

GEO TECHNICAL INVESTIGATION REPORT

**Project:
Proposed Construction of High-rise Buildings
at Mallapur, Hyderabad**

**Client:
M/s B & C Estates, Hyderabad**

August 2009

Prepared by:



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GEO TECHNOLOGIES

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REPORT No.: GT / 0260 / 2009-10

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at Mallapur, Hyderabad**

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DURATION: August - 2009

**GEOTECHNICAL
CONSULTANTS:**



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1. INTRODUCTION

M/s B & C Estates, Mallapur, are proposing to construct High-rise Buildings at Mallapur, Hyderabad.

The buildings comprise two cellars + 14 upper floors.

Soil investigations were carried out for this project by drilling eight (8) bore holes, conducting Standard Penetration Tests, Sample collection and Laboratory testing. The results of these investigations and recommendations are presented in this Report.

Fig.1 gives the Site Plan of the proposed construction, showing the locations of Bore holes.

The aim of this Report is to determine the type and depth of foundations and the Safe Bearing Capacity based on Field and Laboratory Investigations.



2. SCOPE OF WORK

M/s Geo Technologies, Hyderabad, have been awarded the work of Soil Investigation for B & C Estates, Opp: Noma Function Hall, Mallapur, Hyderabad, along with payment of advance Dated 11-07-2009. The following is the Scope of work:

- a) To drill eight (8) bore holes at specified locations.
- b) To conduct Standard Penetration Tests (SPT) as per the IS Code 2131.
- c) To obtain soil / rock samples from the bore holes at significant depths.
- d) To conduct relevant Laboratory tests on the samples for engineering properties.
- e) To determine the safe bearing capacity and depth of foundations.
- f) To prepare a Technical Report incorporating the relevant information and recommendations.

All sub soil investigations are carried out in accordance with the relevant BIS (IS) Codes.



3. GEOLOGICAL SET UP

The geology of Hyderabad region comprises the Peninsular gneissic complex of the Archean age.

The major rock types include pink and grey granites, granitic gneisses, migmatites, pegmatites, quartz veins and dolerite dykes. They occur in the form of domes, scarps, massive columnar blocks and 'tors', scattered over a partly flat and partly undulating country. EW & NS trending dolerite dykes and quartz & pegmatite reefs and veins are intruded into granites and gneisses.

The rock type in the site under investigation is granite. The major minerals are quartz, feldspars, and biotite.

Weathered Zone:

As a result of natural weathering processes, granites and gneisses are broken and fractured, giving rise to inter-connected fissures, which permit percolation of water through the rock. The percolating water promotes further disintegration and decomposition of the rock. Ultimately, the rock is converted to soil, made up of a coarse granular material, which consists of gravel, sand, silt and clay fractions in its constitution. This soil is locally referred to as morum.



Soils:

The soils in the granitic terrain thus are mainly derived from residual or 'in-situ' weathering of the parent bed rock. Red soils, comprising loamy sand, sand, sandy clay, and derived from granites and gneisses, are the predominant types of soils in this region.

Local Geology:

The rock formation is predominantly grey granite, belonging to the group of Peninsular Granites.

The surface formation essentially consists of filling, clayey sand and Silty / Hard morum.



4. 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 structures.

BORE HOLES:

Eight (8) bore holes were drilled at the locations shown in Site Plan (Fig.1).

These are designated as BH-1 to BH-8, respectively.

Table-1 gives the details of bore holes.

The bore holes were planned so as to yield complete information in the effective and critical zones under the foundations.

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



STANDARD PENETRATION TEST (SPT):

Standard Penetration Tests were conducted at frequent intervals in the bore holes. These tests were performed as specified in IS:2131-1981. In this test, a standard weight is dropped through a specified height, and the number of blows required for a penetration of 300 mm is recorded. The number of blows is designated as N. The first 150 mm penetration is neglected for the purpose of seating load. If required, correction is applied to the recorded N value for dilatancy and overburden effects. Also, if the number of blows exceeds 50, Refusal is said to have been reached and further testing is discontinued.

FIELD BORE LOGS:

All the details collected from the field operations are presented in Logs of Bore holes in Annexure at the end of this Report. These logs contain depth wise strata details, drilling rate, results of Standard Penetration Tests and colour of water etc.

SAMPLES:

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



5. 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
- Atterberg Limits (LL, PL & PI)
- 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

The tests were performed as per IS: 1124-1974 and IS: 9143-1979.



6. RESULTS

Fig. 2 gives the Logs of the bore holes, showing the sub soil profile. The variation of strata with depth is indicated.

Table-2 gives the results of tests on soil samples from bore holes.

Table-3 gives the Rock characteristics of granite which is the main rock type in the site.

Table-4 gives the results of tests on Rock Cores from bore holes.



7. SUBSOIL PROFILE & FOUNDATIONS

Based on eight (8) Bore logs, the subsoil profile at the Picket Nallah site is *generalized* as follows:

BLOCK-B (BH-1 to BH-4)

<u>Depth (m)</u>	<u>Strata</u>	<u>N Value</u>
0.00 – 4.00	Filling / clayey sand / Silty morum	8 – 31
4.00 – 5.50	Hard morum	> 50
Below 5.50	Soft Disintegrated Rock (SDR)	> 50

BLOCK-A (BH-5 to BH-8)

<u>Depth (m)</u>	<u>Strata</u>	<u>N Value</u>
0.00 – 5.00	Filling / Silty clay / Silty morum	10 - 47
5.00 – 6.00	Hard morum	> 50
Below 6.00	Soft Disintegrated Rock (SDR)	> 50

It should be noted that in BH-1, Hard rock boulder exists from 3.5 m depth. In BH-2 (Block-B) and BH-6 (Block-A), Soft Disintegrated Rock (SDR) is seen only from 7.5 m depth



In general, below the proposed sub-cellar floor level (about 6 m depth), the stratum comprises Soft Disintegrated Rock (SDR), which is fairly compact and hard. N values in Soft Disintegrated Rock consistently exceed 50, showing refusal.

The Soft Disintegrated Rock (SDR) is weathered and fissured. Significant portions of the rock show discolouration and weathering effects. Feldspar grains are dull. The rock has dull sound under hammer and shows significant loss of strength as compared with fresh rock. No cores were obtained in SDR strata due to fissured nature of strata.

Water table is encountered in the bore holes at 2.6 – 4.5 m.

Keeping the above points in view, open foundations are recommended resting in SDR strata.



8. RECOMMENDATIONS

The following recommendations are made for the proposed construction of High-rise Building in B & C Estates at Mallapur, Hyderabad.

These recommendations are based on Field investigations and Laboratory Tests on samples from eight (8) Bore Holes.

a) The generalized sub soil profile at the site is as follows:

BLOCK-B (BH-1 to BH-4)

<u>Depth (m)</u>	<u>Strata</u>	<u>N Value</u>
0.00 – 4.00	Filling / clayey sand / Silty morum	8 – 31
4.00 – 5.50	Hard morum	> 50
Below 5.50	Soft Disintegrated Rock (SDR)	> 50

BLOCK-A (BH-5 to BH-8)

<u>Depth (m)</u>	<u>Strata</u>	<u>N Value</u>
0.00 – 5.00	Filling / Silty clay / Silty morum	10 - 47
5.00 – 6.00	Hard morum	> 50
Below 6.00	Soft Disintegrated Rock (SDR)	> 50



It should be noted that in BH-1, Hard rock boulder exists from 3.5 m depth. In BH-2 (Block-B) and BH-6 (Block-A), Soft Disintegrated Rock (SDR) is seen only from 7.5 m depth

- b) In general, below the proposed sub-cellar floor level (about 6 m depth), the stratum comprises Soft Disintegrated Rock (SDR), which is fairly compact. N values in Soft Disintegrated Rock consistently exceed 50, showing refusal. No cores were obtained in SDR strata due to fissured nature of strata.
- c) Water table is encountered in the bore holes at 2.6 – 4.5 m.
- d) Open foundations are recommended resting in Soft Disintegrated Rock (SDR).
- e) SBC is recommended as 50 tonnes per sq m for foundations resting in Soft Disintegrated Rock (SDR). All foundations should be carried to SDR strata.
- f) This recommendation is based on the assumption of footings of width 2 m resting in SDR at 1.5 m depth below sub-cellar floor level. The actual size of the footings will be based on loads from the superstructure.

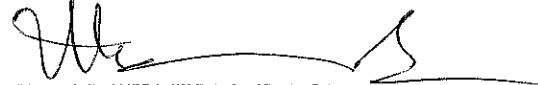


- g) All loose boulders and loose soil should be fully removed before placement of PCC bed.
- h) Since water table exists between 2.6 – 4.5 m depth, the foundation units need to be designed for uplift pressure. Further, adequate water proofing should be made.
- i) Angle of friction for SDR strata is recommended as 40 degrees.



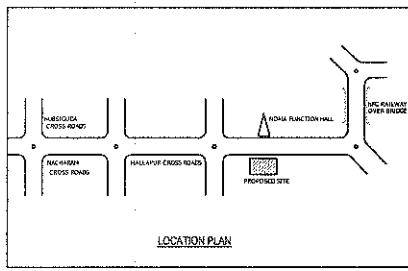
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For **GEO TECHNOLOGIES**



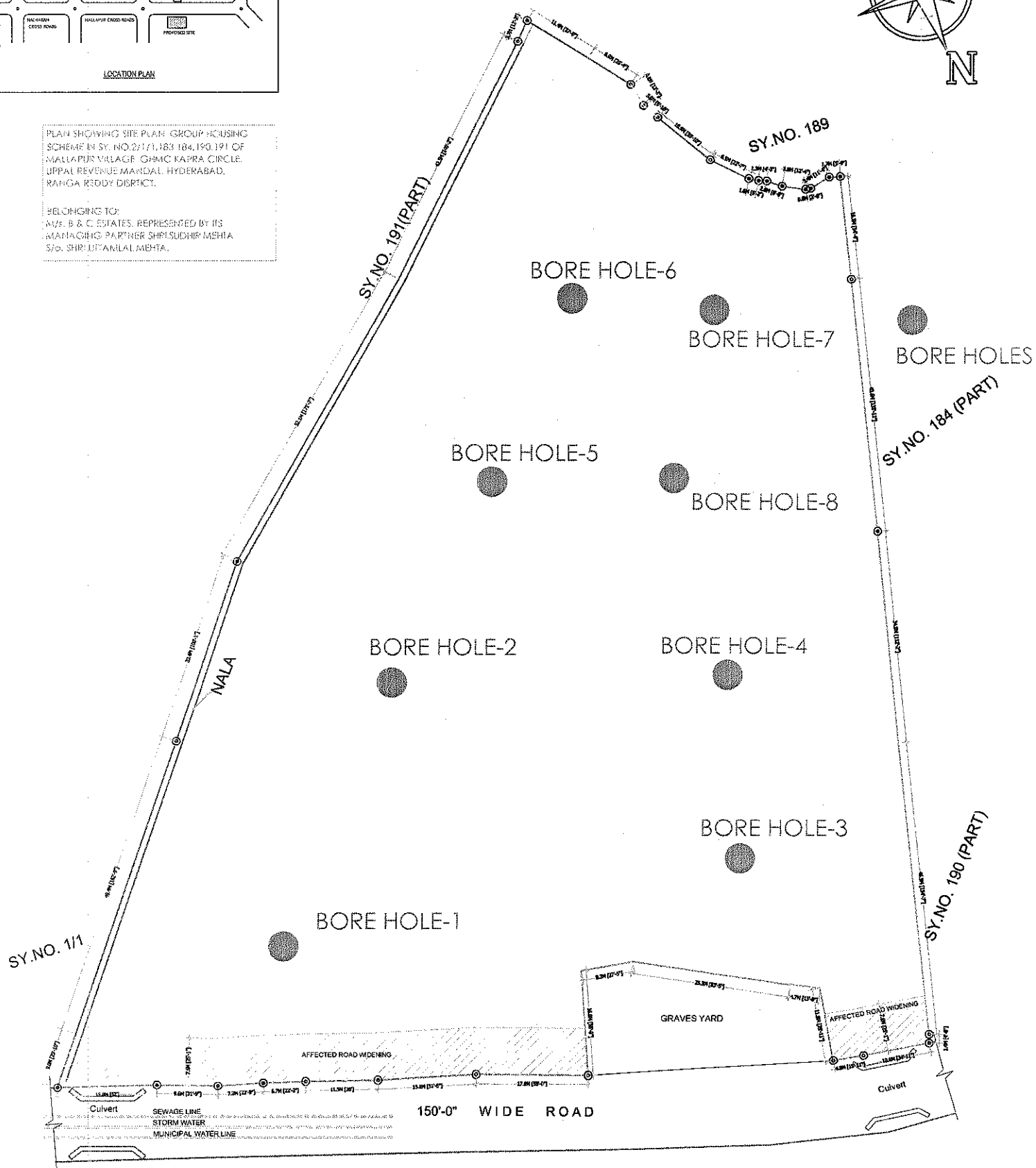
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Geological Consultant & Proprietor

FIG: 1 SITE PLAN SHOWING THE LOCATIONS OF BORE HOLES
 Project: Proposed Construction of High-Rise
 Buildings at Mallapur, Hyderabad



PLAN SHOWING SITE PLAN GROUP HOUSING SCHEME IN SY. NO. 2/1/1,183,184,190,191 OF MALLAPUR VILLAGE OHMC KAPRA CIRCLE, UPPAL REVENUE MANDAL, HYDERABAD, RANGA REDDY DISTRICT.

BELONGING TO:
 M/S. B & C ESTATES, REPRESENTED BY ITS MANAGING PARTNER SHELSUDHIR MEHTA S/O. SHRILATANILAL MEHTA.



RESIDENTIAL TOWNSHIP AT MALLAPUR
 FOR MODI BUILDERS

FIG:2 LOG OF BORE HOLES

Project: Proposed Construction of High-Rise Buildings at Mallapur, Hyderabad

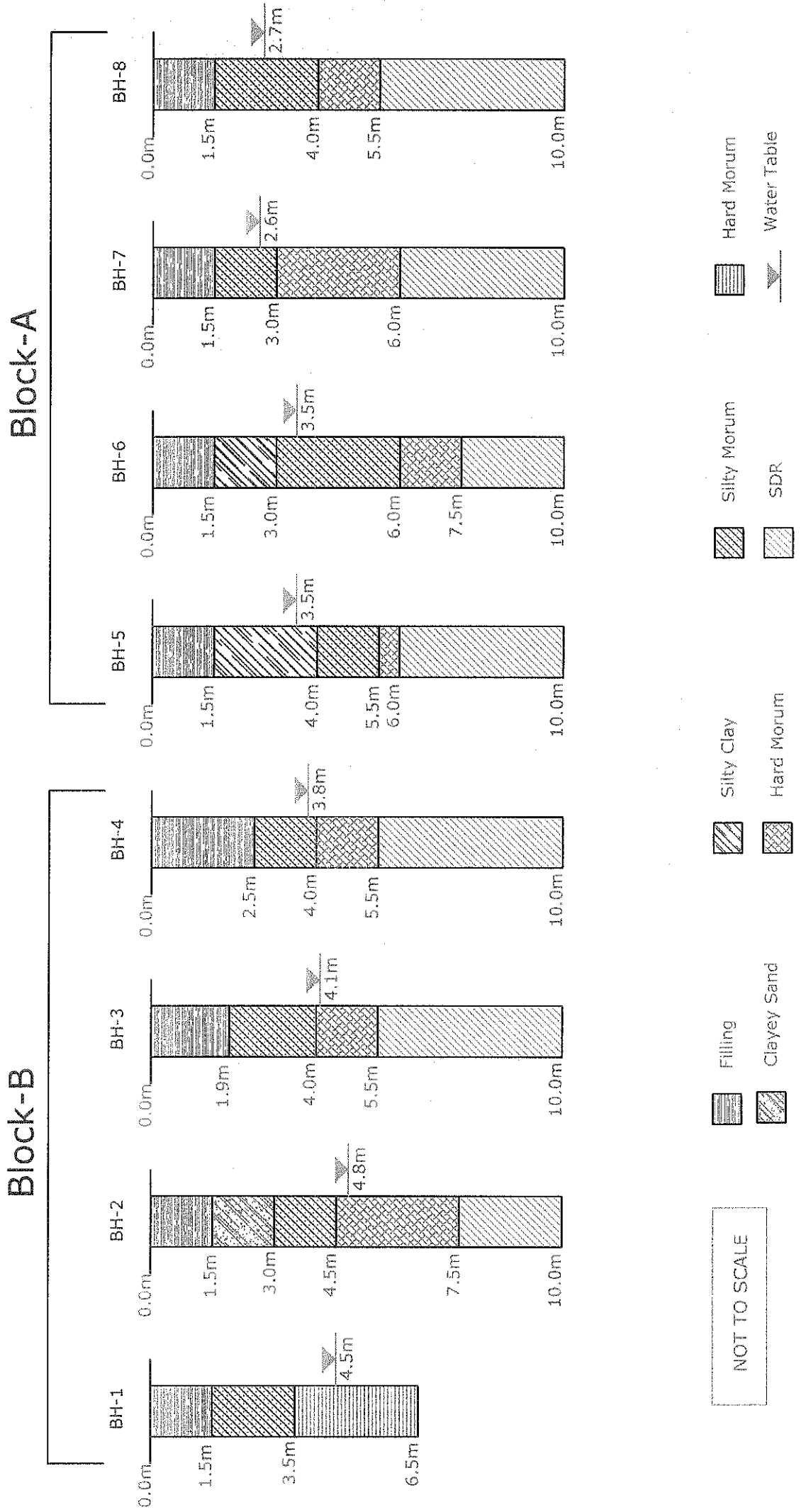


TABLE - 1

SUMMARY OF DRILLING

Project : Proposed High-rise Building at Mallapur, Hyderabad.

S.No.	BORE HOLE No.	DRILLED DEPTH (m)	WATER TABLE DEPTH (m)
1	BH-1	6.50	4.50
2	BH-2	10.00	4.50
3	BH-3	10.00	4.10
4	BH-4	10.00	3.80
5	BH-5	10.00	3.50
6	BH-6	10.00	3.50
7	BH-7	10.00	2.60
8	BH-8	10.00	2.70

TABLE - 2

SUMMARY OF SDR PROPERTIES						
Project : Proposed High-rise Building at Mallapur, Hyderabad.						

BH No.	Sample Depth, m	Specific Gravity	w.c. %	γ kN/cu m	Shear Parameters	
					C kN/m ²	ϕ deg
BH-2	8.00	2.70	7.5	19.3	0	38
	9.00	2.69	7.1	19.5	0	40
BH-3	8.00	2.70	6.8	19.5	0	42
	9.00	2.72	6.5	19.8	0	45
	10.00	2.72	6.2	20.0	0	45
BH-4	6.00	2.67	8.5	19.2	0	40
	7.50	2.68	7.9	19.4	0	42
	9.00	2.68	7.4	19.5	0	45
BH-5	8.00	2.69	9.2	19.3	0	39
	9.00	2.70	8.7	19.6	0	43
BH-6	8.00	2.69	7.5	19.1	0	41
	9.00	2.72	6.8	19.5	0	42
BH-7	8.00	2.73	6.5	19.8	0	43
	9.00	2.69	7.1	20.1	0	45
BH-8	8.00	2.71	6.6	19.6	0	42
	9.00	2.73	5.9	19.9	0	44

NOTATION

γ : Unit Weight (Natural Density) C : Cohesion
 w.c.: Natural Moisture (Water) Content ϕ : Angle of Internal Friction

TABLE - 3

ROCK CHARACTERISTICS

Project : Proposed High-rise Building at Mallapur, Hyderabad.

Rock : Granite

1	TEXTURE	Coarse Grained
2	STRUCTURE	Compact
3	HARDNESS	Hard
4	STREAK	Grey
5	REACTION WITH CHEMICALS	No reaction with acids
6	BEDDING	Not seen
7	JOINTS	Not seen
8	DIP	No discontinuities in the samples
9	STRIKE	Not observed in the samples
10	FAULTS	None by examination of samples

TABLE - 4

RESULTS OF TESTS ON ROCK SAMPLES					
Project : Proposed High-rise Building at Mallapur, Hyderabad.					

Rock : Granite

BORE HOLE No.	DEPTH OF SAMPLE (m)	SPECIFIC GRAVITY	POROSITY (%)	WATER ABSORPTION (%)	UCS kg/ sq cm
BH-1	3.50 - 4.50	2.71	2.80	3.40	860
	4.5 - 5.5	2.70	3.20	3.10	620
	5.5 - 6.5	2.74	2.40	2.70	950

Note: 1. All Tests are conducted in accordance with IS: 1124-974; IS: 9143-979.

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

APPENDIX

CALCULATION OF SAFE BEARING CAPACITY

Project : Proposed High-rise Building at Mallapur, Hyderabad.
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Foundations in Soft Disintegrated Rock (SDR) :**I. Based on 'N' Values****a) Shear criterion:**

Assume width of Footings B as 2 m.

Assume corrected average value of 35 for N,

Assume D the depth of foundations as 1.5 m below cellar floor level.

Allowable bearing pressure is:

$$q \text{ (Allowable.)} = 1/18 [2 \times N \times N B R_d + 6 (100 + N \times N) D R_w]$$

$$= 875 \text{ kN / sq m}$$

b) Settlement Criterion:

Based on settlement criterion, for a permissible settlement of 40 mm,

$$\text{Allowable bearing capacity} = 12.3 N [(B + 0.3) / B] R_d R_w$$

$$= 495 \text{ KN / sq m}$$

II. Based on IS: 12070

In accordance with IS: 12070, Soft Disintegrated Rock with 0% RQD is classified as 'very poor' (group-V) and the recommended net bearing pressure as per the Code is 40 - 45 - 55 t / sq m.

Recommended Safe Bearing Capacity for foundations resting in Soft Disintegrated Rock (SDR) is 50 tonnes per sq m.






GEO TECHNOLOGIES

Annexure – 1:

Field Bore Log charts

FIELD BORE LOG CHART

Project: B&C Estates Mallapur		BORE HOLE NO. 1		Ground Level: Dia. Of Casing: NX Water Table: 4.50m											
Date : 16-07-2009 to 17-07-2009		SPT		Details of Rock core											
Depth (m)	Length of Run (m)	Description	Log of Bore	Sampling		N Value	>10cm core Pieces(cm)	Total Length (cm)	No. of Pieces	% of core Recovery	RQD Value %	Avg. RQD %	Water colour	Rate of Drill Min/m	
				Depth (m)	Type										No. blows for Penetration of (15-30-45)cm
0.0	0.4	Filling		1.50	SPT	6-7-8	15								
0.4	1.1			3.00	SPT	16cm/50blows	>50								
1.5	1.5	Silty Morum													
3.0	0.5														
3.5	1.0	Hard Rock						96	3no+1 sp	96%	91%		Milky		
4.5	1.0								87	3no+9 sp	87%	31%		Milky	
5.5	1.0									97	3no only	97%	97%		Milky

SDR=Soft Disintegrated Rock cm/50= no.of blows

FIELD BORE LOG CHART





Project: B&C Estates Mallapur		Ground Level:											
Date : 18-07-2009 to 19-07-2009		Dia. Of Casing: NX											
Water Table: 4.80m		Water Table: 4.80m											
BORE HOLE NO. 2		BORE HOLE NO. 2											
Depth (m)	Length of Run (m)	Description	Log of Bore	Sampling		SPT	N Value	Details of Rock core		RQD Value %	Avg. RQD %	Water colour	Rate of Drill Min/m
				Depth (m)	Type			No. blows for Penetration of (15-30-45)cm	Total Length (cm)				
0.0	1.2	Filling											
1.2	0.3			1.50	SPT	3-4-4	8					Muddy	
1.5	1.5	Clayey Sand		3.00	SPT	6-7-12	19					Muddy	
3.0	0.5	Silty Morum										Muddy	
3.5	1.0			4.50	SPT	29cm/50blows	>50					Muddy	
4.5	1.5	Hard Morum		6.00	SPT	19cm/50blows	>50					Muddy	
6.0	1.5			7.50	SPT	8cm/50blows	>50					Brownish	
7.5	1.5	SDR		8.00	D/S							Brownish	
9.0	1.0			9.00	SPT	5cm/50blows	>50					Brownish	
9.0	1.0			9.50	D/S							Brownish	

SDR=Soft Disintegrated Rock

cm/50= no.of blows

sp=small pieces

FIELD BORE LOG CHART

Project: B&C Estates Mallapur		BORE HOLE NO. 3		Ground Level: Dia. Of Casing: NX Water Table: 4.10m										
Date : 24-07-2009		Sampling		SPT										
Depth (m)	Length of Run (m)	Description	Log of Bore	Depth (m)	Type	No. blows for Penetration of (15-30-45)cm	N Value	Details of Rock core			Rate of Drill Min/m			
								>10cm core Pieces(cm)	Total Length (cm)	No. of Pieces		% of core Recovery	RQD Value %	Avg. RQD %
0.0	1.5	Filling												
1.5	0.4													
1.9	3.0	Silty Morum		3.00	SPT	15-15-13	28							
3.0	4.0			4.00	D/S									
4.0	4.5	Hard Morum		4.50	SPT	29cm/50blows	>50							
4.5	5.5			5.50	D/S									
5.5	6.0	SDR		6.00	SPT	16cm/50blows	>50							
6.0	7.5			6.50	D/S									
7.5	9.0			7.50	SPT	8cm/50blows	>50							
9.0	10.0			8.00	D/S									
				9.00	SPT	5cm/50blows	>50							
				10.00	D/S									

SDR=Soft Disintegrated Rock cm/50= no. of blows

FIELD BORE LOG CHART

Project: B&C Estates Mallapur		BORE HOLE NO. 4		Ground Level: Dia. Of Casing: NX Water Table: 3.80m										
Date : 23-07-2009		Sampling		Details of Rock core		Rate of Drill Minim								
Log of Bore		SPT		No. of Pieces										
Depth (m)	Length of Run (m)	Description	Log of Bore	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	RQD Value %	Avg. RQD %	Water colour
0.0	1.0													Muddy
1.0	1.5	Filling		1.50	SPT	5-12-12	24							Muddy
1.5	2.5													Muddy
2.5	3.0			3.00	SPT	7-14-17	31							Muddy
3.0	4.0	Silty Morum												Brownish
4.0	4.5			4.50	SPT	29cm/50blows	>50							Brownish
4.5	5.5	Hard Morum												Brownish
5.5	6.0			6.00	SPT	17cm/50blows	>50							Yellow
6.0	7.5	SDR		6.50	D/S									Yellow
7.5	9.0			7.50	SPT	7cm/50blows	>50							Yellow
7.5	9.0			8.00	D/S									Yellow
9.0	10.0			9.50	D/S	5cm/50blows	>50							Yellow

SDR=Soft Disintegrated Rock cm/50= no.of blows

FIELD BORE LOG CHART																			
Project: B&C Estates Malapur				BORE HOLE NO. 5				Ground Level: Dia. Of Casing: NX Water Table: 3.50m											
Date : 19-07-2009 to 20-07-2009		Length of Run (m)		Description		Log of Bore		Sampling		SPT		Details of Rock core							
Depth (m)	From	To	Length of Run (m)	Description	Log of Bore	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	RQD Value %	Avg. RQD %	Water colour	Rate of Drill Min/m		
0.0	1.0	1.0	1.0	Filling															
1.0	1.5	0.5	0.5			1.50	SPT	4-5-5	10							Muddy			
1.5	3.0	1.5	1.5	Silty Clay		3.00	SPT	6-7-12	9							Muddy			
3.0	4.0	1.0	1.0													Muddy			
4.0	4.5	0.5	0.5	Silty Morum		4.50	SPT	28cm/50blows	>50							Muddy			
4.5	5.5	1.0	1.0			5.50	D/S									Brownish			
5.5	6.0	0.5	0.5	Hard Morum		6.00	SPT	7cm/50blows	>50							Brownish			
6.0	7.5	1.5	1.5	SDR		6.50	D/S									Yellow			
7.5	9.0	1.5	1.5				7.50	SPT	5cm/50blows	>50							Yellow		
8.00							8.00	D/S									Yellow		
9.00							9.00	SPT	4cm/50blows	>50							Yellow		
9.0	10.0	1.0	1.0			9.50	D/S									Yellow			

cm/50= no.of blows

SDR=Soft Disintegrated Rock

FIELD BORE LOG CHART

Project: B&C Estates Mallapur		Ground Level:		BORE HOLE NO. 6		Dia. Of Casing: NX		Water Table: 3.50m								
Date : 20-07-2009 to 21-07-2009		Sampling		SPT		Details of Rock core										
Depth (m)	Length of Run (m)	Description	Log of Bore	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	RQD Value %	Avg. RQD %	Water colour	Rate of Drill Min/m	
																From
0.0	0.6	Filling														
0.6	1.5			1.50	SPT	5-7-6	13									
1.5	3.0	Silty Clay		3.00	SPT	10-24-22	46									
3.0	4.5															
4.5	6.0	Silty Morum		4.50	SPT	20cm/50blows	>50									
6.0	7.5	Hard Morum		6.00	SPT	12cm/50blows	>50									
7.5	8.0			7.50	D/S											
8.0	9.5	SDR		8.00	SPT	8cm/50blows	>50									
9.5	10.0			9.50	SPT	7cm/50blows	>50									

SDR=Soft Disintegrated Rock

cm/50= no.of blows

FIELD BORE LOG CHART

Project: B&C Estates Mallapur		BORE HOLE NO. 7		Ground Level: Dia. Of Casing: NX Water Table: 2.60m															
Depth (m)	Length of Run (m)	Description	Log of Bore	Sampling		SPT		Details of Rock core											
				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	RQD Value %	AVG. RQD %	Water colour	Rate of Drill Min/m				
0.0	1.0	Filling																	
1.0	0.5																		
1.5	1.5	Silty Morum		1.50	SPT	6-6-7	13									Muddy			
3.0	1.5			3.00	SPT	16-20-15	35											Muddy	
4.5	1.5	Hard Morum		4.50	SPT	28cm/50blows	>50												
6.0	1.5			5.50	DS														Brownish
7.5	1.5	SDR		6.00	SPT	20cm/50blows	>50												
8.0	0.5			7.50	DS														Yellow
9.0	1.0			7.50	SPT	9cm/50blows	>50												Yellow
9.0	1.0			9.00	SPT	7cm/50blows	>50												Yellow
9.0	1.0			9.50	D/S													Yellow	

SDR=Soft Disintegrated Rock cm/50= no.of blows

FIELD BORE LOG CHART

Project: B&C Estates Mallapur		Ground Level:		BORE HOLE NO. 8		Dia. Of Casing: NX		Water Table: 2.70m		Rate of Drill Min/m		
Date : 22-07-2009		Sampling		SPT		N Value		RQD Value %		Avg. RQD %		
Depth (m)	Length of Run (m)	Description	Log of Bore	Depth (m)	Type	No. blows for Penetration of (15-30-45)cm	N Value	>10cm core Pieces(cm)	Details of Rock core		Water colour	
									Total Length (cm)	No. of Pieces		% of core Recovery
0.0	1.5	Filling		1.50	SPT	5-5-6	11				Muddy	
1.5	1.5	Silty Morum		3.00	SPT	11-22-25	47				Muddy	
3.0	1.0											Muddy
4.0	0.5	Hard Morum		4.50	SPT	27cm/50blows	>50				Muddy	
4.5	1.0					5.50	D/S					Brownish
5.5	0.5	SDR		6.00	SPT	14cm/50blows	>50				Yellow	
6.0	1.5					7.50	SPT	8cm/50blows	>50			Yellow
7.5	0.5					8.00	D/S					Yellow
8.0	1.0	SDR		9.00	SPT	7cm/50blows	>50				Yellow	
9.0	1.0					10.00	D/S					Yellow

SDR=Soft Disintegrated Rock cm/50= no.of blows

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.
14. IRC: 78 – 2000: Standard Specifications and Code of Practice for Road Bridges – section – 7.