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GEOTECHNICAL REPORT FOR

RESIDENTIAL BUILDING AT PONNAMBALAM SALAI, K.K.NAGAR, CHENNAI - 600 078

Client :
M/s. KCee Properties Private Limited,
Chennai.

Architect :

Consultant :

Structural Consultant :

Job No. : G(C)9789 Date : 28.02.2023

NAGADI CONSULTANTS PRIVATE LIMITED

Branch :

Chennai

Project :

RESIDENTIAL BUILDING AT PONNAMBALAM SALAI, K.K.NAGAR, CHENNAI - 600 078

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GEOTECHNICAL INVESTIGATION REPORT

for Residential Building at Ponnambalam Salai,

K.K.Nagar, Chennai - 600 078

EXECUTIVE SUMMARY

M/s. KCee Properties Private Limited, Chennai are associated in construction of a Residential Building at Ponnambalam Salai, K.K.Nagar, Chennai - 600 078.

The site for the proposed residential building is situated at Block No. S 17 & S 18, Door Nos. 106/1, 106/2, 106/3, 106/4, 106/5, 106/6, 106/7, 106/8, 106/9, 106/10, 106/11 & 106/12 on eastern side of 71 street, 11th sector and on western side of Ponnambalam Salai in K.K.Nagar, Chennai - 600 078. The site measures approximately 23.5m x 28.7m. The site is having boundary wall on all the sides and is fairly level in topography. As per the information provided by the client, the existing three storeyed buildings within the site will be demolished prior to the construction of the new building. Vegetation in the form of trees was observed within the site during the period of field investigations. A well of 1.2m diameter is existing on the north western corner of the site and ground water table was noticed at 1.5m depth in the well during the period of field investigations.

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

Geotechnical investigations have been undertaken at the site as per the scope of investigations, stipulated by the client, which consisted of conducting two boreholes down to 8m depth.

The results of borehole investigations indicate the presence of Brown sandy silty clay/clayey silty sand down to the termination depth of the boreholes of 8m below existing ground level.

The soil strata is in a medium stiff / medium dense state down to the investigated depth of 8m below existing ground level.

Ground water table was encountered between 1.9m and 2m 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 Foundations - Isolated/Strip Footings laid at a depth of 3m below the existing ground level with a Net allowable bearing pressure of 9t/m^2 (9kg/cm^2) for widths of foundations ≥1.5m.*

The excavated soil cannot be used for backfilling purposes as the soil is predominantly medium swelling type.

After the excavation for the foundations, the top slush should 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.

The top soil is of medium swelling type. Hence, there will be upward thrust on the ground floor flooring with increase in moisture content. Therefore, considering the proposed floor level to be at the existing ground level, top 30-40cm of natural soil is to be removed and replaced with sand/gravel with addition of lime at 2kg/m² on the underlying soil as well as in the filling for ground floor flooring.

There is a well located in the site. In case, the well is not utilised, the well can be closed by back filling with sand-gravel mix. The back filling should be done in layers and well compacted. Incase, the well is to be utilised, the sides should be properly lined. Additionally the distance of the nearest footing to the well should not be less than 1 time the width of the foundation.

REPORT ON GEOTECHNICAL INVESTIGATION FOR

RESIDENTIAL BUILDING AT PONNAMBALAM SALAI,

K.K.NAGAR, CHENNAI - 600 078

1.0 INTRODUCTION

1.1 Overview

1.1.1 M/s. KCee Properties Private Limited, Chennai are associated in construction of a Residential Building at Ponnambalam Salai, K.K.Nagar, Chennai - 600 078.

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

1.2 Authority

A detailed geotechnical investigations programme has been conducted as per the oral authorisation by M/s. KCee Properties Private Limited, Chennai vide their mail confirmation dated 08.02.2023

2.0 PROJECT DETAILS

2.1 Site Location

The site for the proposed residential building is situated at Block No. S 17 & S 18, Door Nos. 106/1, 106/2, 106/3, 106/4, 106/5, 106/6, 106/7, 106/8, 106/9, 106/10, 106/11 & 106/12 on eastern side of 71 street, 11th sector and on western side of Ponnambalam Salai in K.K.Nagar, Chennai - 600 078.

2.2 Site Layout and Topography

2.2.1 The site measures approximately 23.5m x 28.7m. The site is having boundary wall on all the sides and is fairly level in topography. As per the information provided by the client, the existing three storeyed buildings within the site will be demolished prior to the construction of the new building. Vegetation in the form of trees was observed within the site during the period of field investigations. A well of 1.2m diameter is

existing on the north western corner of the site and ground water table was noticed at 1.5m depth in the well 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 Residential building will consist of an open stilt floor at ground level and five upper floors.

2.4 Seismic Zone

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

2.5 Geographical Information

2.5.1 Site for the proposed residential building is located at:

a) Latitude : 13°02'

b) Longitude : 80°11'

3.0 OBJECT OF INVESTIGATIONS

3.1 For designing the foundation system of the proposed residential 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 8m depth, 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 third week of February 2023.

5.2 Boreholes

5.2.1 The boreholes were progressed by shell and auger method.

5.2.2 The boreholes were terminated at 8m depth below the existing ground level as per the stipulated scope of work.

5.2.3 The depths at which ground water table was encountered in the boreholes during the period of field investigations and termination depths of the boreholes are given below:

BH. No.	Depth of Ground Water Table Below EGL (m)	Termination Depth Below EGL (m)
1	2	8
2	1.9	8

5.2.4 Ground water table was encountered between 1.9m and 2m depth in the boreholes during the period of field investigations.

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

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

5.2.7 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

f) Swell Pressure

g) Consolidation Properties

6.2 In order to determine the above properties listed in 6.1, 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

g) Swell Pressure tests

h) Consolidation 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 substrata.

a) Stratum - I : Brown sandy silty clay

b) Stratum - II : Brown silty sand

c) Stratum - III : Brown clayey silty sand

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
1	0.0 - 2 2.6 - 8	2 - 2.6	-
2	2.9 - 8	-	0.0 - 2.9

7.2.3 The above results show that :

a) Stratum - I consisting of Brown sandy silty clay having significant percentages of clay and varying percentages of sand and silt, has been encountered from Ground level /2.6/2.9m depth to 2/8m depth below existing ground level.

b) Stratum - II consisting of Brown silty sand having significant percentages of sand and varying percentages of silt, has been encountered from 2m down to 2.6m depth below existing ground level, only at the location of borehole BH1.

c) Stratum - III consisting of Brown clayey silty sand having significant percentages of sand and varying percentages of silt and clay, has been encountered from ground level down to 2.9m depth below existing ground level only at the location of borehole BH2.

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 & 3b.

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

a) Stratum - I : Brown sandy silty clay

BH No.	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
1	0	11 - 16	35 - 38	46 - 52
2	0	13 - 18	36 - 37	46 - 51

b) Stratum - II : Brown silty sand

BH No.	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
1	0	81	19	0

This stratum was encountered only at the location of borehole BH 1.

c) Stratum - II : Brown clayey silty sand

BH No.	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
2	0	59 - 71	19 - 26	10 - 51

This stratum was encountered only at the location of borehole BH 2.

7.3.3 The above results indicate that :

a) Stratum - I consists of about 11 - 18% of sand, 35 - 38% of silt and 46 - 52% of clay.

b) Stratum - II consists of about 19% of silt and 81% of sand.

c) Stratum - III consists of about 10 - 51% of clay, % of silt and 59 - 71% of sand.

7.4 In-situ Bulk 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	3.5	1.88	24.9	1.51
	5	1.90	24.2	1.53
	7	1.93	22.9	1.57
2	1.5	1.80	12.7	1.60
	3	1.86	24.2	1.50
	4.5	1.89	23.3	1.53
	6	1.92	21.5	1.58

7.4.2 The dry densities indicate that the soil strata is in a medium stiff / medium dense state down to the investigated depth of 8m below existing ground level.

7.5 Consistency Limits

7.5.1 The Consistency Limits determined for the soil in Stratum - I (Brown sandy silty clay) indicates that the liquid limit varies between 52% to 59%, plastic limit varies between 23% to 26% and plasticity index varies between 29% to 33%.

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

7.5.3 The Consistency Limits determined for the soil in Stratum - III (Brown clayey silty sand) indicates that the liquid limit varies between 19% to 22%, plastic limit varies between 13% to 14% and plasticity index varies between 6% to 8%.

7.5.4 The Consistency Limits indicate that the soil in :

a) Stratum - I (Brown sandy silty clay) is high plastic in nature.

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

c) Stratum - III (Brown clayey silty sand) is low 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 is in a medium stiff / medium dense state down to the investigated depth of 8m depth below existing ground level.

7.7 Triaxial Test Results

7.7.1 The cohesion 'c' obtained from consolidated drained triaxial compression test varies negligible & 0.33kg/cm² and the angle of shearing resistance 'ϕ' of the soil varies between 13° & 15°.

7.7.2 The major and minor stress at failure of sample during the test along with the cohesion and angle of internal friction obtained from the tests are tabulated below:

BH. No.	Depth (m)	Stress (kg/cm²)		Stress (kg/cm²)		c (kg/cm²)	ϕ (°)
		Major (σ_{11})	Minor (σ_{31})	Major (σ_{12})	Minor (σ_{32})		
	3.5	2.48	1	1.66	0.5	0.33	14
1	5	2.49	1	1.67	0.5	0.33	14
	6.5	2.53	1	1.68	0.5	0.32	15
	3	2.40	1	1.61	0.5	0.33	13
2	4.5	2.48	1	1.66	0.5	0.33	14
	6	2.52	1	1.68	0.5	0.32	15

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	1.5	2.5	3
1	-	53.8	-	56.4
2	18.3	-	14.1	-

7.8.2 The above results indicate that the soil strata is predominantly medium swelling in nature. Hence, the excavated soil cannot be used for backfilling purposes.

7.9 Swell Pressure

7.9.1 The results of swell pressure tests are given below:

BH No.	Depth (m)	Swell Pressure (kg/cm²)
1	3.5	0.11
	5	0.09
	6.5	0.07
2	3	0.10
	4.5	0.09
	6	0.08

7.10 Consolidation tests

The results of the consolidation tests are tabulated below.

BH. No.	Depth (m)	e_o	C_c	a_v (cm²/kg)	m_v (cm²/kg)
1	3.5	0.813	0.144	0.031	0.0173
	5	0.804	0.141	0.031	0.0170
	6.5	0.796	0.136	0.030	0.0165
2	3	0.816	0.148	0.032	0.0177
	4.5	0.814	0.146	0.032	0.0175

BH. No.	Depth (m)	e_o	C_c	a_v (cm²/kg)	m_v (cm²/kg)
	6	0.803	0.141	0.031	0.0170

7.11 Compiled Soil Profile

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

7.11.2 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 residential 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

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 Foundation

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 Residential building consists of an open stilt floor at ground level and five upper floors.

8.2.3 The soil strata is in a medium stiff / medium dense state down to the investigated depth of 8m depth below existing ground level.

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

8.3 Depth of Foundations

8.3.1 The depth at which 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 (Residential building consisting of an open stilt floor at ground level and five upper floors).

8.3.2 In view of the above factors, foundations of the proposed structure can be made to rest at a *minimum depth of 3m below the existing ground level*. The soil available at the founding level will be Brown sandy silty clay.

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 9t/m²* can be adopted 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 3m below the existing ground level

9.3 Allowable Bearing Pressure

Net Allowable Bearing Pressure of 9t/m² for widths of footings ≥1.5m for an allowable settlement for 50mm.

9.4 Construction Advisories

9.4.1 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.

9.4.2 The excavated soil cannot be used for backfilling purposes as the soil is predominantly medium swelling type.

9.4.3 After the excavation for the foundations, the top slush should 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.

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

9.4.5 The top soil is of medium swelling type. Hence, there will be upward thrust on the ground floor flooring with increase in moisture content. Therefore, considering the proposed floor level to be at the existing ground level, top 30-40cm of natural soil is to be removed and replaced with sand/gravel with addition of lime at 2kg/m² on the underlying soil as well as in the filling for ground floor flooring.

9.4.6 There is a well located in the site. In case, the well is not utilised, the well can be closed by back filling with sand-gravel mix. The back filling should be done in layers and well compacted. Incase, the well is to be utilised, the sides should be properly lined. Additionally the distance of the nearest footing to the well should not be less than 1 time the width of the foundation.

9.5 Appendices

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

9.5.2 The typical settlement calculations from the parameters derived from the tests are given in Appendix-A1 of this report.

9.5.3 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.

9.6 Notes

9.6.1 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.

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

Dr. N. Santosh Rao
Technical Director
*For **NAGADI CONSULTANTS PVT. LTD.***

ANALYSIS FOR ALLOWABLE BEARING PRESSURE

Data

(i) Soil Properties :

c (kg/cm^2) = 0.33 $\phi = 13^\circ$ γ (g/cm^3) = 1.85

(ii) Depth of Foundation, D (m) = 3

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

Shear Failure Criterion (Ref. IS : 6403)

$N_c = 8.48$ $N_q = 2.55$ $N_\gamma = 1.31$ $R_w = 0.50$ $R_w' = 0.50$

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

B (m)	1.5	≥3.0
q_s (t/m^2)	9.2	9.5

Settlement Criterion (Ref. IS : 8009) from N-values

B (m)	1.5	≥3
N corrected	11	13
Settlement for 1kg/cm² (mm) as per IS 8009 (Part 1) Fig.9	27	27
Therefore the bearing pressure for 30mm settlement (kg/cm²)	1.85	1.85
Therefore the bearing pressure for 60mm settlement (t/m²)	18.5	18.5
ABP considering a water table correction of 0.5 (t/m²)	9.25	9.25

The lower of the above is to be adopted.

ADOPT	**B (m)**	**1.5**	**≥3**
	q (t/m^2)	**9**	**9**

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.

SETTLEMENT CALCULATION BASED ON CONSOLIDATION TEST

Data

(i) Compression Index C_c = 0.145

(ii) Initial void ratio e_o = 0.811

The total settlement of the foundation due to underlying compressible stratum is given by:

$S = \{C_c / (1 + e_o)\}\ H.\ \log_{10}\ \{(P_o + \blacktriangle P)\ /P_o\ \}$

Where:

S = Settlement

C_c = Compression index

H = Thickness of compressible strata

P_o = Original intensity of pressure acting at mid height of compressible stratum

$\blacktriangle P$ = Increment in pressure due to the additional load imposed through Foundation

e_o = Original Void Ratio

Data

Depth of foundation = 200cm

Dimension of footing (assumed) = 300 x 300cm

Bulk density = 1.85gm/cc

Compression index C_c = 0.145

Initial void ratio e_o = 0.811

Compressible strata (H) = 600cms

P_o {Bulk density x (Depth of footing + Compressible Strata /2)}= 0.925kg/cm^2

$\blacktriangle P$ = $\{(q_a\ (B \times L)\}/\{(B+Z)(L+Z)\}$

Where:

q_a = Allowable bearing pressure = 9t/m^2 = 0.9kg/cm^2

B & L = Dimension of footing = 300 x 300cm

Z = depth below foundation level of mid height of compressible stratum = 300cm

$\blacktriangle P$ = 0.225kg/cm^2

substituting the values in the above equation, we get

S = 4.54cm = 45mm

The calculated settlement for an allowable bearing pressure of 9t/m^2 is 45mm which is <50mm.

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)

TABLES



SOIL PROFILE

Project: Residential Building at S.17 & S.18, Ponnambalam Salai, K.K.Nagar, Chennai - 600 078.

B. H. Location: | Water Table: 2.0m | Term. Depth : 8.0m | B.H. No. : 1

N - Value#	Depth (m)	Soil Description	Grain Size Analysis				Atterberg		In-situ		Triaxial Test		
			Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid (%)	Plastic (%)	Density * (g/cm^3)	Water Cont (%)	Type	c (kg/cm^2)	Φ (°)
	0.0	Ground level											
8	1.5	Brown sandy silty clay	0	14	37	49	54	25					
	2.0	Change of strata											
		Brown silty sand	0	81	19	0	-	NP			DS	-	30
	2.6	Change of strata											
11	3.0	Brown sandy silty clay	0	11	37	52	56	26					
	3.5	Brown sandy silty clay							1.88	24.9	CD	0.33	14
12	4.5	Brown sandy silty clay	0	13	36	51	59	25					
	5.0	Brown sandy silty clay							1.90	24.2	CD	0.33	14
16	6.0	Brown sandy silty clay	0	15	35	50	57	25					
	7.0	Brown sandy silty clay							1.93	22.9	CD	0.32	15
22	7.5	Brown sandy silty clay	0	16	38	46	52	23					
	8.0	Termination depth											

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

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Sheet No. : 1

SOIL PROFILE

Project: Residential Building at S.17 & S.18, Ponnambalam Salai, K.K.Nagar, Chennai - 600 078.

B. H. Location: | Water Table: 1.9m | Term. Depth : 8.0m | B.H. No. : 2

N - Value#	Depth (m)	Soil Description	Grain Size Analysis				Atterberg		In-situ		Triaxial Test		
			Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid (%)	Plastic (%)	Density * (g/cm^3)	Water Cont (%)	Type	c (kg/cm^2)	ϕ (°)
	0.0	Ground level											
6	1.0	Brown clayey silty sand	0	59	26	15	22	14					
	1.5	Brown clayey silty sand							1.80	12.7	Soft	Sample	
9	2.5	Brown clayey silty sand	0	71	19	10	19	13					
	2.9	Change of strata											
	3.0	Brown sandy silty clay							1.86	24.2	CD	0.33	13
10	4.0	Brown sandy silty clay	0	13	36	51	59	25					
	4.5	Brown sandy silty clay							1.89	23.3	CD	0.33	14
13	5.5	Brown sandy silty clay	0	14	37	49	57	25					
	6.0	Brown sandy silty clay							1.92	21.5	CD	0.32	15
21	7.0	Brown sandy silty clay	0	16	37	47	54	23					
23	7.5	Brown sandy silty clay	0	18	36	46	52	22					
	8.0	Termination depth											

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

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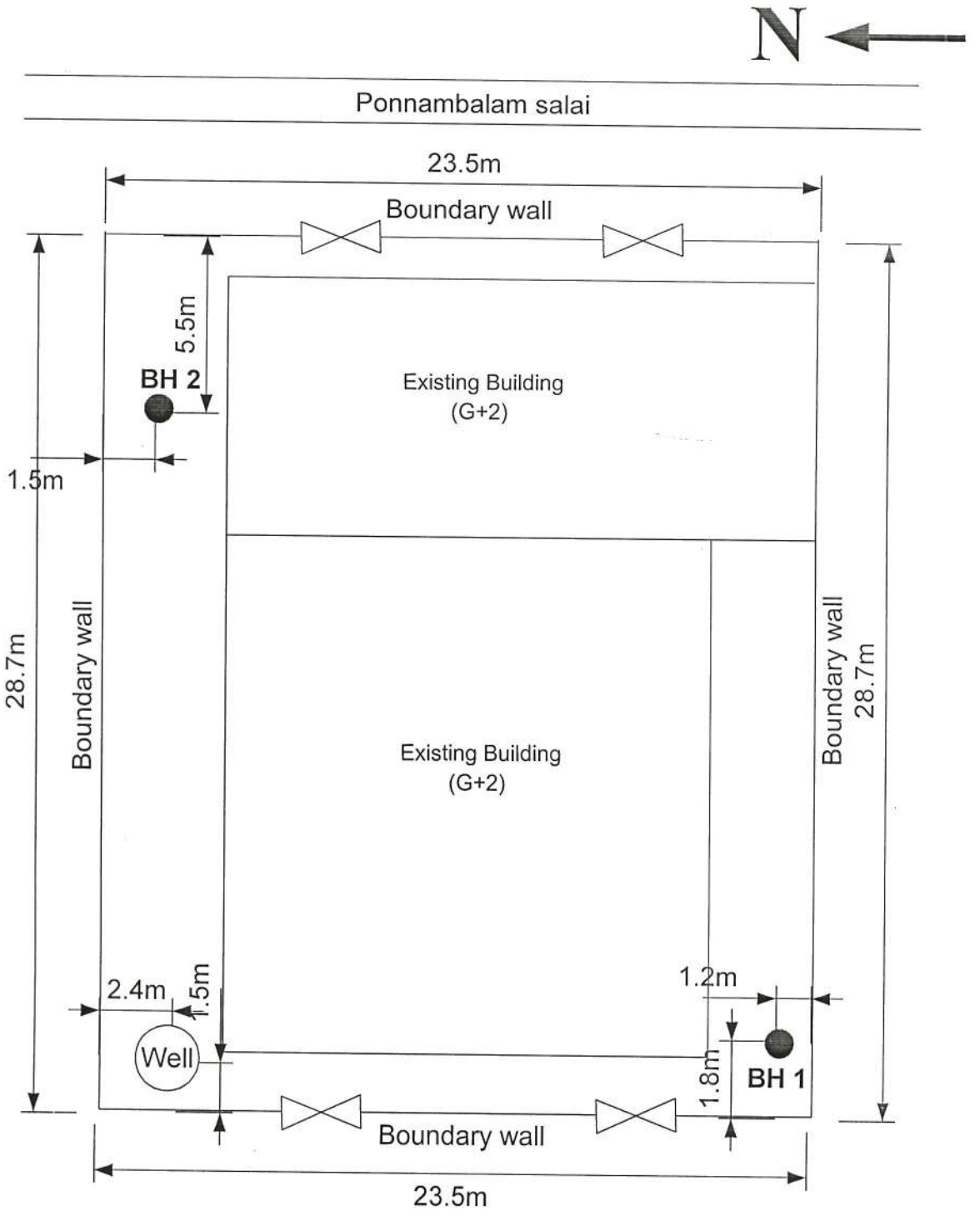
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FIGURES





Legend

● BH -Borehole

SCHEMATIC SITE PLAN

(Not to Scale)

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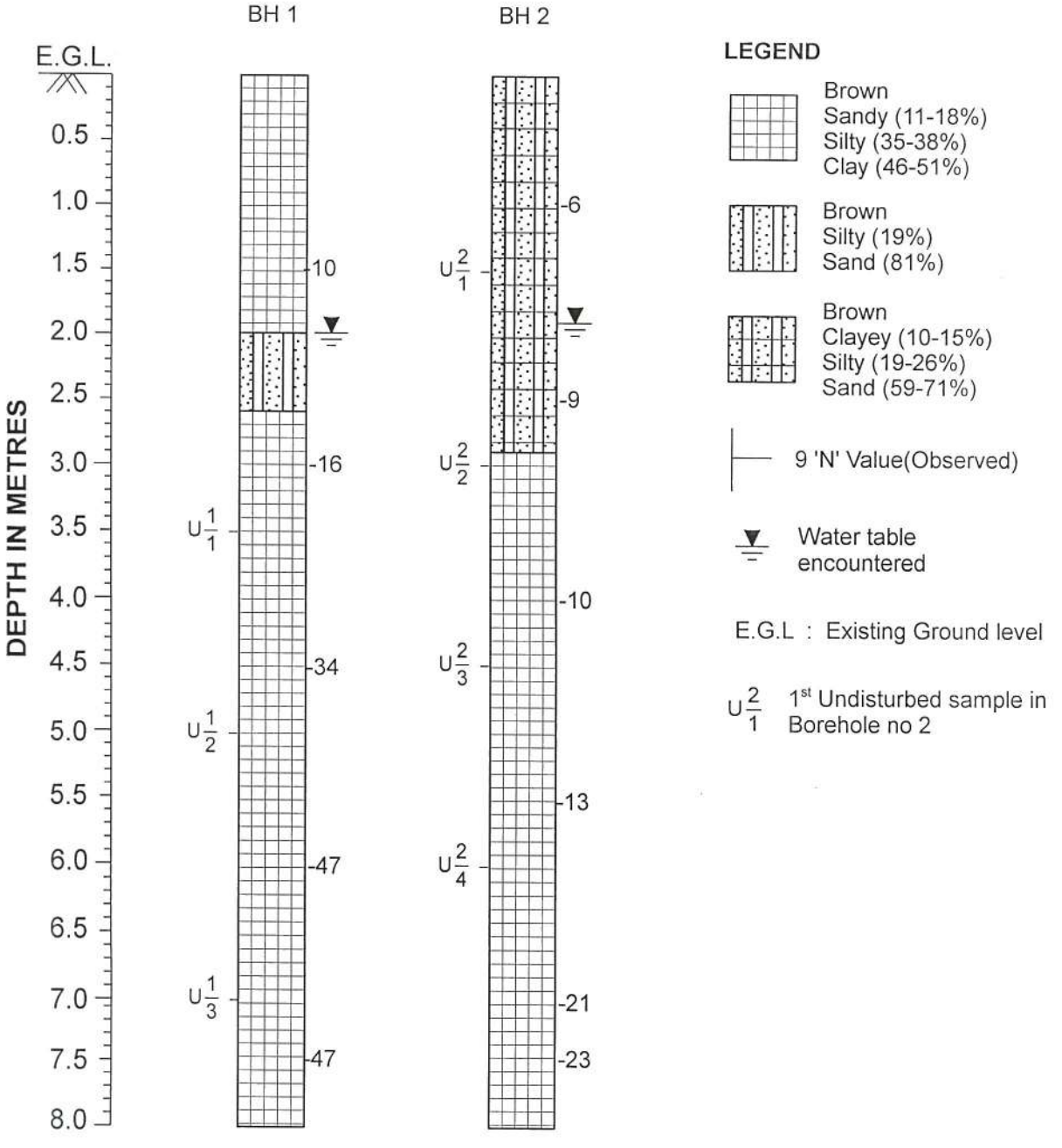
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COMPILED SOIL PROFILE

PROJECT : RESIDENTIAL BUILDING AT PONNAMBALAM SALAI, K.K.NAGAR, CHENNAI - 600 078

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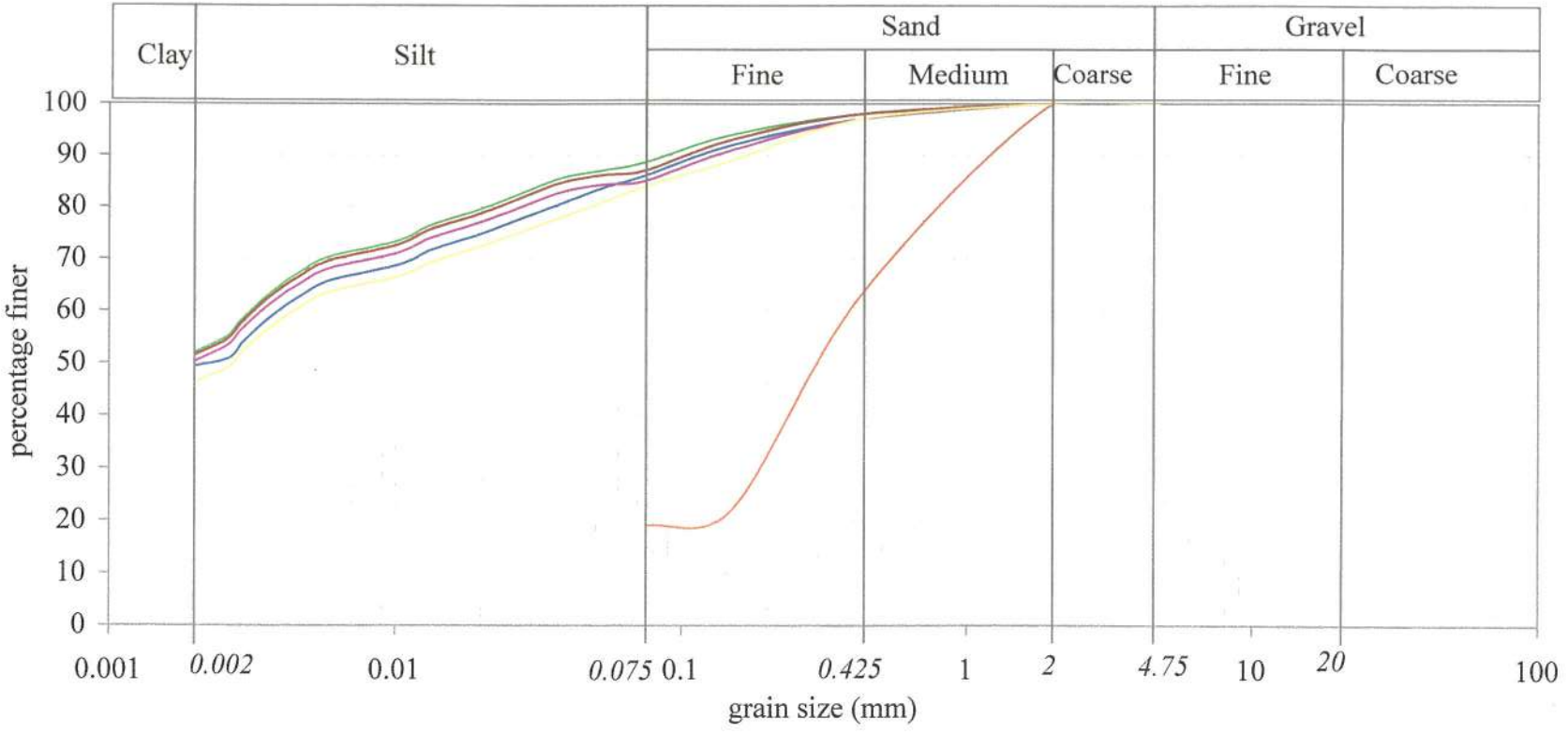
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Line Style	Bore hole	Depth (m)	Description	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	d_{60}	d_{10}	U
	1	1.5	Sandy silty clay	0	14	37	49	0.004	-	-
	1	2.0	Silty sand	0	81	19	0	0.390	-	-
	1	3.0	Sandy silty clay	0	11	37	52	0.003	-	-
	1	4.5	Sandy silty clay	0	13	36	51	0.003	-	-
	1	6.0	Sandy silty clay	0	15	35	50	0.003	-	-
	1	7.5	Sandy silty clay	0	16	38	46	0.005	-	-

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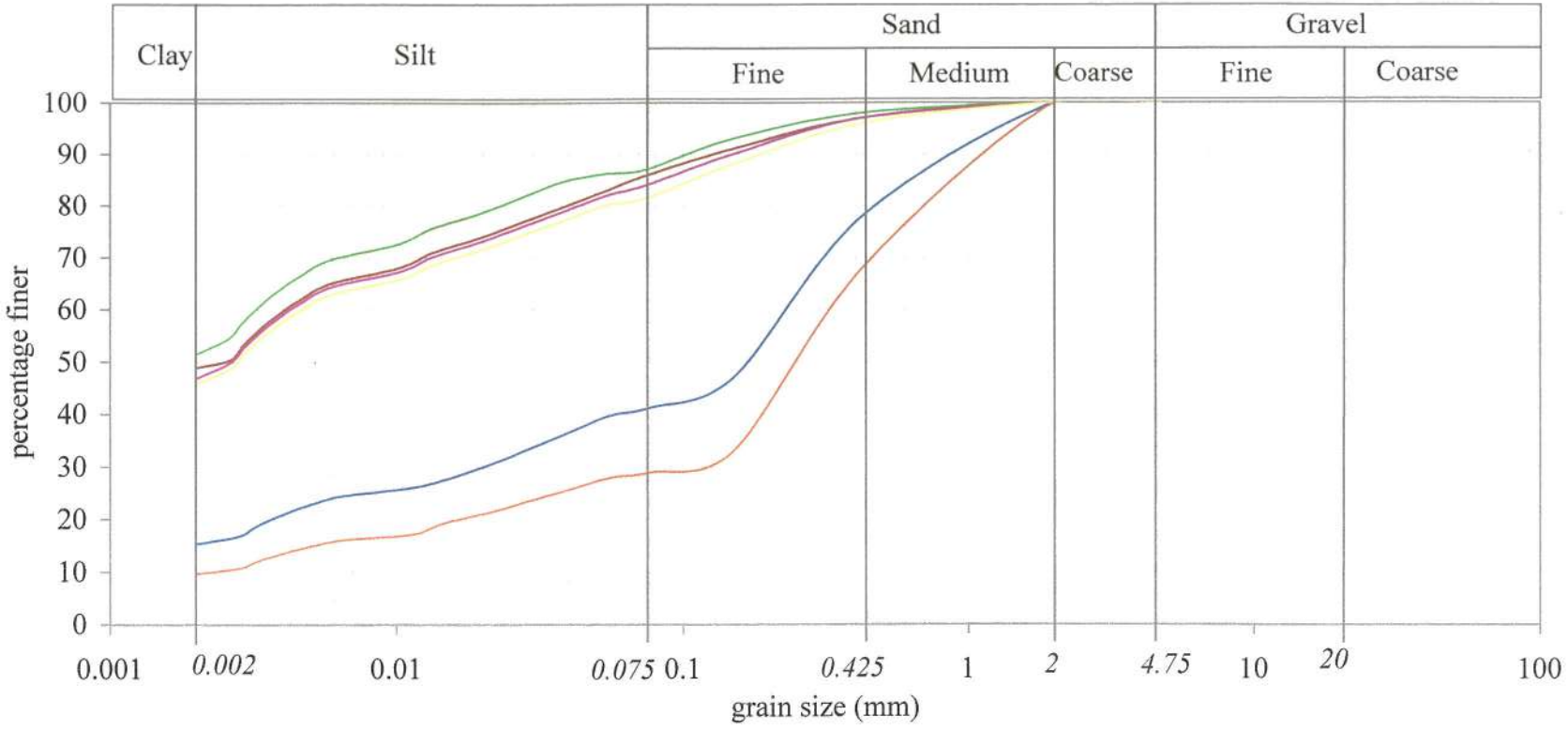
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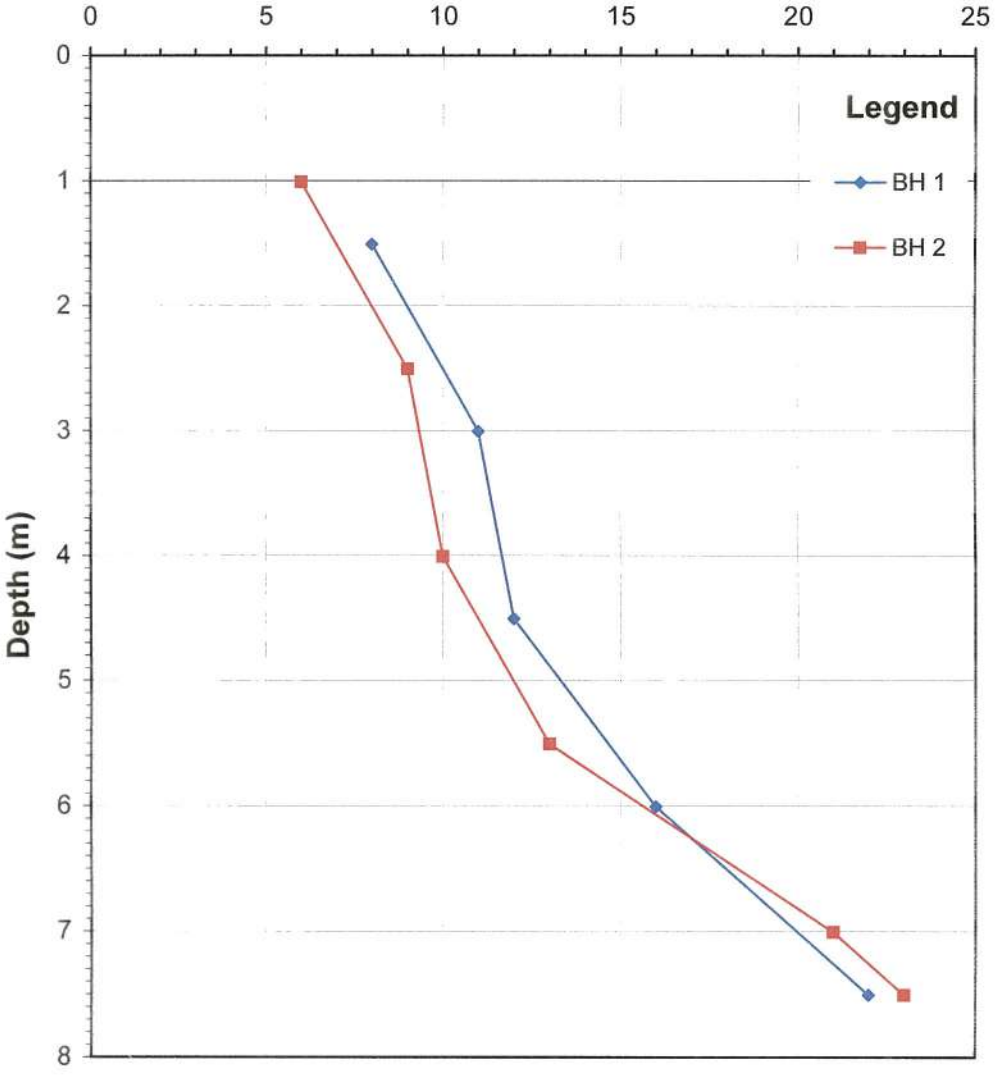
Job No. : G(C)9789

Sheet No. : 3b



Line Style	Bore hole	Depth (m)	Description	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	d_{60}	d_{10}	U
	2	1.0	Clayey silty sand	0	59	26	15	0.230	-	-
	2	2.5	Clayey silty sand	0	71	19	10	0.320	0.0022	145.5
	2	4.0	Sandy silty clay	0	13	36	51	0.003	-	-
	2	5.5	Sandy silty clay	0	14	37	49	0.004	-	-
	2	7.0	Sandy silty clay	0	16	37	47	0.004	-	-
	2	7.5	Sandy silty clay	0	18	36	46	0.005	-	-

SPT Values (Observed)



SPT Values (Observed) Vs Depth Curves

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