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PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING IN OLD S.F.NO.418/2-PT, NEW T.S.NO.5/1, BLOCK NO.7, WARD NO. Z (26), GURUSAMY NAGAR, VILANKURICHI VILLAGE, COIMBATORE NORTH TALUK, COIMBATORE CORPORATION, COIMBATORE DISTRICT-641004.

FOR

M/S.MAYFLOWER ENTERPRISES PVT.LTD

20.02.2023

N 11°2'17.83248", E 77°11'35.6384"

GEOTECHNICAL INVESTIGATIONS

FINAL REPORT



FEBRUARY 2023

ISO 9001:2015
ISO IEC 17025:2017

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CLIENT : M/S.MAYFLOWER ENTERPRISES PVT.LTD

PROJECT ADDRESS: OLD S.F.NO.418/2-PT, NEW T.S.NO.5/1, BLOCK NO.7, WARD NO.Z (26), GURUSAMY NAGAR,VILANKURICHI VILLAGE,COIMBATORE NORTH TALUK,COIMBATORE CORPORATION,COIMBATORE DISTRICT-641004.

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ABBREVIATIONS

EGL / NGL	Existing Ground Level / Natural Ground Level
RL	Reduced Level
BH	Bore Holes
SPT	Standard Penetration Test
GWT	Ground Water Table
TP	Trial Pits
CBR	California Bearing Ratio
NABL	National Accreditation Board for Testing and Calibration Laboratories
NCEER	National Center for Earthquake Engineering Research
BIS	Bureau of Indian Standards
1V: 2H	1 Vertical: 2 Horizontal
MDD	Maximum Dry Density
OMC	Optimum Moisture Content
m	Meter
mm	Milli Meter
m^3	Cubic Meter
MSL	Mean Sea Level
kN/m^3	Kilo Newton per Cubic Meter
Sec/mm	Seconds per Millimeter
SPT 'N'	Standard Penetration Test 'N' value
pH	Hydrogen Ion Concentration
q_a	Allowable Bearing Pressure
IC	In-situ CBR
SBC	Safe Bearing Capacity
SO_4	Sulphate
C	Cohesion
ϕ	Phi, Angle of Internal Friction
RL	Reduced Level
γ	Gamma, Density
CR	Core Recovery
RQD	Rock Quality Designation
TCR	Total Core Recovery
KPa	Kilo Pascal
D	Depth
Kg	Kilograms
Kg/cm^2	Kilograms per square centimeter
CS	Cross Section

TABLE OF CONTENT

1.0	INTRODUCTION		[illegible]
2.0	SCOPE OF WORK		[illegible]
3.0	GEOLOGY OF THE AREA		[illegible]
	3.1	Regional and Local Geology	[illegible]
	3.2	Local Seismicity	[illegible]
4.0	FIELD INVESTIGATIONS		[illegible]
	4.1	Location Details	[illegible]
5.0	METHODOLOGY OF FIELD WORK		[illegible]
	5.1	Boring and Drilling	[illegible]
	5.2	Sampling	[illegible]
	5.3	Rock Coring	[illegible]
	5.4	Standard Penetration Test (SPT)	[illegible]
	5.5	Ground Water Table	[illegible]
6.0	LABORATORY INVESTIGATION		[illegible]
	6.1	Tests IS Standards	[illegible]
	6.2	Tests Charts	[illegible]
	6.3	Uncertainty	[illegible]
7.0	SUB-SOIL PROFILE ANALYSIS		[illegible]
8.0	FOUNDATION DESIGN CONSIDERATIONS		[illegible]
	8.1	Shallow Foundations	[illegible]
	8.2	Design N-value	[illegible]
9.0	NET SAFE BEARING CAPACITY (SBC) COMPUTATIONS		[illegible]
	9.1 Net SBC Computations from Shear Criteria		[illegible]
	9.2 Net Allowable Bearing Pressure Computations from Settlement Criteria		[illegible]
	9.3 Raft Foundation		[illegible]
10.0	MODULUS OF SUB-GRADE REACTION		[illegible]
11.0	CONCLUSION		[illegible]
	CHEMICAL TEST		[illegible]

FIGURES

igure 1	Geology Map	19 – 21

PPENDIX

ppendix A	Bore Logs	22 – 26

PPENDIX

ppendix B1	Laboratory Test Results & Test Certificate (NABL)	27
ppendix B2	NON – NABL Test Results	28
ppendix B3	Particle Size Analysis curves	29 – 31

APPENDIX

ppendix C	Net SBC Calculations	32 – 38
eismic Map	Seismic Map Figure	39
ppendix C1	Photograph	40
orehole ocation	Drawing In Site	41
ettlement	Standard Penetration Resistance Curve	42
ertificate	Engineer's Detail	43
ppendix D	EXCAVATION SAFETY PROCEDURE	44 - 46

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GEOTECHNICAL INVESTIGATION OF PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING IN OLD S.F.NO.418/2-PT, NEW T.S.NO.5/1, BLOCK NO.7, WARD NO. Z (26), GURUSAMY NAGAR, VILANKURICHI VILLAGE, COIMBATORE NORTH TALUK, COIMBATORE CORPORATION, COIMBATORE DISTRICT-641004.

1. INTRODUCTION

Geotechnical Investigation of Proposed Construction of RESIDENTIAL APARTMENT BUILDING Coimbatore- 641004. awarded the work of Geotechnical Investigations Work to Sastha Soil Testing Services dated 16nd February 2023

As part of scope of services, Total Four boreholes were drilled up to 7.50 m depth below EGL or 3 consecutive N-values are greater than 50 or 1.5 m drilling into Soft rock/ M.rock, H.rock, whichever is earlier at the locations identified by the Client, in our site We Have Encountered with fill up soil, DSR from 1.50 M, Ds Rock from 3.00 m, And DSR, Hard Rock from 4.50 m, Hard Rock From 6.00 m to 7.50 m N= 50.

This final report covers the details of boreholes drilled; sub-soil profile noticed in the boreholes, field and laboratory test results of soil samples collected from the boreholes and interpretation of the same for Safe Bearing Capacity (SBC) and foundation recommendations.

2. SCOPE OF WORK

Conducting Standard Penetration Test (SPT) at every 1.5 m intervals up to 10 m depth and thereafter at every 1.5 m intervals till refusal (N>50).

- Collection of 100 mm diameter undisturbed soil samples in cohesive soil layers
- Conducting all relevant laboratory tests on soil/rock samples as per IS codes and as per Client's structural requirements.
- Determination of Safe Bearing Capacity (SBC) of Soil/Rock.
- Preparation and submission of reports

K.SETHURAMAN Mad... C... 93441...

SASTHA SOIL TESTING SERVICES

3. GEOLOGY OF THE AREA - Regional and Local Geology

Geologically, the district is covered by rocks belonging to Archean age comprising the khondalite group, Charnockite Group, migmatite group, Sathayamangalam group, Bhavani Group and Alkali complex of Proterozoic age and Recent to Late Plestocene rocks of Cainozoic age. The Charnockite Group of rocks consisting of Charnockite, pyroxene granulites and associated magnetite quartzite, the Knodalite Group comprising gametiferous – sillimanite gneiss, calc-granulite, crystalline limestone, sillimanite quartzites and associated migmatitic gneisses. The rocks are restricted to the central and southern portions of the district, especially around Sulur, Madukkarai and Pollachi taluks. The fissile hornblende gneisses (Peninsular gneiss – younger phase) of Bhavani Group with enclaves of schistose, micaceous and amphibolitic rocks, fuchsitge – kyanite quartzites, ferruginous quartzite (Satyamangalam Group) intruded by a number of ultramafic and basic rocks and granites are seen in the Northern portions of the district especially around Mettupalayam and Northern areas of Coimbatore. The granites are Proterozoic age and occupy the Western end and Eastern Part of the District as separate bodies and are recognized as Maruthamalai Granite and Punjapuliyampatti Granites respectively. The quaternary alluvium is seen in the Western areas of Coimbatore town. The alluvium is more than 30m thick in the Chinnathadagam valley northwest of Coimbatore and in the Siruvani valley west of Coimbatore.

Soils

The soils of Coimbatore district can be broadly classified into 6 major soils types' viz., Red calcareous Soil, Black Soil, Red non-calcareous, Alluvial and Colluvial Soil, Brown Soil, and Forest Soil. About 60 per cent of the district is covered by red soils, of which red calcareous soil is predominant. They occupy most parts of Palladam, Coimbatore, Mettupalayam and Udumalpet taluks. Medium to deep red calcareous soils are found mainly in Pollachi and Udumalpet taluks. Parts of Palladam, Avinashi and Udumalpet taluks are occupied by red non-calcareous soils. The highlands in Coimbatore, Palladam and Avinashi taluks are mostly occupied by the black soils, which are dark gray to grayish brown in co lour. The Alluvial soils are found in small patches along the Noyil River mainly in the upper reaches. The Colluvial soils are found mainly in Chinnathadagam and Chitrachavadi sub-basins and as scattered patches at the foothills of the Anaimalai. The Forest soils are confined to the reserve forest area and have a surface layer of organic matter.

Age Rock Formation Top soil –Red soil - Recent Age Charnockite - Archaean formation

Hydrogeology

Surface Water and Ground Water Scenario of the District

The district is underlain by both porous and fissured formations. The important aquifer systems in the district are constituted by i) unconsolidated formations and ii) weathered and fractured crystalline rocks.

Weathered & Fractured Granite Gneiss, Granites and Charnockites, Colluvium & Recent alluvium along the river courses. WATER DEPTH IN M 26.5 – 304.00

Local Seismicity. Coimbatore falls under **Zone III** of Seismic Zoning Map as per IS:1893 (Part I) - 2002. (Based on the Vulnerability Atlas of India – 2nd Editions, BMTPC).

SEISMIC ZONE - Seismic Zone III, Zone factor Z=0.16. Seismic intensity: Low. Importance Factor *I* = 1





K.SETHURAMAN

4.0. FIELD INVESTIGATIONS.

Location Details

The bore holes have been drilled at the locations identified by the Client. The bore hole Latitude / Longitude is furnished in the below Table.

S.NO	BH NO	EASTING	NORTHING	BORE HOLE TERMINATION DEPTH
1	01	77°1'13.56384"	11°2'17.83248"	4.50 m
2	02	77°1'13.206"	11°2'18.618"	4.50 m
3	03	77°1'13.35"	11°2'19.14"	6.00 m
4	04	77°1'13.34388"	11°2'18.4686"	7.50 m

5.0. METHODOLOGY OF FIELD WORK.

5.1. Boring and Drilling

Boreholes was sunk by deploying heavy duty rotary drilling rig using the conventional rotary drilling process. Methodology followed for boring confirmed to IS: 1892.Boring was affected by the cutting action of rotating bit with Bentonite slurry circulation and by stabilizing the sides of the boreholes using casing pipes/Bentonite slurry up to required depth to prevent side collapse. While this method was adequate to bore through the stiff soil stratum, progress of boring slowed down considerably near the soil-rock interface, including weathered rock formations. In such cases, further drilling work was carried out by using NX size double tube core barrel with TC (Tungsten Carbide) bits. The bore logs are furnished in Appendix A.

5.2. Sampling

Disturbed samples have been collected from split spoon sampler by conducting the standard penetration tests below the existing ground level as presented in the respective field bore logs. Undisturbed samples (UDS) could not be collected in the bore holes since cohesive to semi- cohesive soils was not in the boreholes.

5.3. Rock Coring

Heavy duty rotary drilling rig having the capacity to drill up to 60 m has been used to drill through the rocky stratum. Tungsten Carbide (TC)/Diamond bits were used to drill through weathered rock/hard rock stratum. Recovered cores were measured and percentage CR and RQD has been calculated asunder:

$$\%\ CR = \frac{Length\ of\ core}{Length\ of\ run}\ x100$$

$$\%RQD = \frac{Length\ of\ core\ in\ pieces\ of\ 101.6mm\ (4inchesandabove)}{Length\ of\ run}\ x\ 100$$

The SPT, UDS and rock core samples, core sampling depth percentage, CR and RQD for each core drill run has been mentioned in the bore log.

5.4. Standard Penetration Test (SPT)

Standard Penetration Test (SPT) to determine penetration resistance was conducted in the boreholes generally up to refusal depth using the procedure described in IS: 2131. In this method, driving bit is replaced by split spoon sampler (50.8 mm OD and 35 mm ID) and the sampler is driven by dropping 63.5 kg hammer on the top of the driving collar with free fall of 75 cm. The length of the sampler is 60 cm. The sampler is first driven through15 cm as "Seating Drive". It is further driven through 30 cm. The number of blows required to drive the sampler for 30 cm beyond seating drive is termed as "Penetration Resistance, N".

Where it was not possible to penetrate the full length of SPT sampler and "refusal" was reached earlier, N values are generally observed to be greater than 100.

Recorded 'N' values are mentioned in the respective bore log sheet attached.

5.5. Ground Water Table

Approximate Ground water table was **not met in the Drilling depth** of 10.000 m depth below EGL at the time of investigation

Road level and site level

The Approximate Level of site is **- 0.000 M Above the Nearby Road.** Approximate MSL Elevation 431 meters Above Sea level.

6.0. LABORATORY INVESTIGATION

Disturbed soil samples recovered from the boreholes at various depths are collected for Laboratory tests to determine their Physical and Engineering properties. The testing procedures were in accordance with current applicable IS Standards.

The Following tests were conducted on selected soil samples recovered from the boreholes:

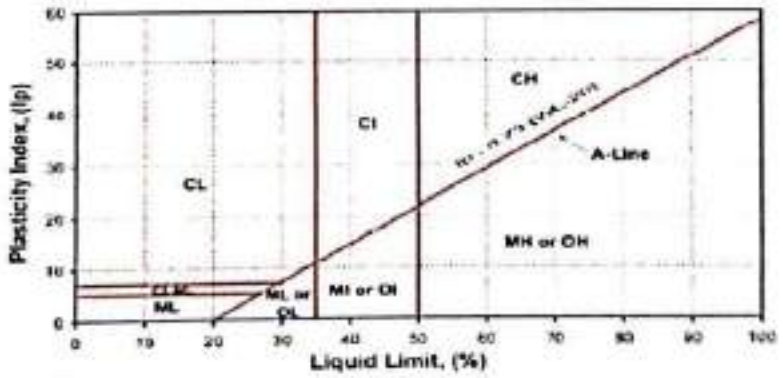
Laboratory Test	IS Code Referred
Bulk Density	By Calculations
Natural Moisture Content (NMC)	IS 2720 Part 2 – 1973 (Reaffirmed 2015)
Specific Gravity	IS 2720 Part 3 Sec 2 – 1980 (Reaffirmed 2016)
Grain Size Analysis	IS 2720 Part 4 – 1985 (Reaffirmed 2015)
Liquid Limit and Plastic Limit	IS 2720 Part 5 – 1985
Free Swell Index	IS 2720 Part 40 – 1977 (Reaffirmed 2002)
Direct Shear Test	IS 2720 Part 13 – 1986 (Reaffirmed 2016)
Unconfined Compressive Strength Test (UCC)	IS 2720 Part 10 – 1991 (Reaffirmed 2015)
Point Load Index Test on Rock	IS 8764 – 1998 (Reaffirmed 2019)

The Laboratory Test Results are furnished in *Appendix B1*. The grain size curves of soil samples are furnished in *Appendix B2*.

Plasticity of Clay

Plasticity	Liquid Limit
Low Plastic	< 35
Medium Plastic	35 to 50
High Plastic	> 50

Plasticity Chart



Consistency of Cohesive Soils		
Consistency	**Cohesion Intercept, Kg/Sq.cm**	**SPT (N) Value**
Very Soft	<0.1	0 to 2
Soft	0.1 to 0.25	2 to 4
Firm / Medium	0.25 to 0.5	4 to 8
Stiff	0.5 to 1.0	8 to 15
Very Stiff	1.0 to 2.0	15 to 30
Hard	> 2.0	> 30

Density Condition of Granular Soil	
Density Descriptor	**SPT (N) Value**
Very Loose	0 to 4
Loose	4 to 10
Medium Dense	10 to 30
Dense	30 to 50
Very Dense	> 50

Degree of Expansion of Fine Grained Soils

Liquid Limit	Plasticity Index	Shrinkage Index	Free Swell Percent	Degree of Expansion	Degree of Severity
20 - 35	< 12	< 15	< 50	Low	Non-critical
35 - 50	12 - 23	15 -30	50 -100	Medium	Marginal
50 - 70	23 - 32	30 - 60	100 - 200	High	Critical
70 - 90	> 32	> 60	> 200	Very High	Severe

Test / Parameter		Uncertainty*	Test / Parameter		Uncertainty*
Moisture Content		± 0.28%	Free Swell Index, %		± 0.4%
Bulk & Dry Density		± 0.05 g/cc	Swell Pressure		± 0.43 kg/cm^2
Specific Gravity		± 0.014	Consolidation	Pressure	± 0.03 kg/cm^2
Liquid Limit		± 0.30%		Void Ratio	±0.01
Plastic Limit			Density Index (relative density) of cohesionless soils		± 5%
Shrinkage Limit		± 0.40%			
Unconfined Compression	c	± 0.052 kg/cm^2	CD Direct Shear Test	ϕ	± 0.52 degrees
UU Triaxial Test	c	± 0.01 kg/cm^2	Soil Gradation		± 0.4% of particle size
	ϕ	± 0.44 degree			
Std Mod Proctor Compaction	MDD	± 0.03 g/cc	Coefficient of Permeability		± 10%
	OMC	± 0.29%	Rock	Crushing Strength	± 2.3 kg/cm^2
Laboratory CBR		± 1.6%		Point Load Strength	± 0.017 kg/cm^2

* at 95 percent confidence level for coverage factor of 2

Table 1

Soil type	Description	Average shear wave velocity in the top 30 m	Foundation class	Description of foundation profile
A	Hard Rock	1500 m/s		
B	Rock	760 - 1500 m/s	A	Rock or other rock like geological formation, including at most 5 m of weaker material at the surface
C	Very dense soil and soft rock	360 - 760 m/s	B	Deposits of very dense sand, gravel or very stiff clay, at least several tens of m in thickness, characterized by a gradual increase of mechanical properties with depth
D	Stiff soil	180 - 360 m/s	C	Deep deposits of dense or medium dense sand, gravel or stiff clay with thickness from several tens to many hundreds of m
E	Soft soil	< 180 m/s	D	Deposits of loose-to-medium cohesionless soil, with or without some soft cohesive layers, or of predominantly soft-to-firm cohesive soil
F	Special soil requiring site specific evaluation: F1 Soils vulnerable to potential failure or collapse under seismic loading, e.g. liquefiable soils, quick and highly sensitive clays, collapsible weakly cemented soils. F2 peats and/or highly organic clays (> 3 m in the soil layer) F3 very high plasticity clays (> 8 m in the soil layer with plasticity index PI > 75) F4 very thick soft/medium stiff clays (> 36 m in the soil layer)		E	A soil profile consisting of a surface alluvium layer with v_s values of type C or D and the thickness ranging between about 5 m and 20 m, underlain by stiffer material with v_s > 800 m/s
			S1	Deposits consisting, or containing a layer at least 10 m thick of soft clays/silts with high plasticity index (PI > 40) and high water content
			S2	Deposits of liquefiable soils, of sensitive clays, or any other soil profile not included in classes A, B, C, D, E or S1

6.3. UNCERTAINTY

- Every Measurement entails an uncertainty. It is well known that no measuring instrument can determine the true value of any measurement. The cumulative effect of factors such as sensitivity of equipment, accuracy in calibration, human factors and environmental conditions will determine the overall uncertainty in the parameter determined from these measurements.

- As a part of our commitment to our clients, we have worked out the uncertainty in the parameters reported by our laboratory. Although this does not form a part of our contract agreement, we present below our statistical estimate of uncertainty of various parameters based on our most recent evaluation.

7.0 SUB-SOIL PROFILE

Generally, one-layer sub-soil profile was noticed in the boreholes, described as under:

Layer I – Layer III: fill up soil, DSR from 1.50 M, Ds Rock from 3.00 m, And DSR, Hard Rock from 4.50 m, Hard Rock From 6.00 m to 7.50 m **N= 50. This layer was noticed at the top in the boreholes and up to the termination depth of the bore holes. The thickness of this layer and recorded N- values in this layer areas under:**

BH. No	Thickness of Layer below EGL (m)	N-values	In-situ Compactness of Soil
01	0 – 1.50, 1.50 – 3.00, 3.00 – 4.50,	50, >50, >50	LOOSE, DENSE
02	0 – 1.50, 1.50 – 3.00, 3.00 – 4.50,	50, >50, >50.	DENSE
03	0 – 1.50, 1.50 – 3.00, 3.00 – 4.50, 4.50 – 6.00	50, >50, >50, >50	DENSE
04	0 – 1.50, 1.50 – 3.00, 3.00 – 4.50, 4.50 – 6.00, 6.00 – 7.50	50, >50, >50, >50, >50	DENSE

8.0. FOUNDATION DESIGN CONSIDERATIONS- Foundation Type, Size & Depth

B + STILT + 9 FLOORS BUILDING

Based on sub-soil profile noticed at site and proposed structures, Open foundations isolated spread can be considered as suitable foundation system. As per Client's specification, the Structure will have B + STILT + 9 Floors Building above EGL. Hence Safe Bearing Capacity (SBC) calculations have been made for foundations at 1.50 to 10 m depth below EGL. Based on the structural configuration, designer can consider the design foundation level.

RAFT FOUNDATION

Raft foundation with wide footing below 4.50 m / 3.00 m from NGL According basement Height requirements

Column foundation

Use Column foundation with wide footing below 4.50 m / 3.00 m from NGL, with connecting Beam all around

(or)

Combined Column foundation / Strip Foundation

Use combined Column foundation with wide footing below 4.50 m / 3.00 m from NGL, with connecting Beam all around

(or)

According to the Structural Engineer's recommendation considering loading conditions.

Isolated spread footings should have minimum embedment of 1.5m in to natural soil below the excavated level and foundations can be considered at the proposed founding level.

Minimum and maximum footing widths for isolated spread footings foundations considered in the report are as follows:

8.2. Design N-value

The N-values in the boreholes at 1.50 m, 3.0 m and 4.50 m depth below EGL are as follows:

Borehole No.	N-value			
	Depth (m)			
	1.50	3.00	4.50	6.00
01	10	>50	>50	>50
02	50	>50	>50	>50
03	50	>50	>50	>50
04	50	>50	>50	>50

10. NET SAFE BEARING CAPACITY (SBC) COMPUTATIONS

Calculations for Net Safe Bearing capacity for the foundations supported in soil layers are recommended based on following approach

- Shear Criteria recommended by IS:6403
- Settlement criteria recommended by IS:8009 (Part I)

Consistent with standard Geotechnical Practices, the lower of values worked out from shear as well as settlement approach is recommended for design

9.1. Net SBC Computations from Shear Criteria

The calculations are based on equation recommended by Code IS: 6403 which takes care of L/B ratio (shape), foundation depth etc., along with other parameters based on general shear failure. The equation used to calculate net ultimate bearing capacity (UBC) is as under.

$$\text{Net UBC} = c\,N_c\,S_c\,d_c\,i_c + \gamma D\,(N_q - 1)\,S_q\,d_q\,i_q + 0.5\gamma\,B\,N_\gamma\,S_\gamma\,d_\gamma\,i_\gamma$$

Where,

c = Cohesion of founding strata in t/m² = 0

ϕ = Angle if internal friction of founding strata

S_c, S_q and S_γ = Shape factors referred from IS: 6403

for square foundation = 1.3, 1.2 and 0.8 Respectively

N_c, N_q and N_γ = Bearing capacity factors referred from IS:6403

d_c, d_q and d_γ = Depth factors referred from IS:6403

$\sqrt{N_\phi} = \tan^2(45 + \phi/2)$

$d_c = 1 + 0.2(D/B)\sqrt{N_\phi}$

d_q and $d_\gamma = 1 + 0.1\,(D/B)\sqrt{N_\phi}$

i_c, i_q and i_γ = Inclination factors, all three factors are equal to 1

D = Depth of foundation below existing ground level = 2.0 m & 3.0 m

B = Width of foundation = 2 m, 3 m

γ = Bulk unit weight of founding strata

9.2. Net Allowable Bearing Pressure Computations from Settlement Criteria

Using curve of IS-8009 (Part I), settlements for 10 t/m² are inferred for foundations of width 2.0 m, 3.0 m for design SPT 'N' values. For foundations beyond 3.0 m width,

Curves become asymptotic and settlements become more or less constant. This settlement inferred is corrected for Ground water table position, embedment and rigidity. Finally, by using this corrected settlement, the net allowable bearing pressure is evaluated for 25 mm immediate settlement.

The calculated Net Safe Bearing Capacity (SBC) values are tabulated below:

BH No.	Width (m)	Recommended Net SBC (kN/m²) IS :6403							
		Depth below EGL (m)							
		1.50		2.00		2.50		3.00	
		Shear	Settlement	Shear	Settlement	Shear	Settlement	Shear	Settlement
BH 1	1.50	36.97	139.61	47.84	139.61	59.55	139.61	496.48	937.37
	2.00	39.17	128.22	49.29	128.22	60.05	128.22	494.63	860.88
BH 2 - 4	1.50	260.09	937.37	332.38	937.37	411.18	937.37	496.48	937.37
	2.00	280.17	860.88	346.78	860.88	418.27	860.88	494.63	860.88

Model calculation for estimation of Net SBC is presented in Appendix C.

9.3 Raft Foundation

In case, higher bearing capacities are required and to avoid differential settlement, rigid raft foundation can be considered at the proposed founding level.

Borehole No.	N-value			
	$Q_{a\text{-}net}$ = 0.088 X Cw X N X S_a in t/sq.m Where, $Q_{a\text{-}net}$ =Net allowable bearing pressure in t/sq.m			
	N-value Depth (m) 3.00	$Q_{a\text{-}net}$ Net allowable bearing pressure in t/sq.m	N-value Depth (m) 4.50	$Q_{a\text{-}net}$ Net allowable bearing pressure in t/sq.m
BH 1	50	55	50	55
BH 2	50	55	50	55
Average	50	**55**	50	**55**

Net Safe Bearing Pressure for a raft foundation is given by,

$Q_{a\text{-}net}$ = 0.088 X Cw X N X S_a in t/sq.m

Where, $Q_{a\text{-}net}$ =Net allowable bearing pressure in t/sq.m

C_w=correction factor for water table = 0.5

N = SPT 'N' value

SBC at 3.00 m depth, N value = 50

$Q_{a\text{-}net}$= 0.088 x 0.5 x 13.4 x25 = 55 t/sq.m x 9.80665, SBC = 539.37 kN/m2

Hence net SBC of 55 t/sq.m or 539.37 kN/m2 can be considered for raft foundations (B ≥ 6m) at 3.00 m / 4.50 **depth** below EGL.

Depth in Metre	SBC (t/m²)	SBC (KN/m²)
3.00 m	55	539.37
4.50 m	55	539.37

SASTHA SOIL TESTING SERVICES

10.0. MODULUS OF SUB-GRADE REACTION

One of the most popular relationships between allowable bearing capacity and modulus of subgrade reaction is given in equation (5) according to Bowles (1996);

$$k_s = 40.(FS).(q_a) \quad \text{---} \quad (5)$$

Where q_a is the allowable bearing capacity of the soil, and FS is the factor of safety that was used in converting the ultimate pressure (q_{ult}) to allowable pressure (q_a). It is important to note that in equation (5), the author assumed a 25 mm settlement value for the soil.

Where;

k_s = Coefficient of subgrade reaction

q_a = Allowable bearing capacity = (ultimate bearing capacity/factor of safety)

S_a = Allowable settlement

Typical values of modulus of subgrade reaction

The typical values of modulus of subgrade reaction of different types of soils are given below;

Soil description	Modulus of subgrade reaction (kN/m²/m)
Humus soil or peat	5000 - 15000
Recent embankment	10000 - 20000
Fine or slightly compacted soil	15000 - 30000
Well compacted sand	50000 - 100000
Very well compacted sand	100000 - 150000
Loam or clay (moist)	30000 - 60000
Loam or clay (dry)	80000 - 100000
Clay with sand	80000 - 100000
Crushed stone with sand	100000 - 150000
Coarse crushed stone	200000 - 250000
Well compacted crushed stone	200000 - 300000

11.0. CONCLUSION

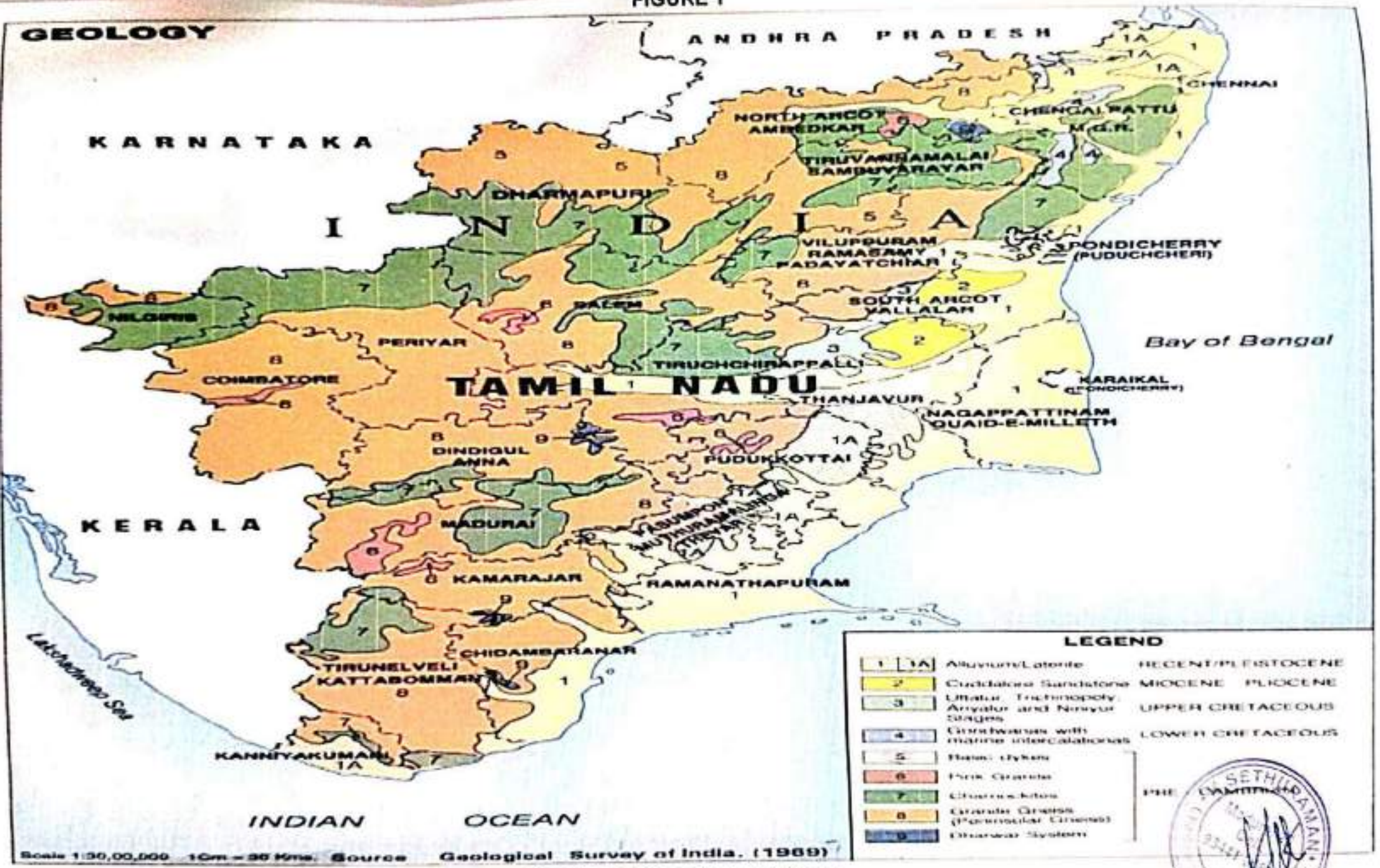
- Boreholes BH 1-4 were drilled at Site, at the locations identified by the Client.
- The detailed description of soil layers met in the boreholes is mentioned in Sec7.0 above.
- Based on the sub-soil profile noticed, Open foundations isolated spread, shallow foundations such as isolated spread foundations can be considered as the suitable foundation system for the proposed structures.
- Stratum at the founding level shall be thoroughly checked before placing the foundations on this layer. If any loose soil pockets or cavities are present, the same shall be replaced with lean concrete/ compacted sand pad before placing the foundations.
- Approximate Ground water table was met in the Area not met in the Drilling depth of 10.000 m depth below EGL at the time of investigation. While during construction if water table is encountered at the founding level suggested/higher, proper de watering measures shall be adopted so as to confine the water table to the base level of footing.
- Recommended excavation slopes in this type of soil are 2H: 1V. Any loose soil (unacceptable soil) on the surface below the grubbing depth shall be removed and filled and compacted with good gravelly soil/ lean concrete.

SOIL CHEMICAL TEST

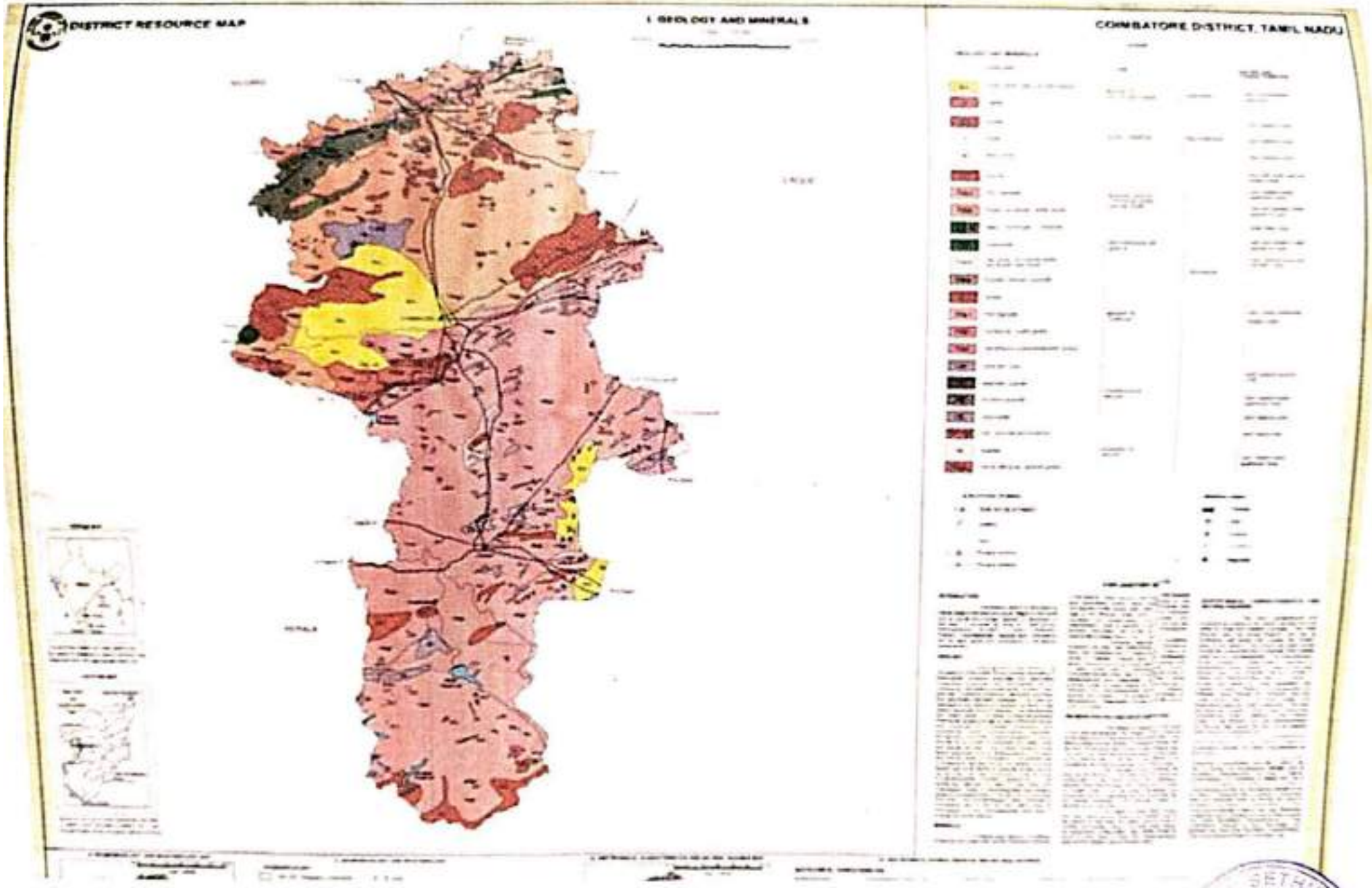
	PARAMETERS	UNITS	RESULTS			CONSTRUCTION AS PER IS 456-2000 LIMITS	TEST METHOD
			BH 1-3.0, BH -2/3.0, BH-4/1.5,3.0	BH-3/1.5,3.0,4.5, BH-2/1.5	BH-1/1.5		
1	Chlorides (as Cl)	mg/L	40	50	40	500 mg/L max. for RCC 2000 mg/L max. for PCC	IS 3025 (Part 32)
2	Sulphates (as SO4)	mg/L	80	80	37	400 mg/L max.	IS:3025 (Part 24)
3	Alkalinity (as CaCO3)	mg/L	75	56	99	-	-

K.SETHURAMAN

FIGURE 1



Geology Map of Tamil Nadu



Geology Map of Coimbatore

R ENTERPRISES PVT LTD

SASTHA SOIL TESTING S



Location Map

APPENDIX A

BORE LOG – 1

SASTHA SOIL TESTING SERVICES

Sastha Soil Testing Services

PROJECT : PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING IN OLD S.F.NO.415/2-PT, NEW T.S.NO.5/1, BLOCK NO.7, WARD NO. Z (26), GURUSAMY NAGAR, VILANKURICHI VILLAGE, COIMBATORE NORTH TALUK, COIMBATORE CORPORATION, COIMBATORE DISTRICT-641004.

LOCATION : OLD S.F.NO.415/2-PT, NEW T.S.NO.5/1, BLOCK NO.7, WARD NO. Z (26), GURUSAMY NAGAR, VILANKURICHI VILLAGE, COIMBATORE NORTH TALUK, COIMBATORE CORPORATION, COIMBATORE DISTRICT-641004.

BORE HOLE NUMBER : BH - 1
METHOD OF SAMPLING : Rotary Drilling
COORDINATES N : 11°2'17.83248"
COORDINATES E : 77°1'13.56384"
GROUND WATER DEPTH : 46.15 m
TOTAL DEPTH (m) : 4.50 m

DRILLING TYPE MACHINE : FM
CORE TYPE : SINGLE
CORE DIAMETER (mm) : 75
WEIGHT OF HAMMER (Kg) : 63.5
DIST.FALLING HAMMER (cm) : 76
CASSING DIAMETER (mm) : 150

DATE COMMENCED : 20.02.2023
DATE COMPLETED : 20.02.2023
GEOTECH ENGINEER : Mr. Krishnan Sethuraman
DRILL CREW : Surendaran P
SUPERVISOR : Vishunu
SITE LEVEL : +1m road level

BORE LOG SHEET

DEPTH (m)	Casing	G.W.L (m)	LETTER SYMBOL	SOIL PROFILE	DISCRIPTION OF SOIL	SPT TEST	SAMPLE	SPT & N VALUE N1	N2	N3	N	STANDARD PENETRATION TEST NUMBER OF BLOWS	UNCONF. COMP. TEST	DEPTH (m)	CORE RECOVERY %
0														0	
1	Casing ϕ 150 mm		FS		FILL UP SOIL									1	
2			DSR		DISINTAGRATED SOIL ROCK	SPT-1								2	
3							DS-1	50/11 CM			>50			3	
4			R		ROCK									4	
5														5	
6														6	
7														7	
8														8	
9														9	
10														10	
11														11	
12														12	
13														13	
14														14	
15														15	
16														16	
17														17	
18														18	
19														19	
20														20	

REMARKS : 4.5

Undisturbed Sample (UDS)

Disturbed Sample (DS)

BORE LOG – 2

SASTHA SOIL TESTING SERVICES

Sastha Soil Testing Services

PROJECT : PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDINGIN OLD S.F.NO.418/2-PT, NEW T.S.NO.5/1, BLOCK NO.7, WARD NO. Z (26), GURUSAMY NAGAR, VILANKURICHI VILLAGE, COIMBATORE NORTH TALUK, COIMBATORE CORPORATION, COIMBATORE DISTRICT-641004.

LOCATION : OLD S.F.NO.418/2-PT, NEW T.S.NO.5/1, BLOCK NO.7, WARD NO. Z (26), GURUSAMY NAGAR, VILANKURICHI VILLAGE, COIMBATORE NORTH TALUK, COIMBATORE CORPORATION, COIMBATORE DISTRICT-641004.

BORE HOLE NUMBER : BH - 2
METHOD OF SAMPLING : Rotary Drilling
COORDINATES N : 11°2'18.618"
COORDINATES E : 77°1'13.206"
GROUND WATER DEPTH : 46.15 m
TOTAL DEPTH (m) : 4.50 m

DRILLING TYPE MACHINE : FM
CORE TYPE : SINGLE
CORE DIAMETER (mm) : 75
WEIGHT OF HAMMER (Kg) : 63.5
DIST.FALLING HAMMER (cm) : 75
CASSING DIAMETER (mm) : 150

DATE COMMENCED : 20.02.2023
DATE COMPLETED : 20.02.2023
GEOTECH ENGINEER : Mr. Krishnan Sethuraman
DRILL CREW : Surendaran P
SUPERVISOR : Vishuni
SITE LEVEL : Same as Road Level

BORE LOG SHEET

DEPTH (m)	Casing	G.WL (m)	LETTER SYMBOL	SOIL PROFILE	DISCRIPTION OF SOIL	SPT TEST	SAMPLE	SPT & N VALUE N1	N2	N3	N	STANDARD PENETRATION TEST NUMBER OF BLOWS	UNCONF. COMP. TEST COMPRESSIVE STRENGTH	DEPTH (m)	CORE RECOVERY %
0						SPT-1								0	
1	Casing ϕ150 mm		DSR		DSR		DS-1	50/11 CM			>50			1	
2			DSR		DSR									2	
3														3	
4			R		ROCK									4	
5														5	
6														6	
7														7	
8														8	
9														9	
10														10	
11														11	
12														12	
13														13	
14														14	
15														15	
16														16	
17														17	
18														18	
19														19	
20														20	

REMARKS : 4.50M TEST WAS STOPPED

Undisturbed Sample (UDS)
Disturbed Sample (DS)

SASTHA SOIL TESTING SERVICES

BORE LOG – 3

SASTHA SOIL TESTING SERVICES

Sastha Soil Testing Services

PROJECT	: PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDINGIN OLD S.F.NO.418/2-PT, NEW T.S.NO.5/1, BLOCK NO.7, WARD NO. Z (26), GURUSAMY NAGAR, VILANKURICHI VILLAGE, COIMBATORE NORTH TALUK, COIMBATORE CORPORATION, COIMBATORE DISTRICT-641004.
LOCATION	: OLD S.F.NO.418/2-PT, NEW T.S.NO.5/1, BLOCK NO.7, WARD NO. Z (26), GURUSAMY NAGAR, VILANKURICHI VILLAGE, COIMBATORE NORTH TALUK, COIMBATORE CORPORATION, COIMBATORE DISTRICT-641004.
BORE HOLE NUMBER	: BH - 3
METHOD OF SAMPLING	: Rotary Drilling
COORDINATES N	: 11°2'19.14"
COORDINATES E	: 77°1'13.35"
GROUND WATER DEPTH	: 46.15 m
TOTAL DEPTH (m)	: 6.00 m
DRILLING TYPE MACHINE	: FM
CORE TYPE	: SINGLE
CORE DIAMETER (mm)	: 75
WEIGHT OF HAMMER (Kg)	: 63.5
DIST.FALLING HANMER (cm)	: 75
CASSING DIAMETER (mm)	: 150
DATE COMMENCED	: 21.02.2023
DATE COMPLETED	: 21.02.2023
GEOTECH ENGINEER	: Mr. Krishnan Sethuraman
DRILL CREW	: Surendaran P
SUPERVISOR	: Vishnu
SITE LEVEL	: Same as Road Level

BORE LOG SHEET

DEPTH (m)	Casing	G.W.L (m)	LETTER SYMBOL	SOIL PROFILE	DISCRIPTION OF SOIL	SPT TEST	SAMPLE	SPT & N VALUE N1	N2	N3	N	STANDARD PENETRATION TEST NUMBER OF BLOWS	UNCONF. COMP. TEST COMPRESSIVE STRENGTH	DEPTH (m)	CORE RECOVERY
1	Casing ϕ 150 mm		DSR		DSR	SPT-1	DS-1	50/11 CM			>50			1	
2			DSR		DSR									2	
3			DSR		DSR									3	
4			DSR		DSR									4	
5			R		ROCK									5	
6														6	
7														7	
8														8	
9														9	
10														10	
11														11	
12														12	
13														13	
14														14	
15														15	
16														16	
17														17	
18														18	
19														19	
20														20	

REMARKS : 6.00M TEST WAS STOPPED

Undisturbed Sample (UDS)

Disturbed Sample (DS)

SASTHA SOIL TESTING SERVICES

BORE LOG – 4

SASTHA SOIL TESTING SERVICES

Sastha Soil Testing Services

PROJECT : PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING IN OLD S.F.NO.418/2-PT, NEW T.S.NO.5/1, BLOCK NO.7, WARD NO. Z (26), GURUSAMY NAGAR, VILANKURICHI VILLAGE, COIMBATORE NORTH TALUK, COIMBATORE CORPORATION, COIMBATORE DISTRICT-641004.

LOCATION : OLD S.F.NO.418/2-PT, NEW T.S.NO.5/1, BLOCK NO.7, WARD NO. Z (26), GURUSAMY NAGAR, VILANKURICHI VILLAGE, COIMBATORE NORTH TALUK, COIMBATORE CORPORATION, COIMBATORE DISTRICT-641004.

BORE HOLE NUMBER : BH - 4
METHOD OF SAMPLING : Rotary Drilling
COORDINATES N : 11°2'18.4686"
COORDINATES E : 77°1'13.34388"
GROUND WATER DEPTH : 46.15 m
TOTAL DEPTH (m) : 7.50 m

DRILLING TYPE MACHINE : FM
CORE TYPE : SINGLE
CORE DIAMETER (mm) : 75
WEIGHT OF HAMMER (Kg) : 63.5
DIST.FALLING HAMMER (cm) : 75
CASSING DIAMETER (mm) : 150

DATE COMMENCED : 21.02.2023
DATE COMPLETED : 21.02.2023
GEOTECH ENGINEER : Mr. Krishnan Sethuraman
DRILL CREW : Surendaran P
SUPERVISOR : Vishunu
SITE LEVEL : Same as Road Level

BORE LOG SHEET

DEPTH (m)	Cassing	G.W.L (m)	LETTER SYMBOL	SOIL PROFILE	DISCRIPTION OF SOIL	SPT TEST	SAMPLE	SPT & N VALUE N1	N2	N3	N	STANDARD PENETRATION TEST NUMBER OF BLOWS	UNCONF. COMP. TEST COMPRESSIVE STRENGTH	DEPTH (m)	CORE RECOVERY %
0														0	
1	Cassing ϕ150 mm		DSR		DSR	SPT-1								1	
							D&-1	50/11 CM			>50				
2			DSR		DSR									2	
3														3	
4			DSR		ROCK									4	
5			R		ROCK									5	
6														6	
7			R		ROCK									7	
8														8	
9														9	
10														10	
11														11	
12														12	
13														13	
14														14	
15														15	
16														16	
17														17	
18														18	
19														19	
20														20	

REMARKS : 7.50M TEST WAS STOPPED

Undisturbed Sample (UDS)
Disturbed Sample (DS)

SASTHA SOIL TESTING SERVICES

GEO-TECHNICAL DATA.

TYPE	SEISMIC ZONE	RECOMMENDED SBC (KN/M²) OF SOIL Terzaghi							RECOMMENDED TYPE OF FOUNDATION		
		1.50 m	3.00 m	4.50 m	6.00 m	7.50 m	9.00 m	10.00 m	Isolated /Combined	Raft	Pile
+ STILT + 9 FLOORS BUILDING	III	38	300	450					YES	YES	NA
		274	300	450					YES	YES	NA
		274	300	300	450				YES	YES	NA
		274	300	450	450	450			YES	YES	NA

1.SOIL STABILIZATION - SOIL STABILIZATION NOT REQUIRED FOR THIS SITE
2.REFILLING THE EXCAVATED SOIL – THE SAME SITE SOIL CAN BE USED FOR REFILLING / BACK FILLING
3.GROUND WATER NOT ENCOUNTERED WITHIN THE DRILLING DEPTH OF 10 M FROM NGL.

SASTHA SOIL TESTING SERVICES
AN ISO-9001:2015 Certified Company
C-128, New HIG Colony, Shenbagathottam, Anna Nagar,
Madurai - 625 020, Ph: 9344104870

ULR-TC1067723100000038F

TC-10677

Issued To	PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING IN OLD S.F.NO.418/2-PT, NEW T.S.NO.5/1, BLOCK NO.7, WARD NO. Z (26), GURUSAMY NAGAR, VILANKURICHI VILLAGE, COIMBATORE NORTH TALUK, COIMBATORE CORPORATION, COIMBATORE DISTRICT-641004.,	Test Certificate No	SSTS/GT/200223/16
		Date of Issue	20.02.2023
		Matrix	Soil Samples
Date of receipt of Soil samples	20.02.2023	Sampling	SPL-20.02.2023
Date of Testing	21.02.2023 To 24.02.2023	Page Nos	27 of 44

NABL ACCREDITED TESTS

Borehole No	Tested depth (m)	R.L of Layers (m)	N Value	Type of Soil (IS Classification)	Particle size Analysis					Liquid Limit (%)	Plastic Limit (%)	PI (%)	NMC (%)	Specific gravity G	Point Load (MN/m²)
					Gravel (%)	Sand (%)			Silt & Clay (%)						
						Coarse	Medium	Fine							
BH 1	1.5	429.5	10	FILL UP SOIL	32.80	19.71	36.39	10.82	0.28	-	-	-	8.32	2.61	-
	3	428	50	DSR	51.25	37.26	8.07	2.91	0.51	-	-	-	7.39	2.72	-
	4.5	426.5	50	HARD ROCK (GNEISS)	-	-	-	-	-	-	-	-	-	-	105.30
BH 2	1.5	429.5	50	DSR	47.13	32.72	15.08	5.02	0.05	-	-	-	8.15	2.67	-
	3	428	50	DSR	56.74	29.70	9.13	4.21	0.22	-	-	-	7.19	2.67	-
	4.5	426.5	50	HARD ROCK (GNEISS)	-	-	-	-	-	-	-	-	-	-	244.44
BH 3	1.5	429.5	50	DSR	58.52	33.46	5.67	2.14	0.21	-	-	-	6.59	2.55	-
	3	428	50	DSR	50.86	34.40	10.86	3.62	0.26	-	-	-	8.65	2.66	-
	4.5	426.5	50	DSR	74.34	21.91	2.41	1.17	0.17	-	-	-	5.35	2.69	-
	6	425	50	HARD ROCK (GNEISS)	-	-	-	-	-	-	-	-	-	-	105.90
BH 4	1.5	429.5	50	DSR	0.81	21.19	66.18	11.45	0.37	-	-	-	11.77	2.68	-
	3	428	50	DSR	12.38	59.87	27.07	0.66	0.02	-	-	-	6.50	2.64	-
	4.5	426.5	50	HARD ROCK (GNEISS)	-	-	-	-	-	-	-	-	-	-	-
	6	425	50	HARD ROCK (GNEISS)	-	-	-	-	-	-	-	-	-	-	91.29
	7.5	423.5	50	HARD ROCK (GRANITE)	-	-	-	-	-	-	-	-	-	-	83.99

Authorised Signatory
M/s K Tamilselvaman
Geo-Tech Engineer

SASTHA SOIL TESTING SERVICES

APPENDIX B2

Issued To	PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING IN OLD S.F.NO.418/2-PT, NEW T.S.NO.5/1, BLOCK NO.7, WARD NO. Z (26), GURUSAMY NAGAR, VILANKURICHI VILLAGE, COIMBATORE NORTH TALUK, COIMBATORE CORPORATION, COIMBATORE DISTRICT-641004.	Test Certificate No	SSTS/GT/200223/16
		Date of Issue	20.02.2023
		Matrix	Soil Samples
Date of receipt of Soil samples	20.02.2023	Sampling	SPL-20.02.2023
Date of Testing	21.02.2023 To 24.02.2023	Page Nos	28 of 44

LAB TEST RESULTS - SOIL SAMPLES

(NON – NABL)

Borehole No	Tested depth (m)	R.L of Layers (m)	N Value	Type of Soil (IS Classification)	Water Absorption %	Bulk density (g/cm3)	Allowable Bearing Pressure (kPa)	qu=SBC (kN/m²)	Direct shear		UCC strength (kPa)	Shear Wave Velocity
									Cohesion (kPa) (t/m²)	ø (DEG)		
BH 1	1.5	429.5	10	FILL UP SOIL	-	1.76	92.25	38	0	30	128.57	197.72
	3	428	50	DSR	-	2.04	461.25	300	0	42	>400	340.09
	4.5	426.5	50	HARD ROCK (GNEISS)	0.21	2.4	461.25	450	0	42	>400	340.09
BH 2	1.5	429.5	50	DSR	-	2.04	461.25	274	0	42	>400	340.09
	3	428	50	DSR	-	2.04	461.25	300	0	42	>400	340.09
	4.5	426.5	50	HARD ROCK (GNEISS)	0.29	2.4	461.25	450	0	42	>400	340.09
BH 3	1.5	429.5	50	DSR	-	2.04	461.25	274	0	42	>400	340.09
	3	428	50	DSR	-	2.04	461.25	300	0	42	>400	340.09
	4.5	426.5	50	DSR	-	2.04	461.25	300	0	42	>400	340.09
	6	425	50	HARD ROCK (GNEISS)	0.24	2.4	461.25	450	0	42	>400	340.09
BH 4	1.5	429.5	50	DSR	-	2.04	461.25	274	0	42	>400	340.09
	3	428	50	DSR	-	2.04	461.25	300	0	42	>400	340.09
	4.5	426.5	50	HARD ROCK (GNEISS)	0.23	2.4	461.25	450	0	42	>400	340.09
	6	425	50	HARD ROCK (GNEISS)	0.27	2.4	461.25	450	0	42	>400	340.09
	7.5	423.5	50	HARD ROCK (GRANITE)	0.33	2.4	461.25	450	0	42	>400	340.09

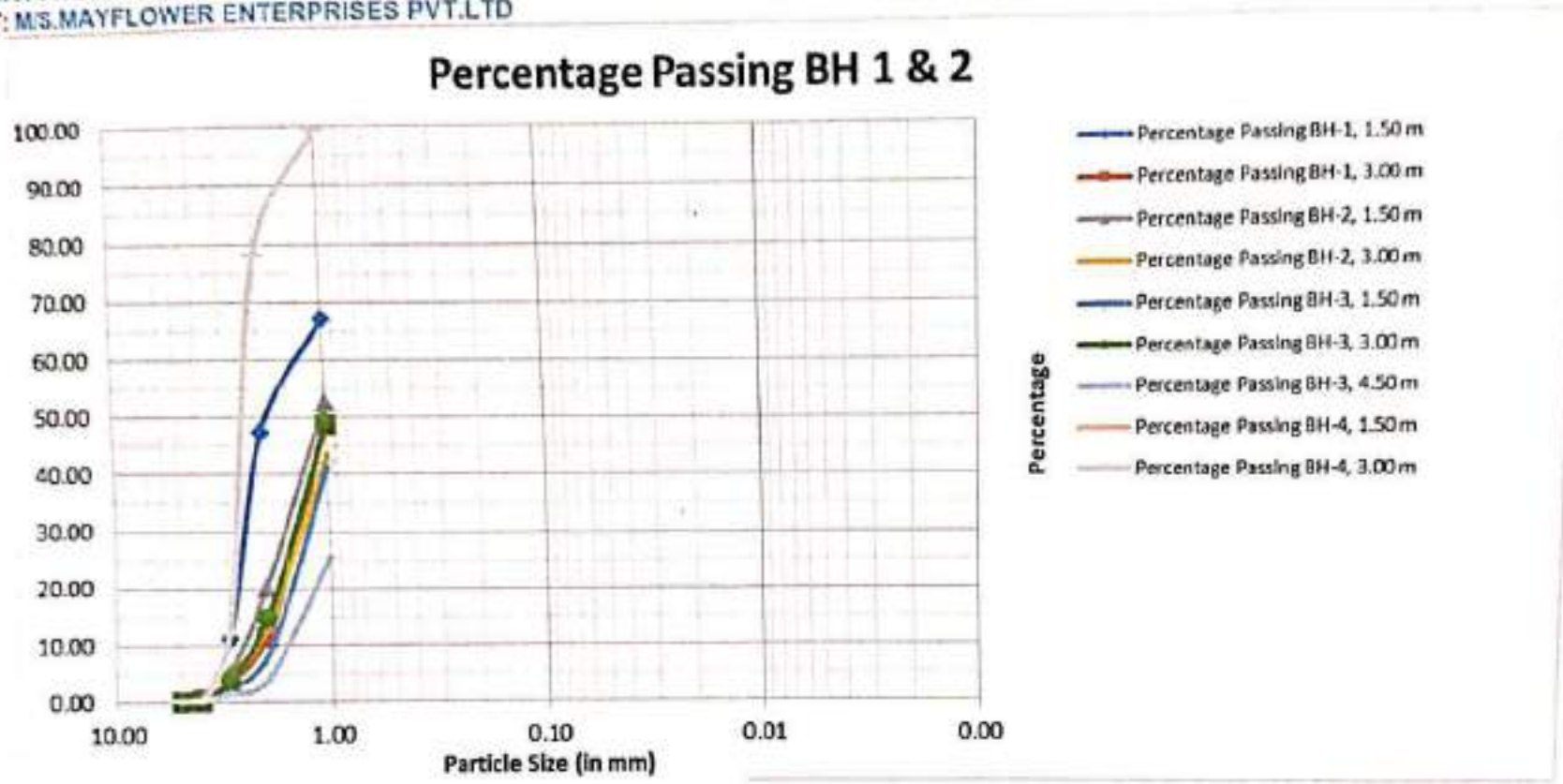
Authorised Signatory
Mr. K. Sathyaman
Geo-Tech Engineer

APPENDIX B5

PARTICLE SIZE ANALYSIS CURVES

PROJECT: PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING IN OLD S.F.NO.418/2-PT, NEW T.S.NO.5/1, BLOCK NO.7, WARD NO. Z (26), GURUSAMY NAGAR, VILANKURICHI VILLAGE, COIMBATORE NORTH TALUK, COIMBATORE CORPORATION, COIMBATORE DISTRICT-641004.

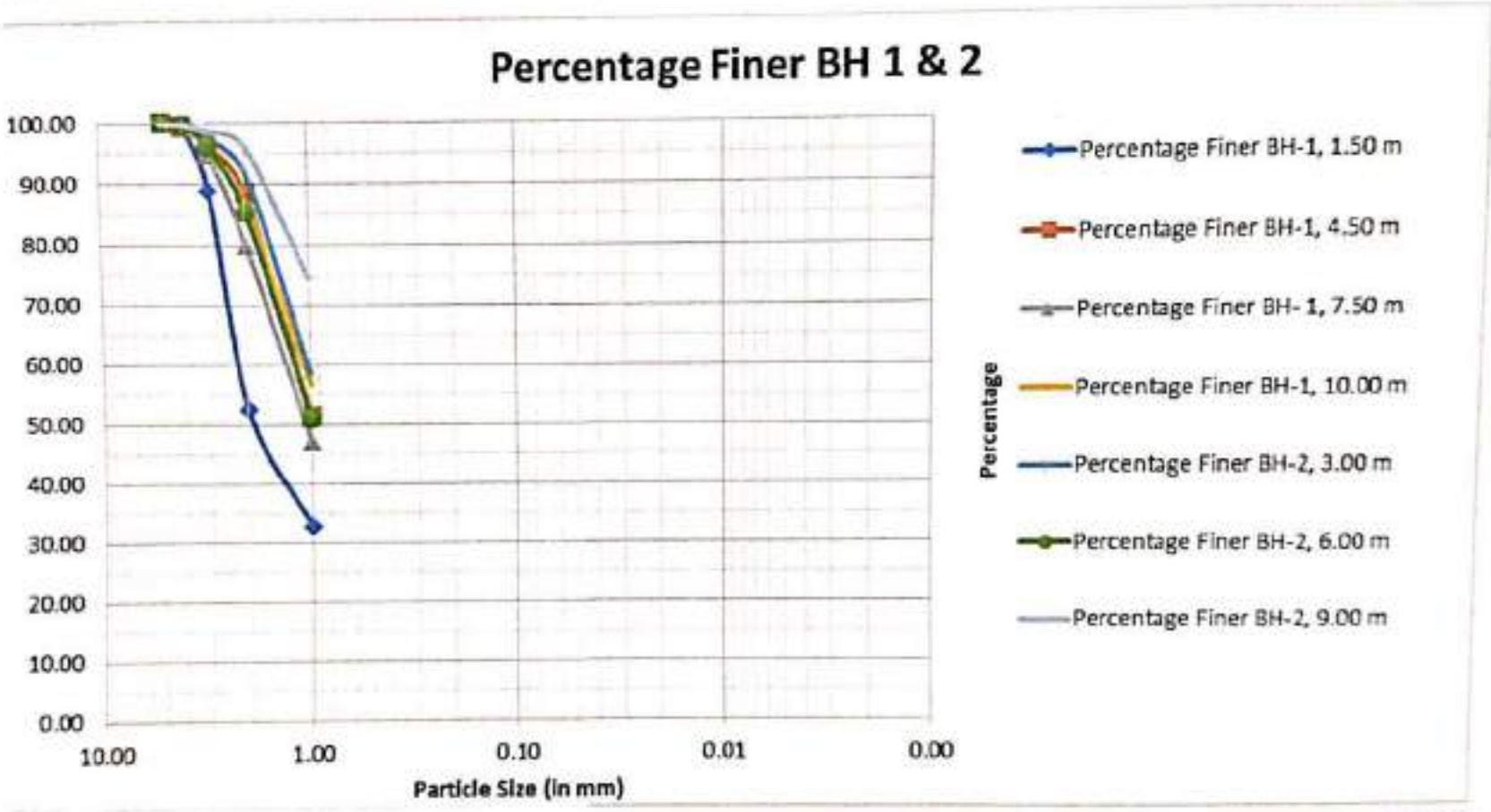
CLIENT: M/S.MAYFLOWER ENTERPRISES PVT.LTD



SASTRA SOIL TESTING SERVICES

PARTICLE SIZE ANALYSIS CURVES

PROJECT: PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING IN OLD S.F.NO.418/2-PT, NEW T.S.NO.5/1, BLOCK NO.7, WARD NO. Z (26), GURUSAMY NAGAR, VILANKURICHI VILLAGE, COIMBATORE NORTH TALUK, COIMBATORE CORPORATION, COIMBATORE DISTRICT-641004.
CLIENT: M/S.MAYFLOWER ENTERPRISES PVT.LTD



K.SETHURAMAN

SASTHA SOIL TESTING SERVICES

Composition

SAMPLE	BH - 1 1.50 m	BH - 1 3.00 m	BH - 2 1.50 m	BH -2 3.00 m	BH -3 1.50 m	BH -3 3.00 m	BH -3 4.50 m	BH -4 1.50 m	BH -4 3.00 m
% FINE GRAVEL =	32.80	51.25	47.13	56.74	58.52	50.86	74.34	0.81	12.38
% COARSE SAND =	19.71	37.26	32.72	29.70	33.46	34.40	21.91	21.19	59.87
%MEDIUM SAND =	36.39	8.07	15.08	9.13	5.67	10.86	2.41	66.18	27.07
%FINE SAND =	10.82	2.91	5.02	4.21	2.14	3.62	1.17	11.45	0.66
% FINE/ SILT =	0.28	0.51	0.05	0.22	0.21	0.26	0.17	0.37	0.02
SAMPLE	BH - 1 1.50 m	BH - 1 3.00 m	BH - 2 1.50 m	BH -2 3.00 m	BH -3 1.50 m	BH -3 3.00 m	BH -3 4.50 m	BH -4 1.50 m	BH -4 3.00 m
% GRAVEL =	32.80	51.25	47.13	56.74	58.52	50.86	74.34	0.81	12.38
% SAND =	66.92	48.24	52.82	43.04	41.27	48.88	25.49	98.82	87.60
% SILT AND CLAY =	0.28	0.51	0.05	0.22	0.21	0.26	0.17	0.37	0.02
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

APPENDIX C

FOUNDATION DESIGN	Subject:	PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING IN OLD S.F.NO.418/2-PT, NEW T.S.NO.5/1, BLOCK NO.7, WARD NO. Z (26), GURUSAMY NAGAR, VILANKURICHI VILLAGE, COIMBATORE NORTH TALUK, COIMBATORE CORPORATION, COIMBATORE DISTRICT-641004.			
	SOIL BEARING CAPACITY BY IS Calculation				
	Design Code/Ref:	Proj. No.	Location:	Designer:	Date:
	IS:6403	SSTS 200223		KSR	28-Feb-23

CALCULATIONS & SKECTHES

Allowable bearing pressure using IS equation for the footing and soil parameters shown in
Figure 1.



BEARING CAPACITY OF SHALLOW FOUNDATIONS

IS Method

Date 28-Feb-23
Identification BH-1

INPUT

Units of Measurement
SI SI or E

Foundation Information
Shape SQ SQ, CI, CO, or RE
B = 2 m
L = 2 m
D = 1.5 m

Soil Information
c = 0 kPa
phi(Ø) = 30 deg
gamma(γ) = 1.76 kN/m^3
D_w = 45 m

Factor of Safety
F = 2.5

IS Results

Bearing Capacity
q ult = 97.92 kPa
q a = 39 kPa

Allowable Column Load
P = 15 kN

IS Computation

Unit conversion	1	N_c =	30.14	d_q =	1.1299	q =	26.40
γ_w =	9.8	s_c =	1.3	N_γ =	22.4	W' =	1.0
ϕ (radians)	0.524	d_c =	1.25981	s_γ =	0.8	k =	0.75
W footing	142	N_q =	18.4	d_γ =	1.1299	σ_{zD}' =	2.64
γ conc	23.6	s_q =	1.2	B/L =	1.0	γ' =	1.76

FOUNDATION DESIGN

Subject:	PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING IN OLD S.F.NO.418/2-PT, NEW T.S.NO.5/1, BLOCK NO.7, WARD NO. Z (26), GURUSAMY NAGAR, VILANKURICHI VILLAGE, COIMBATORE NORTH TALUK, COIMBATORE CORPORATION, COIMBATORE DISTRICT-641004.			
SOIL BEARING CAPACITY BY IS Calculation				
Design Code/Ref:	Proj. No.	Location:	Designer:	Date:
IS:6403	SSTS 200223		KSR	28-Feb-23

CALCULATIONS & SKECTHES

Allowable bearing pressure using IS equation for the footing and soil parameters shown in Figure 1.



BEARING CAPACITY OF SHALLOW FOUNDATIONS

IS Method

Date 28-Feb-23

Identification BH-1

INPUT

Units of Measurement: SI (SI or E)

Foundation Information

Shape	SQ	SQ, CI, CO, or RE
B =	2	m
L =	2	m
D =	1.5	m

Soil Information

c =	0	kPa
phi(Ø) =	42	deg
gamma(γ) =	2.04	kN/m^3
D_w =	45	m

Factor of Safety: F = 2.5

IS Results

Bearing Capacity

q ult =	1237	kPa
q a =	495	kPa

Allowable Column Load

P =	1,695	kN

IS Computation

Unit conversion	1	N_c =	98.1952	d_q =	1.33691	q =	61.20
γ_w =	9.8	s_c =	1.3	N_γ =	167.856	W' =	1.0
ϕ (radians)	0.733	d_c =	1.67381	s_γ =	0.8	k =	0.98279
W footing	283	N_q =	89.6448	d_γ =	1.33691	σ_{zD}' =	6.12
γ conc	23.6	s_q =	1.2	B/L =	1.0	γ' =	2.04

FOUNDATION DESIGN

Subject:	PROPOSED CONSTRUCTION OF RESIDENTIAL APARTMENT BUILDING IN OLD S.F.NO.418/2-PT, NEW T.S.NO.5/1, BLOCK NO.7, WARD NO. Z (26), GURUSAMY NAGAR, VILANKURICHI VILLAGE, COIMBATORE NORTH TALUK, COIMBATORE CORPORATION, COIMBATORE DISTRICT-641004.			
SOIL BEARING CAPACITY BY IS Calculation				
Design Code/Ref:	Proj. No.	Location:	Designer:	Date:
IS:6403	SSTS 200223		KSR	28-Feb-23

CALCULATIONS & SKECTHES

Allowable bearing pressure using IS equation for the footing and soil parameters shown in
Figure 1.



BEARING CAPACITY OF SHALLOW FOUNDATIONS

IS Method

Date 28-Feb-23
Identification BH-1

INPUT

Units of Measurement
SI SI or E

Foundation Information
Shape SQ SQ, CI, CO, or RE
B = 2 m
L = 2 m
D = 4.5 m

Soil Information
c = 0 kPa
phi(Ø) = 42 deg
gamma(γ) = 2.4 kN/m^3
D_w = 45 m

Factor of Safety
F = 2.5

IS Results

Bearing Capacity
q ult = 2215 kPa
q a = 886 kPa

Allowable Column Load
P = 3,119 kN

IS Computation

Unit conversion	1	N_c =	98.1952	d_q =	1.50536	q =	108.00
γ_w =	9.8	s_c =	1.3	N_γ =	167.856	W' =	1.0
ϕ (radians)	0.733	d_c =	2.01072	s_γ =	0.8	k =	1.15257
W footing	425	N_q =	89.6448	d_γ =	1.50536	σ_{zD}' =	10.8
γ conc	23.6	s_q =	1.2	B/L =	1.0	γ ' =	2.4

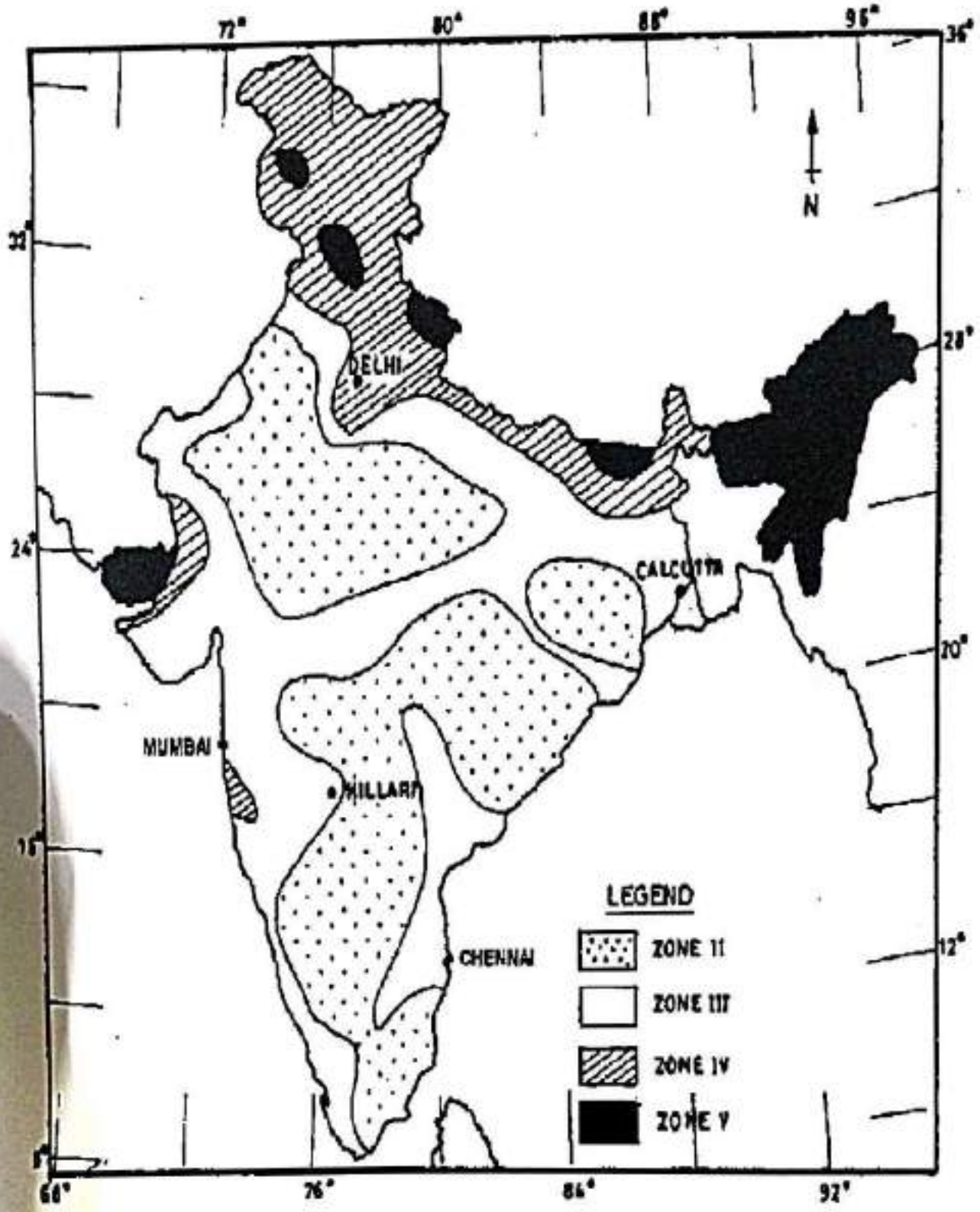
Bore Hole	D	γ	Ø	C	B	L	q_{nu}		q_a		P	q_{np}
	Footing Embedment depth (m)	Soil Density (g/cm^3)	Angle of internal friction (rad)	Cohesion of Soil (kPa)	Footing Size (m)	Footing Size (m)	Net Ultimate Bearing Capacity (kPa)	Factor of Safety SF	Allowable Bearing Capacity (kPa)	W footing	Allowable Column Load (kN)	Safe Settlement Pressure (kPa)
BH 1	1.5	1.76	30	0	1.5	1.5	92.42	2.5	36.97	79.65	3.53	139.61
	1.5	1.76	30	0	2	2	97.92	2.5	39.17	141.6	15.07	128.22
	2	1.76	30	0	1.5	1.5	119.59	2.5	47.84	106.2	1.43	139.61
	2	1.76	30	0	2	2	123.23	2.5	49.29	188.8	8.37	128.22
	2.5	1.76	30	0	1.5	1.5	148.88	2.5	59.55	132.75	1.24	139.61
	2.5	1.76	30	0	2	2	150.13	2.5	60.05	236	4.21	128.22
	3	2.04	42	0	1.5	1.5	1241.19	2.5	496.48	159.3	957.77	937.37
	3	2.04	42	0	2	2	1236.57	2.5	494.63	283.2	1695.31	860.88
	3.5	2.04	42	0	1.5	1.5	1470.68	2.5	588.27	185.85	1137.76	937.37
	3.5	2.04	42	0	2	2	1439.65	2.5	575.86	330.4	1973.05	860.88
	4	2.04	42	0	1.5	1.5	1716.41	2.5	686.56	212.4	1332.37	937.37
	4	2.04	42	0	2	2	1654.92	2.5	661.97	377.6	2270.28	860.88
	4.5	2.4	42	0	1.5	1.5	2327.52	2.5	931.01	238.95	1855.82	937.37
	4.5	2.4	42	0	2	2	2214.56	2.5	885.83	424.8	3118.50	860.88

Bore Hole	D	γ	Ø	c	B	L	q_{nu}		q_a		P	q_{np}
	Footing Embedment depth (m)	Soil Density (g/cm^3)	Angle of internal friction (rad)	Cohesion of Soil (kPa)	Footing Size (m)	Footing Size (m)	Net Ultimate Bearing Capacity (kPa)	Factor of Safety SF	Allowable Bearing Capacity (kPa)	W footing	Allowable Column Load (kN)	Safe Settlement Pressure (kPa)
BH 2	1.5	2.04	42	0	1.5	1.5	650.21	2.5	260.09	79.65	505.54	937.37
	1.5	2.04	42	0	2	2	700.42	2.5	280.17	141.6	979.08	860.88
	2	2.04	42	0	1.5	1.5	830.96	2.5	332.38	106.2	641.66	937.37
	2	2.04	42	0	2	2	866.95	2.5	346.78	188.8	1198.33	860.88
	2.5	2.04	42	0	1.5	1.5	1027.95	2.5	411.18	132.75	792.41	937.37
	2.5	2.04	42	0	2	2	1045.67	2.5	418.27	236	1437.07	860.88
	3	2.04	42	0	1.5	1.5	1241.19	2.5	496.48	159.3	957.77	937.37
	3	2.04	42	0	2	2	1236.57	2.5	494.63	283.2	1695.31	860.88
	3.5	2.04	42	0	1.5	1.5	1470.68	2.5	588.27	185.85	1137.76	937.37
	3.5	2.04	42	0	2	2	1439.65	2.5	575.86	330.4	1973.05	860.88
	4	2.04	42	0	1.5	1.5	1716.41	2.5	686.56	212.4	1332.37	937.37
	4	2.04	42	0	2	2	1654.92	2.5	661.97	377.6	2270.28	860.88
	4.5	2.4	42	0	1.5	1.5	2327.52	2.5	931.01	238.95	1855.82	937.37
	4.5	2.4	42	0	2	2	2214.56	2.5	885.83	424.8	3118.50	860.88

Bore Hole	D	γ	Ø	c	B	L	q_{nu}		q_a		P	q_{np}
	Footing Embedment depth (m)	Soil Density (g/cm³)	Angle of internal friction (rad)	Cohesion of Soil (kPa)	Footing Size (m)	Footing Size (m)	Net Ultimate Bearing Capacity (kPa)	Factor of Safety SF	Allowable Bearing Capacity (kPa)	W footing	Allowable Column Load (kN)	Safe Settlement Pressure (kPa)
BH 3	1.5	2.04	42	0	1.5	1.5	650.219	2.5	260.08	79.65	505.54	937.36
	1.5	2.04	42	0	2	2	700.42	2.5	280.16	141.6	979.07	860.88
	2	2.04	42	0	1.5	1.5	830.96	2.5	332.38	106.2	641.66	937.36
	2	2.04	42	0	2	2	866.95	2.5	346.78	188.8	1198.32	860.88
	2.5	2.04	42	0	1.5	1.5	1027.95	2.5	411.18	132.75	792.40	937.36
	2.5	2.04	42	0	2	2	1045.66	2.5	418.26	236	1437.06	860.88
	3	2.04	42	0	1.5	1.5	1241.19	2.5	496.47	159.3	957.77	937.36
	3	2.04	42	0	2	2	1236.56	2.5	494.62	283.2	1695.30	860.88
	3.5	2.04	42	0	1.5	1.5	1470.67	2.5	588.27	185.85	1137.76	937.36
	3.5	2.04	42	0	2	2	1439.65	2.5	575.86	330.4	1973.04	860.88
	4	2.04	42	0	1.5	1.5	1716.41	2.5	686.56	212.4	1332.36	937.36
	4	2.04	42	0	2	2	1654.92	2.5	661.96	377.6	2270.27	860.88
	4.5	2.04	42	0	1.5	1.5	1978.38	2.5	791.35	238.95	1541.60	937.36
	4.5	2.04	42	0	2	2	1882.37	2.5	752.95	424.8	2587.00	860.88

Bore Hole	D	γ	Ø	c	B	L	q_{nu}		q_a		T	q_{np}
	Footing Embedment depth (m)	Soil Density (g/cm³)	Angle of internal friction (rad)	Cohesion of Soil (kPa)	Footing Size (m)	Footing Size (m)	Net Ultimate Bearing Capacity (kPa)	Factor of Safety SF	Allowable Bearing Capacity (kPa)	W footing	Allowable Column Load (kN)	Safe Settlement Pressure (kPa)
BH 4	1.5	2.04	42	0	1.5	1.5	650.21	2.5	260.08	79.65	505.54	937.36
	1.5	2.04	42	0	2	2	700.42	2.5	280.16	141.6	979.07	860.88
	2	2.04	42	0	1.5	1.5	830.96	2.5	332.38	106.2	641.66	937.36
	2	2.04	42	0	2	2	866.95	2.5	346.78	188.8	1198.32	860.88
	2.5	2.04	42	0	1.5	1.5	1027.95	2.5	411.18	132.75	792.40	937.36
	2.5	2.04	42	0	2	2	1045.66	2.5	418.26	236	1437.06	860.88
	3	2.04	42	0	1.5	1.5	1241.19	2.5	496.47	159.3	957.77	937.36
	3	2.04	42	0	2	2	1236.56	2.5	494.62	283.2	1695.30	860.88
	3.5	2.04	42	0	1.5	1.5	1470.67	2.5	588.27	185.85	1137.76	937.36
	3.5	2.04	42	0	2	2	1439.65	2.5	575.86	330.4	1973.04	860.88
	4	2.04	42	0	1.5	1.5	1716.41	2.5	686.56	212.4	1332.36	937.36
	4	2.04	42	0	2	2	1654.92	2.5	661.96	377.6	2270.27	860.88
	4.5	2.4	42	0	1.5	1.5	2327.51	2.5	931.00	238.95	1855.81	937.36
	4.5	2.4	42	0	2	2	2214.56	2.5	885.82	424.8	3118.50	860.88

SEISIMIC MAP OF INDIA



APPENDIX C1
PHOTOGRAPHS

Drilling Under Progress

BH 01



BH 02

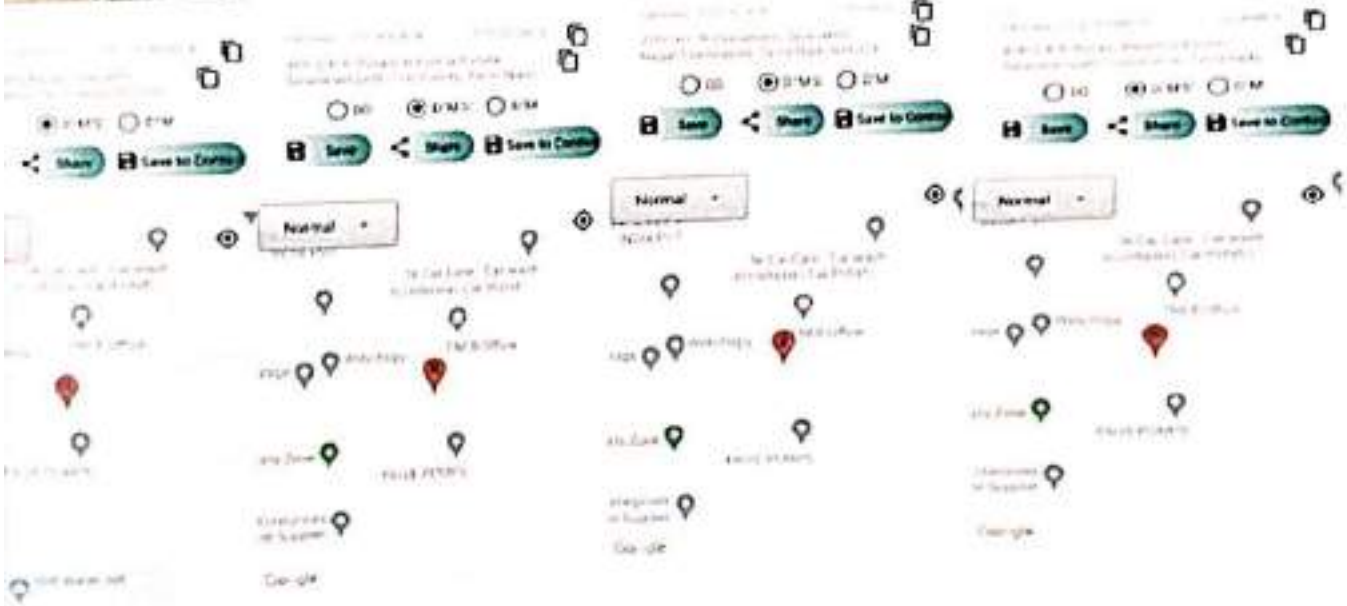


BH 03

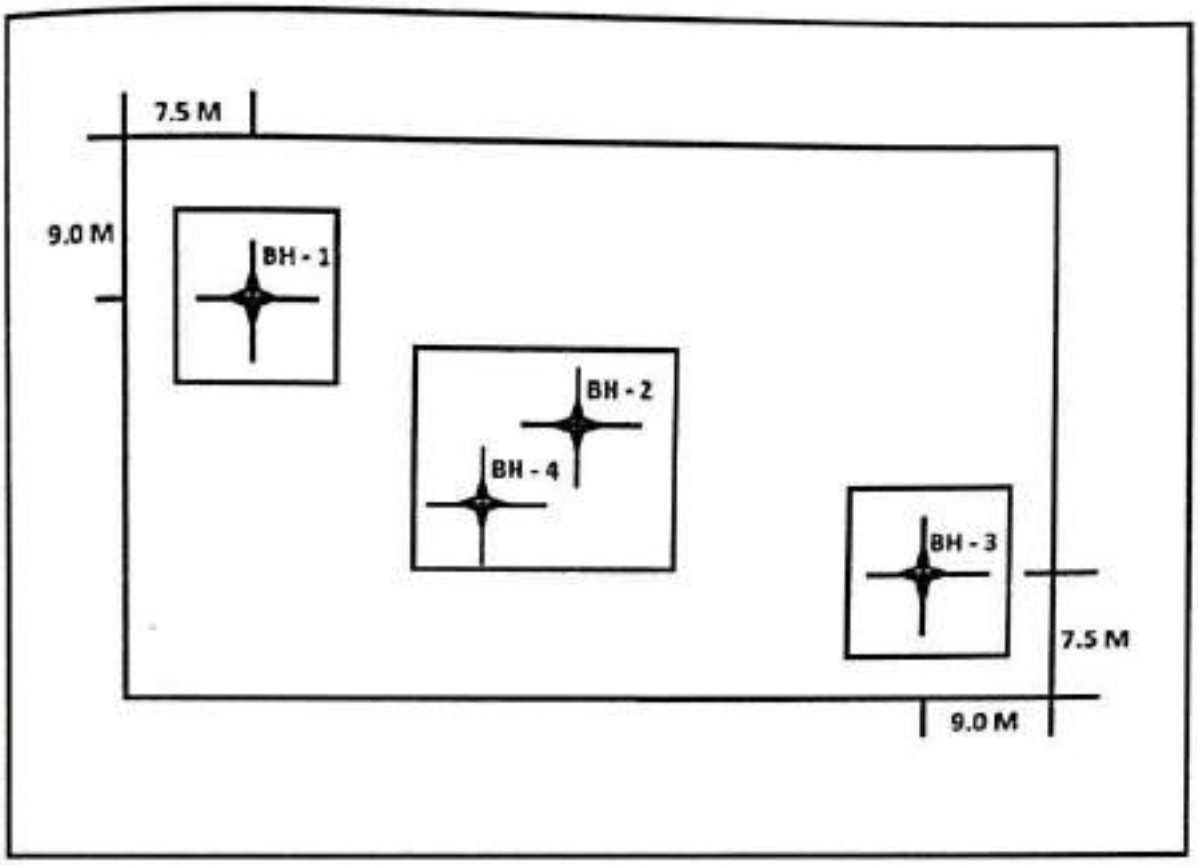


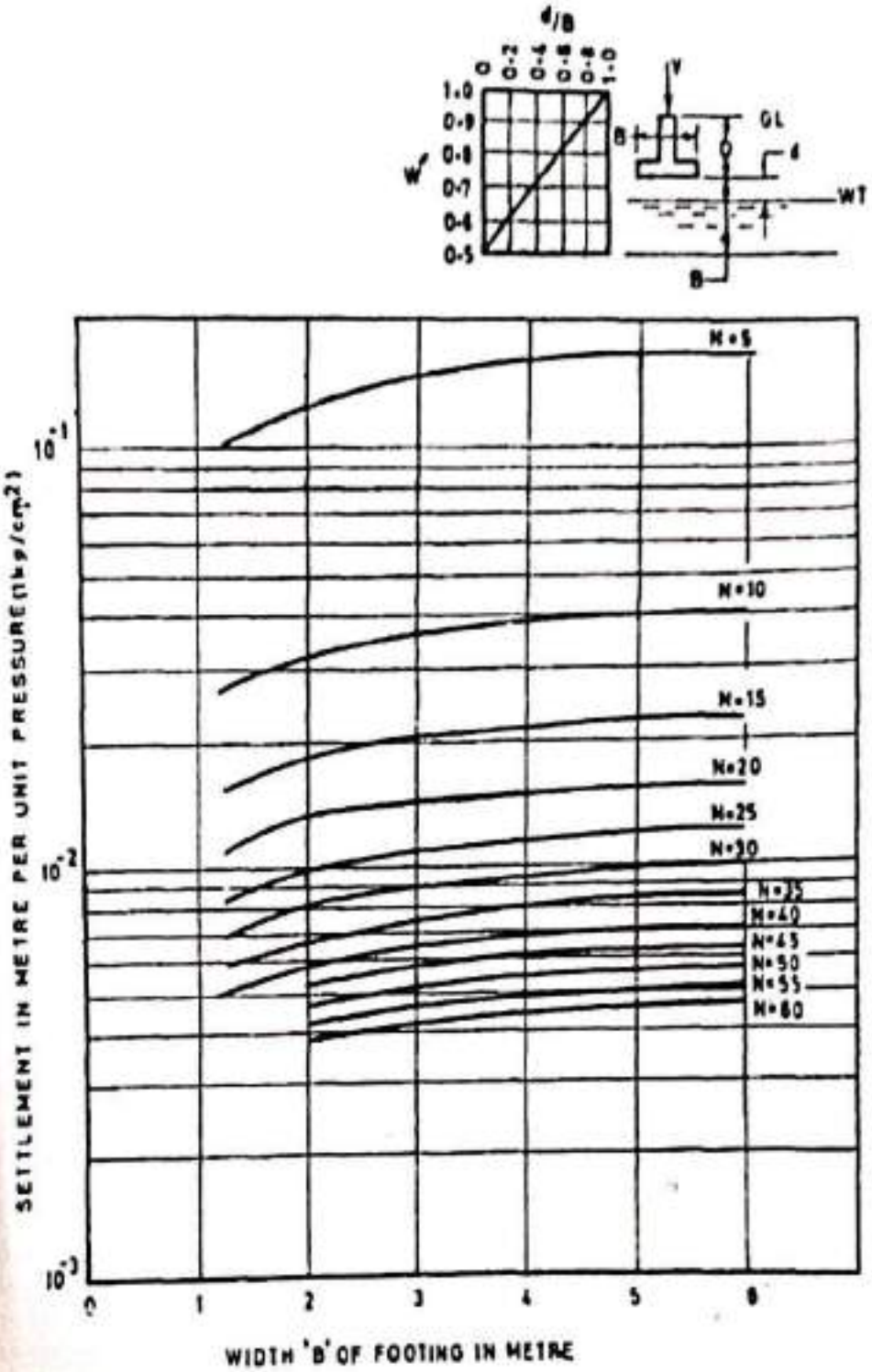
BH 04





BOREHOLE LOCATION DRAWING IN SITE





GL = Ground level. WT = Water table.

FIG. 9 SETTLEMENT PER UNIT PRESSURE FROM STANDARD PENETRATION RESISTANCE

END OF REPORT

GEOTECHNICAL ENGINEER DETAILS:

Name	:	KRISHNAN SETHU RAMAN
Address	:	C-128, New Hig Colony, Shenbaga Thottam, Near Mela Madai Apollo Signal, Anna Nagar, Madurai-20.
Branch	:	Chennai. 2, 94 Th Street 21st Avenue, Ashok Nagar, Duraisamy Road, Near JRK Metric School Vadapalani, Chennai-600083.
Mobile no	:	09344104870, 06382534513
Test report number	:	**SSTS/GT/200223/16**
Register no	:	GTE001/2019.30.08.2019
Office no	:	0452 - 4295151
Email id	:	sasthageotechengineers@gmail.com

MLPA

GOVERNMENT OF TAMILNADU
TOWN AND COUNTRY PLANNING DEPARTMENT

MADURAI LOCAL PLANNING AUTHORITY
Anna Maligai, 3rd Floor, Corporation Building, Madurai – 625 002.
Phone: 0452-2530544, E-mail -ID : mlpa_cta@yahoo.in

PROFESSIONAL REGISTRATION CERTIFICATE

This is to certify that **Thiru. K.Sethuraman** has enrolled as **GEO TECH ENGINEER - (GTE)** with Madurai Local Planning Authority **(MLPA)**, who has the qualification of **Degree of Master of Engineering (Geotechnical)** and experience in the relevant field for **24 years.**

He has been given the **Registration No.GTE 001/2019 on 30.08.2019.** He shall be required to comply with the duties and responsibilities prescribed by the Government of Tamil Nadu in Part V, "Registration of Professionals", Tamil Nadu Combined Development and Building Rules, 2019 approved vide **G.O.(Ms)No.18, MAWS (MA1) Department, Dated: 04.02.2019.**

This Registration is valid upto **29.08.2024.**



MEMBER SECRETARY (I/C),
MADURAI LOCAL PLANNING AUTHORITY,
MADURAI.

Appendix D

EXCAVATION SAFETY PROCEDURE:

- Avoid underground services and make sure not to undermine nearby structures – use safe digging practice and dig away from them.
- Check the excavation each day before starting work and after any event that may affect its stability.
- Provide safe access to get in and out.
- Prevent collapse – shore, bench, or batter back. Do not assume ground will stand unsupported.
- Prevent people and materials falling in – with barriers strong enough not to collapse if someone falls against them.

wide variety of considerations, some of

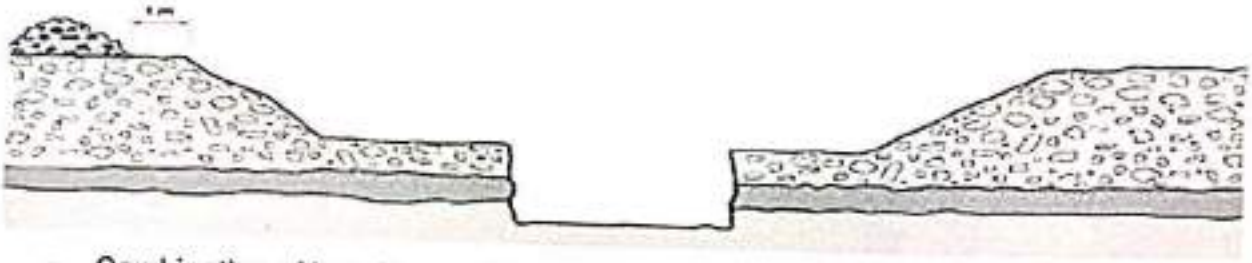
which are:

- soil type, weight and strength
- ground water
- sloping ground
- surcharges or vibrations that could destabilise the excavation, such as vehicles, buildings or stockpiled materials
- the potential for the excavation to disturb or damage nearby structures, underground or overhead services
- safe working methods and construction methodologies
- availability and capacity of equipment and temporary works.
- weather conditions
- dewatering plan
- adjacent buildings and structures
- water courses (including underground)
- trees
- local weather conditions
- If there will be other construction activity nearby that may cause vibration
- static and dynamic loads near the excavation
- managing pedestrians and traffic with a traffic management plan (TMP)
- securing barriers or fencing to keep members of the public and other site workers away from the excavation site
- Pumps or other dewatering systems to remove water and prevent build-up

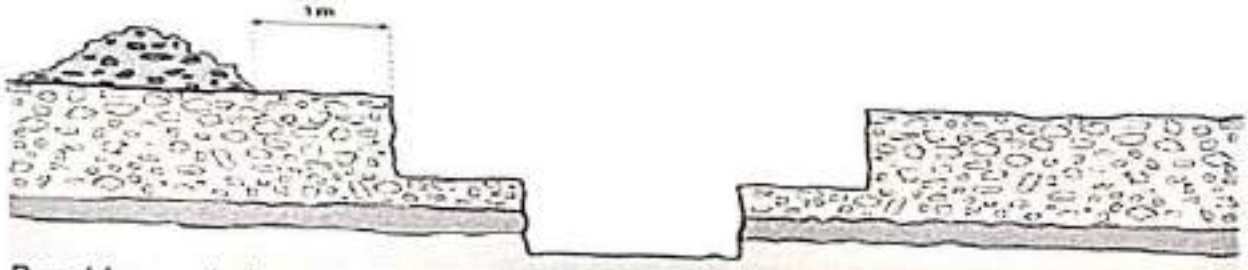
WorkSafe notifications

Fall prevention devices including secure fences, edge protection, working platforms and covers. Ramps, steps or other access into the excavation are examples of working platforms

- placement of excavated materials, plant or other loads
- wheel stoppers, can be one way of restricting plant movement near an excavation
- **Shorting** prevents collapse by maintaining positive pressure on the sides of the excavation, protecting workers.



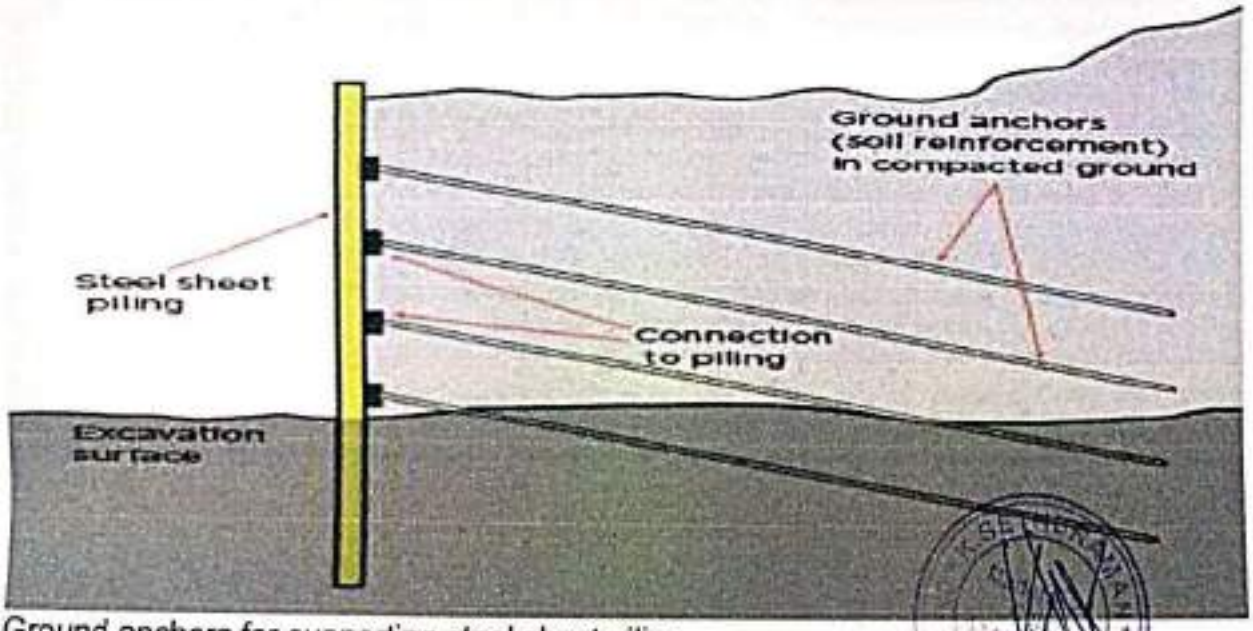
- Combination of benching and battering controls



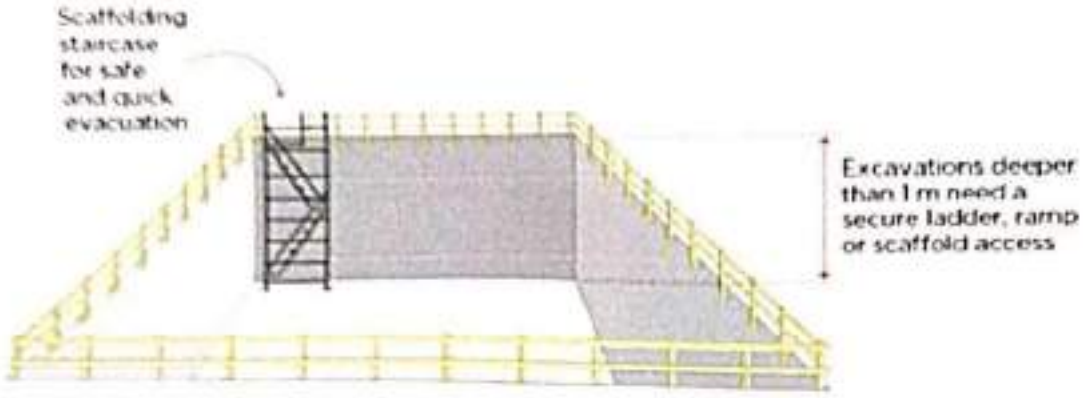
Benching control



Battering controls



Ground anchors for supporting steel sheet piling



- Scaffolding staircase for a safe and quick evacuation
- Adjacent buildings or structures

- Excavation work may seriously affect the security or stability of part of a structure at or adjacent to the location of the proposed excavation, which can lead to structural failure or collapse. Excavation work must not start until steps are taken to prevent the collapse or partial collapse of potentially affected buildings or structures. Excavation below the level of the footing of a structure, including retaining walls, that could affect the stability of the structure should be assessed by a competent person and secured by a ground support system which has been designed by a competent person. Suitable supports to brace the structure may also be required and should be identified by a competent person. It is also important other buildings in and around the excavation site are not adversely affected by vibration or concussion during the excavation work. Special precautions may need to be taken in the vicinity of hospitals and other buildings containing equipment sensitive to shock and vibration. Care should be taken to ensure that excavation work does not cause flooding or water penetration to an adjacent building.

- Shoring

- Shoring is a positive ground support system that can be used when the location or depth of an excavation makes battering and benching impracticable. It should always be designed for the specific workplace conditions by a competent person, for example an engineer. Shoring is the provision of support for an excavated face or faces to prevent the movement of soil and therefore ground collapse. It is a common method of ground support in trench excavation where unstable ground conditions are often encountered, for example soft ground or ground liable to be wet during excavation, for example sand, silt or soft moist clay. Where ground is not self-supporting and benching or battering are not practical or effective control measures, shoring should be used. Shoring should also be used when there is a risk of a person being buried, struck or trapped by dislodged or falling material which forms the side of, or is adjacent to, the excavation work. Where such a risk also exists for those installing shoring, other control measures must be in place to ensure the health and safety of people entering the excavation. Shoring the face of an excavation should progress as the excavation work progresses. Where earthmoving machinery is used risk assessment should be used to determine whether a part of the trench may be left unsupported. The system of work included should ensure workers do not enter a part of the excavation that is not protected. They should not work ahead of the shoring protection if it is being progressively installed. The basic types of shoring are hydraulically operated metal shoring and timber shoring. The most common shoring used consists of hydraulic jacks and steel struts, walls and sheeting. Sometimes aluminium or timber components are used. The use of metal shoring has largely replaced timber shoring because of its ability to ensure even distribution of pressure along a trench line, and it is easily adapted to various depths and trench widths. Some of the common types of shoring are: • hydraulic systems • steel sheet piling • steel trench sheeting • timber systems (e.g. example soldier sets) • prefabricated concrete panels • ground anchors.



our services doesn't just end there

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Escrow Services, Rentals, Litigation Solutions, Property Valuation and Property Management

Compliance & Special Services

Demolition, Vaasthu checks, regularization of unauthorized buildings, and office space solutions.



empowering your real estate decisions with smart tools

Property Valuation & Cost Estimation

Guideline Value, Apartment Composite Value, Stamp Duty & Registration Fees Calculator, Building Value Calculator, Capital Gains Calculator, Area Unit Converter, Length Unit Converter

Ownership, Compliance & Legal Verification

Encumbrance Certificate (EC) Search, Find Your SRO, Temple Property Check, WAQF Property Check, View Patta/Chitta, View FMB, Patta Analyzer, EC Analyzer

Zoning & Land Use Analysis

Land Use Zone Finder, CRZ Zone Check, Aquifer Zone Check, CBA Check, EWS Check, Road Width Check, Proposed Road Widening Check, FSI Calculator

Property Documentation & Workflow Tools

Forms & Templates, Document Generator, Document Translation, Dictionary

Vastu & Property Management Tools

Home Vastu Shastra, Plot Vastu Shastra, Property Management

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We're honored to be part of your real estate journey

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