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For GATALA DEVELOPERS & PROPERTIES PVT. LTD.

GATALA

Managing Director

GEOTECHNICAL REPORT FOR

RESIDENTIAL BUILDING AT KUNDRATHUR MAIN ROAD, MADHANANTHAPURAM VILLAGE, PORUR, CHENNAI

Client :

M/s. Gatala Developers and Properties Pvt Ltd., Chennai.

Architect :

Consultant :

Structural Consultant :

Job No. : G(C)9894 Date : 06.02.2024

NAGADI CONSULTANTS PRIVATE LIMITED

Branch :

Chennai

Project :

RESIDENTIAL BUILDING AT KUNDRATHUR MAIN ROAD, MADHANANTHAPURAM VILLAGE, PORUR, CHENNAI

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for GATALA DEVELOPERS & PROPERTIES PVT. LTD.

Managing Director

GATALA

Job No. : G(C)9894 — Date : 06.02.2024

GEOTECHNICAL INVESTIGATION REPORT

for Residential Building at Kundrathur Main Road, Madhananthapuram Village, Porur, Chennai

EXECUTIVE SUMMARY

M/s. Gatala Developers and Properties Pvt Ltd., Chennai are associated in construction of Residential Building at Kundrathur Main Road, Madhananthapuram Village, Porur, Chennai.

The site for the proposed project is situated at Door No. 3/532, New Survey Nos. 69/2B1 & 70/5A1H2 on the Western side of road in Kundrathur Main Road, Madhananthapuram Village, Porur, Chennai. The site is enclosed by compound wall on three sides and open on the Southern side. The site approximately measures 39.3m x 82.2m in size and is fairly level in topography. Vegetation in the form of bushes and mango tree were observed within the site during the period of field investigations. As per the information provided by the client, the existing sheds within the site will be demolished prior to the construction of the new building.

The proposed Residential Building consists of an open stilt floor at ground level and nine 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-value is >100) and further drilling in refusal/rock strata by minimum 3m depth.

The results of borehole investigations indicate the presence of filled up soil down to 2.2/2.4m depth below existing ground level below which virgin soil was encountered. The virgin soil is Brown/Grey sandy silty clay/Clayey silty sand with gravel/ Silty sand with or without gravel/ Clayey silty sand with or without gravel down to 19/20m depth at which refusal/rock strata in the form of completely weathered rock strata (Charnockites based) was encountered. The rock strata continued down to the termination depths of the boreholes of 22/23m below the existing ground level.

for GATALA DEVELOPERS & PROPERTIES PVT. LTD.

GATALA

Managing Director

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Job No. : G(C)9894

Sheet No. :

The soil strata down to 15m depth below existing ground level is generally in a soft/loose state. However, the soil strata between 6m to 9m depth and the soil strata beyond 15m depth down to the depths of refusal strata encountered at 19/20m depth below existing ground level, is in a medium stiff/ medium dense state.

Ground water table was encountered between 3m and 3.6m depth in the boreholes during the period of field investigations.

In view of the observed subsoil strata conditions, the proposed residential building can be supported on *Bored Pile Foundations*. The load carrying capacity for different diameters of piles is given below:

Diameter of Pile (mm)	*Embedment in Rock Strata*	*Safe Pile Capacity (t)*	*Safe Uplift Capacity (t)*
500		*100*	*25*
600	*4D*	*150*	*40*
750		*230*	*60*
500		*130*	*40*
600	*6D*	*190*	*60*
750		*295*	*95*

D - Diameter of Pile

The bentonite slurry to be used for stabilising the pile bore during piling should conform to the requirements as given in BIS code IS:2911 (Part1/Sec2).

The bottom of the pile bore should be properly cleaned as per the procedure given in the BIS IS:2911 (Part1/Sec2), prior to carrying out the tremie concreting. This is essential to ensure that the end bearing capacity of the pile is fully mobilised.

for GATALA DEVELOPERS & PROPERTIES PVT. LTD.

GATALA

Managing Director

REPORT ON GEOTECHNICAL INVESTIGATION FOR

RESIDENTIAL BUILDING AT KUNDRATHUR MAIN ROAD,

MADHANANTHAPURAM VILLAGE, PORUR, CHENNAI

1.0 INTRODUCTION

1.1 Overview

1.1.1 M/s. Gatala Developers and Properties Pvt Ltd., Chennai are associated in construction of Residential Building at Kundrathur Main Road, Madhananthapuram Village, Porur, Chennai.

1.1.2 The geotechnical investigations have been carried out 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 authorisation by M/s. Gatala Developers and Properties Pvt Ltd., Chennai vide their Work order dated 26.12.2023.

2.0 PROJECT DETAILS

2.1 Site Location

The site for the proposed project is situated at Door No. 3/532, New Survey Nos. 69/2B1 & 70/5A1H2 on the Western side of road in Kundrathur Main Road, Madhananthapuram Village, Porur, Chennai.

2.2 Site Layout and Topography

2.2.1 The site is enclosed by compound wall on three sides and open on the Southern side. The site approximately measures 39.3m x 82.2m in size and is fairly level in topography. Vegetation in the form of bushes and mango tree were observed within the site during the period of field investigations. As per the information provided by the

client, the existing sheds within the site will be demolished prior to the construction of the new building.

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 consists of an open stilt floor at ground level and nine upper floors.

2.4 Seismic Zone

Site for the proposed Residential Building is situated in Madhananthapuram Village, 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°01'

b) Longitude : 80°08'

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 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 strata (where N-value is >100); and further drilling in refusal/rock strata by a minimum of 3m depth, as required by the client.

b) Conducting standard penetration tests at 1.5m depth 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 second week of January 2024.

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) was encountered between 19 and 20m depth below the existing ground level in the form of completely weathered rock (Charnockites based). The drilling in refusal/rock strata was conducted using NX size core barrel fitted with diamond bits.

5.2.3 The boreholes were to be terminated after drilling a minimum of 3m in refusal/rock strata as per the stipulated scope of work.

5.2.4 The depths at which ground water table was encountered in the boreholes during the period of field investigations, depths at which refusal/rock strata (where N-value is >100) was encountered in the boreholes and termination depths of the boreholes are given below:

BH No.	Depth of Ground Water Table Below EGL (m)	Depth of Rock Strata Below EGL (m)	Termination Depth Below EGL (m)
1	3	19	22
2	3.6	20	23

5.2.5 Ground water table was encountered between 3m and 3.6m depth in the boreholes during the period of field investigations.

5.2.6 Standard Penetration Tests were conducted in soil strata at 1/1.5m 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 6.1, 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 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 to 4.

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 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 : Filled up (Soil with brickbats)

b) Stratum - II : Brown/Grey sandy silty clay/ clayey sandy silty with gravel

c) Stratum - III : Grey silty sand with or without gravel

d) Stratum - IV : Grey clayey silty sand with or without gravel

e) Stratum - V : Brownish grey with white completely weathered rock strata (Charnockite Based)

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

BH No.	Depth (m) : from - to				
	Stratum - I	Stratum - II	Stratum - III	Stratum - IV	Stratum - V
1	0.0 - 2.2	2.2 - 5.5 10.3 - 12	5.5 - 10.3 15 - 18	12 - 15 18 - 20	20 - 23
2	0.0 - 2.4	4 - 7.3 8.6 - 12	7.3 - 8.6 15 - 19	2.4 - 4 12 - 15	19 - 22

7.2.3 The above results- show that :

a) Stratum - I consisting of Filled-up strata (soil with brickbats) has been encountered down to the depths of 2.2-2.4m below existing ground level.

b) Stratum - II consisting of Brown/Grey sandy silty clay/ clayey sandy silty with

gravel having significant percentages of clay and varying percentages of sand, silt and gravel, has been encountered from 2.2/4/8.6/10.3 down to 5.5/7.3/12m depth below existing ground level.

c) Stratum - III consisting of Grey silty sand with or without gravel having significant percentages of sand and varying percentages of silt and gravel, has been encountered form 5.5/7.3/15m to 8/11.3/14m depths below existing ground level.

d) Stratum - IV consisting of Grey clayey silty sand with or without gravel having significant percentages of sand and varying percentages of clay, silt and gravel, has been encountered form 2.4/12/18m to 4/15/20m depths below existing ground level.

e) Stratum - V consisting of Brownish Grey with white completely weathered rock strata (Charnockite Based) has been encountered from 19/20m depth down to the termination depths of boreholes of 22/23m 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 3c.

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

a) Stratum - II : Brown/Grey sandy silty clay/ clayey sandy silty with gravel

BH No.	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
1	0	12 - 31	32 - 39	37-49
2	0 - 10	18 - 31	32 - 37	26 - 45

b) Stratum - III : Grey silty sand with or without gravel

BH No.	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
1	2 - 4	77 - 79	19 - 20	0
2	2	79 - 86	12 - 21	0

c) Stratum - IV : Grey clayey silty sand with or without gravel

BH No.	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
1	2 - 5	35 - 56	23 - 34	16 - 29
2	6	35 - 72	16 - 33	12 - 26

7.3.3 The above results indicate that :

a) Stratum - II consists of about 12-31% of sand, 32-39% of silt and 37-49% of clay / 12-27% of clay 25-31% of sand, 32-58% of silt and 5-10% of gravel.

b) Stratum - III consists of about 12-21% of silt, 77-86% of sand and 2-4% of gravel.

c) Stratum - IV consists of about 12-29% of clay, 16-34% of silt, 35-72% of sand and 2-6% of gravel.

7.4 In-situ Bulk Density, Water Content and Dry density

7.4.1 The in-situ bulk density, water content and dry density obtained from undisturbed soil sample are tabulated below.

BH No.	Depth (m)	In-situ Bulk Density (g/cm^3)	Water Content (%)	Dry Density (g/cm^3)
1	5	1.90	27.3	1.49
	11	1.94	22.3	1.59
2	5	1.89	25.9	1.50
	9.5	1.95	18.9	1.64
	11	1.93	23.5	1.56

7.4.2 The above results indicate that the soil strata is in a stiff/medium dense state at the

above sampled depths. Undisturbed soil samples could not be collected satisfactorily at some depths below 3m, as the samples were cohesionless/soft/loose 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/Grey sandy silty clay/ clayey sandy silty with gravel) indicate that the liquid limit varies between 35% to 62%, plastic limit varies between 16% to 25% and plasticity index varies between 19% to 37 %.

7.5.2 The Consistency Limits determined for the soil in Stratum - III (Grey silty sand with or without gravel) indicate that the soil in this strata is non plastic in nature.

7.5.3 The Consistency Limits determined for the soil in Stratum - IV (Grey clayey silty sand with or without gravel) indicate that the liquid limit varies between 23% to 37%, plastic limit varies between 14% to 18% and plasticity index varies between 9% to 13 %.

7.5.4 The Consistency Limits indicate that the soil in :

a) Stratum - II (Brown/Grey sandy silty clay/ clayey sandy silty with gravel) is medium to high plastic in nature.

b) Stratum - III (Grey silty sand with or without gravel) is non plastic in nature

c) Stratum - IV (Grey clayey silty sand with or without gravel) 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 to 4.

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 N-values indicate that soil strata down to 15m depth below existing ground level is in generally a soft/loose state with N-values ranging between 4 to 9. However, the soil strata between 6m to 9m depth and the soil strata beyond 15m depth down to the depths of refusal strata encountered at 19/20m depth below existing ground level, is in a medium stiff/ medium dense state with N-values ranging between 15 to 78.

7.7 Triaxial Test Results

The cohesion 'c' obtained from unconfined compression test (UCC) on clayey samples varies between 1.12kg/cm² and 1.34kg/cm² .

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 depths (m)	
	3	4.5
1	47.8	57.2
2	18.9	55.7

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 Rock Conditions

7.9.1 The rock encountered below refusal is Charnockite based rock in a completely weathered state (i.e. characterised by nil core recovery and nil RQD).

7.9.2 In completely weathered rock, high blow counts have been recorded for small depths of penetration of the SPT sampler, indicating that the completely weathered rock encountered below refusal is very hard and compact in-situ.

7.10 Compiled Soil Profile

7.10.1 An overview of the results and their analysis has been presented in the form of a

compiled soil (fig. 2).

7.10.2 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/termination depth of pile

c) Allowable bearing pressure on the soil at the foundation level/ safe pile capacity

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 Residential Building consists of an open stilt floor at ground level and nine upper floors.

8.2.3 The soil strata down to 15m depth below existing ground level is generally in a soft/loose state. However, the soil strata between 6m to 9m depth and the soil strata beyond 15m depth down to the depths of refusal strata encountered at 19/20m depth

below existing ground level, is in a medium stiff/ medium dense state.

8.2.4 In view of the above, *Bored Pile Foundations* can be adopted.

8.3 Depth of Pile Foundations

8.3.1 To ensure similarity of settlement of all the pile foundations for the proposed residential building, the pile foundations should be founded in the refusal/rock strata.

8.3.2 As the pile foundations will be founded in refusal/rock strata, to achieve economy as well as maximum efficacy, the pile foundations should preferably be loaded to the safe structural capacity.

8.3.3 To ensure the mobilization of the full safe structural capacity, the Bored Piles should be embedded or socketed in refusal/completely weathered rock strata to a minimum depth equivalent to six times the diameter of the pile.

8.3.4 Alternatively, the Bored Piles with lower pile capacities can also be adopted when the piles are embedded or socketed in refusal/completely weathered rock strata to a minimum of 4 times the diameter of pile.

8.4 Pile Capacities

8.4.1 The safe pile capacities and safe uplift capacities for different diameters of piles are given below:

Diameter of Pile (mm)	*Embedment in Rock Strata*	*Safe Pile Capacity (t)*	*Safe Uplift Capacity (t)*
500	*4D*	*100*	*25*
600		*150*	*40*
750		*230*	*60*
500	*6D*	*130*	*40*
600		*190*	*60*

Diameter of Pile (mm)	*Embedment in Rock Strata*	*Safe Pile Capacity (t)*	*Safe Uplift Capacity (t)*
750		*295*	*95*

9.0 RECOMMENDATIONS

9.1 Type of Foundations

Bored Pile Foundations

9.2 Pile Foundations

Safe pile capacities of different diameter of piles are given below:

Diameter of Pile (mm)	*Embedment in Rock Strata*	*Safe Pile Capacity (t)*	*Safe Uplift Capacity (t)*
500		*100*	*25*
600	*4D*	*150*	*40*
750		*230*	*60*
500		*130*	*40*
600	*6D*	*190*	*60*
750		*295*	*95*

D - Diameter of Pile

9.3 Construction Advisories

9.3.1 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.

9.3.2 The bentonite slurry to be used for stabilising the pile bore during piling should conform to the requirements as given in BIS code IS:2911 (Part1/Sec2).

9.3.3 The bottom of the pile bore should be properly cleaned as per the procedure given in the BIS IS:2911 (Part1/Sec2), prior to carrying out the tremie concreting. This is essential to ensure that the end bearing capacity of the pile is fully mobilised.

9.4 Appendices

9.4.1 The typical analysis of the capacity of piles has been given in Appendix-A of this report.

9.4.2 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.

9.5 Notes

9.5.1 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.

9.5.2 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.

TYPICAL CALCULATIONS OF PILE CAPACITIES

Typical calculations for the pile capacity has been given hereunder for a pile of diameter 500mm. For piles of other diameters, a similar procedure has been used to arrive at the recommended pile capacities.

A.1 Pile Capacity

A.1.1 As per IS 2911 (Part 1/sec 2):2010, the safe pile capacity or the allowable load on the pile is calculated using the formula given below :

$Q_a = C_{u1}N_c.\pi B^2/4F_s + \alpha c_{u2}.\pi BL/F_s$

Where, c_{u1} = shear strength of rock below the base of the pile, in kN/m²

= 800kN/m² (as per fig 3 of IS 2911 (Part I/Sec 2)-2010)

N_c = bearing capacity factor taken as 9;

F_s = factor of safety usually taken as 3;

α = 0.9 (recommended value);

c_{u2} = average shear strength of rock in the socketed length of pile, in kN/m²

= 600kN/m² (as per fig 3 of IS 2911 (Part I/Sec 2)-2010)

B = minimum width of pile shaft (diameter in case of circular piles), in m

= 0.5m

L = socket length of pile, in m = 6 x 0.5 = 3m.

A.1.2 Substituting the values in the above equation we get,

Q_a = 47.12t + 84.82t

= 131.9t

A.1.3 Therefore, adopt ***Safe Pile Capacity = 130t***

A.2 Uplift Capacity

A.2.1 The safe uplift capacity is calculated based on the safe skin friction capacity of the pile in uplift using the formula given below :

$Q_{au} = \alpha c_u.\pi BL/F_s$

where α = 0.9 (recommended value);

c_u = average shear strength of rock in the socketed length of pile, in kN/m²

= 600kN/m² (as per fig 3 of IS 2911 (Part I/Sec 2)-2010)

B = minimum width of pile shaft (diameter in case of circular piles)=0.5m

L = socket length of pile, in m = 6 x 0.5 = 3m.

F_s = factor of safety usually taken as 6

A.2.2 Substituting the values in the above equation we get Q_a = 42.4t.

A.2.3 Therefore adopt ***Safe Uplift Capacity = 40t***

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)
5. IS 2911 (Part I to IV) : Design and construction of Pile Foundations

TABLES



SOIL PROFILE

Project: Residential Building at Kundrathur Main Road, Madhananthapuram Village, Porur, Chennai.

B. H. Location: | Water Table: 3.6m | Term. Depth : 23m | 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											
	2.0	Filled up (soil with brickbats)											
	2.2	Change of strata											
4	3.0	Brown sandy silty clay	0	23	37	40	49	21					
	3.5	Brown sandy silty clay									Soft sample		
7	4.5	Brown sandy silty clay	0	12	39	49	62	25					
	5.0	Brown sandy silty clay							1.90	27.3	UCC	1.25	0
	5.5	Change of strata											
16	6.0	Grey silty sand with gravel	2	77	21	0	-	NP					
	6.5	Grey silty sand with gravel									Sample slipped		
22	7.5	Grey silty sand with gravel	2	78	20	0	-	NP					
	8.0	Grey silty sand with gravel									Sample slipped		
27	9.0	Grey silty sand with gravel	2	79	19	0	-	NP					
	9.5	Grey silty sand with gravel									Sample slipped		
	10.3	Change of strata											

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Job No. : G(C)9894

Sheet No. : 1

SOIL PROFILE

Project: Residential Building at Kundrathur Main Road, Madhananthapuram Village, Porur, Chennai.

B. H. Location: | Water Table: 3.6m | Term. Depth : 23m | 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/cm^3)	Water	Type	c (kg/cm^2)	Φ (°)
9	10.5	Grey sandy silty clay	0	31	32	37	48	19					
	11.0	Grey sandy silty clay							1.94	22.3	UCC	1.12	0
	12.0	Change of strata											
6		Grey clayey silty sand with gravel	2	35	34	29	37	18					
	13.0	Grey clayey silty sand with gravel									Soft sample		
	15.0	Change of strata											
6		Grey silty sand with gravel	4	77	19	0	-	NP					
	18.0	Change of strata											
51		Grey clayey silty sand with gravel	5	56	23	16	23	14					
	20.0	Change of strata											
>100 (52/36cm)		Brownish grey with white completely weathered rock (Charnockites based)											
>100 (95/18cm)	21.5	Brownish grey with white completely weathered rock (Charnockites based)											
>100 (65/11cm)	23.0	Brownish grey with white completely weathered rock (Charnockites based)											

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

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Sheet No. : 2

SOIL PROFILE

Project: Residential Building at Kundrathur Main Road, Madhananthapuram Village, Porur, Chennai.

B. H. Location: | Water Table: 3m | Term. Depth : 22m | 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/cm^3)	Water	Type	c (kg/cm^2)	Φ (°)
	0.0	Ground level											
	2.0	Filled up (soil with brickbats)											
	2.4	Change of strata											
4	3.0	Brown clayey silty sand with gravel	6	35	33	26	35	17					
	3.5	Brown clayey silty sand with gravel									Sample slipped		
	4.0	Change of strata											
	4.5	Brown sandy silty clay	0	18	37	45	55	23					
7	5.0	Brown sandy silty clay							1.89	25.9	UCC	1.23	0
	5.6	Change of strata											
5	6.0	Brown clayey sandy silt with gravel	5	25	58	12	-	NP					
	6.5	Brown clayey sandy silt with gravel									Sample slipped		
	7.3	Change of strata											
23	7.5	Grey silty sand with gravel	2	86	12	0	-	NP					
	8.0	Grey silty sand with gravel									Sample slipped		
	8.6	Change of strata											
24	9.0	Grey clayey sandy silt with gravel	10	31	32	27	35	16					
	9.5	Grey clayey sandy silt with gravel							1.95	18.9	UCC	0.22	23

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Job No. : G(C)9894

Sheet No. : 3

SOIL PROFILE

Project: Residential Building at Kundrathur Main Road, Madhananthapuram Village, Porur, Chennai.

B. H. Location: | Water Table: 3m | Term. Depth : 22m | 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	Type	c (kg/cm²)	ϕ (°)
	10.4	Change of strata											
8	10.5	Grey sandy silty clay	0	23	37	40	50	21					
	11.0	Grey sandy silty clay							1.93	23.5	UCC	1.34	0
	12.0	Change of strata											
8		Grey clayey silty sand	0	72	16	12	-	NP			Sample slipped		
	12.5	Grey clayey silty sand											
	15.0	Change of strata											
9		Grey silty sand with gravel	2	81	17	0	-	NP			Sample slipped		
	15.5	Grey silty sand with gravel											
	18.0	Change of strata											
8		Grey silty sand with gravel	0	79	21	0	-	NP					
>100 (12/2cm)	19.0	Change of strata											
		Brownish grey with white completely weathered rock (Charnockites based)											
>100 (97/17cm)	21.0	Brownish grey with white completely weathered rock (Charnockites based)											
>100 (89/15cm)	22.0	Brownish grey with white completely weathered rock (Charnockites based)											
		*-Natural Bulk Density # -N Values (Observed)											

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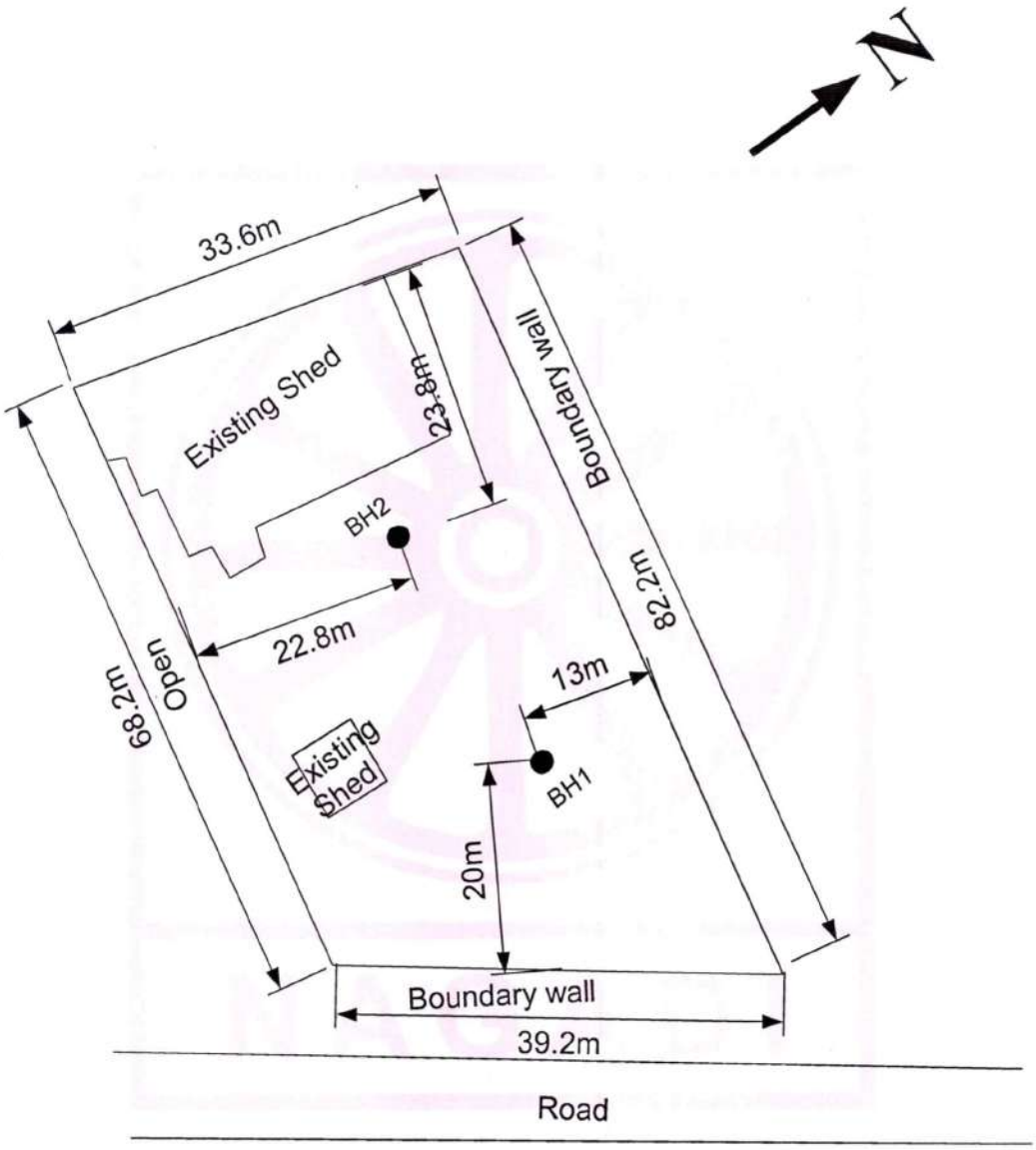
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Sheet No. : 4

FIGURES





for GATALA DEVELOPERS & PROPERTIES PVT. LTD.

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Legend

● BH -Borehole

SCHEMATIC SITE PLAN

(Not to Scale)

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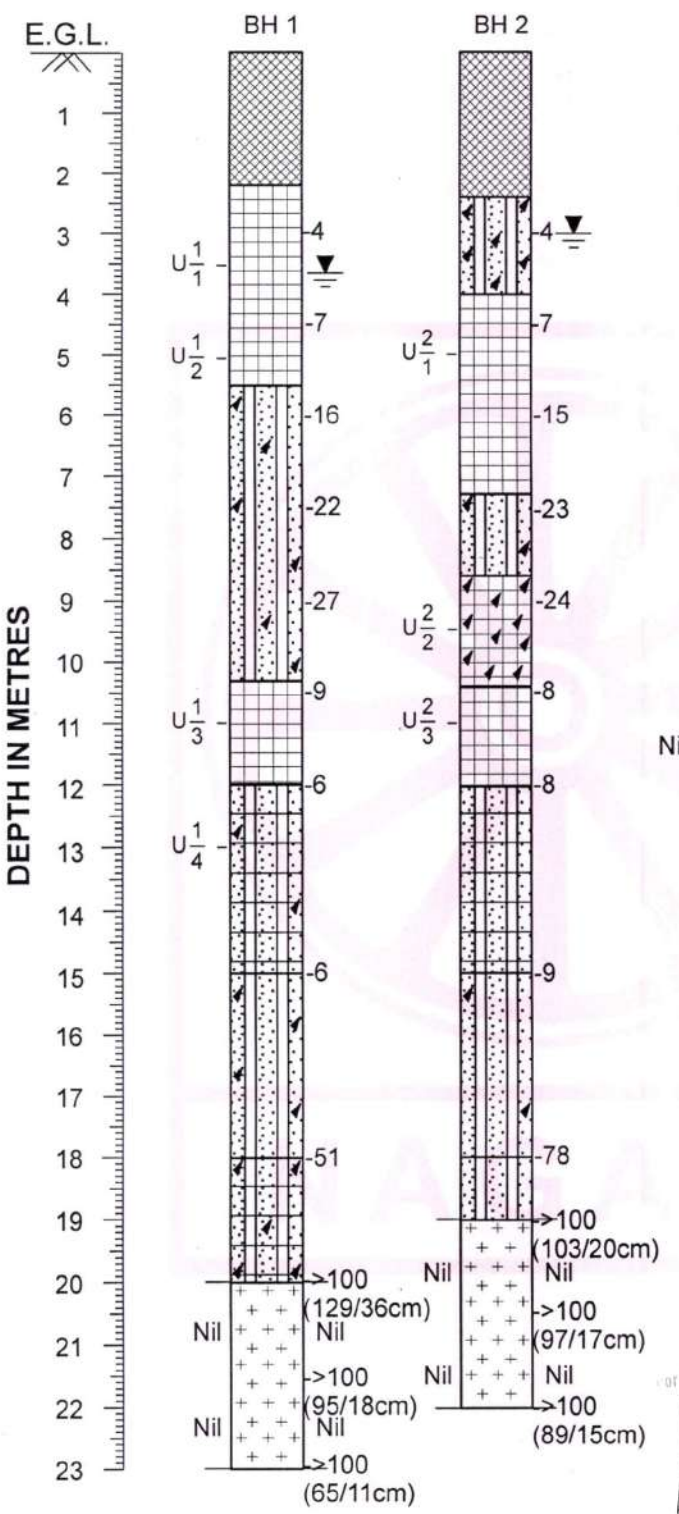
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LEGEND

- Filled-up Strata (Soil with brickbats)
- Brown/Grey Sandy (12-31%) Silty (32-39%) Clay (37-49%)/Clayey (12-27%) Sandy (25-31%) Silty (32-58%) With Gravel (5-10%)
- Grey Silty (12-21%) Sand (77-86%)with Gravel (2-4%)
- Brown/ Grey Clayey (12-29%) Silty (16-34%) Sand (35-72%)with Gravel (2-6%)
- Weathered rock
- Nil — Weathered rock - Core recovery - Nil
- Nil — Weathered rock - RQD- Nil
- 4 'N' Value(Observed)
- Water table was encountered
- E.G.L : Existing Ground level
- $U\frac{2}{1}$ 1st Undisturbed sample in Borehole no 2.

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COMPILED SOIL PROFILE

PROJECT : RESIDENTIAL BUILDING AT KUNDRATHUR MAIN ROAD, MADHANANTHAPURAM VILLAGE, CHENNAI

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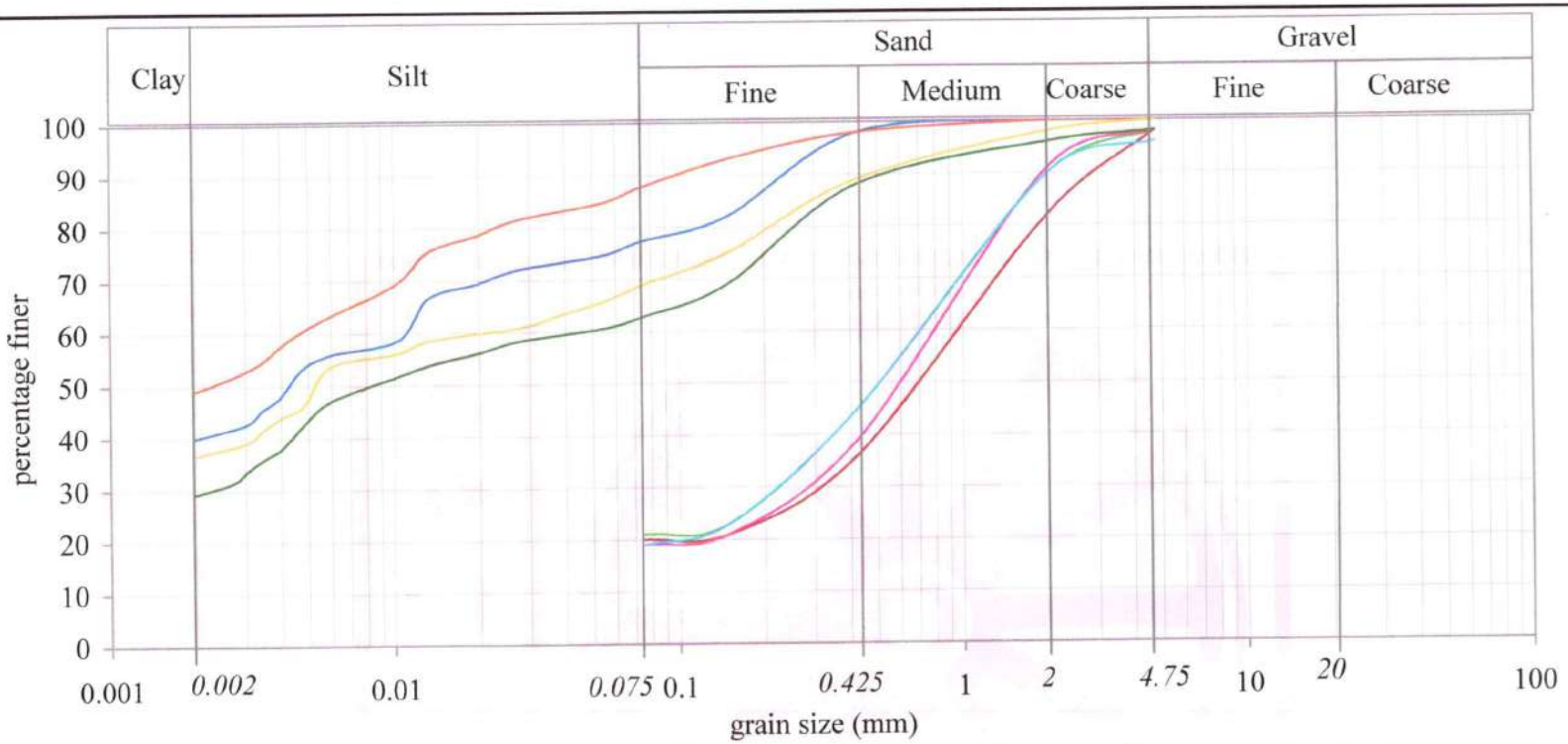
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Sheet No. : 3a



Line Style	Bore hole	Depth (m)	Description	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	d_{60}	d_{10}	U
	1	3.0	Sandy silty clay	0	23	37	40	0.012	-	-
	1	4.5	Sandy silty clay	0	12	39	49	0.005	-	-
	1	6.0	Silty sand with gravel	2	77	21	0	0.700	-	-
	1	7.5	Silty sand with gravel	2	78	20	0	0.975	-	-
	1	9.0	Silty sand with gravel	2	79	19	0	0.800	-	-
	1	10.5	Sandy silty clay	0	31	32	37	0.023	-	-
	1	12.0	Clayey silty sand with gravel	2	35	34	29	0.050	-	-
	1	15.0	Silty sand with gravel	4	77	19	0	0.700	-	-

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Line Style	Bore hole	Depth (m)	Description	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	d_{60}	d_{10}	U
	1	18.0	Clayey silty sand with gravel	5	56	23	16	0.275	-	-
	2	3.0	Clayey silty sand with gravel	6	35	33	26	0.088	-	-
	2	4.5	Sandy silty clay	0	18	37	45	0.005	-	-
	2	6.0	Clayey sandy silt with gravel	5	25	58	12	0.016	-	-
	2	7.5	Silty sand with gravel	2	86	12	0	0.990	-	-
	2	9.0	Clayey sandy silt with gravel	10	31	32	27	0.088	-	-
	2	10.5	Sandy silty clay	0	23	37	40	0.008	-	-
	2	12.0	Clayey silty sand	0	72	16	12	0.280	-	-

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Line Style	Bore hole	Depth (m)	Description	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	d_{60}	d_{10}	U
	2	15.0	Silty sand with gravel	2	81	17	0	0.875	-	-
	2	18.0	Silty sand	0	79	21	0	0.495	-	-

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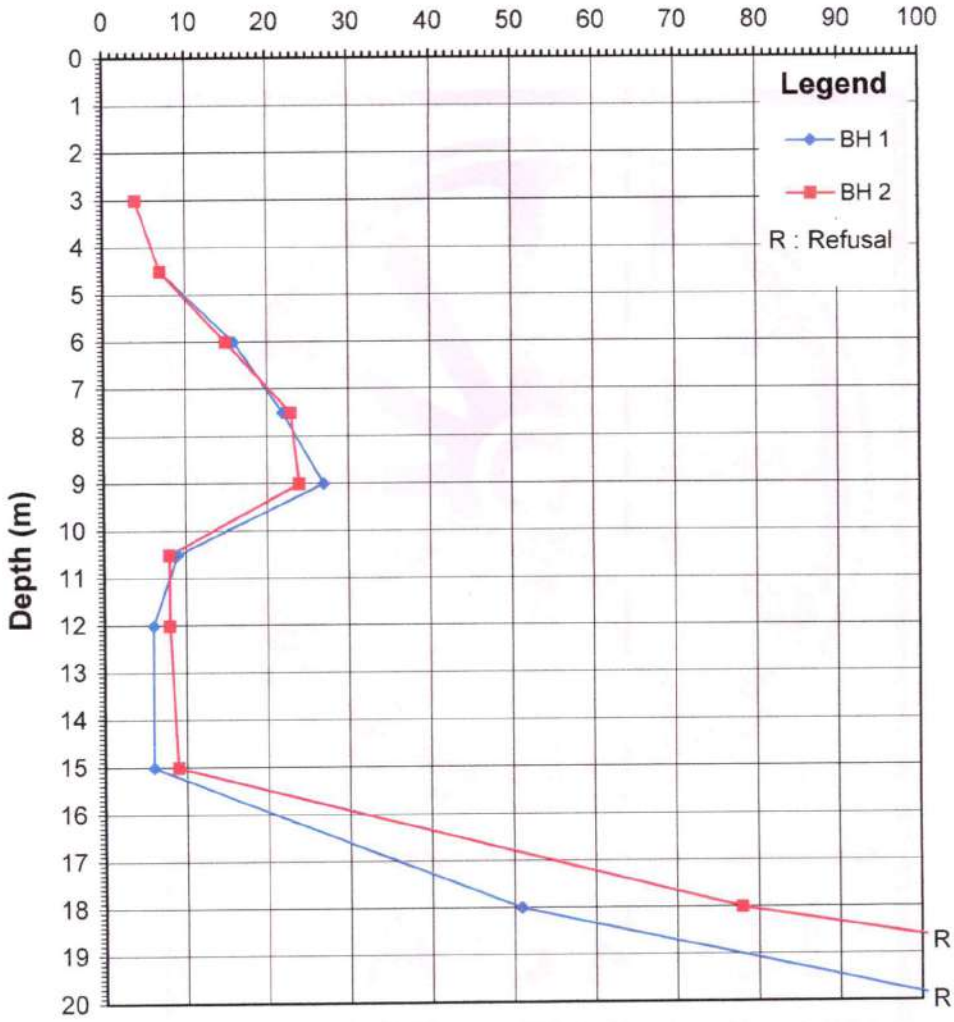
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for GATALA DEVELOPERS & PROPERTIES PVT. LTD.

Managing Director

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SPT Values (Observed)



SPT Values (Observed) Vs Depth Curves

for GATALA DEVELOPERS & PROPERTIES PVT. LTD.

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Sheet No. : 4

THE LANDLENS SUITE

Eight ways to know a piece of land before you pay for it.

This report covers one part of the picture. These cover the rest, drawn from the same government records, for any property in Tamil Nadu.

LandLens One
Ask anything about a property and get an answer grounded in live government records, with the sources shown.
/landlens/one

Verify My Land
Every record check run on one property and returned as a single report.
/landlens/verify-my-land

Legal Opinion
An advocate's written opinion on the title, built on the records we pull for it.
/landlens

One Map
Every layer on one map: the parcel, its boundary, zoning, water bodies and what sits around it.
/landlens/one/map

PriceMap
What land actually changed hands for around this plot, taken from the registered deeds.
/landlens/pricemap

Build Scope
What you are allowed to build here: floor space, height, coverage and setbacks.
/landlens/build-scope

Property Tracker
Watch a property and hear about it when something new is registered against it.
/landlens/property-tracker

Deal Room
Run the transaction in one place: documents, stamping, signatures and the parties.
/landlens/deal-room

FREE TOOLS · NO ACCOUNT NEEDED

Twenty-four checks you can run yourself, at no cost.

Records and verification

The registers themselves, read for you.

- Encumbrance Certificate
- Patta and Chitta
- Field Measurement Sketch
- EC Analyzer
- Bank charge check
- Court case search
- Seller background check
- Approval check by survey

Value and duty

What it is worth and what it costs to register.

- Guideline value by street
- Guideline value by survey
- Stamp duty and registration fees
- Capital gains
- Floor space index
- Area unit converter

Zoning and land use

What the plan says can happen on this land.

- Land use zone finder
- CMDA land use check
- Coastal regulation zone
- Master plan check
- Water bodies finder
- Airport height clearance

Registers and directories

Who holds it, and which office keeps the record.

- Find your registering office
- Temple property check
- Waqf property check
- RERA register

Every free tool
/tools

Services we run for you
/services

The LandLens suite
/landlens/one

Verified RealEstate™

Every claim in this document traces back to a government record.

- Legal opinions, due diligence and title verification
- Building plan, layout and sub-division approvals
- Completion and occupancy certificates, regularisation
- Escrow, negotiation and NRI property management
- Land survey, soil testing, architecture and construction

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Prepared from the registers named on the page each finding sits on. Where a register could not be read, this document says so in its place rather than leaving the gap to be read as a clean result.