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# PROPOSED CONSTRUCTION OF BASEMENT + STILT LEVEL CAR PARKING + 9 UPPER FLOORS RESIDENTIAL BUILDING GOVINDASAMY NAGAR LAYOUT, SRI ANDAL LAYOUT TRICHY ROAD, COIMBATORE -641005

FOR

M/S. MAYFLOWER INFRASTRUCTURES

16-09-2023

N 10°59'59.7318", E 77°0'29.6532 "

# GEOTECHNICAL INVESTIGATIONS



## SEPTEMBER-2023

ISO 9001:2015
ISO IEC 17025:2017


## SASTHA SOIL TESTING SERVICES

HEAD OFFICE:C-128, New HIG Colony Ground Floor, Shenbagathottam, Anna Nagar, (Near Melamadai Signal), Madurai - 625 020,

Branch: Chennai. 2, 94 th street 21st Avenue, Ashok Nagar, Duraisamy Road, Near JRK Metric school, Vadapalani, Chennai-600083

Ph: 9344104870, 6382534513, 9345145151, Off:0452-4295151.

Email:sasthageotechengineers@gmail.com,Website: http://sasthasoiltesting.com




K.SETHURAMAN * Chartered Engineer and Valuer * Madurai Cell: 93441 04870


Er. K. SETHURAMAN, M.E.,(Geo tech)MIE..MIGS.,MITTArbi.,FIV.,P.Engg.
Govt. Approved Geo-Tech Engineer / Chartered Engineer / Valuer
SASTHA SOIL TESTING SERVICES (An ISO 9001 : 2015 Certified Firm)
GSTIN : 33ACTFS6957K1Z7, MSME UAN: TN12D0009976
FIV Regn. No. 42/2015, LPA Regn. No :GTE 001 / 2019
PE Regn. No :00596/16, BAI Regn. No: TN/MDU/S/120/PAT
C-128, New HIG Colony, Near Melamadai-Apollo Signal
Shenbagathottam, Anna Nagar, Madurai-625020.
Cell : 93441 04870, 63825 34513

## DOCUMENT RELEASE SHEET

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**CLIENT: M/S. MAYFLOWER INFRASTRUCTURES**

**PROJECT ADDRESS: GOVINDASAMY NAGAR LAYOUT, SRI ANDAL LAYOUT TRICHY ROAD, COIMBATORE - 641005**

**PROJECT: GEOTECHNICAL INVESTIGATION OF PROPOSED CONSTRUCTION OF BASEMENT + STILT LEVEL CAR PARKING + 9 UPPER FLOORS RESIDENTIAL BUILDING GOVINDASAMY NAGAR LAYOUT, SRI ANDAL LAYOUT TRICHY ROAD, COIMBATORE -641005.**

**FINAL REPORT**

**SEPTEMBER - 2023**

**SASTHA SOIL TESTING SERVICES**

C-128, New HIG Colony Ground Floor,
Shenbagathottam, Anna Nagar,
Madurai – 625016.

**Branch:** Chennai. 2, 94 th street
21st Avenue, Ashok Nagar,
Duraisamy Road, Near JRK
Metric school Vadapalani,
Chennai600083.

**Mobile No:** 06382534513

**E-Mail:** sasthageotechengineers@gmail.com

**Website:** http://sasthasoiltesting.com

| | | | |
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K.SETHURAMAN Madurai-20 Civil Engineer and Valuer 9344[illegible]

# 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 |
| ø | Phi, Angle of Internal Friction |
| RL | Reduced Level |
| Y | 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 |

K. SETHURAMAN * Chartered Engineer and Valuer * Madurai-20

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# GEOTECHNICAL INVESTIGATION OF PROPOSED CONSTRUCTION OF BASEMENT + STILT LEVEL CAR PARKING + 9 UPPER FLOORS RESIDENTIAL BUILDING GOVINDASAMY NAGAR LAYOUT, SRI ANDAL LAYOUT TRICHY ROAD, COIMBATORE -641005.

## 1. INTRODUCTION

GEOTECHNICAL INVESTIGATION OF PROPOSED CONSTRUCTION OF **BASEMENT + STILT LEVEL CAR PARKING + 9 UPPER FLOORS RESIDENTIAL BUILDING GOVINDASAMY NAGAR LAYOUT, SRI ANDAL LAYOUT TRICHY ROAD, COIMBATORE -641005.** for **M/S. MAYFLOWER INFRASTRUCTURES** awarded the work of Geotechnical Investigations Work to Sastha Soil Testing Services dated **16th SEPTEMBER 2023.**

As part of scope of services, Total Five boreholes were drilled upto10.0m and 15.00m depth below EGL or 3 consecutive N-values are greater than 50 or 1.5m drilling into Soft rock/ M. rock, H.rock, whichever is earlier at the locations identified by **In our site we have encountered With Fill Up Soil From 0.00 to 0.50m, DSR From 1.50 M And DS Rock From 4.50 M, DSR, Hard Rock From 6.00, DSR, Hard Rock From 6.00 to 10.00m, DSR 10.00 M – 15.00 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 OFWORK

Conducting Standard Penetration Test (SPT) at every1.5 m intervals up to 10.0m and 15.0m depth and thereafter at every1.5m intervals till refusal (N>50).

- Collection of100mm 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 Madurai-20 Chartered Engineer and Valuer

## 3. GEOLOGY OF THE AREA -Regional and Local Geology

### 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 homblende 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

SETHURAMAN * Chartered Engineer and Valuer * Madurai-20 93441

## 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.



## 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°0'29.6532" | 10°59'59.7318" | 10.0M |
| 2 | 02 | 77°0'28.67616" | 10°59'59.05896" | 15.0M |
| 3 | 03 | 77°0'29.53944" | 10°59'58.17588" | 15.0M |
| 4 | 04 | 77°0'30.17196" | 10°59'57.14916" | 15.0M |
| 5 | 05 | 77°0'28.97604" | 10°59'57.0426" | 15.0M |

## 5.0. METHODOLOGY OF FIELDWORK.

### 5.1. Boring and Drilling

A borehole 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:

$$\% \text{ CR} = \frac{\textit{Length of core}}{\textit{Length of run}} \times 100$$

K.SETHURAMAN * Chartered Engineer and Valuer * Madurai-20 Cell: 9344[illegible]

$$\%RQD = \frac{Length\ of\ core\ in\ pieces\ of\ 101.6mm\ (4inches and above)}{Length\ of\ run} \times 100$$

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 (50.8mmODand35mmID) and the sampler is driven by dropping 63.5kg hammer on the top of the driving collar with free fall of 75cm.The length of the sampler is 60cm.The sampler is first driven through15 cm as "Seating Drive". It is further driven through 30cm. The number of blows required to drive the sampler for 30cm 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

Ground water table was **NOT MET at during the drilling depth** at the time of investigation.

NOTE: Approximate **GROUND WATER LEVEL 45.00M**

**Road level and site level**

The Approximate Level of site is **0.900m above** the Nearby Road. Approximate MSL Elevation **431.00Meters**Above Sea level

**MITIGATION MEASURES**

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.

K.SETHURAMAN Chartered Engineer and Valuer Madurai 20 Cell 9344

## 6.0. LABORATORYINVESTIGATION

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:

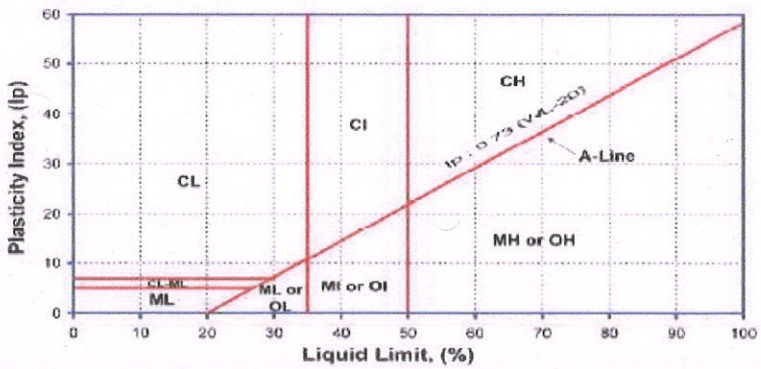
| Laboratory Test | IS Code Referred |
|---|---|
| Bulk Density | By Calculations |
| Natural Moisture Content (NMC) | IS 2720 Part 2 – 1973 (Reaffirmed 2015) |
| Specific Gravity | IS 2720 Part 3 Sec 2 – 1980 (Reaffirmed 2016) |
| Grain Size Analysis | IS 2720 Part 4 – 1985 (Reaffirmed 2015) |
| Liquid 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 arefurnishedin*AppendixB1*.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 | | ± 1.0% |
| | OMC | ± 0.29% | Rock | Crushing Strength | ± 2.3 kg/cm$^2$ |
| Laboratory CBR | | ± 1.6% | | Point Load Strength Index | ± 0.017 kg/cm$^2$ |

* at 95 percent confidence level for coverage factor of 2

**Table 3**
Seismic site classification as per NEPHP and Eurocode 8

| NEHRP, USA | | | Eurocode 8 | |
|---|---|---|---|---|
| Site Class or soil profile type | Description | Average shear wave velocity in the top 30 m | Subsoil class | Description of stratigraphic profile |
| A | Hard Rock | >1500 | – | – |
| B | Rock | 760–1500 | A | Rock or other rock-like geological formation, including at most 5 m of weaker material at the surface |
| C | Very Dense soil/soft rock | 360–760 | 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 | 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 | D | Deposits of loose to medium cohesionless soil (with or without some soft cohesive layers), or of cohesive soil predominantly soft-to-firm |
| F | Special soil requiring site-specific evaluation (1. Soils vulnerable to potential failure or collapse under seismic loading e.g., liquefiable soils, quick and highly sensitive clays, collapsible weakly cemented soils; 2. peats and/or highly organic clays (3 m or thicker layer); 3. very highly plasticity clays (8 m or thicker layer with plasticity index>75); 4. very thick soft/medium stiff clays (36 m or thicker layer) | | E | A soil profile consisting of a surface alluvium layer with Vs30 values of class C or D and thickness varying between about 5 m and 20 m, underlain by stiffer material with Vs30 > 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-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-SOILPROFILE

Generally, one-layer sub-soil profile was noticed in the boreholes, described as under: Layer I – Layer III With Fill Up Soil From 0.00 to 0.50m, DSR From 1.50 M And DS Rock From 4.50 M, DSR, Hard Rock From 6.00, DSR, Hard Rock From 6.00 to 10.00m, DSR 10.00 M – 15.00 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 |
|---|---|---|---|
| BH 1 | 0.00 - 1.50,3.00 - 4.50-10.00 | 50,>50,>50,>50,>50,>50,>50. | DENSE |
| BH 2 | 0.00 - 1.50,3.00 - 4.50 10.00 – 11.50- 15 | 50,>50,>50,>50,>50,>50,>50. | DENSE |
| BH 3 | 0.00 - 1.50,3.00 - 4.50-10.00 – 11.50-15.00 | 50,>50,>50,>50,>50,>50,>50. | DENSE |
| BH 4 | 0.00 - 1.50,3.00 - 4.50-10.00 – 11.50-15.00 | 50,>50,>50,>50,>50,>50,>50. | DENSE |
| BH 5 | 0.00 - 1.50,3.00 - 4.50-10.00 – 11.50-15.00 | 50,>50,>50,>50,>50,>50,>50. | DENSE |

**8.0. FOUNDATION DESIGN CONSIDERATIONS-** Foundation Type, Size & Depth **BASEMENT + STILT LEVEL CAR PARKING + 9 UPPER FLOORS RESIDENTIAL BUILDING** Based on sub-soil profile noticed at site and proposed structures, Open **Raft foundations** can be considered as suitable foundation system. As per Client's specification, the Structure will have **BASEMENT + STILT LEVEL CAR PARKING + 9 UPPER FLOORS RESIDENTIAL BUILDING** above EGL. Hence Safe Bearing Capacity (SBC) calculations have been made for foundations at 1.50 to 15.0 m depth below EGL. Based on the structural configuration, designer can consider the design foundation level.

**Raft foundation**

Use Raft foundation below **4.50 m / 6.00 m** from NGL. (Fix According to basement depth)
(or)

**Column foundation**

Use Column foundation with wide footing below **4.50 m / 6.00 m** from NGL, with connecting Beam all around, ground improvement **Use PCC of 200 mm thickness below Footing**

(or)

**Combined Column foundation / Strip Foundation**

Use combined Column foundation with wide footing below **4.50 m / 6.00 m** from NGL, with connecting Beam all around, ground improvement **Use PCC of 200 mm thickness below Footing**

According to the Structural Engineer's recommendation considering loading conditions. 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, 3.0m, 4.50m and 6.00mdepth below EGL are as follows:

| Borehole No. | N-value | | | |
|---|---|---|---|---|
| | Depth (m) | | | |
| | 1.50 | 3.00 | 4.50 | 6.00 |
| BH 1 | 50 | 50 | 50 | 50 |
| BH 2 | 50 | 50 | 50 | 50 |
| BH 3 | 50 | 50 | 50 | 50 |
| BH 4 | 50 | 50 | 50 | 50 |
| BH 5 | 50 | 50 | 50 | 50 |



## 9.0. 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.

$$\text{Net UBC} = cN_cS_c d_c i_c + \gamma D (N_q - 1)S_q d_q i_q + 0.5\gamma BN\gamma S\gamma d\gamma i\gamma$$

Where,

c = Cohesion of founding strata in $t/m^2$ = 0

ø= Angle if internal friction of founding strata

$S_c$, $S_q$ and $S\gamma$=Shape factors referred from IS: 6403

for square foundation =1.3,1.2and0.8 Respectively

$N_c$, $N_q$ and $N\gamma$= Bearing capacity factors referred from IS:6403

$d_c$, $d_q$ and $d\gamma$=Depth factors referred from IS:6403

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

$d_c = 1+0.2(D/B)\sqrt{N\gamma}$

$d_q$ and $d\gamma = 1 + 0.1 (D/B)\sqrt{N\gamma}$

$i_c$, $i_q$ and $i\gamma$= Inclination factors, all three factors are equal to 1

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

B = Width of foundation = 2m,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 $10t/m^2$ are inferred for foundations of width2.0m,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.

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

## 10.0. MODULUS OF SUB-GRADEREACTIONs

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)

$\delta_a$ = 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 |

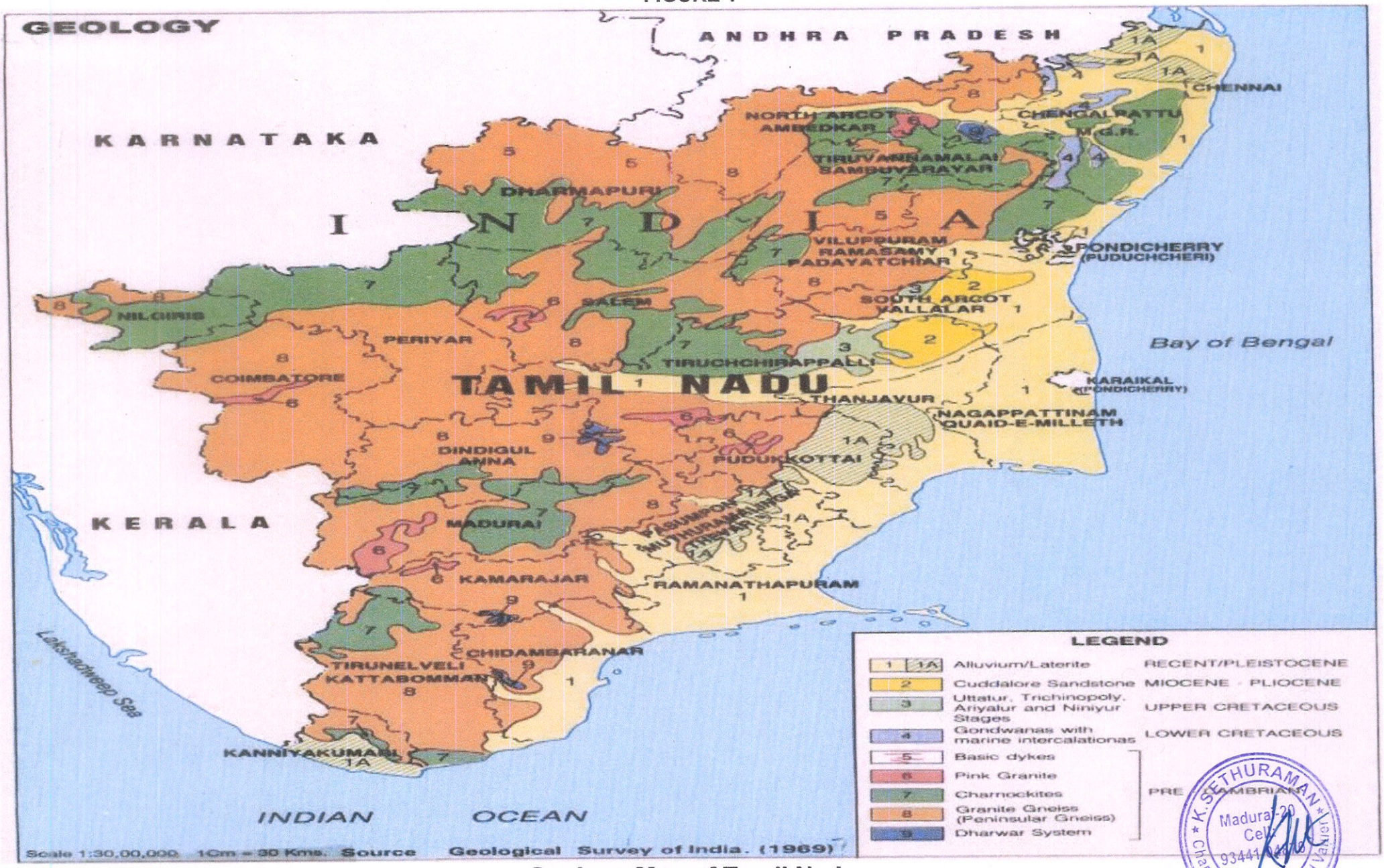


## 11.0. CONCLUSION

- Borehole BH-1- to- 5 was 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, **Raft Foundation / Column Foundation** 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 – **NOT MET during the drilling depth** 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 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.



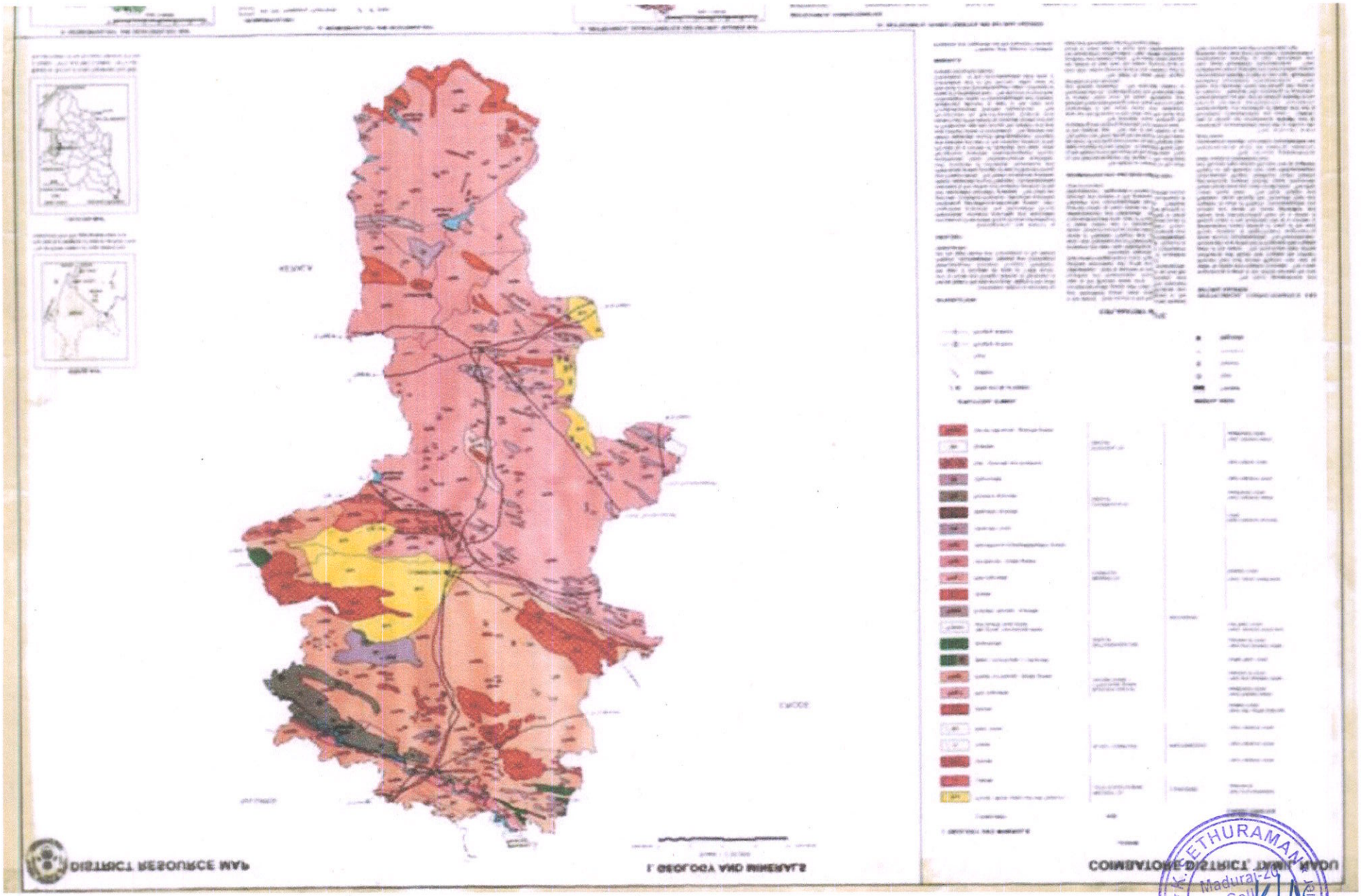
FIGURE 1



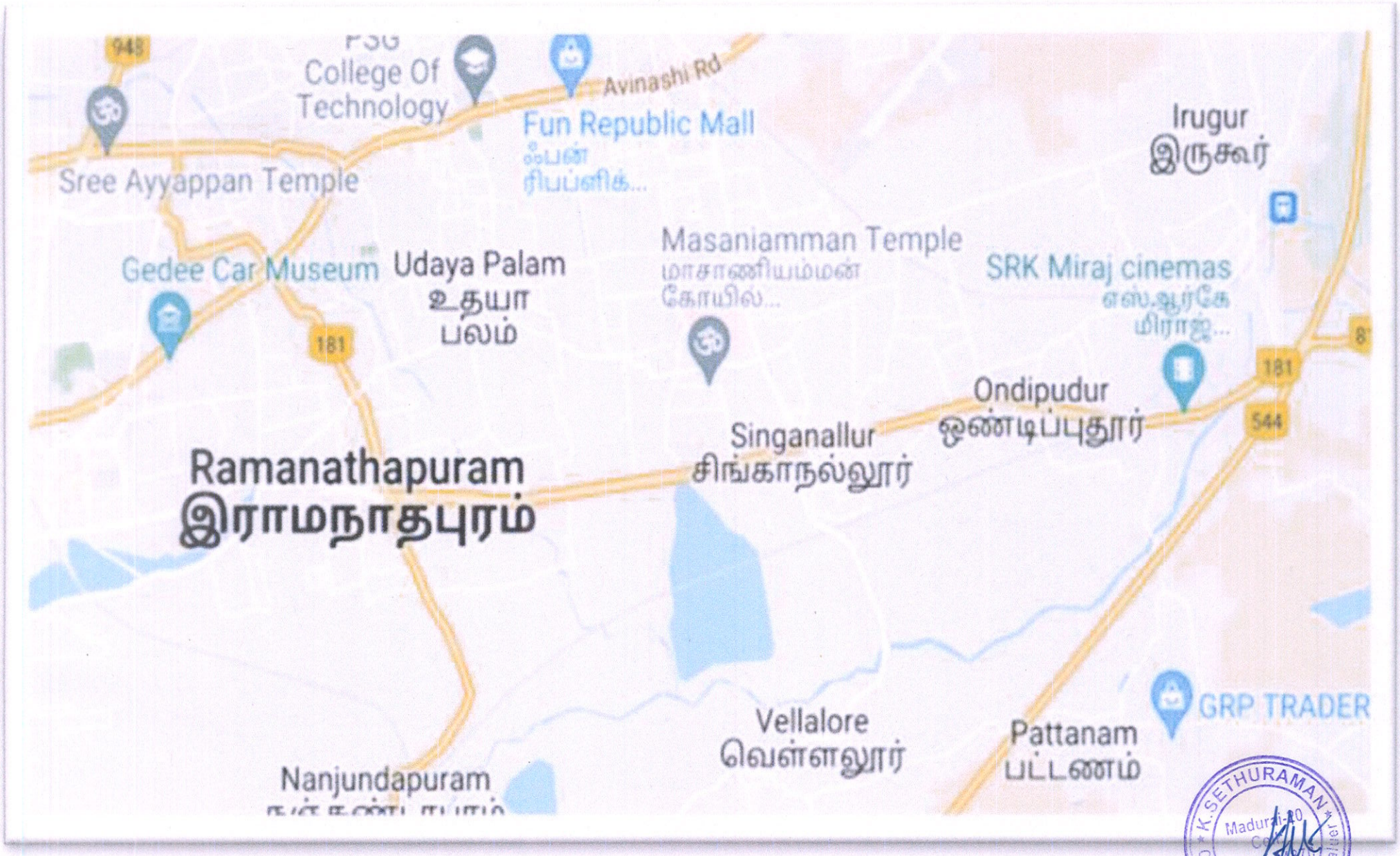

**Geology Map of Tamil Nadu**

K. SETHURAMAN * Chartered Engineer and Valuer * Madurai-20 Cell: 93441

## FIGURE 2



**Geology Map of Coimbatore**




**Location Map**

# APPENDIX A

## BORE LOG – 1

SASTHA SOIL TESTING SERVICES

K. SETHURAMAN, B.E., (Civil), M.E., (Geo Tech), MIE., MISE., MIT (UK)., FIV., F.Engg. Chartered Engineer, Govt Approved Valuer
Builders, Technical Valuers, Pile Foundations
Arbitrators, Forms, Geo - Technical Engineering Services

h+A1:BW53a Soil Testing Services

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PROJECT | : | PROPOSED CONSTRUCTION OF BASEMENT + STILT LEVEL CAR PARKING + 9 UPPER FLOORS RESIDENTIAL BUILDING GOVINDASAMY NAGAR LAYOUT, SRI ANDAL LAYOUT TRICHY ROAD, COIMBATORE -641005. | | | | | |
| LOCATION | : | GOVINDASAMY NAGAR LAYOUT, SRI ANDAL LAYOUT TRICHY ROAD, COIMBATORE -641005. | | | | | |
| BORE HOLE NUMBER | : | BH - 1 | DRILLING TYPE MACHINE | : | FM | DATE COMMENCED | : 16-09-2023 |
| METHOD OF SAMPLING | : | Rotary Drilling | CORE TYPE | : | SINGLE | DATE COMPLETED | : 16-09-2023 |
| COORDINATES Lat | : | 10°59'59.7318" | CORE DIAMETER (mm) | : | 75 | GEOTECH ENGINEER | : Mr. Krishnan Sethuraman |
| COORDINATES Long | : | 77°0'29.6532" | WEIGHT OF HAMMER (Kg) | : | 63.5 | DRILL CREW | : Surendar |
| GROUND WATER DEPTH | : | 45.00 m | DIST.FALLING HAMMER (cm) | : | 75 | SUPERVISOR | : M.DEEPAK |
| TOTAL DEPTH (m) | : | 10.50 m | CASSING DIAMETER (mm) | : | 150 | SITE LEVEL | : (-)3' Feet Down |

### BORE LOG SHEET

| DEPTH (m) | Cassing | G.W.L (m) | LETTER SYMBOL | SOIL PROFILE | | SPT TEST | SAMPLE | SPT & N VALUE N1 | N2 | N3 | N | STANDARD PENETRATION TEST NUMBER OF BLOWS 10 20 30 40 50 60 / UNCONF. COMP. TEST COMPRESSIVE STRENGTH 0.4 0.8 1.2 1.6 2.0 4.0 | DEPTH (m) | CORE RECOVERY % 25 50 75 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | | | | 0 | |
| 1 | Cassing Of 150 mm | | FS | | FILLED UP SOIL | | | | | | | | | |
| 2 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-1 | DS-1 | $50_{13CM}$ | | | >50 | | 1 | 100 |
| 3 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-2 | DS-2 | REBOUND | | | >50 | | 2 | 100 |
| 4 | | | DSR | | DISINTEGRATED SOFT ROCK | SPR-3 | DS-3 | REBOUND | | | >50 | | 3 | 100 |
| 5 | | | ROCK | | HARD ROCK | SPT-4 | DS-4 | REBOUND | | | >50 | | 4 | 100 |
| 6 | | | ROCK | | HARD ROCK | SPT-5 | DS-5 | REBOUND | | | >50 | | 5 | 100 |
| 7 | | | ROCK | | HARD ROCK | SPT-6 | DS-6 | REBOUND | | | >50 | | 6 | 100 |
| 8 | | | ROCK | | HARD ROCK | SPT-7 | DS-7 | REBOUND | | | >50 | | 7 | 100 |
| 9 | | | | | | | | | | | | | 8 | 100 |
| 10 | | | | | | | | | | | | | 9 | 100 |
| 11 | | | | | | | | | | | | | 10 | 100 |
| 12 | | | | | | | | | | | | | 11 | 100 |
| 13 | | | | | | | | | | | | | 12 | 100 |
| 14 | | | | | | | | | | | | | 13 | 100 |
| 15 | | | | | | | | | | | | | 14 | 100 |
| 16 | | | | | | | | | | | | | 15 | 100 |
| 17 | | | | | | | | | | | | | 16 | 90 |
| 18 | | | | | | | | | | | | | 17 | 90 |
| 19 | | | | | | | | | | | | | 18 | 90 |
| 20 | | | | | | | | | | | | | 19 | 100 |
| | | | | | | | | | | | | | 20 | 100 |

REMARKS : 10.50 M TEST WAS STOPPED

Drilling done by Viswa Geotech Sevices

Undisturbed Sampel (UDS)

Disturbed Sampel (DS)

K. SETHURAMAN Chartered Engineer and Valuer Madurai Cell 93441 04870

# BORE LOG – 2

SASTHA SOIL TESTING SERVICES — K. SETHURAMAN, B.E., (Civil), M.E., (Geo Tech), MIE., MISTE., Govt Regd. Valuer, Chartered Engineer, Govt Approved Valuer, Builders, Technical Valuers, Pile Foundations, Arbitrators, Farms, Geo - Technical Engineering Services

## Sastha Soil Testing Services

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PROJECT | : | PROPOSED CONSTRUCTION OF BASEMENT + STILT LEVEL CAR PARKING + 9 UPPER FLOORS RESIDENTIAL BUILDING GOVINDASAMY NAGAR LAYOUT, SRI ANDAL LAYOUT TRICHY ROAD, COIMBATORE -641005. | | | | | |
| LOCATION | : | GOVINDASAMY NAGAR LAYOUT, SRI ANDAL LAYOUT TRICHY ROAD, COIMBATORE -641005. | | | | | |
| BORE HOLE NUMBER | : | BH - 2 | DRILLING TYPE MACHINE | : | FM | DATE COMMENCED | : 16-09-2023 |
| METHOD OF SAMPLING | : | Rotary Drilling | CORE TYPE | : | SINGLE | DATE COMPLETED | : 16-09-2023 |
| COORDINATES Lat | : | 10°59'59.05896" | CORE DIAMETER (mm) | : | 75 | GEOTECH ENGINEER | : Mr. Krishnan Sethuraman |
| COORDINATES Long | : | 77°0'28.67616" | WEIGHT OF HAMMER (Kg) | : | 63.5 | DRILL CREW | : Surendar |
| GROUND WATER DEPTH | : | 45.00 m | DIST.FALLING HAMMER (cm) | : | 75 | SUPERVISOR | : M.DEEPAK |
| TOTAL DEPTH (m) | : | 15.00 m | CASSING DIAMETER (mm) | : | 150 | SITE LEVEL | : (-)3' Feet Down |

## BORE LOG SHEET

| DEPTH (m) | Cassing | G.W.L (m) | LETTER SYMBOL | SOIL PROFILE | | SPT TEST | SAMPLE | SPT & N VALUE N1 | N2 | N3 | N | STANDARD PENETRATION TEST NUMBER OF BLOWS 10 20 30 40 50 60 / UNCONF. COMP. TEST COMPRESSIVE STRENGTH 0.4 0.8 1.2 1.6 2.0 4.0 | DEPTH (m) | CORE RECOVERY % 25 50 75 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | | | | 0 | |
| 1 | Cassing Of 150 mm | | FS | | FILLED UP SOIL | | | | | | | | | |
| 2 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-1 | DS-1 | $50_{12CM}$ | | | >50 | | 1 | 100 |
| 3 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-2 | DS-2 | REBOUND | | | >50 | | 2 | 100 |
| 4 | | | DSR | | DISINTEGRATED SOFT ROCK | SPR-3 | DS-3 | REBOUND | | | >50 | | 3 | 100 |
| 5 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-4 | DS-4 | REBOUND | | | >50 | | 4 | 100 |
| 6 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-5 | DS-5 | REBOUND | | | >50 | | 5 | 100 |
| 7 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-6 | DS-6 | REBOUND | | | >50 | | 6 | 100 |
| 8 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-7 | DS-7 | REBOUND | | | >50 | | 7 | 100 |
| 9 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-8 | DS-8 | REBOUND | | | >50 | | 8 | 100 |
| 10 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-9 | DS-9 | REBOUND | | | >50 | | 9 | 100 |
| 11 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-10 | DS-10 | $50_{14CM}$ | | | >50 | | 10 | 100 |
| 12 | | | DSR | | DISINTEGRATED SOFT ROCK | | | | | | | | 11 | 100 |
| 13 | | | DSR | | DISINTEGRATED SOFT ROCK | | | | | | | | 12 | 100 |
| 14 | | | DSR | | DISINTEGRATED SOFT ROCK | | | | | | | | 13 | 100 |
| 15 | | | DSR | | DISINTEGRATED SOFT ROCK | | | | | | | | 14 | 100 |
| 16 | | | | | | | | | | | | | 15 | 90 |
| 17 | | | | | | | | | | | | | 16 | 90 |
| 18 | | | | | | | | | | | | | 17 | 90 |
| 19 | | | | | | | | | | | | | 18 | 100 |
| 20 | | | | | | | | | | | | | 19 | 100 |
| | | | | | | | | | | | | | 20 | 100 |

REMARKS : 15.00 M TEST WAS STOPPED

Drilling done by Viswa Geotech Sevices

Undisturbed Sampel (UDS)

Disturbed Sampel (DS)

K. SETHURAMAN, Chartered Engineer and Valuer, Madurai-20, Cell: 93441 04420

# BORE LOG – 3

SASTHA SOIL TESTING SERVICES

K. SETHURAMAN, B.E., (Civil) M.E., (Geo Tech) FIE., MIES., MIT Adv. Mg, P.Engg. Chartered Engineer, Govt Approved Valuer
Builders, Technical Valuers, Pile Foundations
Arbitrators, Farms, Geo - Technical Engineering Services

## Sastha Soil Testing Services

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PROJECT | : | PROPOSED CONSTRUCTION OF TWO BASEMENT LEVEL CAR PARKING + GROUND + 6 STOREY + ROOF COMMERCIAL BUILDING KAMATCHI GARDEN KALAPATTI ROAD COIMBATORE -641035 | | | | | |
| LOCATION | : | KAMATCHI GARDEN KALAPATTI ROAD COIMBATORE -641035 | | | | | |
| BORE HOLE NUMBER | : | BH - 3 | DRILLING TYPE MACHINE : | FM | DATE COMMENCED | : | 14-09-2023 |
| METHOD OF SAMPLING | : | Rotary Drilling | CORE TYPE : | SINGLE | DATE COMPLETED | : | 14-09-2023 |
| COORDINATES Lat | : | 11°3'25.53984" | CORE DIAMETER (mm) : | 75 | GEOTECH ENGINEER | : | Mr. Krishnan Sethuraman |
| COORDINATES Long | : | 77°2'16.41876" | WEIGHT OF HAMMER (Kg) : | 63.5 | DRILL CREW | : | Surendar |
| GROUND WATER DEPTH | : | 45.00 m | DIST.FALLING HAMMER (cm) : | 75 | SUPERVISOR | : | VISHNUVARTHAN |
| TOTAL DEPTH (m) | : | 15.00 m | CASSING DIAMETER (mm) : | 150 | SITE LEVEL | : | EQUAL |

## BORE LOG SHEET

| DEPTH (m) | Cassing | G.W.L (m) | LETTER SYMBOL | SOIL PROFILE | | SPT TEST | SAMPLE | SPT & N VALUE N1 | N2 | N3 | N | STANDARD PENETRATION TEST NUMBER OF BLOWS 10 20 30 40 50 60 / UNCONF. COMP. TEST COMPRESSIVE STRENGTH 0.4 0.8 1.2 1.6 2.0 4.0 | DEPTH (m) | CORE RECOVERY % 25 50 75 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | | | | 0 | |
| | | | FS | | FILLED UP SOIL | | | | | | | | | |
| 1 | Cassing Of 150 mm | | DSR | | DISINTEGRATED SOFT ROCK | SPT-1 | DS-1 | $50_{01\frac{4}{4}CM}$ | | | >50 | | 1 | 100 |
| 2 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-2 | DS-2 | REBOUND | | | >50 | | 2 | 100 |
| 3 | | | | | | | | | | | | | | 100 |
| 4 | | | DSR | | DISINTEGRATED SOFT ROCK | SPR-3 | DS-3 | REBOUND | | | >50 | | 4 | 100 |
| 5 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-4 | DS-4 | REBOUND | | | >50 | | | 100 |
| 6 | | | | | | | | | | | | | | 100 |
| 7 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-5 | DS-5 | REBOUND | | | >50 | | 7 | 100 |
| 8 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-6 | DS-6 | REBOUND | | | >50 | | 8 | 100 |
| 9 | | | | | | | | | | | | | 9 | 100 |
| 10 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-7 | DS-7 | REBOUND | | | >50 | | 10 | 100 |
| 11 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-8 | DS-8 | REBOUND | | | >50 | | 11 | 100 |
| 12 | | | | | | | | | | | | | 12 | 100 |
| 13 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-9 | DS-9 | REBOUND | | | >50 | | 13 | 100 |
| 14 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-10 | DS-10 | $50_{15CM}$ | | | >50 | | 14 | 100 |
| 15 | | | | | | | | | | | | | 15 | 90 |
| 16 | | | | | | | | | | | | | 16 | 90 |
| 17 | | | | | | | | | | | | | 17 | 90 |
| 18 | | | | | | | | | | | | | 18 | 100 |
| 19 | | | | | | | | | | | | | 19 | 100 |
| 20 | | | | | | | | | | | | | 20 | |

REMARKS : 15.00 M TEST WAS STOPPED

Drilling done by Viswa Geotech Sevices

Undisturbed Sampel (UDS)

Disturbed Sampel (DS)

K. SETHURAMAN * Chartered Engineer and Valuer * Madurai 93441 04870

# BORE LOG – 4

SASTHA SOIL TESTING SERVICES — K. SETHURAMAN, B.E., (Civil), M.E., (Geo Tech), MIE., MIGS., MIT Arb., FIV., FEng. Chartered Engineer, Govt Approved Valuer. Builders, Technical Valuers, Pile Foundations, Arbitrators, Farms, Geo - Technical Engineering Services

**Sastha Soil Testing Services**

| | | |
|---|---|---|
| PROJECT | : | PROPOSED CONSTRUCTION OF BASEMENT + STILT LEVEL CAR PARKING + 9 UPPER FLOORS RESIDENTIAL BUILDING GOVINDASAMY NAGAR LAYOUT, SRI ANDAL LAYOUT TRICHY ROAD, COIMBATORE -641005. |
| LOCATION | : | GOVINDASAMY NAGAR LAYOUT, SRI ANDAL LAYOUT TRICHY ROAD, COIMBATORE -641005. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| BORE HOLE NUMBER | : | BH - 4 | DRILLING TYPE MACHINE | : | FM | DATE COMMENCED | : 16-09-2023 |
| METHOD OF SAMPLING | : | Rotary Drilling | CORE TYPE | : | SINGLE | DATE COMPLETED | : 16-09-2023 |
| COORDINATES Lat | : | 10°59'57.14916" | CORE DIAMETER (mm) | : | 75 | GEOTECH ENGINEER | : Mr. Krishnan Sethuraman |
| COORDINATES Long | : | 77°0'30.17196" | WEIGHT OF HAMMER (Kg) | : | 63.5 | DRILL CREW | : Surendar |
| GROUND WATER DEPTH | : | 45.00 m | DIST.FALLING HAMMER (cm) | : | 75 | SUPERVISOR | : M.DEEPAK |
| TOTAL DEPTH (m) | : | 15.00 m | CASSING DIAMETER (mm) | : | 150 | SITE LEVEL | : (-)3' Feet Down |

## BORE LOG SHEET

| DEPTH (m) | Cassing | G.W.L (m) | LETTER SYMBOL | SOIL PROFILE | | SPT TEST | SAMPLE | SPT & N VALUE N1 | N2 | N3 | N | STANDARD PENETRATION TEST NUMBER OF BLOWS 10 20 30 40 50 60 / UNCONF. COMP. TEST COMPRESSIVE STRENGTH 0.4 0.8 1.2 1.6 2.0 4.0 | DEPTH (m) | CORE RECOVERY % 25 50 75 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | | | | 0 | |
| 1 | Cassing Of 150 mm | | FS | | FILLED UP SOIL | | | | | | | | 1 | 100 |
| 2 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-1 | DS-1 | $50_{01.5CM}$ | | | >50 | | 2 | 100 |
| 3 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-2 | DS-2 | $50_{15CM}$ REBOUND | | | >50 | | 3 | 100 |
| 4 | | | DSR | | DISINTEGRATED SOFT ROCK | SPR-3 | DS-3 | REBOUND | | | >50 | | 4 | 100 |
| 5 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-4 | DS-4 | REBOUND | | | >50 | | 5 | 100 |
| 6 | | | | | | | | | | | | | 6 | 100 |
| 7 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-5 | DS-5 | REBOUND | | | >50 | | 7 | 100 |
| 8 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-6 | DS-6 | REBOUND | | | >50 | | 8 | 100 |
| 9 | | | | | | | | | | | | | 9 | 100 |
| 10 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-7 | DS-7 | REBOUND | | | >50 | | 10 | 100 |
| 11 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-8 | DS-8 | REBOUND | | | >50 | | 11 | 100 |
| 12 | | | | | | | | | | | | | 12 | 100 |
| 13 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-9 | DS-9 | REBOUND | | | >50 | | 13 | 100 |
| 14 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-10 | DS-10 | $50_{15CM}$ | | | >50 | | 14 | 100 |
| 15 | | | | | | | | | | | | | 15 | 90 |
| 16 | | | | | | | | | | | | | 16 | 90 |
| 17 | | | | | | | | | | | | | 17 | 90 |
| 18 | | | | | | | | | | | | | 18 | 100 |
| 19 | | | | | | | | | | | | | 19 | 100 |
| 20 | | | | | | | | | | | | | 20 | 100 |

REMARKS : 15.00 M TEST WAS STOPPED

Drilling done by Vision Geotech Services

Undisturbed Sampel (UDS)

Disturbed Sampel (DS)

K. SETHURAMAN Madurai-20 Cell: 93441 00810 Chartered Engineer Govt. Approved Valuer

# BORE LOG – 5

SASTHA SOIL TESTING SERVICES

K. SETHURAMAN, B.E., (Civil), M.E., (Geo Tech), MIE., MIGS., MIST Adv.
F.I.V., F.Engg. Chartered Engineer, Govt Approved Valuer
Builders, Technical Valuers, Pile Foundations
Arbitrators, Farms, Geo - Technical Engineering Services

## Sastha Soil Testing Services

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PROJECT | : | PROPOSED CONSTRUCTION OF TWO BASEMENT LEVEL CAR PARKING + GROUND + 6 STOREY + ROOF COMMERCIAL BUILDING KAMATCHI GARDEN KALAPATTI ROAD COIMBATORE -641035 | | | | | |
| LOCATION | : | KAMATCHI GARDEN KALAPATTI ROAD COIMBATORE -641035 | | | | | |
| BORE HOLE NUMBER | : | BH - 5 | DRILLING TYPE MACHINE | : | FM | DATE COMMENCED | : 14-09-2023 |
| METHOD OF SAMPLING | : | Rotary Drilling | CORE TYPE | : | SINGLE | DATE COMPLETED | : 14-09-2023 |
| COORDINATES Lat | : | 10°59'57.0426" | CORE DIAMETER (mm) | : | 75 | GEOTECH ENGINEER | : Mr. Krishnan Sethuraman |
| COORDINATES Long | : | 77°0'28.97604" | WEIGHT OF HAMMER (Kg) | : | 63.5 | DRILL CREW | : Surendar |
| GROUND WATER DEPTH | : | 45.00 m | DIST.FALLING HAMMER (cm) | : | 75 | SUPERVISOR | : VISHNUVARTHAN |
| TOTAL DEPTH (m) | : | 15.00 m | CASSING DIAMETER (mm) | : | 150 | SITE LEVEL | : EQUAL |

## BORE LOG SHEET

| DEPTH (m) | Cassing | G.W.L (m) | LETTER SYMBOL | SOIL PROFILE | | SPT TEST | SAMPLE | SPT & N VALUE N1 | N2 | N3 | N | STANDARD PENETRATION TEST NUMBER OF BLOWS 10 20 30 40 50 60 / UNCONF. COMP. TEST COMPRESSIVE STRENGTH 0.4 0.8 1.2 1.6 2.0 4.0 | DEPTH (m) | CORE RECOVERY % 25 50 75 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | | | | | | 0 | |
| 1 | Cassing Of 150 mm | | FS | | FILLED UP SOIL | | | | | | | | | |
| 2 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-1 | DS-1 | 50/15CM | | | >50 | | 1 | 100 |
| 3 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-2 | DS-2 | REBOUND | | | >50 | | 2 | 100 |
| 4 | | | DSR | | DISINTEGRATED SOFT ROCK | SPR-3 | DS-3 | REBOUND | | | >50 | | 3 | 100 |
| 5 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-4 | DS-4 | REBOUND | | | >50 | | 4 | 100 |
| 6 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-5 | DS-5 | REBOUND | | | >50 | | 5 | 100 |
| 7 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-6 | DS-6 | REBOUND | | | >50 | | 6 | 100 |
| 8 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-7 | DS-7 | REBOUND | | | >50 | | 7 | 100 |
| 9 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-8 | DS-8 | REBOUND | | | >50 | | 8 | 100 |
| 10 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-9 | DS-9 | REBOUND | | | >50 | | 9 | 100 |
| 11 | | | DSR | | DISINTEGRATED SOFT ROCK | SPT-10 | DS-10 | REBOUND | | | >50 | | 10 | 100 |
| 12 | | | DSR | | DISINTEGRATED SOFT ROCK | | | | | | | | 11 | 100 |
| 13 | | | DSR | | DISINTEGRATED SOFT ROCK | | | | | | | | 12 | 100 |
| 14 | | | DSR | | DISINTEGRATED SOFT ROCK | | | | | | | | 13 | 100 |
| 15 | | | | | | | | | | | | | 14 | 100 |
| 16 | | | | | | | | | | | | | 15 | 90 |
| 17 | | | | | | | | | | | | | 16 | 90 |
| 18 | | | | | | | | | | | | | 17 | 90 |
| 19 | | | | | | | | | | | | | 18 | 100 |
| 20 | | | | | | | | | | | | | 19 | 100 |
| | | | | | | | | | | | | | 20 | 100 |

REMARKS : 15.00 M TEST WAS STOPPED

Drilling done by Viswa Geotech Sevices

Undisturbed Sampel (UDS)

Disturbed Sampel (DS)

K. SETHURAMAN * Madurai-20 * Cell: 93441 04670 * Chartered Engineer and Valuer

# APPENDIX B1

**SASTHA SOIL TESTING SERVICES**

AN ISO-9001:2015 Certified Company

C-128, New HIG Colony, Shenbagathottam, Anna Nagar,

Madurai - 625 020, Ph: 9344104870

**ULR-TC1067723100000199F**

TC-10677

| | | | |
|---|---|---|---|
| **Issued To** | **GEOTECHNICAL INVESTIGATION OF PROPOSED CONSTRUCTION OF BASEMENT + STILT LEVEL CAR PARKING + 9 UPPER FLOORS RESIDENTIAL BUILDING GOVINDASAMY NAGAR LAYOUT, SRI ANDAL LAYOUT TRICHY ROAD, COIMBATORE -641005.** | **Test Certificate No** | SSTS/GT/160923/16 |
| | | **Date of Issue** | 27-09-2023 |
| | | **Matrix** | Soil Samples |
| **Date of receipt of Soil samples** | 18-09-2023 | **Sampling** | SPL-16.09.2023 |
| **Date of Testing** | 18.09.2023 To 20.09.2023 | **Page Nos** | 26 of 43 |

| 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 | Poin Load INdex Mn/mm$^2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Gravel (%) | Sand (%) | | | Silt & Clay (%) | | | | | | |
| | | | | | | Coarse | Medium | Fine | | | | | | | |
| BH 1 | 1.5 | 362.5 | 50 | DSR | 0.76 | 14.87 | 77.08 | 7.12 | 0.17 | Non-Plastic | | | 23.33 | 2.65 | - |
| | 3 | 361 | 50 | DSR | 1.52 | 85.58 | 12.67 | 0.21 | 0.02 | Non-Plastic | | | 11.90 | 2.62 | - |
| | 4.5 | 359.5 | 50 | DSR | 5.85 | 90.45 | 3.56 | 0.10 | 0.04 | Non-Plastic | | | 8.68 | 2.68 | - |
| | 6 | 358 | 50 | HARD ROCK | - | - | - | - | - | - | | | - | - | - |
| | 7.5 | 356.5 | 50 | HARD ROCK | - | - | - | - | - | - | | | - | - | - |
| | 9 | 355 | 50 | HARD ROCK | - | - | - | - | - | - | | | - | - | - |
| | 10.5 | 353.5 | 50 | HARD ROCK | - | - | - | - | - | - | | | - | - | - |
| BH 2 | 1.5 | 362.5 | 50 | DSR | - | - | - | - | - | - | | | - | - | - |
| | 3 | 361 | 50 | DSR | 0.26 | 55.64 | 40.11 | 3.87 | 0.12 | Non-Plastic | | | 14.14 | 2.62 | - |
| | 4.5 | 359.5 | 50 | DSR | - | - | - | - | - | - | | | - | - | - |
| | 6 | 358 | 50 | DSR | 28.81 | 41.37 | 26.66 | 3.00 | 0.16 | Non-Plastic | | | 8.99 | 2.68 | - |
| | 7.5 | 356.5 | 50 | DSR | - | - | - | - | - | - | | | - | - | - |
| | 9 | 355 | 50 | DSR | 42.64 | 42.98 | 13.29 | 1.05 | 0.04 | Non-Plastic | | | 8.14 | 2.67 | - |
| | 10.5 | 353.5 | 50 | DSR | - | - | - | - | - | - | | | - | - | - |
| | 12 | 352 | 50 | DSR | 35.44 | 46.03 | 17.04 | 1.37 | 0.12 | Non-Plastic | | | 9.17 | 2.67 | - |
| | 13.5 | 350.5 | 50 | DSR | - | - | - | - | - | - | | | - | - | - |
| | 15 | 349 | 50 | DSR | 41.56 | 41.96 | 15.60 | 0.77 | 0.11 | Non-Plastic | | | 10.39 | 2.67 | - |

K.SETHURAMAN Madurai Cell: 93441 04878 Chartered Engineer Valuer

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Gravel (%) | Sand (%) | | | Silt & Clay (%) | | | | | |
| | | | | | | Coarse | Medium | Fine | | | | | | |
| BH 3 | 1.5 | 362.5 | 50 | DSR | 1.35 | 19.29 | 72.80 | 6.33 | 0.23 | Non-Plastic | | | 22.47 | 2.67 |
| | 3 | 361 | 50 | DSR | - | - | - | - | - | - | | | - | - |
| | 4.5 | 359.5 | 50 | DSR | 24.85 | 54.09 | 19.95 | 1.07 | 0.04 | Non-Plastic | | | 9.55 | 2.67 |
| | 6 | 358 | 50 | DSR | - | - | - | - | - | - | | | - | - |
| | 7.5 | 356.5 | 50 | DSR | 30.32 | 49.19 | 19.23 | 1.24 | 0.02 | Non-Plastic | | | 8.40 | 2.71 |
| | 9 | 355 | 50 | DSR | - | - | - | - | - | - | | | - | - |
| | 10.5 | 353.5 | 50 | DSR | 25.66 | 53.97 | 18.84 | 1.35 | 0.18 | Non-Plastic | | | 9.98 | 2.69 |
| | 12 | 352 | 50 | DSR | - | - | - | - | - | - | | | - | - |
| | 13.5 | 350.5 | 50 | DSR | 37.17 | 48.95 | 13.23 | 0.61 | 0.04 | Non-Plastic | | | 11.79 | 2.71 |
| | 15 | 349 | 50 | DSR | - | - | - | - | - | - | | | - | - |
| BH 4 | 1.5 | 362.5 | 50 | DSR | - | - | - | - | - | - | | | - | - |
| | 3 | 361 | 50 | DSR | 0.30 | 54.49 | 42.66 | 2.12 | 0.43 | Non-Plastic | | | 13.91 | 2.72 |
| | 4.5 | 359.5 | 50 | DSR | - | - | - | - | - | - | | | - | - |
| | 6 | 358 | 50 | DSR | 34.39 | 45.38 | 19.11 | 0.92 | 0.20 | Non-Plastic | | | 8.55 | 2.69 |
| | 7.5 | 356.5 | 50 | DSR | - | - | - | - | - | - | | | - | - |
| | 9 | 355 | 50 | DSR | 35.24 | 47.98 | 15.60 | 0.98 | 0.20 | Non-Plastic | | | 9.12 | 2.70 |
| | 10.5 | 353.5 | 50 | DSR | - | - | - | - | - | - | | | - | - |
| | 12 | 352 | 50 | DSR | 26.29 | 43.94 | 28.26 | 1.27 | 0.24 | Non-Plastic | | | 15.21 | 2.70 |
| | 13.5 | 350.5 | 50 | DSR | - | - | - | - | - | - | | | - | - |
| | 15 | 349 | 50 | DSR | 38.74 | 43.40 | 16.96 | 0.64 | 0.26 | Non-Plastic | | | 10.42 | 2.68 |
| BH 5 | 1.5 | 362.5 | 50 | DSR | - | - | - | - | - | - | | | - | - |
| | 3 | 361 | 50 | DSR | 2.03 | 16.26 | 71.55 | 9.85 | 0.31 | Non-Plastic | | | 23.20 | 2.70 |
| | 4.5 | 359.5 | 50 | DSR | - | - | - | - | - | - | | | - | - |
| | 6 | 358 | 50 | DSR | 34.80 | 48.92 | 15.51 | 0.75 | 0.02 | Non-Plastic | | | 11.03 | 2.71 |
| | 7.5 | 356.5 | 50 | DSR | - | - | - | - | - | - | | | - | - |
| | 9 | 355 | 50 | DSR | 39.49 | 44.34 | 15.72 | 0.37 | 0.08 | Non-Plastic | | | 13.78 | 2.68 |
| | 10.5 | 353.5 | 50 | DSR | - | - | - | - | - | - | | | - | - |
| | 12 | 352 | 50 | DSR | 39.50 | 39.96 | 19.63 | 0.90 | 0.01 | Non-Plastic | | | 9.89 | 2.69 |
| | 13.5 | 350.5 | 50 | DSR | - | - | - | - | - | - | | | - | - |
| | 15 | 349 | 50 | DSR | 38.50 | 38.90 | 20.63 | 1.01 | 0.96 | Non-Plastic | | | 11.28 | 2.70 |



Authorized Signatory
Mr. K. Sethuraman

# APPENDIX B2

| | | | | |
|---|---|---|---|---|
| Issued To | GEOTECHNICAL INVESTIGATION OF PROPOSED CONSTRUCTION OF BASEMENT + STILT LEVEL CAR PARKING + 9 UPPER FLOORS RESIDENTIAL BUILDING GOVINDASAMY NAGAR LAYOUT, SRI ANDAL LAYOUT TRICHY ROAD, COIMBATORE -641005. | | Test Certificate No | SSTS/GT/140923/14 |
| | | | Date of Issue | 25-09-2023 |
| | | | Matrix | Soil Samples |
| Date of receipt of Soil samples | 14-09-2023 | | Sampling | SPL-18.09.2023 |
| Date of Testing | 18.09.2023 To 23.09.2023 | | Page Nos | 29 of 41 |

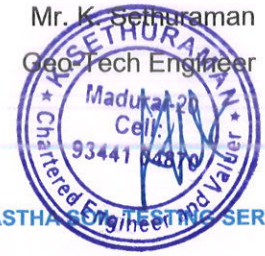
## LAB TEST RESULTS - SOIL SAMPLES
(NON – NABL)

| | Tested depth (m) | R.L of Layers (m) | N Value | Type of Soil (IS Classification) | Water Absorption of Rock (%) | Bulk density (g/cm3) | Allowable Bearing Pressure (kPa) | qu=SBC (kN/m$^2$) Footing Size (m) 3 x 3 Assumed | Direct shear | | UCC strength (kPa) | Shear Wave Velocity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Cohesion (kPa) (t/m$^2$) | ø (DEG) | | |
| BH 1 | 1.5 | 362.5 | 50 | DSR | - | 2.04 | 461.25 | 274 | 0 | 42 | >400 | 340.09 |
| | 3 | 361 | 50 | DSR | - | 2.04 | 461.25 | 300 | 0 | 42 | >400 | 340.09 |
| | 4.5 | 359.5 | 50 | DSR | - | 2.04 | 461.25 | 300 | 0 | 42 | >400 | 340.09 |
| | 6 | 358 | 50 | HARD ROCK | 1.13 | 2.40 | 461.25 | 710 | 0 | 42 | >400 | 340.09 |
| | 7.5 | 356.5 | 50 | HARD ROCK | 2.99 | 2.40 | 461.25 | 839 | 0 | 42 | >400 | 340.09 |
| | 9 | 355 | 50 | HARD ROCK | 2.15 | 2.40 | 461.25 | 968 | 0 | 42 | >400 | 340.09 |
| | 10.5 | 353.5 | 50 | HARD ROCK | 1.82 | 2.40 | 461.25 | 1097 | 0 | 42 | >400 | 340.09 |

K. SETHURAMAN Madurai-20 Cell: 93441 Chartered Engineer Valuer

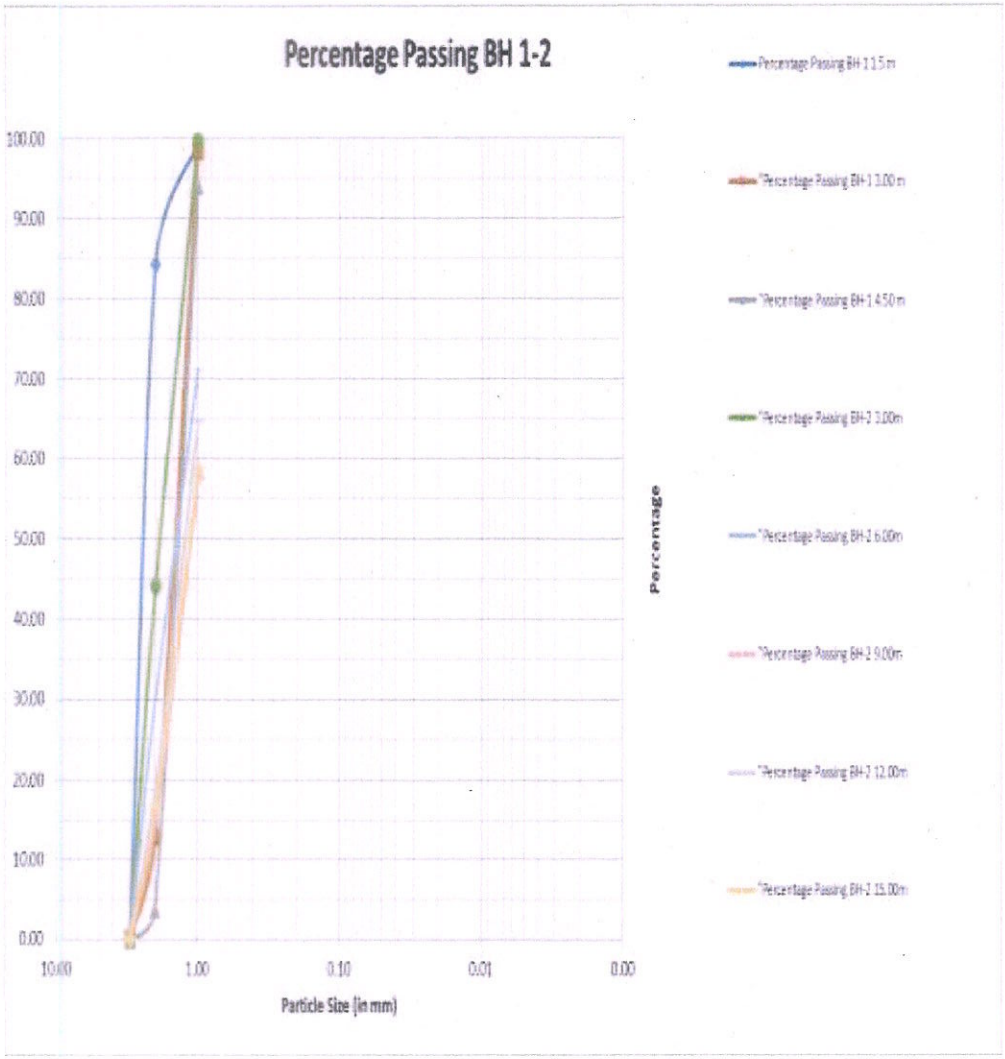
| | Tested depth (m) | R.L of Layers (m) | N Value | Type of Soil (IS Classification) | Bulk density (g/cm3) | Allowable Bearing Pressure (kPa) | qu=SBC (kN/m$^2$) Footing Size (m) 3 x 3 Assumed | Direct shear | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Cohesion (kPa) (t/m$^2$) | ø (DEG) | UCC strength (kPa) | Shear Wave Velocity |
| BH 2-5 | 1.5 | 362.5 | 50 | DSR | 2.04 | 461.25 | 274 | 0 | 42 | >400 | 340.09 |
| | 3 | 361 | 50 | DSR | 2.04 | 461.25 | 300 | 0 | 42 | >400 | 340.09 |
| | 4.5 | 359.5 | 50 | DSR | 2.04 | 461.25 | 300 | 0 | 42 | >400 | 340.09 |
| | 6 | 358 | 50 | DSR | 2.04 | 461.25 | 300 | 0 | 42 | >400 | 340.09 |
| | 7.5 | 356.5 | 50 | DSR | 2.04 | 461.25 | 300 | 0 | 42 | >400 | 340.09 |
| | 9 | 355 | 50 | DSR | 2.04 | 461.25 | 300 | 0 | 42 | >400 | 340.09 |
| | 10.5 | 353.5 | 50 | DSR | 2.04 | 461.25 | 300 | 0 | 42 | >400 | 340.09 |
| | 12 | 352 | 50 | DSR | 2.04 | 461.25 | 300 | 0 | 42 | >400 | 340.09 |
| | 13.5 | 350.5 | 50 | DSR | 2.04 | 461.25 | 300 | 0 | 42 | >400 | 340.09 |
| | 15 | 349 | 50 | DSR | 2.04 | 461.25 | 300 | 0 | 42 | >400 | 340.09 |

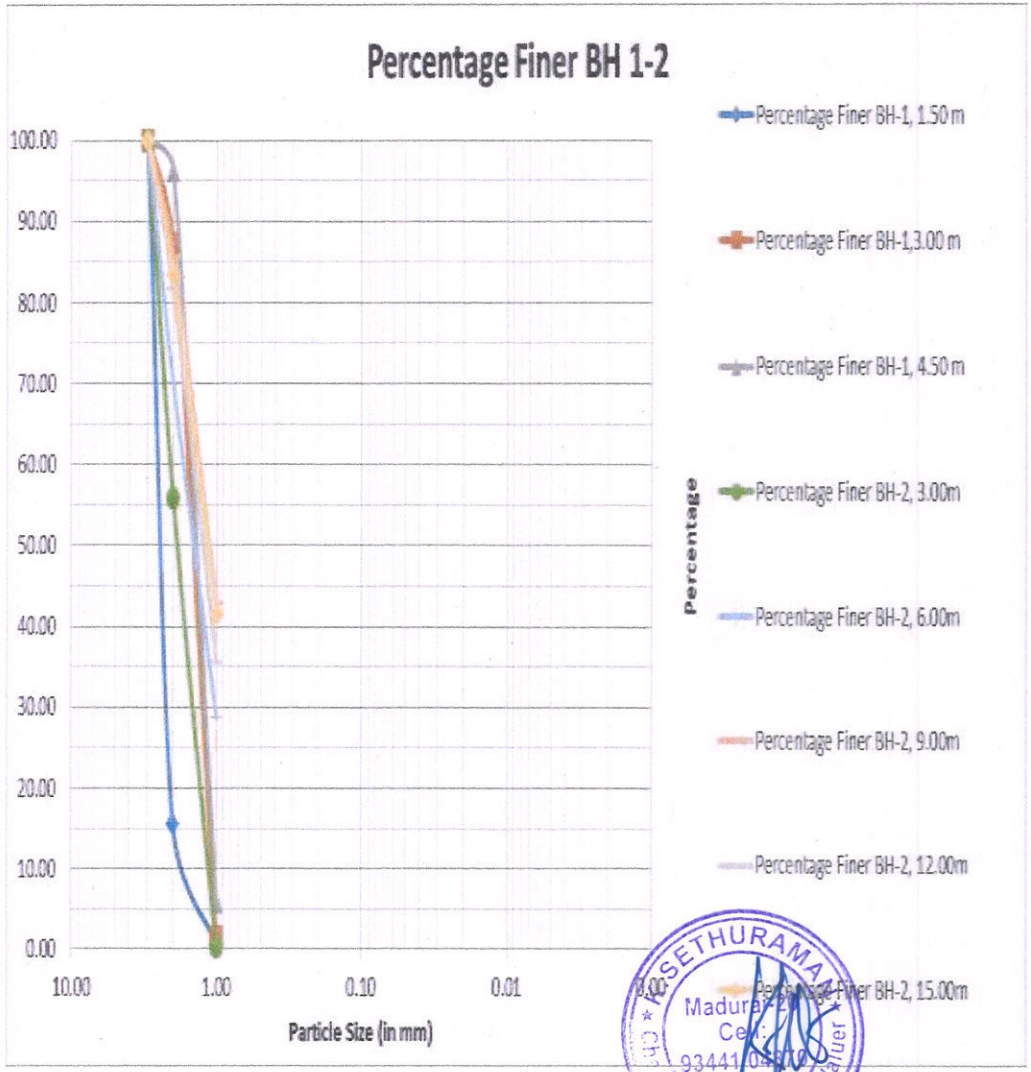
Authorized Signatory
Mr. K. Sethuraman
Geo-Tech Engineer



# APPENDIX B3
# PARTICLE SIZE ANALYSIS CURVES

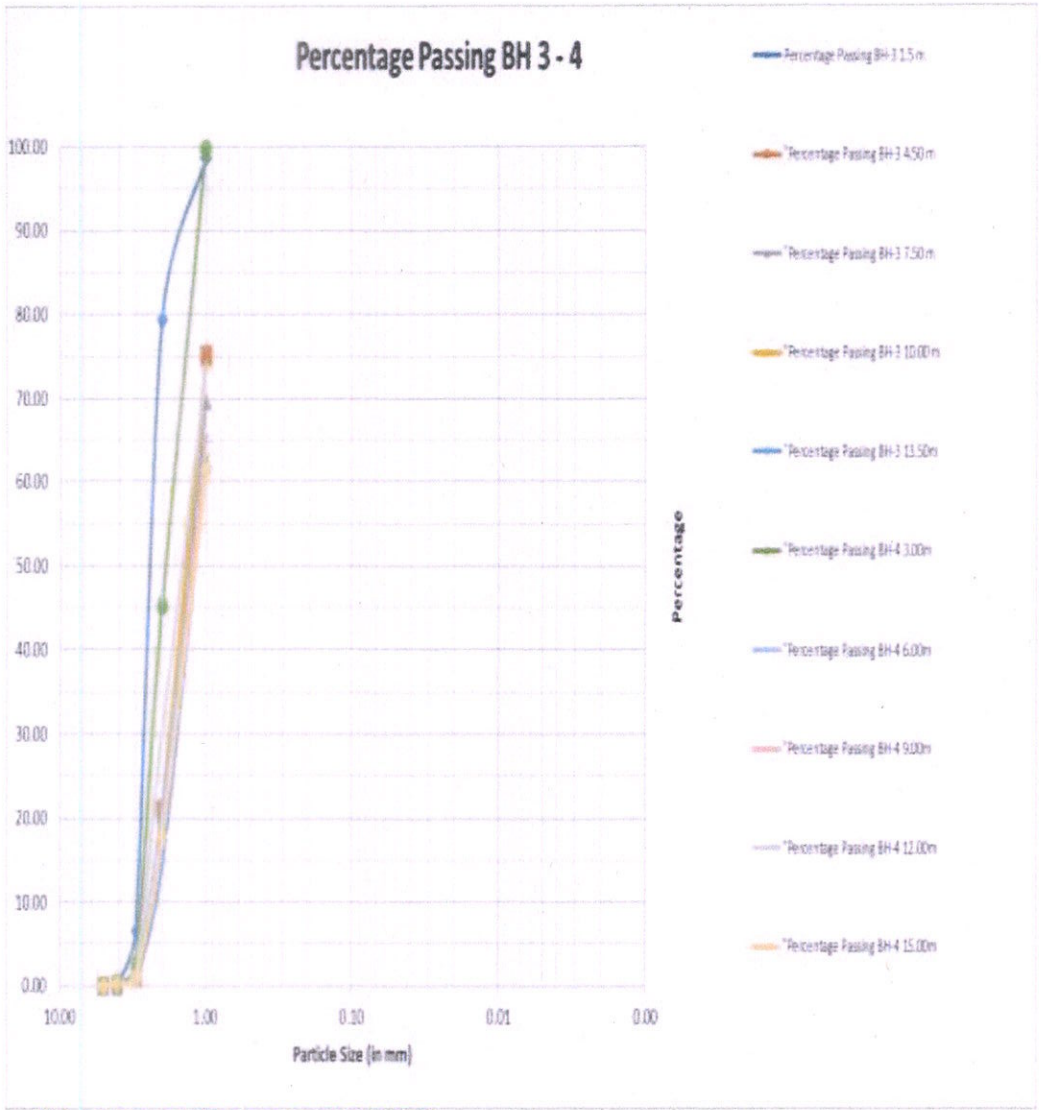
**PROJECT:** GEOTECHNICAL INVESTIGATION OF PROPOSED CONSTRUCTION OF BASEMENT + STILT LEVEL CAR PARKING + 9 UPPER FLOORS RESIDENTIAL BUILDING GOVINDASAMY NAGAR LAYOUT, SRI ANDAL LAYOUT TRICHY ROAD, COIMBATORE -641005.
**CLIENT:** M/S. MAYFLOWER INFRASTRUCTURES

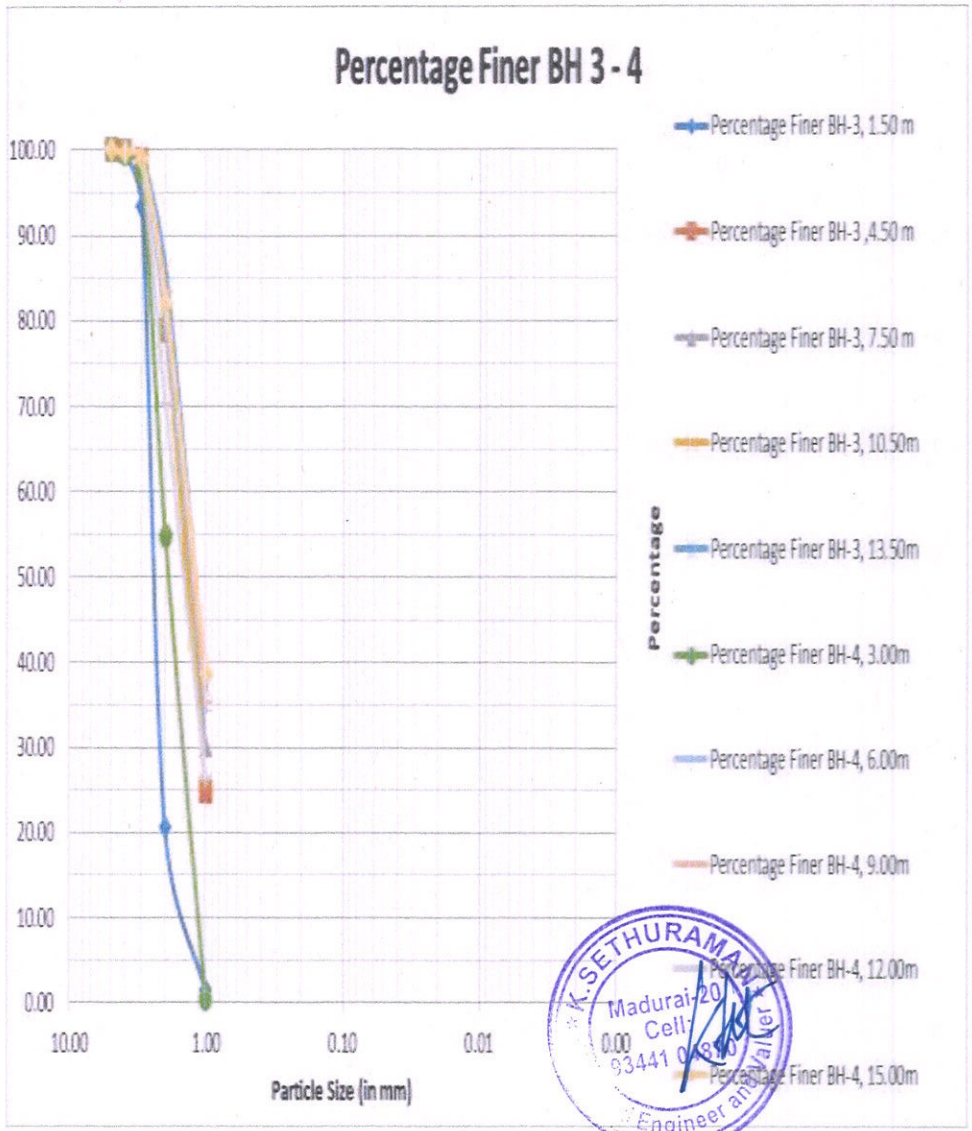


# PARTICLE SIZE ANALYSIS CURVES

**PROJECT:** GEOTECHNICAL INVESTIGATION OF PROPOSED CONSTRUCTION OF BASEMENT + STILT LEVEL CAR PARKING + 9 UPPER FLOORS RESIDENTIAL BUILDING GOVINDASAMY NAGAR LAYOUT, SRI ANDAL LAYOUT TRICHY ROAD, COIMBATORE -641005.
**CLIENT:** M/S. MAYFLOWER INFRASTRUCTURES

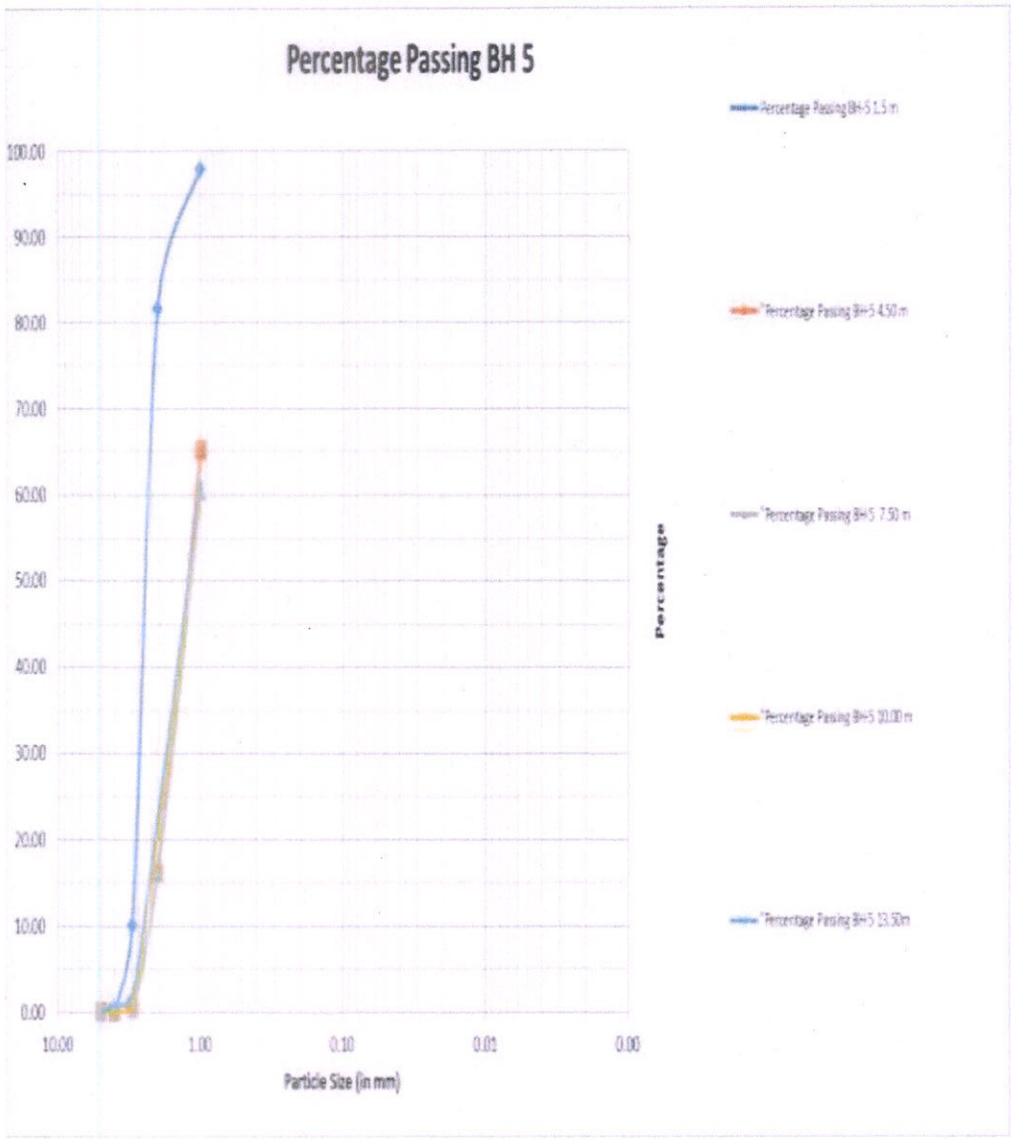


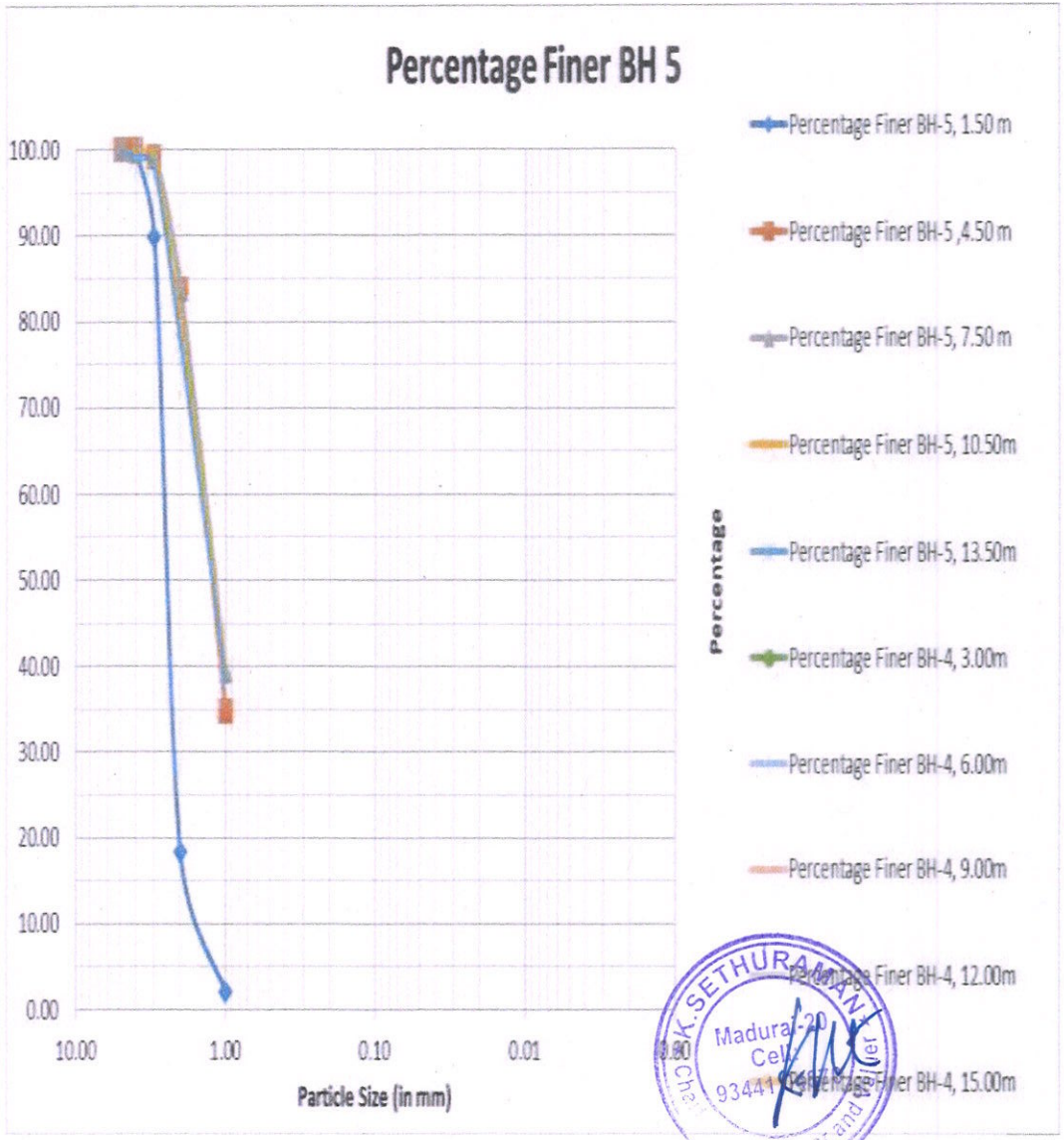




K.SETHURAMAN
Madurai-20
Cell:
93441 04800
Engineer and Valuer

# PARTICLE SIZE ANALYSIS CURVES

**PROJECT:** GEOTECHNICAL INVESTIGATION OF PROPOSED CONSTRUCTION OF BASEMENT + STILT LEVEL CAR PARKING + 9 UPPER FLOORS RESIDENTIAL BUILDING GOVINDASAMY NAGAR LAYOUT, SRI ANDAL LAYOUT TRICHY ROAD, COIMBATORE -641005.
**CLIENT:** M/S. MAYFLOWER INFRASTRUCTURES



# BH 1- 2

## Composition

| SAMPLE | BH - 1 1.50 m | BH - 1 3.00m | BH - 1 4.50m | BH - 2 3.00m | BH - 2 6.00m | BH - 2 9.00m | BH - 2 12.00m | BH - 2 15.00m |
|---|---|---|---|---|---|---|---|---|
| % FINE GRAVEL = | 0.76 | 1.52 | 5.85 | 0.26 | 28.81 | 42.64 | 35.44 | 41.56 |
| % COARSE SAND = | 14.87 | 85.58 | 90.45 | 55.64 | 41.37 | 42.98 | 46.03 | 41.96 |
| %MEDIUM SAND = | 77.08 | 12.67 | 3.56 | 40.11 | 26.66 | 13.29 | 17.04 | 15.60 |
| %FINE SAND = | 7.12 | 0.21 | 0.10 | 3.87 | 3.00 | 1.05 | 1.37 | 0.77 |
| % FINE/ SILT = | 0.17 | 0.02 | 0.04 | 0.12 | 0.16 | 0.04 | 0.12 | 0.11 |
| | | | | | | | | |
| **SAMPLE** | **BH - 1 1.50 m** | **BH - 1 4.50m** | **BH - 1 7.50m** | **BH - 2 3.00m** | **BH - 2 6.00m** | **BH - 2 9.00m** | **BH - 2 12.00m** | **BH - 2 15.00m** |
| % GRAVEL = | 0.76 | 1.52 | 5.85 | 0.26 | 28.81 | 42.64 | 35.44 | 41.56 |
| % SAND = | 99.07 | 98.46 | 94.11 | 99.62 | 71.03 | 57.32 | 64.44 | 58.33 |
| % SILT AND CLAY = | 0.17 | 0.02 | 0.04 | 0.12 | 0.16 | 0.04 | 0.12 | 0.11 |
| **TOTAL** | **100.00** | **100.00** | **100.00** | **100.00** | **100.00** | **100.00** | **100.00** | **100.00** |

# BH 3 - 4

## Composition

| SAMPLE | BH - 3 1.50 m | BH - 3 4.50m | BH - 3 7.50m | BH - 3 10.50m | BH - 3 13.50 m | BH - 4 3.00m | BH - 4 6.00m | BH - 4 9.00m | BH - 4 12.00m | BH - 4 15.00m |
|---|---|---|---|---|---|---|---|---|---|---|
| % FINE GRAVEL = | 1.35 | 24.85 | 30.32 | 25.66 | 37.17 | 0.30 | 34.39 | 35.24 | 26.29 | 38.74 |
| % COARSE SAND = | 19.29 | 54.09 | 49.19 | 53.97 | 48.95 | 54.49 | 45.38 | 47.98 | 43.94 | 43.40 |
| %MEDIUM SAND = | 72.80 | 19.95 | 19.23 | 18.84 | 13.23 | 42.66 | 19.11 | 15.60 | 28.26 | 16.96 |
| %FINE SAND = | 6.33 | 1.07 | 1.24 | 1.35 | 0.61 | 2.12 | 0.92 | 0.98 | 1.27 | 0.64 |
| % FINE/ SILT = | 0.23 | 0.04 | 0.02 | 0.18 | 0.04 | 0.43 | 0.20 | 0.20 | 0.24 | 0.26 |
| | | | | | | | | | | |
| SAMPLE | BH - 3 1.50 m | BH - 3 4.50m | BH - 3 7.50m | BH - 3 10.50m | BH - 3 13.50 m | BH - 4 3.00m | BH - 4 6.00m | BH - 4 9.00m | BH - 4 12.00m | BH - 4 15.00m |
| % GRAVEL = | 1.35 | 24.85 | 30.32 | 25.66 | 37.17 | 0.30 | 34.39 | 35.24 | 26.29 | 38.74 |
| % SAND = | 98.42 | 75.11 | 69.66 | 74.16 | 62.79 | 99.27 | 65.41 | 64.56 | 73.47 | 61.00 |
| % SILT AND CLAY = | 0.23 | 0.04 | 0.02 | 0.18 | 0.04 | 0.43 | 0.20 | 0.20 | 0.24 | 0.26 |
| TOTAL | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

# BH 5

## Composition

| SAMPLE | BH - 5 1.50 m | BH - 5 4.50m | BH - 5 7.50m | BH - 5 10.50m | BH - 5 13.50 m |
|---|---|---|---|---|---|
| % FINE GRAVEL = | 2.03 | 34.80 | 39.49 | 39.50 | 38.50 |
| % COARSE SAND = | 16.26 | 48.92 | 44.34 | 39.96 | 38.90 |
| %MEDIUM SAND = | 71.55 | 15.51 | 15.72 | 19.63 | 20.63 |
| %FINE SAND = | 9.85 | 0.75 | 0.37 | 0.90 | 1.01 |
| % FINE/ SILT = | 0.31 | 0.02 | 0.08 | 0.01 | 0.96 |
| | | | | | |
| **SAMPLE** | **BH - 5 1.50 m** | **BH - 5 4.50m** | **BH - 5 7.50m** | **BH - 5 10.50m** | **BH - 5 13.50 m** |
| % GRAVEL = | 2.03 | 34.80 | 39.49 | 39.50 | 38.50 |
| % SAND = | 97.66 | 65.18 | 60.43 | 60.49 | 60.54 |
| % SILT AND CLAY = | 0.31 | 0.02 | 0.08 | 0.01 | 0.96 |
| **TOTAL** | **100.00** | **100.00** | **100.00** | **100.00** | **100.00** |

# APPENDIX C

## 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<br>$Q_{a\text{-}net}$ = 0.088 X Cw X N X $S_a$ in t/sq.m<br>Where, $Q_{a\text{-}net}$ =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 | N-value Depth (m) 6.00 | $Q_{a\text{-}net}$ Net allowable bearing pressure in t/sq.m |
| BH 1-5 | 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

| Depth in Metre | SBC (t/m²) | SBC (KN/m²) |
|---|---|---|
| **4.50 m / 6.00m** | **55** | **539.37** |

SBC at 4.50 m depth,

N value = 50

$Q_{a\text{-}net}$= 0.088 x 0.5 x 50 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 **4.50 m / 6.00 depth** below EGL

K.SETHURAMAN Madurai-20 Cell: 93441 04847 Chartered Engineer and Valuer

## SAFE BEARING CAPACITY OF SOIL - CALCULATION SHEET

**(BASED ON SHEAR CRITERIA)**

| | | |
|---|---|---|
| TYPE OF FOUNDATION : | SQUARE | |
| LENGTH OF FOOTING, L = | 3.00 | M |
| WIDTH OF FOOTING, B = | 3.00 | M |
| DEPTH OF FOOTING, $D_f$ = | 4.50 | M |
| COHESION, C IN kg/sq.cm = | 0 | |
| ANGLE OF INTERNAL FRICTION,Φ = | 40 | |
| SPECIFIC GRAVITY OF SOIL, G = | 2.65 | |
| CORRECTION FOR WATER TABLE = | 0.5 | |
| DENSITY = | 1.80 | |
| SUBMERGED DENSITY = | 0.80 | |
| FACTOR OF SAFETY ,FS = | 2.5 | |

| BEARING CAPACITY FACTORS | |
|---|---|
| Nc = | 75.31 |
| Nq = | 64.2 |
| Nγ = | 109.41 |
| **DEPTH FACTORS** | |
| dc = | 0.89 |
| dq = | 1.00 |
| dγ = | 1.00 |

| SHAPE FACTORS | |
|---|---|
| sc = | 1.30 |
| sq = | 1.20 |
| sγ = | 0.80 |
| **INCLINATION FACTORS** | |
| ic = | 1.00 |
| iq = | 1.00 |
| iγ = | 1.00 |

**THEREFORE THE FAILURE IS A GENERAL SHEAR FAILURE**

**ULTIMATE BEARING CAPACITY OF SOIL (qu) :**

$$qu = cN_cS_cd_ci_c + q(N_q-1)S_qd_qi_q + 0.5B\gamma N_\gamma S_\gamma d_\gamma i_\gamma W'$$

$$= 325.5408 \quad t/m^2$$

**SAFE BEARING CAPACITY OF SOIL (qu) :** FOS = 2.5

$$= 130.2163 \quad t/m^2$$

**SAFE BEARING CAPACITY OF SOIL (qs) :**

**qs = 130.216 $t/m^2$**

**Immediate settlement of Layer 1 :**

Es = Weighted average of E of individual layers

Given,

| | | | |
|---|---|---|---|
| σ | = | 130.216 | t/m2 |
| μ | = | 0.27 | |
| B | = | 3 | m |
| I | = | 1.00 | *(For Square Footing)* |
| E | = | 300000 | $t/m^2$ |

Si = $S_{ellastic} = \sigma B (1-\mu^2)*I/E_s$

=(130.216*3(1-0.27^2)*1.0)/3000000 mm

0.8249 mm < 50MM Hence OK

K. SETHURAMAN Chartered Engineer and Valuer Madurai 93441 43870

## SAFE BEARING CAPACITY OF SOIL - CALCULATION SHEET

**(BASED ON SHEAR CRITERIA)**

| | | |
|---|---|---|
| TYPE OF FOUNDATION : | **STRIP** | |
| LENGTH OF FOOTING, L = | 1.00 | M |
| WIDTH OF FOOTING, B = | 3.00 | M |
| DEPTH OF FOOTING, $D_f$ = | 4.50 | M |
| COHESION, C IN kg/sq.cm = | 0 | |
| ANGLE OF INTERNAL FRICTION,Φ = | 40 | |
| SPECIFIC GRAVITY OF SOIL, G = | 2.65 | |
| CORRECTION FOR WATER TABLE = | 0.5 | |
| DENSITY = | 1.80 | |
| SUBMERGED DENSITY = | 0.80 | |
| FACTOR OF SAFETY ,FS = | 2.5 | |

| **BEARING CAPACITY FACTORS** | |
|---|---|
| **Nc =** | 75.31 |
| **Nq =** | 64.2 |
| **Nγ =** | 109.41 |

| **SHAPE FACTORS** | |
|---|---|
| **sc =** | 1.00 |
| **sq =** | 1.00 |
| **sγ =** | 1.00 |

| **DEPTH FACTORS** | |
|---|---|
| **dc =** | 0.89 |
| **dq =** | 1.00 |
| **dγ =** | 1.00 |

| **INCLINATION FACTORS** | |
|---|---|
| **ic =** | 1.00 |
| **iq =** | 1.00 |
| **iγ =** | 1.00 |

**THEREFORE THE FAILURE IS A GENERAL SHEAR FAILURE**

**ULTIMATE BEARING CAPACITY OF SOIL (qu) :**

$$qu = cN_cS_cd_ci_c + q(N_q-1)S_qd_qi_q + 0.5B\gamma N_\gamma S_\gamma d_\gamma i_\gamma W'$$

$$= 293.1660 \quad t/m^2$$

**SAFE BEARING CAPACITY OF SOIL (qu) :** **FOS = 2.5**

$$= 117.2664 \quad t/m^2$$

**SAFE BEARING CAPACITY OF SOIL (qs) :**

**qs = 117.266 $t/m^2$**

**Immediate settlement of Layer 1 :**

Es = Weighted average of E of individual layers

Given,

σ = 117.266 t/m2

μ = 0.27

B = 3 m *(For Square Footing)*

I = 1.00

E = 300000 $t/m^2$

Si = $S_{ellastic} = \sigma B (1-\mu^2)*I/E_s$

=(117.266*3(1-0.27^2)*1.0)/3000000 mm

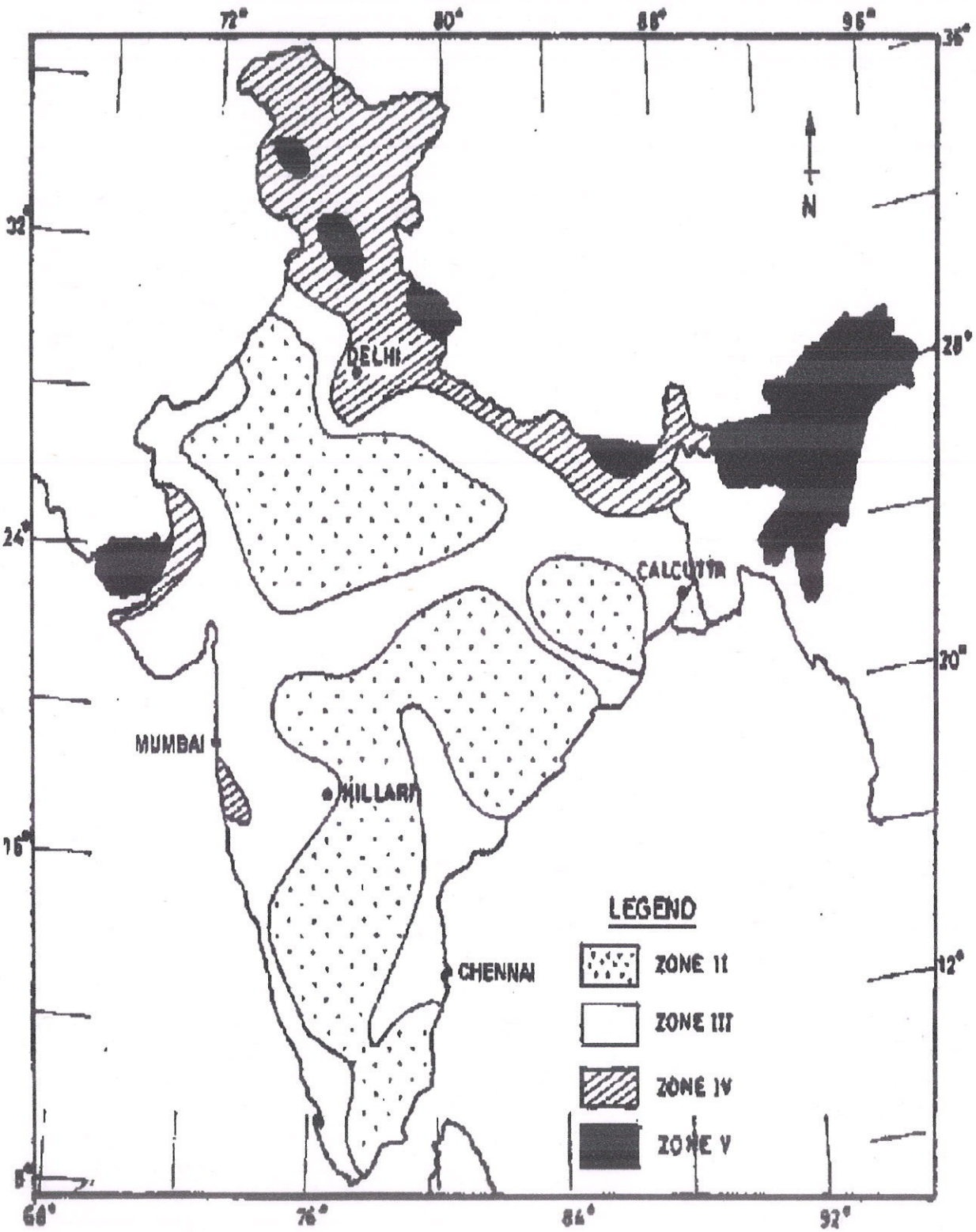
0.8249 mm < 50MM Hence OK

K.SETHURAMAN * Chartered Engineer and Valuer Madura-20 Cell: 93441 04817

# SUMMARY

| TYPE OF FOUNDATION | WIDTH OF FOUNDATION (M) | DEPTH (M) | SAFE BEARING CAPACITY ($T/M^2$) |
|---|---|---|---|
| SQUARE | 3.00 | 4.50 | 130 |
| | 3.00 | 6.00 | 166 |
| STRIP | 3.00 | 4.50 | 117 |
| | 3.00 | 6.00 | 147 |

## SEISIMIC MAP OF INDIA



# APPENDIX C1

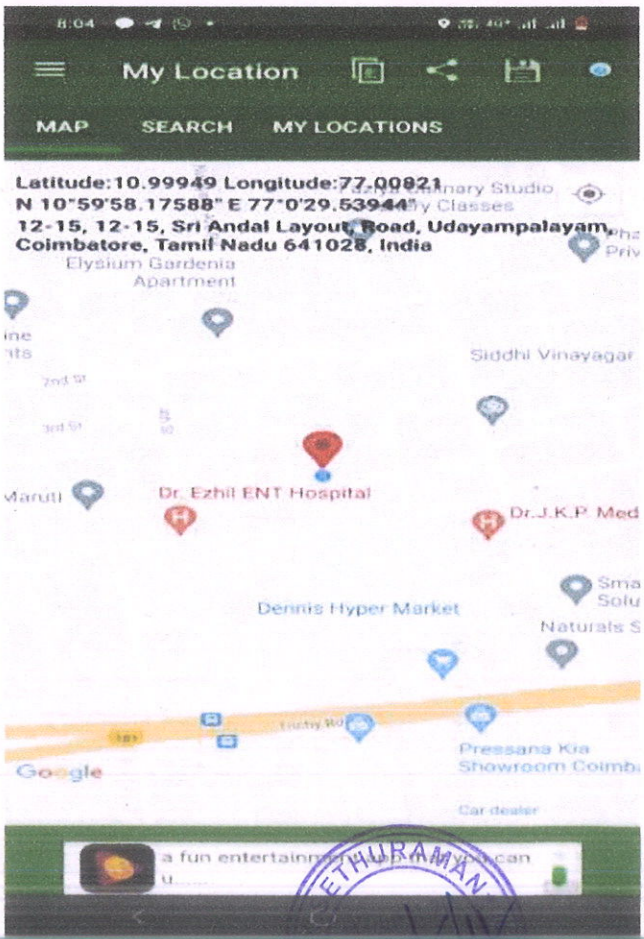
## PHOTOGRAPHS

### Drilling Under Progress

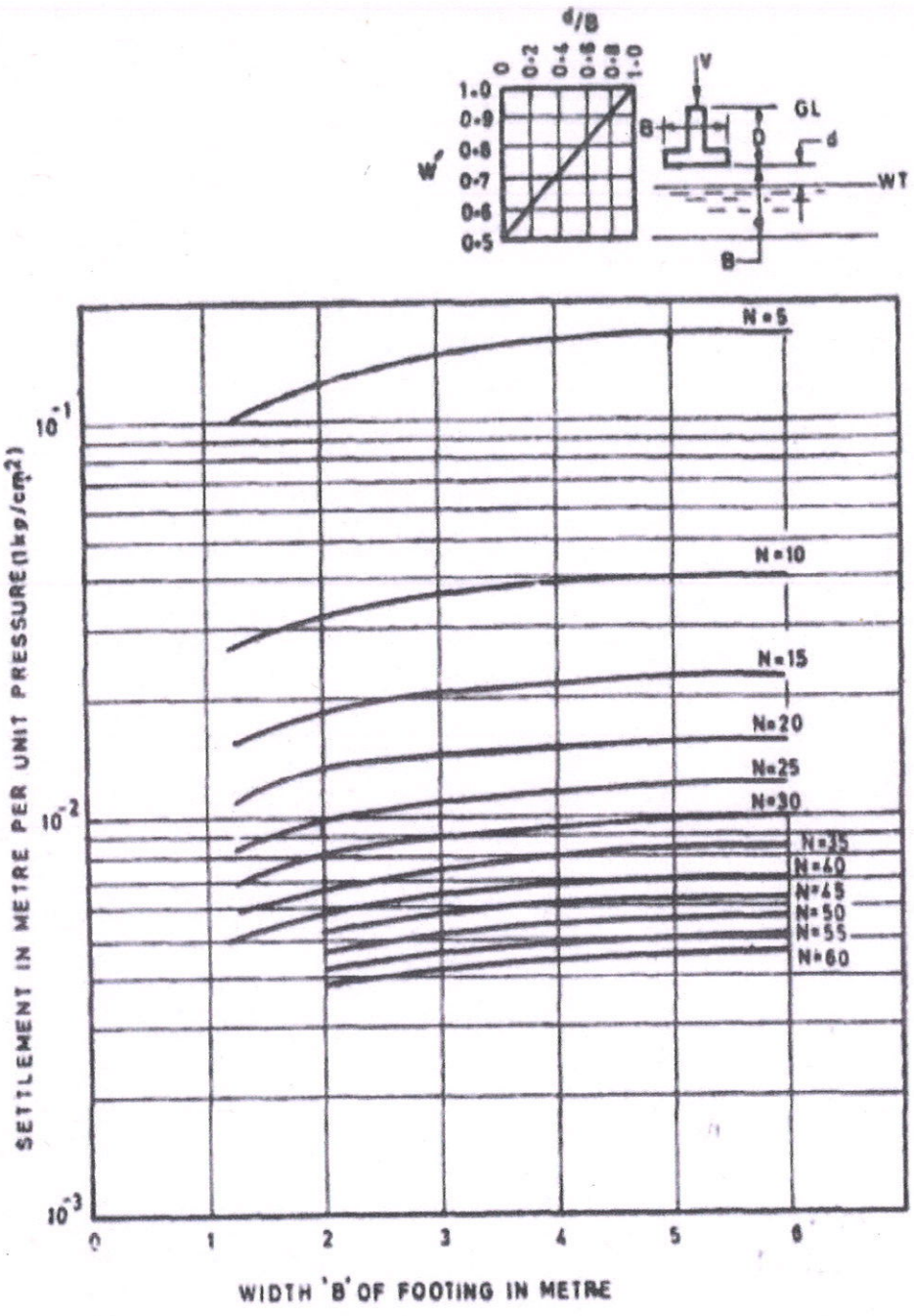








## STANDARD PENETRATION RESISTANCE CURVE




GL = Ground level. WT = Water table.

FIG. 9 SETTLEMENT PER UNIT PRESSURE FROM STANDARD PENETRATION RESISTANCE

***END OF REPORT***

K.SETHURAMAN Madurai-20 Chartered Engineer and Valuer

## GEOTECHNICAL ENGINEER DETAILS:

| | | |
|---|---|---|
| **Name** | : | KRISHNAN SETHU RAMAN |
| **Address** | : | C-128, New Hig Colony, ShenbagaThottam, 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/160923/16** |
| **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_ctcp@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.

30/8/2019

K.SETHURAMAN Madurai-20 Cell: 09344104870 Registered Engineer and Valuer



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