

# **SUB-SURFACE SOIL** **INVESTIGATION REPORT**

**PROJECT: G+10 APPARTMENT**

**CLIENT: CHAS MUNICIPAL CORPORATION**

**SUBMITTED TO- S R HOME MAKERS PVT LTD**

## **INVESTIGATION DONE BY:**

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# **1. INTRODUCTION**

## **1. Project Description**

**M/S S R HOME MAKERS PVT LTD** has been decided to conduct the Geo-technical investigation at five locations as per their general Layout drawing. The objective of this detailed Geo-technical Investigation is to interpret the engineering properties of the soil/rock for the purpose of design parameters, confirming to relevant IS specifications.

The engineering properties of the soil has determined on the basis of the fieldwork and lab. Test under instructions of the M/S S R HOME MAKERS PVT LTD. The report presents soil bearing capacity on the basis of the field testing result.

## **2. Scope of work & Purposes of Study**

The overall purpose of these investigations was to present soil Stratigraphy of foundation locations, various strength parameters of soil/rock and thereby to develop geotechnical recommendation for foundation design and construction. To accomplish these purposes, the study was conducted in the following phases:

- (a) Drilling boreholes through soil and up to hard rock to determine site stratigraphy.
- (b) Analyzing all the data to develop foundation design and construction /recommendations.

### **2.1 Planning of Geo-technical Investigation**

On the basis of nature of the project, it was decided to carry out soil exploration in order to:

- (i) Obtain founding of penetration resistance by standard penetration test (as per IS:2131-1981) in the boreholes.
- (ii)Drilling in rock in weathered and in hard rock, obtains rock cores of Nx size by diamond core drilling method using double tube core barrels, determination of material characteristics.

### **3 FIELD INVESTIGATION**

#### **3.1 Soil Boring**

The boreholes were progressed using rotary drilling machine hydraulically operated auger to the Specified depth or refusal, whichever is encountered earlier. The drill machine has hydraulic feed and is driven by a bevel gear system run by 10 HP Kirloskar engine. The diameter of the borehole was 150 mm. Where caving of the borehole occurred, casing was used to keep the borehole stable. The work was in general accordance IS: 1892-1979.

Standard Perpetration Test (SPT) was conducted in the borehole at 1.5 m interval by connection a split spoon sampler to 'A' rods and driving it by 45 cm. The tests were conducted in accordance with IS: 2131-1981.

The numbers of blows for each 15 cm of penetration were recorded. The blows required to penetrate the initial 15 cm of the split spoon for seating the sampler is ignored due to the possible presence of loose materials or cuttings from the drilling operation. The cumulative number of blows required to penetrate the balance 30 cm of the 45 cm sampling interval is termed the SPT value of the 'N' value.

The 'N' values are presented on the profiles for each borehole. Refusal to further boring penetration was considered when the 'N' value exceeds 100 or when practical refusal boring penetration by shell and auger was encountered.

Where the 'N' value exceeds 100, the penetration of split spoon sampler (after initial seating) is recorded together with the number of blows given of the sampler. Where the seating blow count exceeds 100, value is recorded as "Ref" on the soil profile.

#### **3.2 Bore Hole Location :**

B.H. No.	LOCATION	DEPTH (m)	GROUND LEVEL	DIAMETER (mm)
B.H. -1	BH-1	10.5 m	219.00	150
B.H. -2	BH-2	10.5 m	219.070	150
B.H. -3	BH-3	10.5 m	219.110	150
B.H. -4	BH-4	10.5 m	219.020	150
B.H.- 5	BH-5	10.5 m	219.035	150

The borehole locations & RL were provided by M/S S R HOME MAKERS PVT. LTD.

### **3.3 Disturbed Sampling (Soil) in boreholes**

Disturbed soil is usually collected in the SPT sampler.

### **3.4 Undisturbed Sampling (Soil) in boreholes**

Undisturbed samples are usually collected using 100mm diameter and 450 mm long MS tubes provided with sampler head with ball check arrangement.

### **3.5 Rock Core Samples**

Drilling was advanced by rotary core drilling method using double tube core barrels as per the guidelines of IS: 6926-1996. A core barrel and Nx sized bits are used for drilling and recovering rock cores. Recovered rock cores were numbered serially and preserved in good quality study wooden core boxes as specified in IS: 4078-1980 Rock core recovery and Rock Quality Designation (RQD) were computed for every run length drilled.

Disturbed samples were collected from the split spoon after conduction SPT. The samples were preserved in transparent polythene bags. Undisturbed samples were collected by attaching a 75 mm diameter thin walled 'Shelby' tubes and driving the sampler lightly using a 63.5 kg hammer in accordance with IS:2132. The tubes were sealed with wax at both ends.

### **3.6 Rock Drilling**

Rotary drilling through the rock was performed using heavy-duty skid mounted make hydraulically operated diamond rotary Core drill machine. The drill machine has hydraulic feed and is driven by a bevel gear system run by a 10 HP Kirloskar engine. The drill chuck has four jaws to accommodate NW size drill rods.

Drilling and sampling of the rock was performed using NX size double tube core barrel. A32 Carat diamond impregnated bit was used to drill through the rock formation. It was attached to the end of a core barrel, which is connected to the machine by a string of NW drill rods and rotated by the drilling machine.

Water was circulated through the drill rods to the bottom of the hole. The water serves the purpose of lubrication, cooling and protection of the diamond drill bit in addition to flushing the cuttings out to the hole. A reciprocating pump was used to circulate the water. While drilling through soft rock the is likely to collapse, casing was installed. A NX casing (80 mm OD) was used. The casing with a diamond shoe bit was used to assist the casing to advance.

The percent recovery and Rock Quality Designation (RQD) was measured for each core run. The percent recovery is defined as the percent ratio to the cumulative length of core sample recovered to the total length of the core run. The Rock Quality Designation (RQD) is defined as the ratio of the cumulative length of core pieces 10 cm or longer the total length of the core

runs, expressed as percentage. The Rock Mass Rating (RMR) and engineering parameter that assists in assessing the rock quality and behavior is also presented on the individual rock profiles.

Details of samples collected are presented on the rock profiles together with graphical plots of recovery and RQD at various depths. The net effective drilling time, a qualitative assessment of the nature of the strata, is also included on the borehole logs. The colour of return water and the extent of water loss while drilling the borehole recorded on the boring logs may be used for an assessment of the nature of rock, water-tightness of joints and possible presence of interconnected channels/ cavities.

**3.7 Rock classification** in terms of weathering and state of fractures and strength is carried out in the following manner. Tabulations given below explain it briefly.

**SCALE OF WEATHERING GRADES OF ROCK MASS**  
(Based on IS: 4464)

<b>Terms</b>	<b>Description</b>	<b>Grade</b>	<b>Interpretation</b>
Fresh	No visible sign of rock material weathering perhaps slight discoloration on major discontinuity surfaces	I	<b>CR&gt;90%</b>
Slightly weathered	Discoloration indicates weathering of rock material and discontinuity surfaces. All the rock material may be discolored by weathering	II	<b>CR between 70 % to 90 %</b>
Moderately weathered	Less than half of the rock material is decomposed or disintegrated to a soil. Fresh or discolored rock is present either as a continuous from work or as core stones	III	<b>CR between 51 % to 70 %</b>
Highly weathered	More than half of the rock material is decomposed or disintegrated to a soil. Fresh or discolored rock is present either as a discontinuous framework or as core stones	IV	<b>CR between 11% to 50 %</b>
Completely weathered	All. Rock material is decomposed and / or disintegrated to soil. The original mass structure is still largely intact	V	<b>CR between zero to 10 %</b>
Residual soil	All rock material is converted to soil. The mass structure and material fabric are destroyed. There is a large change in volume, but the soil has not been significantly transported.	VI	<b>CR= zero % but N&gt;50</b>

It should be understood that all grades of weathering may not be seen in a given rock mass and that in some cases a particular grade may be present to a very small extent. Distribution of the various weathering grades of rock material in the rock mass may be related to the porosity of the rock material and the presence of open discontinuities of all types in the rock mass.

### **RELATION BETWEEN RQD AND IN- SITU ROCK QUALITY**

Rock quality is further measured by frequency of natural joints in rock mass. Rock Quality Designation (RQD) is used to define state of fractures of massiveness of rock.

Following table define the quality of rock mass

<b>RQD CLASSIFICATION</b>	<b>RQD %</b>
Excellent	91-100
Good	76-90
Fair	51-75
Poor	26-50
Very poor	00-25

### **CLASSIFICATION OF ROCK WRT COMPRESSIVE STRENGTH**

Rock is also classified by strength of intact rock cores collected during drilling. Rock compressive strength (UCS) is used to define strength of rock. Following table summarizes classification of rock based on strength.

<b>ROCK STRENGTH</b>	<b>COMPRESSIVE STRENGTH (kg/cm<sup>2</sup>)</b>
Extremely Weak	<20
Very Weak	20-100
Weak	101-250
Average (Moderately Strong)	251-500
Strong	501-1000
Very Strong	1001-2500
Extremely Strong	>2500

### **Estimated RMR values**

<b>GEOMECHANICAL CLASSIFICATION OF ROCK MASSES (RMR)</b>
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**I. STRENGTH OF INTACT ROCK MATERIAL (MPA)**

DESCRIPTION	COMPRESSIVE STRENGTH	POINT LOAD STRENGTH	RATING
Exceptionally Strong	>250	>8	15

Very Strong	100-250	4-8	12
Strong	50-100	2-4	7
Average	25-50	1-2	4
Weak	10-25	-	2
Very Weak	2-10	-	1
Extremely Weak	<2		0

## II. Rock Quality Designation (RQD)

DESCRIPTION	RQD	Rating
Excellent	90-100	20
Good	75-90	17
Fair	50-75	13
Poor	25-50	8
Very Poor	<25	3

## III. Spacing of Discontinuities

DESCRIPTION	Spacing ,m	Rating
Very wide	>2	20
Wide	0.6-2	15
Moderate	0.2-0.6	10
Close	0.06-0.20	8
Very close	<0.006	5

## IV. Condition of Discontinuities

Very rough and un weathered wall rock, tight and discontinuous, no separation	Rough and slightly weathered wall rock surface , separation <1 mm	Slightly rough and moderately to highly weathered wall rock surface separation <1mm	Slickenside wall rock surface or 1-5 mm thick gauge or 1-5mm wide opening, continuity	5mm thick soft gauge 5mm wide continuous discontinuity
Rating : 30	25	20	10	0

## V. Ground Water condition

General Description	Completely dry	damp	Wet	Dripping	Flowing
Rating	15	10	7	4	0

Table 3 of IS -12070, Design & Construction of Shallow Foundation on Rock, gives net allowable pressure based on RMR values. These values will ensure settlement of foundation to be less than 12mm. This table is reproduced below.

Classification	I	II	III	IV	V
Description of Rock	Very Good	Good	Fair	Poor	Very Poor
RMR	100-81	80-61	60-41	40-21	20-0
Qns ton.m <sup>2</sup>	600-448	448-288	280-151	145-90-58	55-45-40

RMR value for highly fractured rock is also determined based on experience as joints are not very clearly defined. In cases where the shear failure is to be considered to occur through highly fractured rock masses, cohesion cannot be relied upon to provide resistance to failure; hence only angle of internal friction is considered to determine the bearing capacities by conventional



method. If Rock is not intact UCS value of recovered core does not represent the strength or rock mass.

### **3.8 Groundwater**

Groundwater level was measured in the boreholes 24 hours after drilling and sampling was completed.

## **4 FOUNDATION DATA ANALYSIS:**

### **4.1 Open Foundation**

For Satisfactory performance of a foundation, the following criteria must be satisfied;

- 1) The Foundation must not fail in shear.
- 2) The Foundation must not settle by an amount more than the permissible settlement.

The smaller of the bearing pressure values obtained is adopted as the allowable bearing capacity.

### **4.2 Depth of Open Foundation**

The embedment of the foundation shall be decided keeping in view the overall characteristics like fissure, bedding plans, cavities, ultimate crushing strength, proposed treatment of foundation strata etc.

### **4.3 Allowable Bearing Pressure of open Foundation on Rock**

Analysis for allowable bearing capacity on rock has been done by the following three methods.

- A) Based on rock mass rating (RMR value) and correlations developed in IS : 12070.
- B) Based on shear failure method as per IS: 6403-1981.
- C) Based on field SPT data as per IS: 8009-1976 part-I

#### **4.3.1 Allowable Bearing Pressure from the RMR System:**

Analysis has been carried out using the RMR also known as Geo-mechanics classification by considering various parameters such as uniaxial compressive strength RQD, spacing and condition of discontinuities and ground water condition. The correlation between the RMR value and allowable pressure has been given in Table -3 IS 12070. This will ensure settlement of raft foundation to be less than 12mm.

Net safe bearing pressure based on RMR:

<b>Classification no.</b>	<b>I</b>	<b>II</b>	<b>III</b>	<b>IV</b>	<b>V</b>
Description of rock	Very good	Good	Fair	Poor	Very Poor
RMR	100-81	80-61	60-41	40-21	20-0
Qns (ton/m <sup>2</sup> )	600-448	448-288	280-151	145-90-58	55-45-40

The RMR for use in Table should be the average within a depth below foundation level equal to the width of foundation, provided the RMR is fairly uniform within the depth. If the upper part of the rock, within a depth of about one fourth of the width of foundation, is of lower quality the value of this part should be used or the inferior rock should be removed. Since these values are based on limiting the settlement, they should not be increased if the foundation is embedded in to the rock.

## **5. GENERAL SITE CONDITION**

### **5.1 Site Stratigraphy**

The boring has been done as per the layout plan. Following observations have been made during the Geo-Technical Survey:

- Uniformity in the soil strata, the detailed soil profile and various soil layers have been provided in the soil profile attached.
- The underlying strata below the sandy silty layer is sandy gravelly soil and after that is completely weathered micaceous Gneiss.
- The SPT 'N' value was observed to be over 100 at the overburden weathered rock interface.

**The area falls under Zone-II as classified by Bureau of India standards, Indicating least to moderate active zone.**

#### **Sub-surface conditions:**

<b>Stratum I</b>	Sandy silty soil/ Sandy gravelly soil
<b>Stratum II</b>	Medium to very completely Weathered rock
<b>Stratum III</b>	Weathered rock/Rock

## **6 FOUNDATION RECOMMENDATIONS:**

### **6.1 Safe Bearing Pressure from settlement Criteria from SPT N values.**

For settlement consideration IS 8009-(Part-1) 1976 has been referred.

Based on the SPT penetration the allowable safe bearing capacity for 25 mm settlement and with factor of safety 3 can be calculated as per Terzaghi & Peck as -

$$q_{ap} = 3.5 (N - 3) [(B+0.3) / 2B]^2 R_{w2} R_d (T/m^2)$$

**Where,**

$q_{ap}$  : Allowable safe bearing capacity based on SPT penetration "N" in t/m<sup>2</sup>

N : Average Standard Penetration Resistance

B : Width of Footing (or least lateral dimension) in (m)

D : Depth of foundation below ground level in (m)

R<sub>w2</sub> : Correction for Water table = 0.5 [ 1 + (Z<sub>w2</sub> / B) ]

Z<sub>w2</sub> : Depth of water table below foundation in (m)

R<sub>d</sub> : Correction for depth = 1 + 0.2 (D/B) (maximum limited to 1.20)

Here, 25 mm settlement has been taken

## 6.2 Safe Bearing Capacity from C- $\phi$ Parameters

IS code (IS: 6403-1981), (sec.5.1.2) recommends a bearing capacity equation which is similar in nature to those given by Meyerhof and Brinch Hansen. The net ultimate bearing Capacity of a shallow foundation of breadth B (m) is given as per IS code by the equation.

$$q_{nf} = cN_c \cdot s_c \cdot d_c \cdot i_c + 1/2 \cdot B \cdot \gamma \cdot N_y \cdot s_y \cdot d_y \cdot i_y \cdot W'$$

The net safe bearing capacity =  $q_{ns} = (q_{nf} / \text{factor of safety})$

Where,  $q$  = effective surcharge at the base level of foundation (t/m<sup>2</sup>)

$c$  = cohesion (t/m<sup>2</sup>)

$\gamma$  = unit weight of subsoil (t/m<sup>2</sup>)

B = breadth of footing

L = length of footing

$\phi$  = angle of internal friction of soil

D<sub>f</sub> = depth of foundation

N<sub>c</sub>, N<sub>q</sub>, N<sub>y</sub> = Bearing capacity factors given in relevant tables for general shear failure.

For obtaining N<sub>c</sub>' , N<sub>q</sub>' , N<sub>y</sub>' corresponding to local shear failure a reduced value of  $\phi' = \tan^{-1}(0.67\phi)$  and corresponding value are taken for N<sub>c</sub>, N<sub>q</sub>, N<sub>y</sub>.

**Bearing Capacity Factors:** N<sub>c</sub>, N<sub>q</sub> and N<sub>y</sub>

**Depth Factor:** S<sub>c</sub>, s<sub>q</sub>, and S<sub>y</sub> are shape factors

**Depth Factor:** D<sub>c</sub>, d<sub>q</sub> and d<sub>y</sub> are depth factors

**inclination factors:** I<sub>c</sub>, i<sub>q</sub> and i<sub>y</sub> = 1.0 (for vertical loading)

**W'** water table factor (=0.5 for water table at the footing level & 1.0 for water table at depth B below the footing. to be obtained by linear Interpolation) the value of the other factors are as tabulated below;

$$q_{nf} = cN_c \cdot s_c \cdot d_c \cdot i_c + 1/2 \cdot B \cdot \gamma \cdot N_y \cdot s_y \cdot d_y \cdot i_y \cdot W'$$

Shape factor	Sq./circ.	Rect....	Strip	Dc=1+0.2(df/b) (N $\phi$ ) 0.5
S <sub>c</sub>	1.3	1+0.2B/L	1.0	D <sub>q</sub> -d <sub>y</sub> =1 for $\phi < 10$
S <sub>q</sub>	1.2	1+0.2B/L	1.0	D <sub>q</sub> =d <sub>y</sub> =1+0.1 (N $\phi$ ) 0.5 for $\phi > 10$
s <sub>y</sub>	0.8/0.6	1-0.4B/L	1.0	I <sub>c</sub> =i <sub>q</sub> =i <sub>y</sub> =1.0 for vertical loading

The net safe bearing capacity values calculation as above have to be checked for settlement in order to arrive at the allowable bearing capacity values.

## Discussion on Foundation: -

The structure for which the subsoil exploration was conducted the load coming on this foundation is moderate. Considering the above factor **shallow foundation** in the form of **isolated & strip footings** are the best option for the building in discussion.

The **bearing capacities** for such isolated or strip foundation along with allowable settlement is tabulated below.

BH	GROUND LEVEL (m)	FOUNDATION LEVEL (m)	DEPTH (m)	FOUNDATION MATERIAL	NET ALLOWABLE BEARING PRESSURE (KN/m <sup>2</sup> )
BH-1	219.000	216.000	3	Yellowish Sandy gravelly soil	210.00
			4		240.00
BH-2	219.270	216.270	3		210.00
			4		240.00
BH-3	219.110	216.210	3		210.00
			4		240.00
BH-4	219.020	216.020	3		210.00
			4		240.00
BH-5	219.035	216.035	3		210.00
			4		240.00

**Notes:**

1. The depth of embedment of foundation has been given from the existing ground level any cutting or filling at that point should be adequately taken care of.
2. Minimum embedment of foundation for heavy load (i.e., more than 100T) should be in weathered rock strata at 1.5 m depth.

**Recommendation:**

- The subsoil characteristic of proposed site was determined from detail soil exploration with five number boreholes.
- Shallow foundation in the form of isolated/strip footings is recommended for the proposed structure.
- The shallow foundations is should be adequately connected with grade beams to minimize differential settlement
- The final decision regarding the foundation will depend on the judgment of the engineer concerned.

For C.J.R. CONSULTANT



S.B.Prasad

## **REFERENCE:**

1. IS: 2131:1971- Method of SPT for Soils.
2. IS: 2720 (Part-I) – Sample Preparation.
3. IS: 2720 (Part-II) – Moisture content.
4. IS: 2720 (Part-III)-Specific gravity.
5. IS: 2720 (Part-IV)- Grain Size analysis.
6. IS: 2720 (Part-V)-LL & PL.
7. IS: 2720 (Part-VI) – Shrinkage limit.
8. IS: 2720 (Part-X)- Trail Compression.
9. IS: 2720 (Part-XV )-Consolidation.
10. IS: 1948-970-Classification of Soils.
11. IS: 1892-1972-Subsurface investigation.
12. IS: 6403-1981- Bearing Capacity of shallow foundation.
13. IS: 8009-1981-(part 01) –Calculation of settlement of foundations.
14. IS: BISHOP A W & HENKEL D J – Measurement of soil properties in triaxial test.
15. BRAHMA S P- foundation Engineering.
16. HVORLEW MJ- Sub surface exploration and sampling of soil for Civil Engineering Purposes.
17. LAMBE T W – Soil testing for Engineers.
18. PUNAMIA B C – Soil Mechanics and Foundation.

**FIELD SOIL INVESTIGATION DATA**

**PROJECT: Soil investigation report for phoenix -II  
at CHAS  
BORE HOLE NO.-1**

**JOB CODE:C023101**

**CO-ORDINATES:**

ELEVATION IN METERS	DEPTH IN m BELOW REF.	NATURE OF SAMPLING	DATE OF SAMPLING	DEPTH OF TESTING BELOW REF. LVL.	LVL. OF WATER TABLE	Standard Penetration Test		DIA. OF CASING mm	TIME TAKEN FOR BORING EACH 30cm IN MINUTES	% CORE RECOVERY	% RQD	ROCK CORE DRILLING OBSERVATIONS DESCRIPTION OF CORE ROCK TYPE COLOUR GRAIN SIZE TEXTURE MINERAL COMPOSITION	DETAILS OF WATER SAMPLES	WATER LOSS	SYMBOLIC REPRESENTATION	VISUAL DESCRIPTION OF SOIL WITH IS CLASSIFICATION
						Penetration cm	"N" VALUE									
<b>100.000</b>	0.00	P		1.50		30	08	150				Overburden. (0.00-4.20m).	Yellowish			Yellowish medium dense , non- plastic sandy silt with gravels, inorganic soil. (0.00-4.20m). (SM)
	2.00					30	22									
	3.00					30	22									
<b>95.800</b>	4.00	P		4.50		30	44	UN-CASED				Very Dense grayish completely weathered Rocks. (4.20-10.50m).	Grayish			
	6.00					30	53									
	7.50					15	100									
	9.00					02	100									
<b>89.500</b>	10.00															
	11.00															
	12.00															
	13.00															
	14.00															
	15.00															
	16.00															
	17.00															
	18.00															
	19.00															
	20.00															
	21.00															

**NOTES:**

1. Classification of soil as per IS:1498
2. Abbreviation Used: D- Disturbed Sample, C- Rock Core sample, UD- Undisturbed Sample P- SPT SAMPLE
3. Type of Machine Used: Hydraulic Feed
4. Type of Core Barrel used: Double tube
5. Shearing Strength Test based on Direct shear test on UD sample by UUTest.

**INVESTIGATION DONE BY: C.J.R.CONSLTANTCONSULTANT JHARKHAND**

**FIELD SOIL INVESTIGATION DATA**

**PROJECT: Soil investigation report for phoenix -II  
at CHAS  
BORE HOLE NO.-2**

**JOB CODE:C023101**

**CO-ORDINATES:**

ELEVATION IN METERS	DEPTH IN m BELOW REF.	NATURE OF SAMPLING	DATE OF SAMPLING	DEPTH OF TESTING BELOW REF. LVL.	LVL. OF WATER TABLE	Standard Penetration Test		DIA. OF CASING mm	ROCK CORE DRILLING OBSERVATIONS				VISUAL DESCRIPTION OF SOIL WITH IS CLASSIFICATION				
						Penetration cm	"N" VALUE		TIME TAKEN FOR BORING EACH 30cm IN MINUTES	% CORE RECOVERY	% RQD	DESCRIPTION OF CORE ROCK TYPE COLOUR GRAIN SIZE TEXTURE MINERAL COMPOSITION		DETAILS OF WATER SAMPLES	WATER LOSS	SYMBOLIC REPRESENTATION	
<b>100.000</b>	0.00	P		1.50		30	05	150					Overburden. (0.00-4.50m).	Yellowish			Yellowish medium dense , non- plastic sandy silt with gravels, inorganic soil. (0.00-4.50m). (SM)
1.00																	
2.00																	
	3.00	P		3.00		30	21										
<b>95.800</b>	4.00																
	5.00	P		4.50		30	43	UN-CASED					Very Dense grayish completely weathered Rocks. (4.20-10.50m).	Grayish			
	6.00	P		6.00		30	52										
	7.00	P		7.50		15	100										
	8.00																
	9.00	P		9.00		02	100										
<b>89.500</b>	10.00																
	11.00																
	12.00																
	13.00																
	14.00																
	15.00																
	16.00																
	17.00																
	18.00																
	19.00																
	20.00																
	21.00																

**NOTES:**

1. Classification of soil as per IS:1498
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3. Type of Machine Used: Hydraulic Feed
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5. Shearing Strength Test based on Direct shear test on UD sample by UUTest.

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**FIELD SOIL INVESTIGATION DATA**

**PROJECT: Soil investigation report for phoenix -II  
at CHAS  
BORE HOLE NO.-3**

**JOB CODE:C023101**

**CO-ORDINATES:**

ELEVATION IN METERS	DEPTH IN m BELOW REF.	NATURE OF SAMPLING	DATE OF SAMPLING	DEPTH OF TESTING BELOW REF. LVL.	LVL. OF WATER TABLE	Standard Penetration Test		DIA. OF CASING mm	TIME TAKEN FOR BORING EACH 30cm IN MINUTES	% CORE RECOVERY	% RQD	ROCK CORE DRILLING OBSERVATIONS DESCRIPTION OF CORE ROCK TYPE COLOUR GRAIN SIZE TEXTURE MINERAL COMPOSITION	DETAILS OF WATER SAMPLES	WATER LOSS	SYMBOLIC REPRESENTATION	VISUAL DESCRIPTION OF SOIL WITH IS CLASSIFICATION
						Penetration cm	"N" VALUE									
<b>100.000</b>	0.00							<b>150</b>				<b>Overburden. (0.00-4.20m).</b>	<b>Yellowish</b>			<b>Yellowish medium dense , non- plastic sandy silt with gravels, inorganic soil. (0.00-4.15m). (SM)</b>
	1.00	<b>P</b>		<b>1.50</b>		<b>30</b>	<b>07</b>									
	2.00															
	3.00	<b>P</b>		<b>3.00</b>		<b>30</b>	<b>22</b>									
<b>95.800</b>	4.00															
	5.00	<b>P</b>		<b>4.50</b>		<b>30</b>	<b>43</b>	<b>UN-CASED</b>				<b>Very Dense grayish completely weathered Rocks. (4.20-10.50m).</b>	<b>Grayish</b>			
	6.00	<b>P</b>		<b>6.00</b>		<b>30</b>	<b>54</b>									
	7.00	<b>P</b>		<b>7.50</b>		<b>15</b>	<b>100</b>									
	8.00															
	9.00	<b>P</b>		<b>9.00</b>		<b>03</b>	<b>100</b>									
<b>89.500</b>	10.00															
	11.00															
	12.00															
	13.00															
	14.00															
	15.00															
	16.00															
	17.00															
	18.00															
	19.00															
	20.00															
	21.00															

**NOTES:**

1. Classification of soil as per IS:1498
2. Abbreviation Used: D- Disturbed Sample, C- Rock Core sample, UD- Undisturbed Sample P- SPT SAMPLE
3. Type of Machine Used: Hydraulic Feed
4. Type of Core Barrel used: Double tube
5. Shearing Strength Test based on Direct shear test on UD sample by UUTest.

**INVESTIGATION DONE BY: C.J.R.CONSLTANTCONSULTANT JHARKHAND**



**FIELD SOIL INVESTIGATION DATA**

**PROJECT: Soil investigation report for phoenix -II  
at CHAS  
BORE HOLE NO.-4**

**JOB CODE:C023101**

**CO-ORDINATES:**

ELEVATION IN METERS	DEPTH IN m BELOW REF.	NATURE OF SAMPLING	DATE OF SAMPLING	DEPTH OF TESTING BELOW REF. LVL.	LVL. OF WATER TABLE	Standard Penetration Test		DIA. OF CASING mm	ROCK CORE DRILLING OBSERVATIONS				VISUAL DESCRIPTION OF SOIL WITH IS CLASSIFICATION			
						Penetration cm	"N" VALUE		TIME TAKEN FOR BORING EACH 30cm IN MINUTES	% CORE RECOVERY	% RQD	DESCRIPTION OF CORE ROCK TYPE COLOUR GRAIN SIZE TEXTURE MINERAL COMPOSITION		DETAILS OF WATER SAMPLES	WATER LOSS	SYMBOLIC REPRESENTATION
<b>100.000</b>	0.00							<b>150</b>					<b>Overburden. (0.00-4.20m).</b>	<b>Yellowish medium dense , non- plastic sandy silt with gravels, inorganic soil. (0.00-4.29m). (SM)</b>		
	1.00	<b>P</b>		<b>1.50</b>		<b>30</b>	<b>09</b>									
	2.00															
	3.00	<b>P</b>		<b>3.00</b>		<b>30</b>	<b>21</b>									
<b>95.800</b>	4.00												<b>Very Dense grayish completely weathered Rocks. (4.20-10.50m).</b>			
	5.00	<b>P</b>		<b>4.50</b>		<b>30</b>	<b>42</b>	<b>UN-CASED</b>								
	6.00	<b>P</b>		<b>6.00</b>		<b>30</b>	<b>53</b>									
	7.00	<b>P</b>		<b>7.50</b>		<b>15</b>	<b>100</b>									
	8.00															
	9.00	<b>P</b>		<b>9.00</b>		<b>03</b>	<b>100</b>									
	10.00															
	11.00															
	12.00															
	13.00															
	14.00															
	15.00															
	16.00															
	17.00															
	18.00															
	19.00															
	20.00															
	21.00															

**NOTES:**

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2. Abbreviation Used: D- Disturbed Sample, C- Rock Core sample, UD- Undisturbed Sample P- SPT SAMPLE
3. Type of Machine Used: Hydraulic Feed
4. Type of Core Barrel used: Double tube
5. Shearing Strength Test based on Direct shear test on UD sample by UUTest.

**INVESTIGATION DONE BY: C.J.R.CONSLTANTCONSULTANT JHARKHAND**

**FIELD SOIL INVESTIGATION DATA**

**PROJECT: Soil investigation report for phoenix -II  
at CHAS  
BORE HOLE NO.-5**

**JOB CODE:C023101**

**CO-ORDINATES:**

ELEVATION IN METERS	DEPTH IN m BELOW REF.	NATURE OF SAMPLING	DATE OF SAMPLING	DEPTH OF TESTING BELOW REF. LVL.	LVL. OF WATER TABLE	Standard Penetration Test		DIA. OF CASING mm	ROCK CORE DRILLING OBSERVATIONS				VISUAL DESCRIPTION OF SOIL WITH IS CLASSIFICATION				
						Penetration cm	"N" VALUE		TIME TAKEN FOR BORING EACH 30cm IN MINUTES	% CORE RECOVERY	% RQD	DESCRIPTION OF CORE ROCK TYPE COLOUR GRAIN SIZE TEXTURE MINERAL COMPOSITION		DETAILS OF WATER SAMPLES	WATER LOSS	SYMBOLIC REPRESENTATION	
<b>100.000</b>	0.00	P		1.50		30	09	150					Overburden. (0.00-4.20m).	Yellowish			Yellowish medium dense , non- plastic sandy silt with gravels, inorganic soil. (0.00-4.24m). (SM)
	2.00																
	3.00					30	23										
<b>95.800</b>	4.00																
	5.00	P		4.50		30	41	UN-CASED					Very Dense grayish completely weathered Rocks. (4.20-10.50m).	Grayish			
	6.00	P		6.00		30	51										
	7.00	P		7.50		14	100										
	8.00																
	9.00	P		9.00		04	100										
<b>89.500</b>	10.00																
	11.00																
	12.00																
	13.00																
	14.00																
	15.00																
	16.00																
	17.00																
	18.00																
	19.00																
	20.00																
	21.00																

**NOTES:**

1. Classification of soil as per IS:1498
2. Abbreviation Used: D- Disturbed Sample, C- Rock Core sample, UD- Undisturbed Sample P- SPT SAMPLE
3. Type of Machine Used: Hydraulic Feed
4. Type of Core Barrel used: Double tube
5. Shearing Strength Test based on Direct shear test on UD sample by UUTest.

**INVESTIGATION DONE BY: C.J.R.CONSLTANTCONSULTANT JHARKHAND**

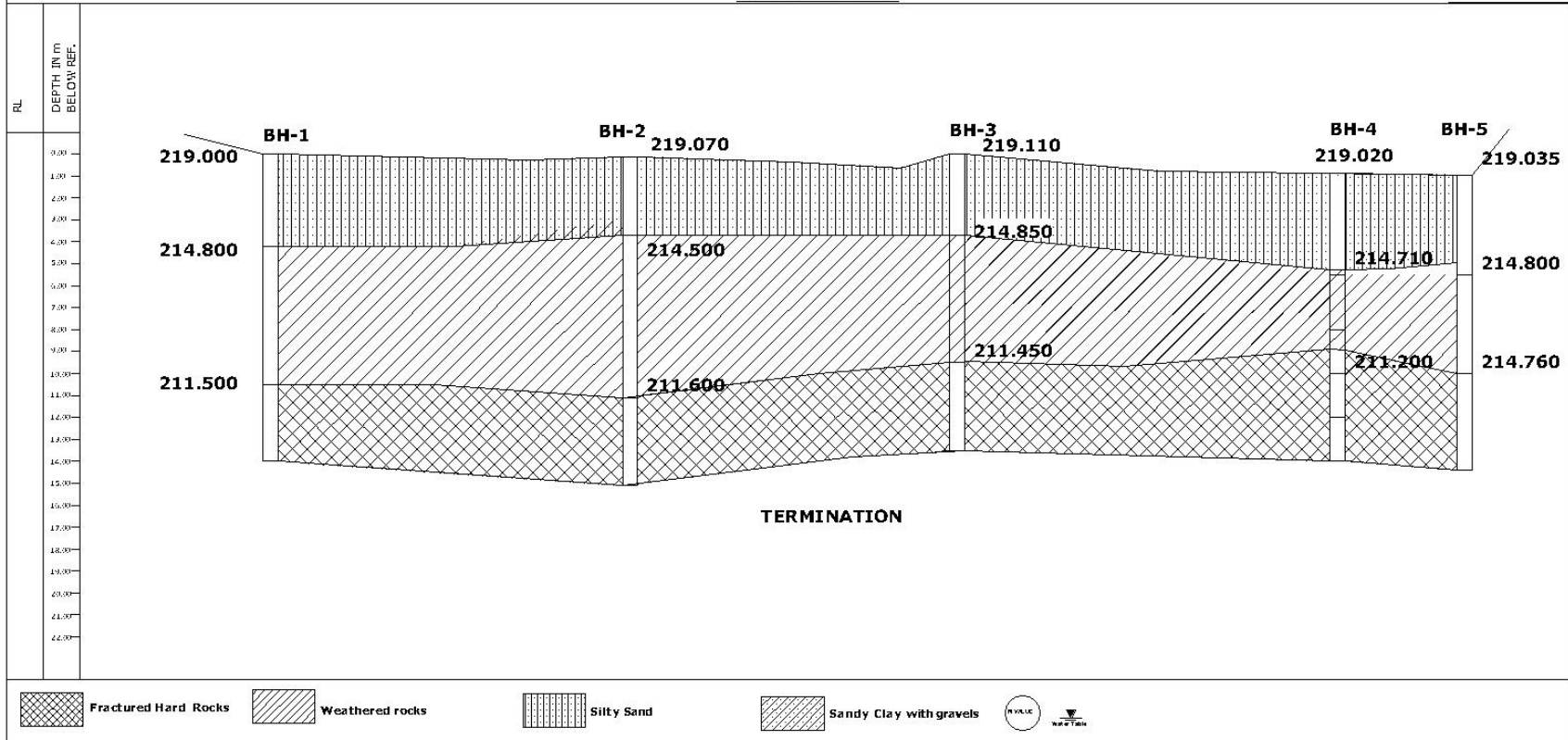
SOIL INVESTIGATION DATA

JOB CODE: S1101215

PROJECT: Soil investigation report for phoenix -II  
at CHAS

IRC: 78-2014  
NOT TO SCALE

SUB-SOIL PROFILE



INVESTIGATION DONE BY: C.J.R. CONSULTANTCONSULTANT JHARKHAND



**S R HOME MAKERS PVT LTD  
PROJ- POENIX-II  
CHAS, BOKARO**