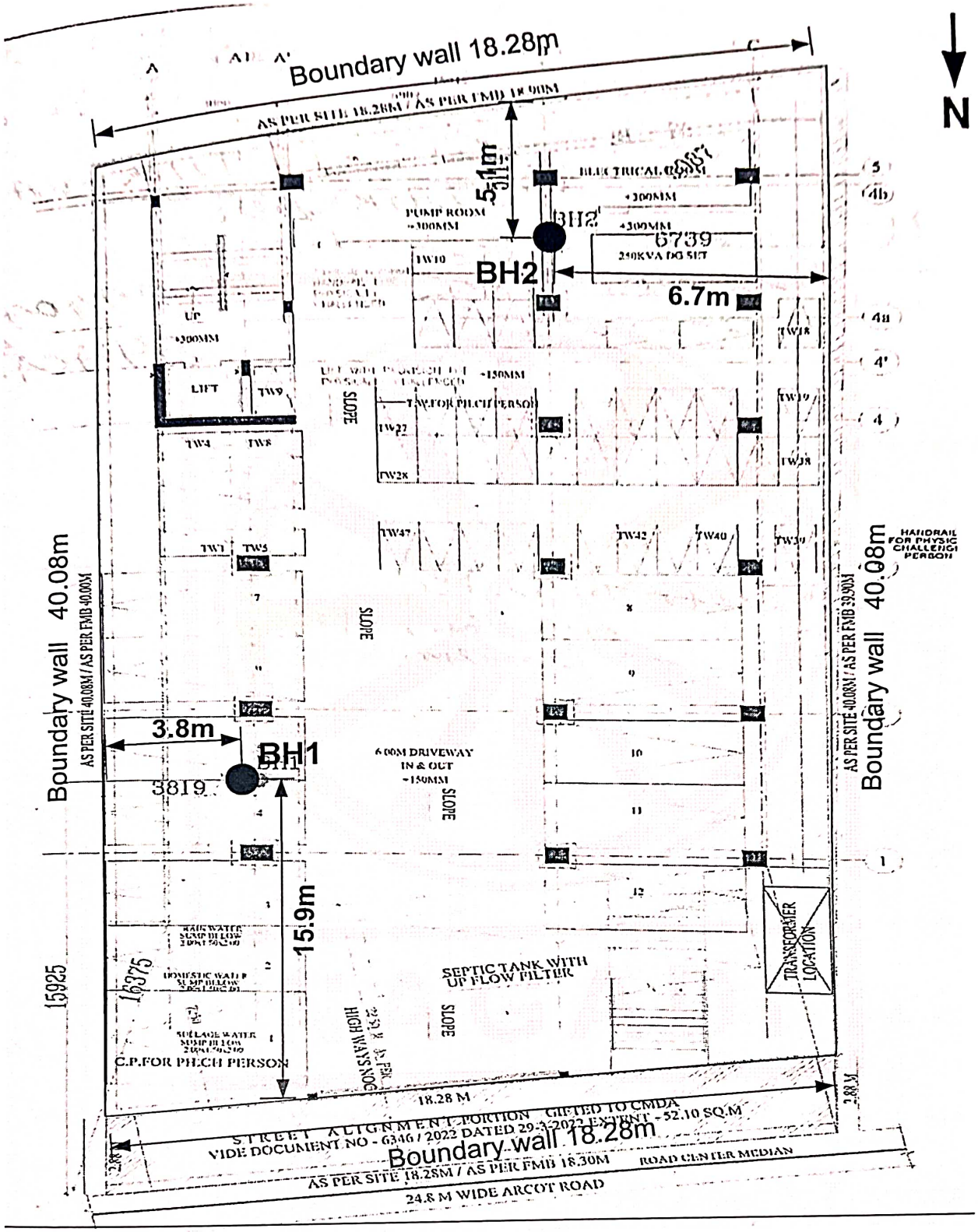
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Job No. : G(C)9787A

Sheet No.4



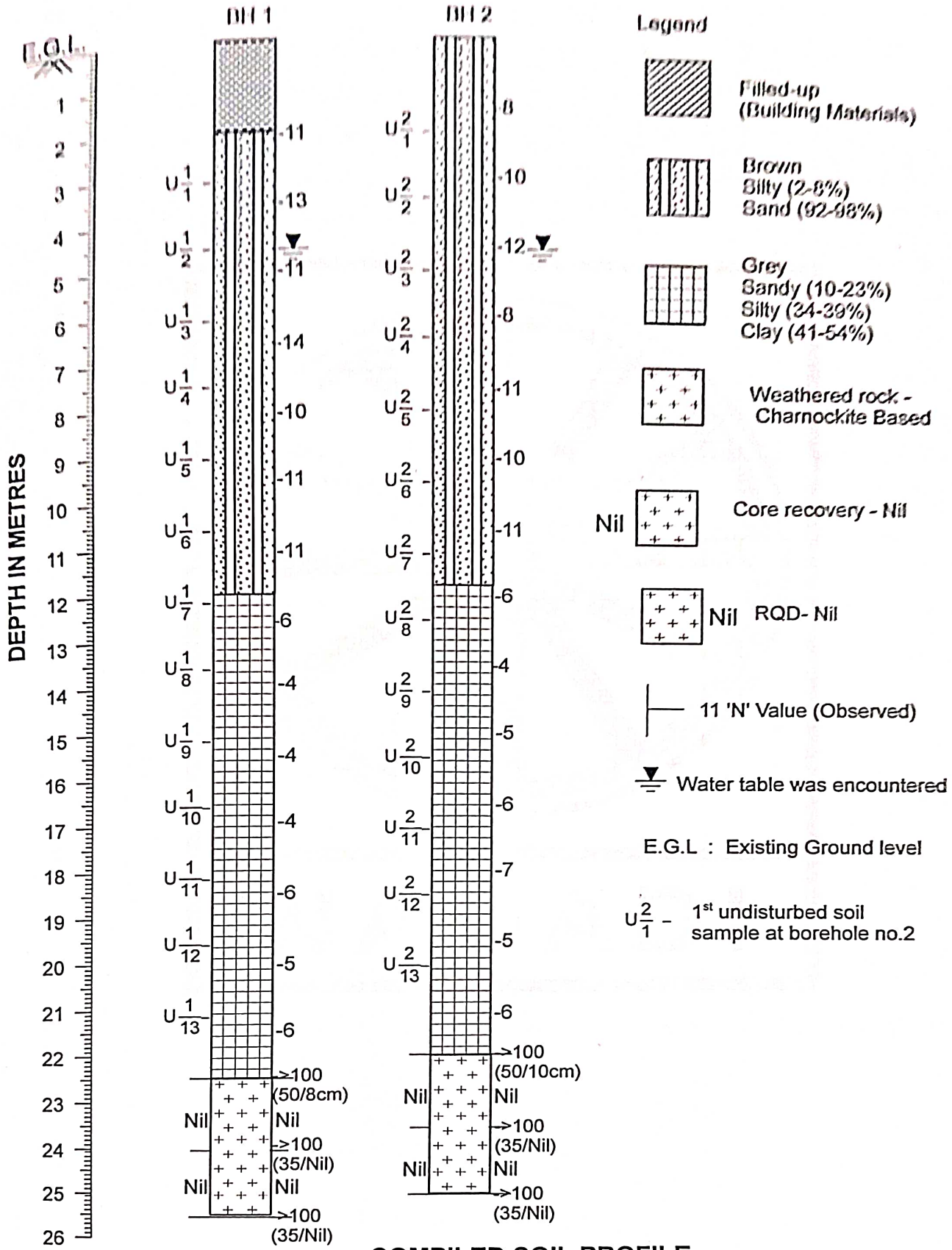
SCHEMATIC SITE PLAN
(NOT TO SCALE)

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Sheet No. : 1



COMPILED SOIL PROFILE

PROJECT : Commercial Building at Porur, Chennai – 600 116

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Job No. G(C)9787A

Sheet No. : 2

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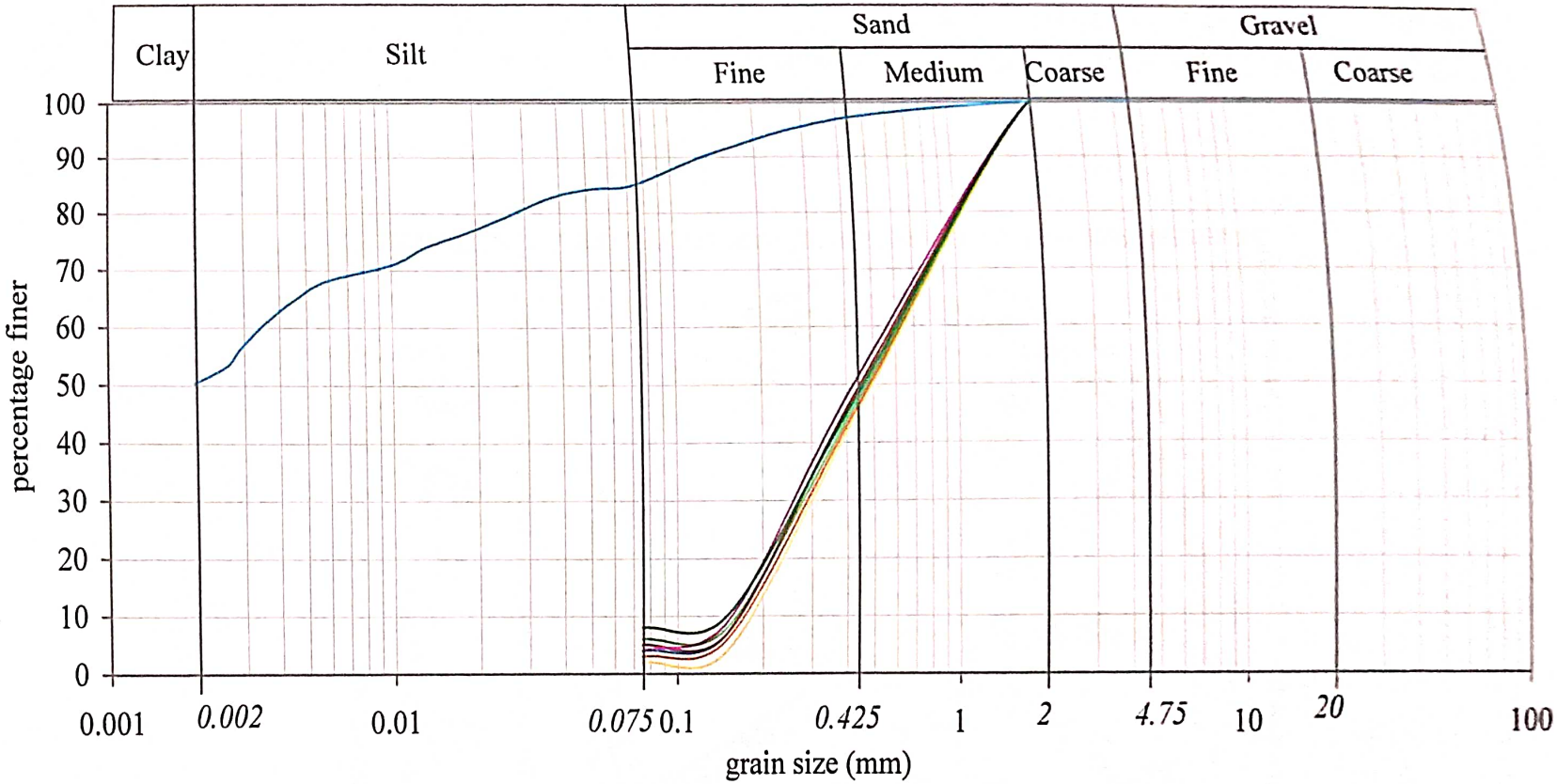
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Job No. : G(C)9787A

Sheet No. : 3a



Line Style	Bore hole	Depth (m)	Description	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	d_{60}	d_{10}	U
	1	2.0	Silty sand	0	96	4	0	0.625	0.18	3.5
	1	3.0	Silty sand	0	97	3	0	0.625	0.18	3.5
	1	5.0	Silty sand	0	94	6	0	0.625	0.17	3.7
	1	6.5	Silty sand	0	95	5	0	0.625	0.18	3.5
	1	8.0	Silty sand	0	96	4	0	0.625	0.17	3.7
	1	9.5	Silty sand	0	98	2	0	0.625	0.19	3.3
	1	11.0	Silty sand	0	92	8	0	0.625	0.15	4.2
	1	12.5	Sandy silty clay	0	15	35	50	0.002	-	-

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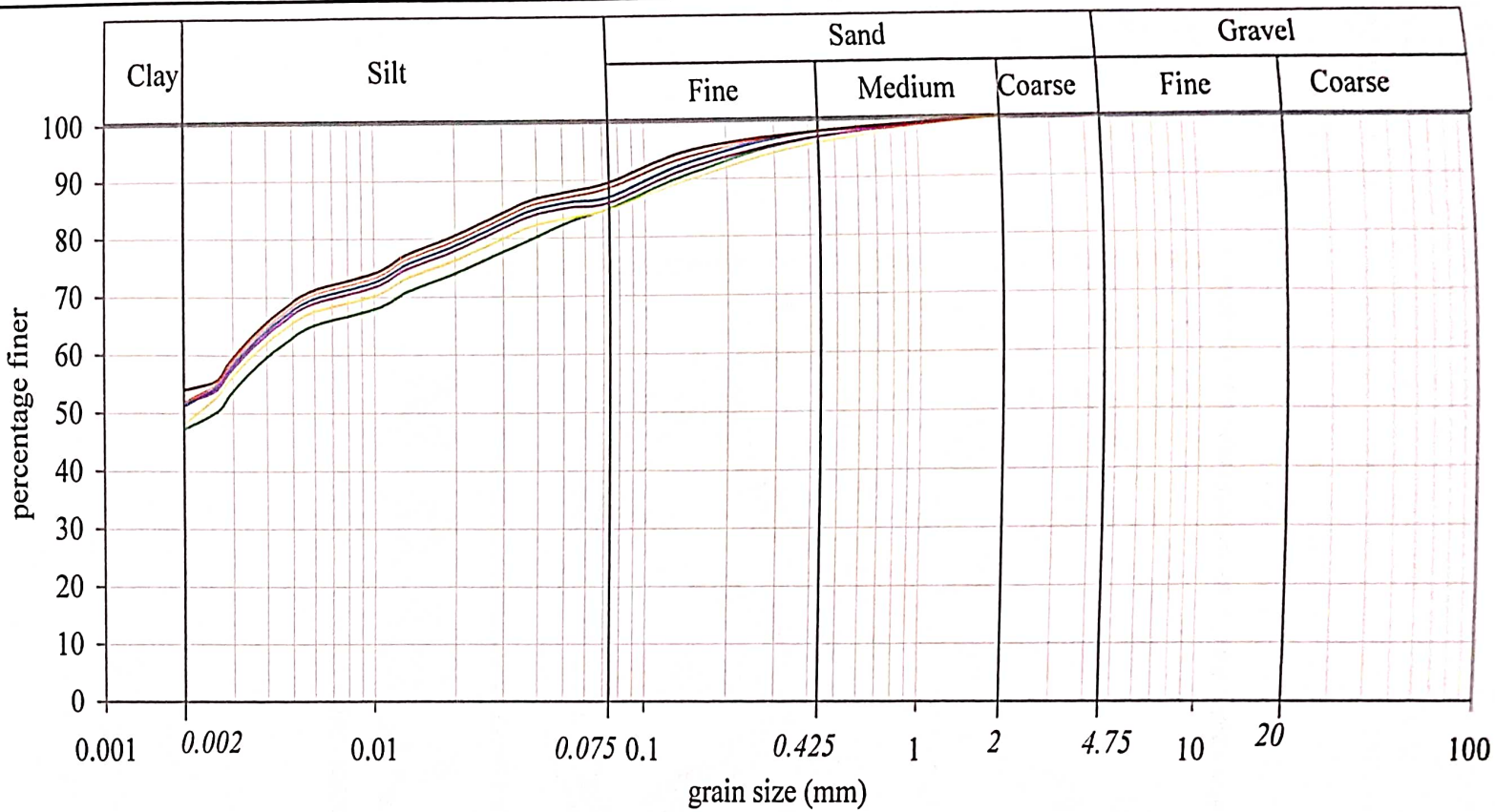
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Job No. : G(C)9787A

Sheet No. : 3b



Line Style	Bore hole	Depth (m)	Description	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	d_{60}	d_{10}	U
	1	14.0	Sandy silty clay	0	13	36	51	0.003	-	-
	1	15.5	Sandy silty clay	0	11	37	52	0.003	-	-
	1	17.0	Sandy silty clay	0	15	38	47	0.003	-	-
	1	18.5	Sandy silty clay	0	10	36	54	0.003	-	-
	1	20.0	Sandy silty clay	0	14	34	52	0.003	-	-
	1	21.5	Sandy silty clay	0	15	37	48	0.004	-	-

Line Style	Bore hole	Depth (m)	Description	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	d_{60}	d_{10}	U
	2	1.5	Silty sand	0	95	5	0	0.625	0.17	3.7
	2	3.0	Silty sand	0	96	4	0	0.625	0.18	3.5
	2	4.5	Silty sand	0	94	6	0	0.625	0.17	3.7
	2	6.0	Silty sand	0	95	5	0	0.625	0.18	3.5
	2	7.5	Silty sand	0	94	6	0	0.625	0.17	3.7
	2	9.0	Silty sand	0	97	3	0	0.625	0.18	3.5
	2	10.5	Silty sand	0	93	7	0	0.625	0.16	3.9
	2	12.0	Sandy silty clay	0	23	36	41	0.008	-	-

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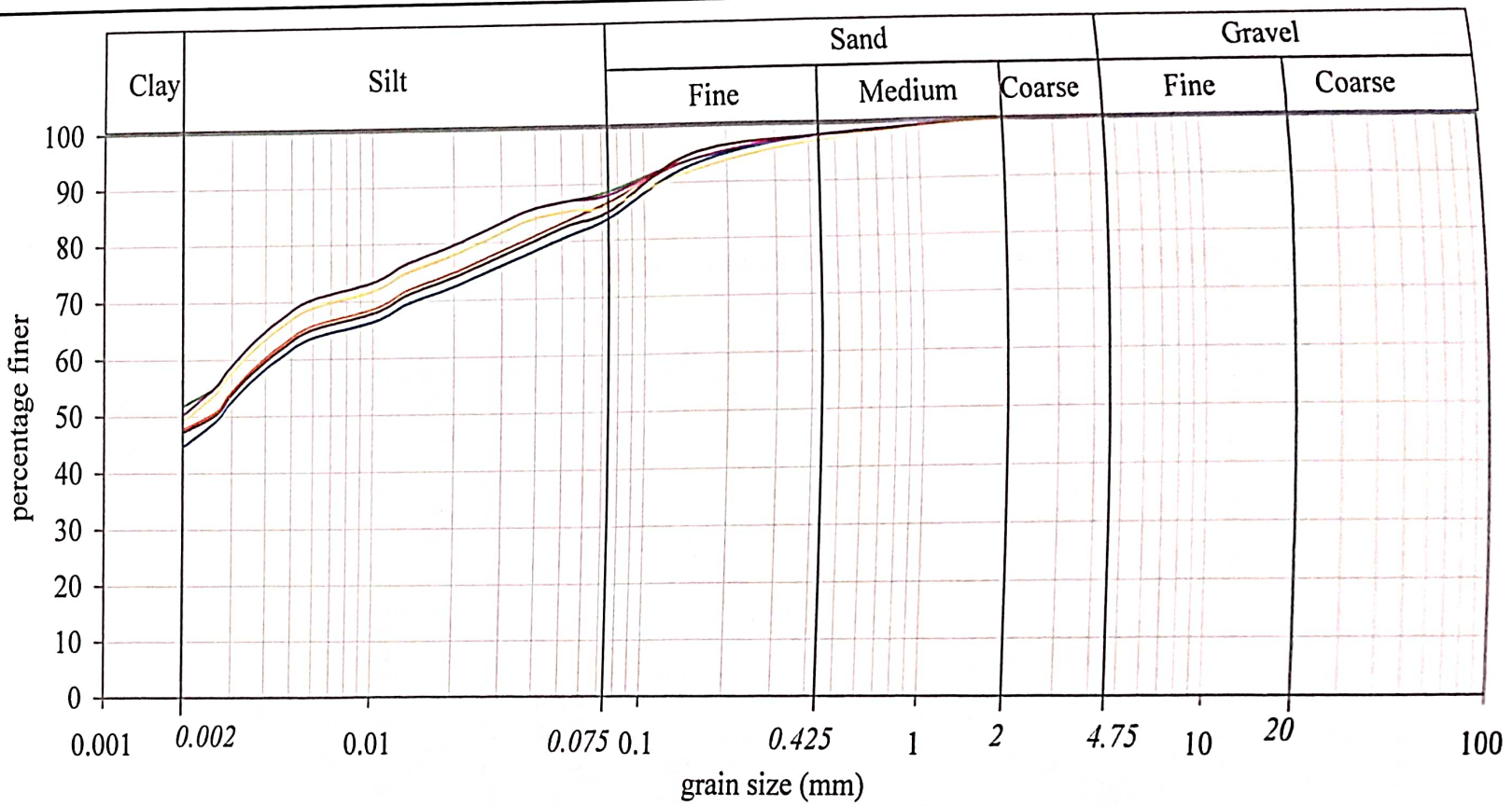
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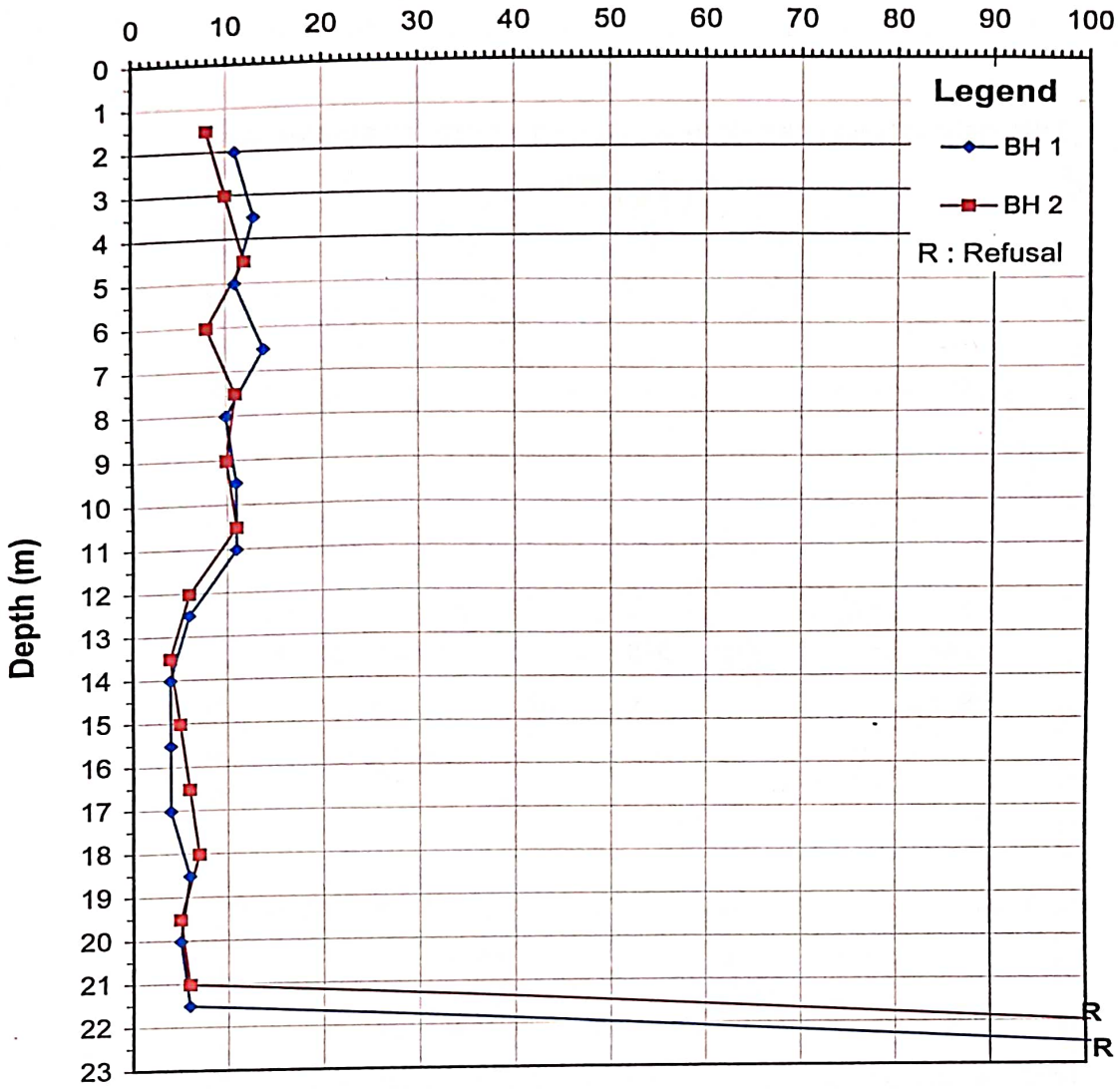
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Sheet No. : 3d



Line Style	Bore hole	Depth (m)	Description	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	d_{60}	d_{10}	U
	2	13.5	Sandy silty clay	0	16	39	45	0.005	-	-
	2	15.0	Sandy silty clay	0	13	39	48	0.004	-	-
	2	16.5	34	0	11	37	52	0.003	-	-
	2	18.0	Sandy silty clay	0	15	38	47	0.004	-	-
	2	19.5	Sandy silty clay	0	12	38	50	0.003	-	-
	2	21.0	Sandy silty clay	0	14	37	49	0.003	-	-

SPT Values (Observed)



SPT Values (Observed) Vs Depth Curves

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