GEO TECHNICAL INVESTIGATION REPORT

Project:

Gulmohar gardens Phase-II at Shakti Sai Nagar, Mallapur, Hyderabad

Client:

M/s Modi Builders Pvt. Ltd. Hyderabad

November-2009

Prepared by:

GEO TECHNOLOGIES

 # 5-83/ B,V.V Nagar Street No 8,Habsiguda
Hyderabad-500 007
Tel:42217757,Cell:9347275255
E-mail:nvenkatrao2005@yahoo.com

GEO TECHNOLOGIES

GEO TECHNICAL INVESTIGATION REPORT

REPORT No.: GT /0304/2009-10

PROJECT: **Gulmohar gardens Phase – II at Shakti Sai Nagar, Mallapur, Hyderabad**

CLIENT: **M/s Modi Builders Pvt. Ltd. Hyderabad**

DURATION: November 2009

GEOTECHNICAL CONSULTANTS:

GEO TECHNOLOGIES
5-83/B, V. V. NAGAR
HABSIGUDA, STREET No. 8
HYDERABAD - 500 007
Tele/Fax: 040 - 42217757
Email: geo.technologies@yahoo.com;
nvenkatrao2005@yahoo.com

CONTENTS

1. INTRODUCTION

M/s Modi Builders Pvt. Ltd. are proposing to develop a Group Housing Project `Gulmohar Garden Phase-II' at Shakti Sai Nagar, Mallapur, Hyderabad.

Geotechnical investigations were carried out for the well portion in the N-E corner of the site by drilling of three (3) bore holes and conducting Standard Penetration Tests. The results of these investigations and recommendations are presented in this Report.

Fig.1 gives the site plan of the project, showing the well area and borehole locations.

The aim of this Report is to determine the depth of the well below existing ground level and to recommend suitable type of foundations and the Safe Bearing Capacity for the well portion.

2. FIELD INVESTIGATIONS

OBJECTIVE:

The sub soil investigation was carried out to determine the nature of stratum and engineering properties of soil which may affect the mode of construction of the proposed building in the well portion.

BORE HOLES:

Three (3) bore holes were drilled at the specified locations. These are designated as BH-1, BH-2 & BH-3. They were drilled to 6 m depth for BH-1 & BH-2, and 4.5 m depth for BH-3.

DRILLING:

Rotary Drilling was performed as per IS: 1892. The size of the casing used was 125 to 75 mm yielding samples of NX size.

The following information was collected during the drilling operations:

- Nature of strata
- Water colour
- Details of samples / rock cores
- Rate of drilling

STANDARD PENETRATION TEST (SPT):

Standard Penetration Tests were conducted at 1.5 m intervals in the bore holes, in accordance with IS: 2131-1981.

FIELD BORE LOGS:

All the details collected from the field operations are presented in Logs of Bore holes given in Annexure-1.

SAMPLES:

All the samples collected from the bore holes were properly packed, labeled and transported to Geo Technologies Soil Testing Laboratory at Hyderabad.

3. LABORATORY TESTING

The samples were tested at our Geo Technical Laboratory of GEO TECHNOLOGIES at Hyderabad.

The following tests were performed on soil samples:

- Grain size analysis
- Specific gravity
- Bulk Density
- Shear tests

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

The following tests were conducted on rock samples:

- Specific Gravity
- Porosity
- Water absorption
- Unconfined compressive test (UCC)

All the tests were performed as per IS: 1124 and IS: 9143

4. RESULTS

Fig. 2 gives the combined Log of bore holes.

Table-1 gives the results of tests on soil samples in BH-1 & BH-2.

Table-2 gives results of tests on rock cores in BH-3.

5. SUB SOIL PROFILE & FOUNDATIONS

Based on three (3) Bore logs, the subsoil profile (below the existing ground level) in the well portion is *generalized* as follows:

Depth (m)	Strata	N Value
0.00 – 4.50	Filling / Silty clay	4 – 7
4.50 – 6.00	Hard morum / Rock (Boulder?)	> 50

It should be noted that hard rock is seen only in BH-3 at 4.0 m depth.

N values in filling / silty clay layer are very low (4 – 7).

This is underlain by hard morum, with N values more than 50.

The rock is granite, an igneous rock. Core Recovery (CR) and RQD are 100% and 25%, respectively.

Water table was seen at the existing ground level.

Since the sub-soil consists of filling up to 4.5 m depth, Raft foundation is recommended for the columns in the well portion. SBC of the sub soil is recommended as 10 t / sq m.

Soil stabilization is recommended with well-compacted morum and sand beds.

Alternatively, open foundations can be used resting in hard morum strata, with SBC of 20 tonnes per sq m. Appendix gives the calculations for SBC.

6. RECOMMENDATIONS

The following recommendations are made for the well portion in the proposed Group Housing Project `Gulmohar Garden Phase-II' at Shakti Sai Nagar, Mallapur, Hyderabad.

These recommendations are based on Field investigations and Laboratory Tests on samples from three (3) Bore Holes.

a) The sub-soil profile in the well portion consists of filling / soft soil in the top 4.5 m, followed by silty gravel (hard morum) up to 6 m depth. Hard rock (boulder) is seen in BH-3 at 4 m depth.

b) The soil up to 4.5 m depth below existing ground level is essentially non-engineered filled material. N values in this layer are very low (4 to 7). This layer is not suitable for foundations without proper soil stabilization.

c) N values in hard morum exceed 50, showing refusal.

d) Water table exists at existing ground level.

e) Raft foundations are recommended after proper stabilization of soil.

g) SBC of the sub soil is recommended as 10 tonnes per sq m.

h) Proper stabilization of the sub soil is recommended as follows:

i) Below the PCC bed, 1.0 m thick well-compacted sand bed should be laid.

(ii) Below the sand bed, 1.0 m thick well-compacted gravelly morum is recommended. The fill should not have boulders / large pebbles.

(iii) The sand / morum fill should be compacted to at least 95 percent of Maximum Dry Density (MDD) under Optimum Moisture Content (OMC).

(iv) Below the morum bed, packed boulder bed (UCRS) is recommended.

i) Alternatively, open foundations can be used resting in hard morum strata at 5 m depth below existing ground level. SBC is recommended as 20 tonnes per sq m.

j) All loose boulders should be fully removed before placement of PCC bed.

k) All concreting should be done in dry conditions

For ***GEO TECHNOLOGIES***

(Dr. D. BABU RAO)
M.E., Ph.D. (USA), MIGS
Former Professor & Head of Civil Engineering
Principal Geotechnical Consultant

(Dr. N. VENKAT RAO)
M.Sc. Tech., Ph.D. FAEG, MIGS
Former Professor & Head of Geophysics
Geological Consultant & Proprietor

FIG:1 SITE PLAN SHOWING THE LOCATION OF BORE HOLES

Project: Gulmohar Gardens Phase-II at shakti sai Nagar, Mallapur, Hyderabad

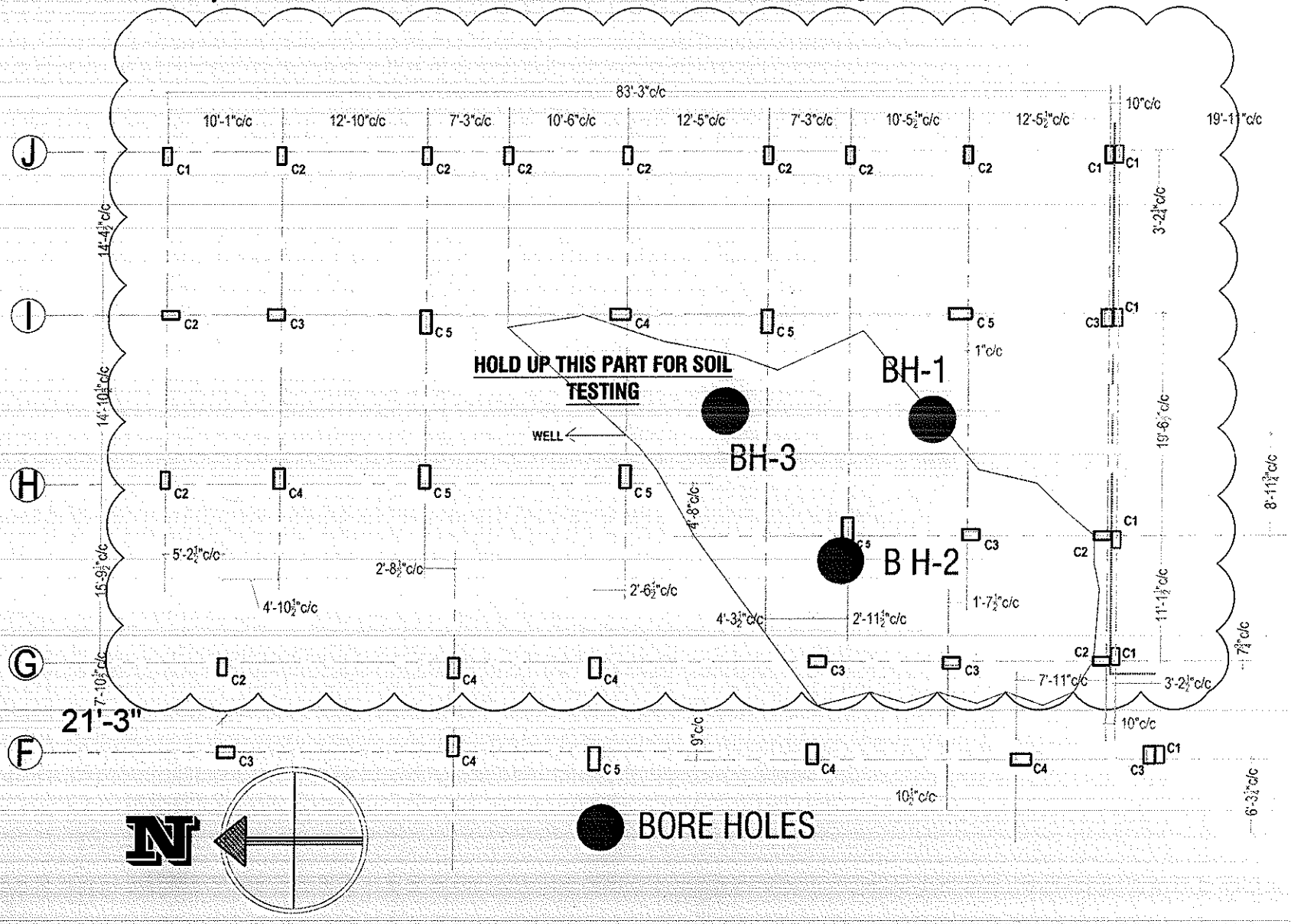


FIG:2 LOG OF BORE HOLES

Project: Gulmohar gardens Phase-II at Shakti Sai Nagar, Mallapur, Hyderabad

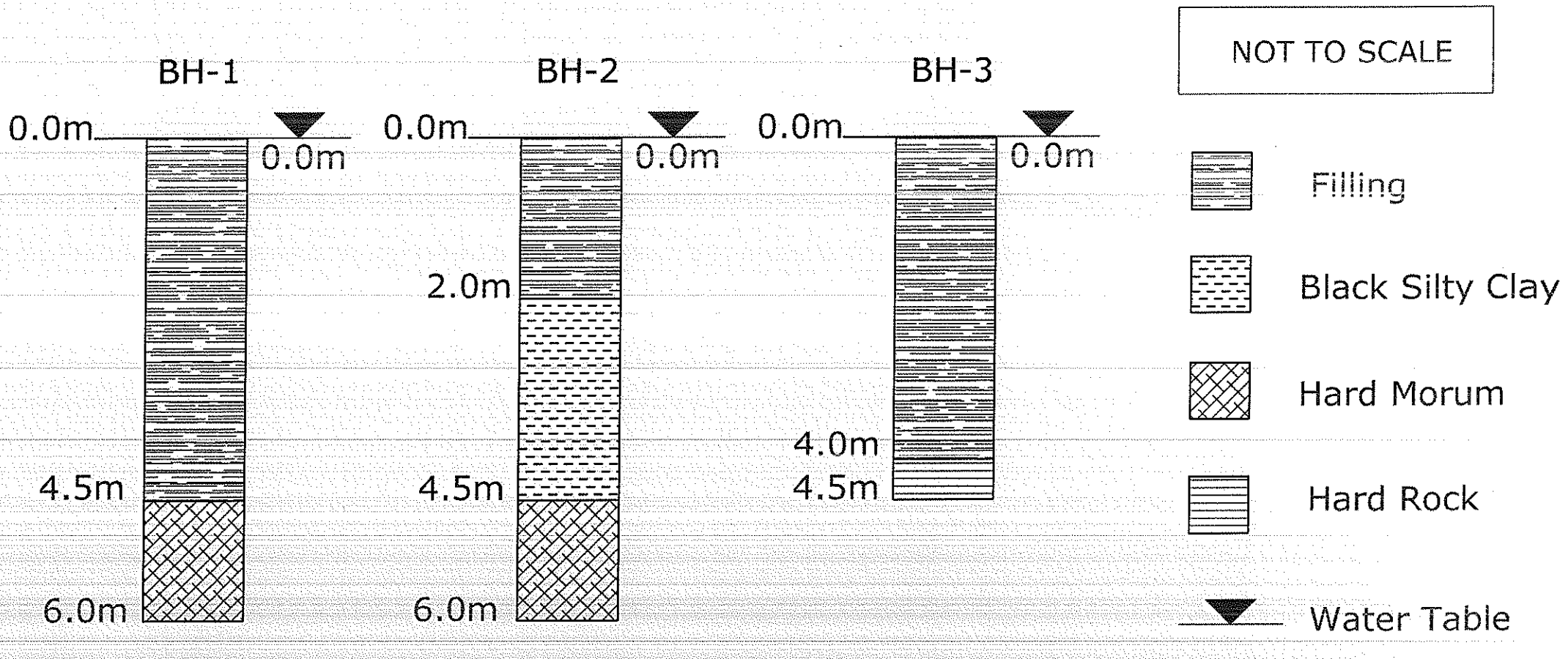


TABLE - 1
SUMMARY OF SOIL PROPERTIES

Project: Modi Builders - Gulmohar Gardens Phase-II at Shakti Sai Nagar, Mallapur, Hyderabad

Bore	Depth of Sample (m)	Soil Description	Specific Gravity	w.c. %	γ kN / cu m	Grain Size, %				Atterberg Limits		Shear Parameters	
						Gravel	Sand	Silt	Clay	LL %	PL %	C kN/m^2	φ deg
BH-1	4.50	Silty gravel	2.65	5.3	17.9	25	47	17	11	NP	-	10	33
	6.00	Silty gravel	2.64	6.2	18.1	28	44	20	8	NP	-	12	33
BH-2	4.50	Silty gravel	2.64	6.1	18.0	24	45	18	13	NP	-	11	32
	6.00	Silty gravel	2.65	5.7	18.2	27	42	22	9	NP	-	8	34

NOTATION

γ : Unit Weight (Natural Density)

w.c. : Natural Moisture (Water) Content

C : Cohesion

φ : Angle of Internal Friction

TABLE - 2
RESULTS OF TESTS ON ROCK CORES

BH No.	Depth, m	Specific gravity	Porosity, %	Water Absorption, %	UCS, Kg/sq cm
BH-3	4.0 - 4.5	2.73	2.72	2.68	535

Note: 1. All Tests are conducted in accordancccce with IS: 1124-1974 & IS: 9143-1979.

2. When the length of the core is < 10 cm, UCS test is not conducted.

APPENDIX - 1

CALCULATION OF SAFE BEARING CAPACITY

Project: Modi Builders - Gulmohar Gardens Phase-II at Shakti Sai Nagar, Mallapur, Hyderabad

Foundations in Filled material:

Assumed Depth of foundation = 1.5 m

Assumed width of foundation... 3 m

Unit wt. r = 16.7 KN / cu m Sbmerged Unit wt. r' = 6.9 KN / cu m

Cohesion = 50 KN / sq m

Angle of internal friction = 0 deg.

Using IS Code 6403 – 1981 formula:

Nc' = 5.14 Nq' = 1.0 Nr' = 0.0

Net, Ult B.C. = 1.3 c' Nc' + r' D (Nq' – 1) + 0.4 r' B Nr'

= 334 KN per sq m

With a F.S. of 3.0, SBC = 111.3 KN per sq m

Recommended Safe Bearing Capacity for foundations resting in filled soil is 10 tonnes per sq m.

In view of low SBC, raft footings would be suitable for this site.

APPENDIX - 2

CALCULATION OF SAFE BEARING CAPACITY

Project: Modi Builders - Gulmohar Gardens Phase-II at Shakti Sai Nagar, Mallapur, Hyderabad

Foundations in Silty gravel (hard morum):

(a) Shear Criterion:

Assumed Depth of foundation = 5 m

Assumed width of foundation... 2 m

Unit wt. r = 18.1 KN / cu m Sbmerged Unit wt. r' = 8.3 KN / cu m

Cohesion = 12 KN / sq m (Neglected)

Angle of internal friction = 33 deg.

Using IS Code 6403 – 1981 formula:

Nc' = 29.37 Nq' = 18.39 Nr' = 23.55

Net, Ult B.C. = 1.3 c' Nc' + r' D (Nq' – 1) + 0.4 r' B Nr'

= 877 KN per sq m

With a F.S. of 3.0, SBC = 292 KN per sq m

b) Settlement Criterion:

In frictional soils as these, settlement is a better criterion.

Corrected N value is taken as 30. For a permissible settlement of 40 mm,

Allowable bearing capacity = 12.2 N [(B + 0.3)/B] Rq Rd

= 420 KN per sq m

For a permissible settlement of 25 mm,

Allowable bearing capacity = 420 x 25/40 = 262 KN per sq m

Recommended Safe Bearing Capacity for foundations resting in hard morum at 5 m depth is 20 tonnes per sq m.

GEO TECHNOLOGIES

Annexure

Field Bore Log charts

FIELD BORE LOG CHART

Project: Gulmohar gardens Phase-II at Shakti Sai Nagar, Mallapur, Hyderabad	BORE HOLE NO. 1	Ground Level:
		Dia. Of Casing: NX
Date : 26-11-2009		Water Table: 0.00 m

Depth (m)		Length of Run (m)	Description	Log of Bore	Sampling		SPT		Details of Rock core				RQD Value %	Avg. RQD %	Water colour	Rate of Drill Min/m
From	To				Depth (m)	Type	No. blows for Penetration of (15-30-45)cm	N Value	>10cm core Pieces(cm)	Total Length (cm)	No. of Pieces	% of core Recovery				
0.0	1.0	1.0	Filling		1.00	SPT	2-2-2	4								
1.0	2.0	1.0			2.00	SPT	2-3-4	7								
2.0	3.0	1.0			3.00	SPT	3-3-3	6								
3.0	4.5	1.5			4.50	SPT	13cm/50blows	>50								
4.5	6.0	1.5	Hard Morum		6.00	SPT	7cm/50blows	>50								

SDR=Soft Disintigrated Rock cm/50= no.of blows sp=Small pieces vsp=Very Small Pieces

FIELD BORE LOG CHART

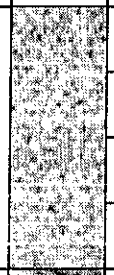
Project: Gulmohar gardens Phase-II at Shakti Sai Nagar, Mallapur, Hyderabad	BORE HOLE NO. 2	**Ground Level:**
		Dia. Of Casing: NX
Date : 26-11-2009 to 27-11-2009		**Water Table: 0.00 m**

Depth (m)		Length of Run (m)	Description	Log of Bore	Sampling		SPT		Details of Rock core				RQD Value %	Avg. RQD %	Water colour	Rate of Drill Min/m
From	To				Depth (m)	Type	No. blows for Penetration of (15-30-45)cm	N Value	>10cm core Pieces(cm)	Total Length (cm)	No. of Pieces	% of core Recovery				
0.0	1.0	1.0	Filling		1.00	SPT	2-3-3	6								
1.0	2.0	1.0			2.00	SPT	1-2-2	4								
2.0	3.0	1.0	Black Sily clay		3.00	SPT	2-2-2	4								
3.0	4.5	1.5			4.50	SPT	12cm/50blows	>50								
4.5	6.0	1.5	Hard Morum		6.00	SPT	9cm/50blows	>50								

SDR=Soft Disintigrated Rock cm/50= no.of blows sp=Small pieces vsp=Very Small Pieces

FIELD BORE LOG CHART

Project: Gulmohar gardens Phase-II at Shakti Sai Nagar, Mallapur, Hyderabad	**BORE HOLE NO. 3**	**Ground Level:**
		Dia. Of Casing: NX
Date : 27-11-2009		**Water Table: 0.00 m**

Depth (m)		Length of Run (m)	Description	Log of Bore	Sampling		SPT		Details of Rock core				RQD Value %	Avg. RQD %	Water colour	Rate of Drill Min/m
From	To				Depth (m)	Type	No. blows for Penetration of (15-30-45)cm	N Value	>10cm core Pieces(cm)	Total Length (cm)	No. of Pieces	% of core Recovery				
0.0	1.0	1.0	Filling		1.00	SPT	1-1-1	2								
1.0	2.0	1.0			2.00	SPT	2-2-3	5								
2.0	3.0	1.0			3.00	SPT	2-3-3	6								
3.0	4.0	1.0														
4.0	4.5	0.5	Hard Rock						15+11=25	50	2no+4 sp	100%	50%			

SDR=Soft Disintigrated Rock cm/50= no.of blows sp=Small pieces vsp=Very Small Pieces

Annexure – 2

BIS (IS) CODES

1. IS: 2131 – 1981: Method of Standard Penetration Test for Soils.
2. IS: 4968 (Part 1) – 1976: Method for subsurface sounding for soils.
3. IS: 2132: Code of Practice for thin walled tube sampling of Soils.
4. IS: 2720 Part I onwards: Methods of Laboratory Tests for Soils.
5. IS: 1498 – 1970: Classification and Identification of Soils for General Engineering Purpose.
6. IS: 6403 – 1981: Code of Practice for determination of Bearing Capacity of Shallow Foundations.
7. IS: 12070 – 1987: Code of Practice for Design and Construction of Shallow Foundations on Rocks.
8. IS: 8009 – 1976 (Part I): Code of Practice for calculation of settlements of Foundations.
9. IS: 78 – 1983 – Appendix I: Classification and Characteristics of Rocks.
10. IS: 1892 – 1962: Code of Practice for Site Investigations for Foundations.
11. IS: 4453 – 1985: Code of Practice for presentation of drilling information and core description in foundation investigation.
12. IS: 4078: Code of Practice for indexing and storage of drill cores.
13. IS: 6926 – 1996: Diamond Core Drilling for Site Investigation.