



# **GEO – ENGINEERING SERVICES**

## **Geo – Technical Consultants**

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ADD ON REPORT OF THE SOIL INVESTIGATIONS CARRIED OUT TO  
M/S. MODI PROPERTIES & INVESTMENTS PVT.LTD, AT THE SITE  
PROPOSED FOR CONSTRUCTION OF CLUB HOUSE AND APARTMENT  
BLOCK, SITUATED AT NAGARAM VILLAGE & MANDAL,  
HYDERABAD.

### 1. INTRODUCTION:

On the request of the The authorities of M/s. Modi Properties & Investments Pvt.Ltd, team of geologists of M/s. Geo-Engineering Services ( Geological Consultants) Hyderguda,Hyderabad have re- visited the site on 02.07.2013 In order to ascertain the strength of the formations exposed before laying down the foundations.

The structure consists of **Cellar + Stilt + 5 Floors.**

The building will comprise of beams and Column framed structure.

Fig.1 shows the site plan.

The aim of this report is to re- assess the type of soil, to evaluate the nature and depth of foundations, and to determine the safe bearing capacity of the buildings.

## **2. FIELD INVESTIGATIONS:**

The Cellar Portion was excavated. Three pits were excavated at cellar level ( 3.5m & 5.0m bgl ) by using JCB.. Undisturbed and disturbed soil samples were collected from the excavated trial pits. The undisturbed soil samples were collected by penetrating M.S sampler tube with tapered bottom edge with a diameter of 75/100mm from the bottom of the pit.

The excavated portions towards North and Northeast portions of the area shows that the formations are erratically weathered to moderate depths and The soil formations existing are medium dense in nature.

At Central portions, where the Weathered rock and bouldery formations exposed shows that the soil formations are high dense in nature and weathered to shallow depths underlain by hard rock underneath.

The excavated portions towards South and Western parts of the formations are loose and highly weathered to considerable depths and The soil formations existing are low dense in nature.

All locations are shown in Fig.1. This is adequate in accordance with IS: 1892-1979 (Code of Practice for Subsurface Investigation of Foundations). Fig.2 gives Logs of Trial Pits.

The site plan is shown in Fig.1.

Logs of trial pits are shown as Fig.2.

In accordance with IS: 1892 – 1979 (Code of Practice for sub-surface investigation of foundations), these are adequate to assess the nature of the uniform ground.

At Section No. 1, due Northeast, denoted as SP-1, the soil section consists of Silty Clayey Soil up to 2.3m followed by Soft Disintegrated Rock with clay up to 4.4m underlain by Hard Disintegrated Rock with calcareous lime upto 5.3m below ground level.

At Section No. 2, due South, denoted as SP-2, the soil section consists of filled up Soil upto 0.7m followed by black clayey soil upto 1.1m underlain by soft disintegrated rock with calcareous lime upto 4.8m and further underlain by Hard Disintegrated Rock with calcareous lime upto 5.1m below ground level.

At Section No. 3, centre, denoted as SP- 3, the sub-soil consists of sandy silty soil upto 0.5m followed by soft disintegrated rock with boulders upto 3.5m underlain by Hard Disintegrated Rock with Boulders upto 5.2m and further underlain by Highly Weathered Rock upto 5.4m below ground level .

Water is not found in any of the pits.

### **3. LABORATORY TESTING:**

The Undisturbed samples were tested at the Soil Mechanics Laboratory at Hyderabad. The following Tests were conducted:

- \* Specific gravity
- \* Bulk density
- \* Grain size distribution
- \* Direct shear test

All the Tests were conducted in accordance with IS: 2720 (Methods of Tests for Soils).

#### 4. RESULTS:

It is seen that the soil at the site, at significant depth, generally consists of morum. Morum is a residual soil, typical of Hyderabad and its surrounding areas. In its natural state, the soil is compact and hard at bottom depths.

The sub-surface soil is essentially frictional material, with low cohesion.

In accordance with IS: 1498-1970 (Soil Classification), at TP-3, the soil is designated as, GM - SM (Silty gravelly, poorly graded gravel - Sand- Silt mixture/silty sand). Where as at SP-1 & SP-2, the soil is designated as GC (Clayey gravels, poorly graded gravel-sand-clay mixtures).

Keeping in view the nature of the soil, and the field results 'N - Value ' of 20 has been assumed for the foundations resting on soft disintegrated rock with calcareous lime. N-Value of 25 has been assumed for the foundations resting on Hard Disintegrated Rock with calcareous lime and N- Value of 32 has been assumed for the foundations resting on Highly weathered rock with boulders.

## 5. RECOMMENDATIONS.

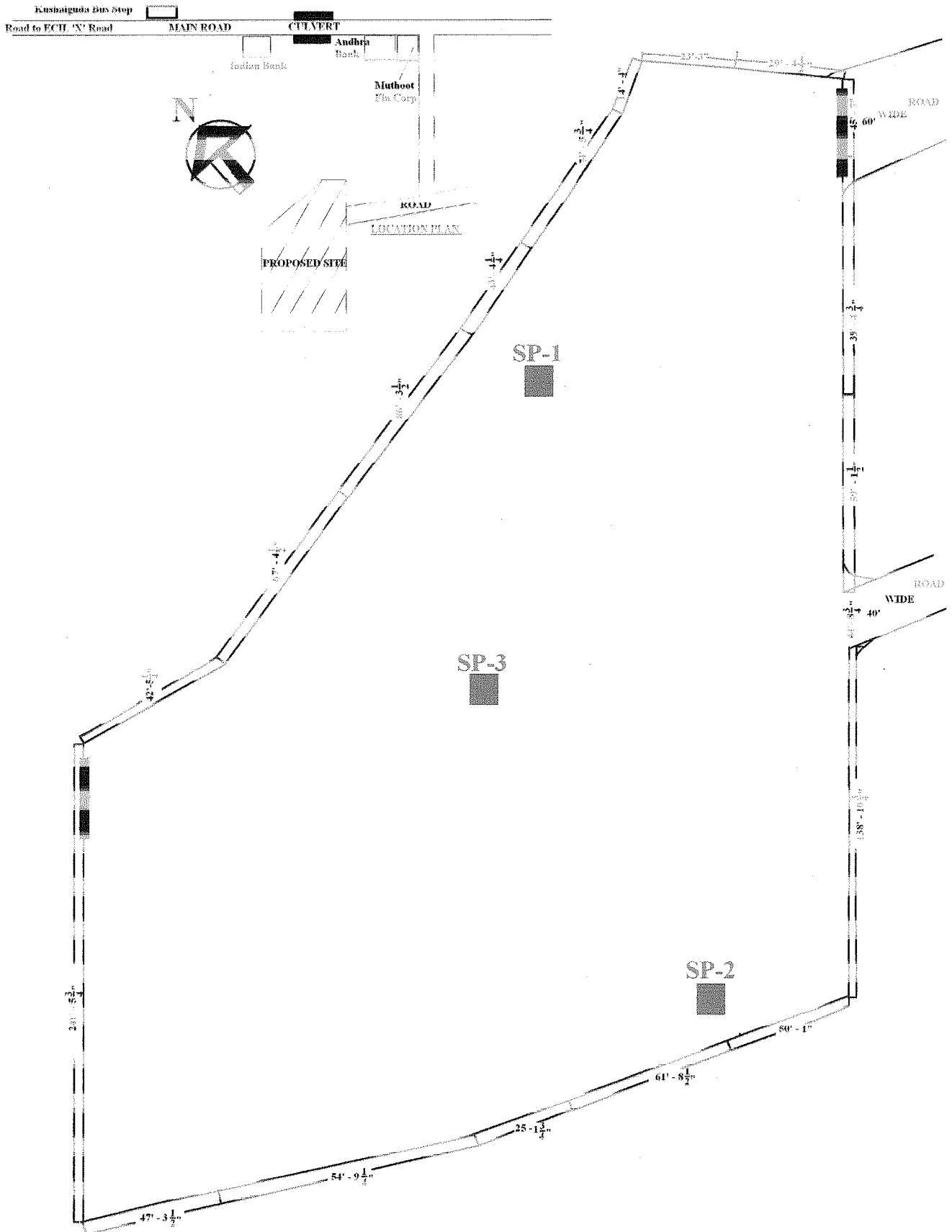
ased on Geo-technical investigations, the following recommendations are given.

1. At SP-1, due Northeast, The soil section consists of Silty clayey and Black clayey soils on the top followed by Soft Disintegrated Rock with Calc.lime and further underlain by Hard Disintegrated Rock with calcareous lime at bottom depths. At SP- 2, due South, The soil section consists of Filled up soil followed by black clayey soil underlain by soft disintegrated rock with calcareous lime and further underlain by Hard Disintegrated Rock with calcareous lime at bottom depths. At SP- 3, Centre of the site, the sub-soil consists of sandy silty soil followed by soft disintegrated rock with boulders underlain by Hard Disintegrated Rock with boulders underlain by Highly weathered rock with boulders at bottom depths.
2. The SBC is recommended as 25 Tonnes/Sq m for the foundations resting on Soft Disintegrated Rock with Calcareous Lime and 35 Tonnes/Sq m for the foundations resting on Hard Disintegrated Rock with Calcareous Lime. 45 Tonnes/Sq m for the foundations resting on Highly weathered Rock with boulders.
- 3). The above recommendation is based on the isolated square footings of size 2.0 x 2.0m at a depth of 1.0m(SP-1 due Northeast), 2.0m ( SP-2, due South) and 0.6m(SP- 3, Centre) from the excavated level. The actual size and depth will be based on the loads from the super structure.

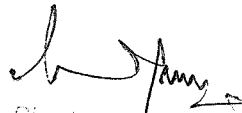
- 4). It is recommended that every foundation base be examined by competent engineer before placement of PCC bed.
- 5) All foundations pits should be filled back with well compacted morum or gravel.
- 6) Avoid resting of foundation in loose soil or isolated rock boulders.
- 7) All concreting should be done under dry conditions.
- 8) All footings( if they are resting on rock ) should be adequately anchored against lateral forces.
- 9) Sand bed of thickness 300mm is recommended below the PCC Layer, if Clay/Calcareous lime occurs.
- 10) Hyderabad and the surrounding areas are now reclassified as **zone II** in Seismic map of India. Necessary Seismic checks may be applied for the tall buildings.

**For Geo-Engineering Services,**

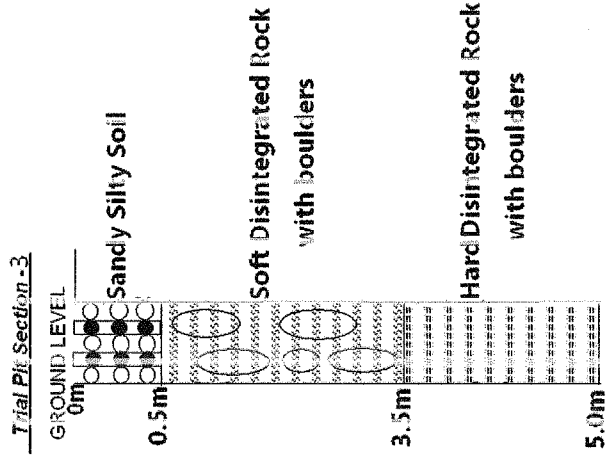
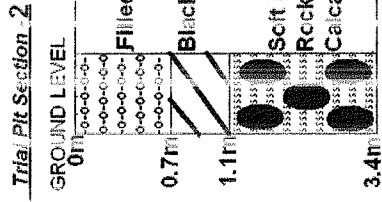
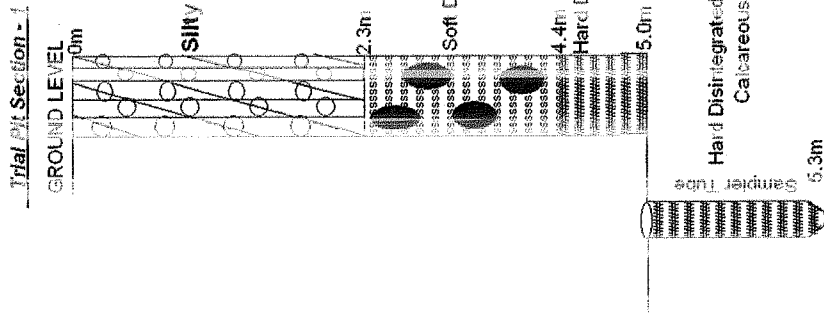
  
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**FIG.1: SITE PLAN OF THE PROPOSED CLUB HOUSE & APARTMENT BLOCK SITUATED AT NAGARAM VILLAGE & MANDAL, HYDERABAD.**

  
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# FIG: 2 LOGS OF SECTIONS



  
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APPENDIX - 1

CALCULATIONS OF BEARING CAPACITY

SP No.1

For the foundations resting on Hard Disintegrated Rock  
with Calcareous lime.

Shear Criterion:

Assumed depth of foundation 'D' = 1.0m from excavated level.

Assumed width of foundation 'B' = 2.0m x 2.0m

Cohesion = 'C' = 1.05 Kg/Sq.Cm

Angle of shear resistance =  $\phi$  = 32 deg.

Bearing Capacity Factors for  $\phi$  = 32deg.

$N_c = 27.2$      $N_q = 16.2$      $N_\gamma = 19.0$

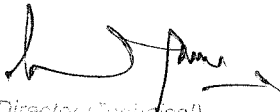
Factor of Safety , F.S = 3.0

Bulk Unit Weight of Trial Pit soil =  $\gamma = 2.05$  gm / cc

Water Table correction is not required.

$$q_s = \frac{1}{F} \left( 1.3 C N_c + \gamma D (N_q - 1) + 0.4 \gamma B N_\gamma \right) + \gamma D$$
$$= \frac{1}{3.0} \left( 99.45 \right) + 2.05 = 35.2 \text{ or } 35 \text{ Tonnes/Sq.m}$$

**The recommended bearing capacity is 350.0 kN per sq m i.e.35 T/ sq.m.**

  
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APPENDIX - 2

CALCULATIONS OF BEARING CAPACITY

SP No.2

For the foundations resting on Soft Disintegrated Rock  
with Calcareous lime.

Shear Criterion:

Assumed depth of foundation 'D' = 2.0m from excavated level.

Assumed width of foundation 'B' = 2.0m x 2.0m

Cohesion = 'C' = 1.75 Kg/Sq.Cm

Angle of shear resistance =  $\phi$  = 29 deg.

Bearing Capacity Factors for  $\phi$  = 29 deg.

$N_c = 16.6$      $N_q = 8.1$      $N_\gamma = 7.2$

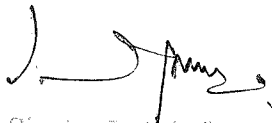
Factor of Safety, F.S = 3.0

Bulk Unit Weight of Trial Pit soil =  $\gamma = 1.85$  gm / cc

Water Table correction is not required.

$$q_s = \frac{1}{F} \left( 1.3 C N_c' + \gamma D (N_q' - 1) + 0.4 \gamma B N_\gamma' \right) + \gamma D$$
$$\frac{1}{3.0} (74.7) + 3.70 = 28.6 \text{ or } 25 \text{ Tonnes/Sq.m}$$

*The recommended bearing capacity is 250.0 kN per sq m i.e.25 T/ sq.m.*

  
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APPENDIX - 3

CALCULATIONS OF BEARING CAPACITY

SP No.3

*For the foundations resting on Highly weathered Rock with boulders.*

Assumed value of N = 32

Assumed depth of foundation = 0.6m (from excavated Level).

Assumed size of footing = 2.0m x 2.0m

a). Shear Criterion:

Allowable bearing capacity with a F.S of 3.0 is:

$$q = 1/18 ( 3N^2 B R_r + 5 ( 100 + N^2 ) D R_d )$$

$$= 528.67 \text{ kN per sq. m}$$

b). Settlement Criterion:

For a permissible settlement of 40mm, according to IS: Code,

$$q = 12.25 N ( B + 0.3 ) / B R_r R_d$$

$$= 450.8 \text{ kN per sq.m}$$

***The recommended bearing capacity is 450.80 kN per sq m  
or 45 Tonnes per sq.m.***

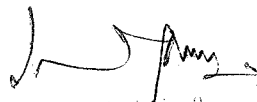
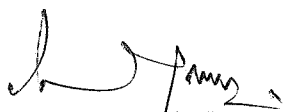
  
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TABLE -1

SUMMARY OF SOIL PROPERTIES

Property / TP No	SP - 1 Sample	SP - 2 Sample
Soil	GC	GC
Specific gravity	2.65	2.25
Density, gm/ cc	2.05	1.85
Grain size distribution		
Gravel >4.75 mm	32	20
Coarse sand 4.75 – 2mm	22	18
Medium sand 2- 0.425mm	20	16
Fine sand, 0.425-0.075mm	20	25
Silt 0.075 – 0.002mm	02	06
Clay < 0.075 mm	04	15
Cohesion, Kg/Sq.cm	1.05	1.75
Angle of internal friction, degrees	32	29

  
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