PROPOSED E.W.S -II TYPE HOUSING AT F.P.-63/10 , T.P.-32(RAIYA), DIST.:-RAJKOT.

BLDG.PLAN   GR+1 FL.

COMMERCIAL BLDG.

TERRACE FLOOR PLAN

SYMBOL	DESCRIPTION	MOUNTING HEIGHT
	LIGHTING DISTRIBUTION BOARD(LDB) [J/C-25A DP , O/G-20A ,SP-1,16A,SP-2,10A SP-3]	
	6 A /16 A LOOPED PLUG POINT	1200mm
	6A SWITCH SOCKET OUTLET	ON BOARD
	20A PP AC POINT	1800mm
	15A PP SWITCH SOCKET OUTLET	1200mm
	36 Watt Tube Light	2100mm
	36 Watt Tube Light	2100mm
	36 Watt Tube Light	CEILING
	Ceiling Fan	CEILING
	1X18W BRAKET LIGHT	2100mm
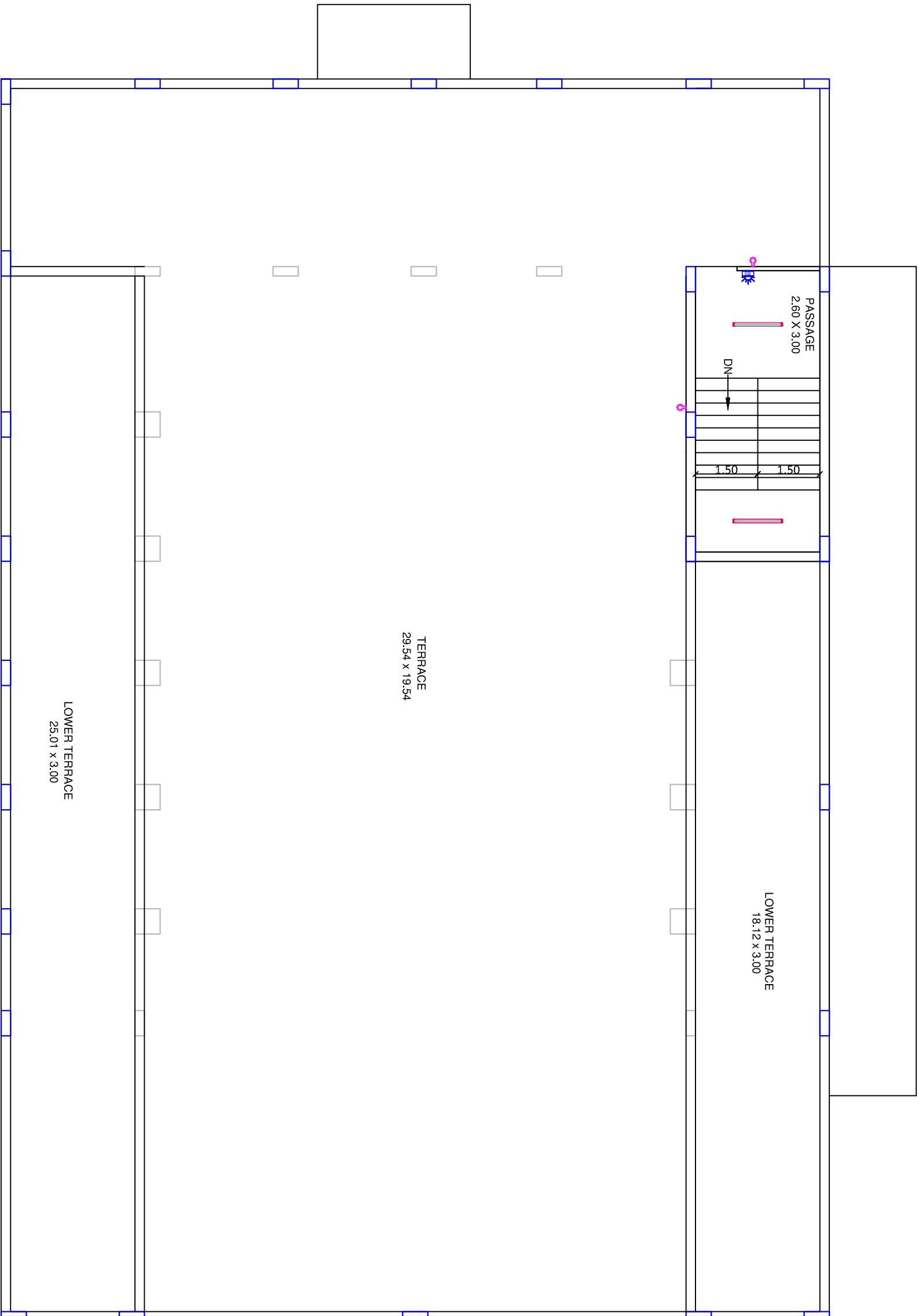
TERRACE FLOOR PLAN

TERRACE
29.54 x 19.54

PASSAGE
2.60 X 3.00

DN

1.50   1.50

LOWER TERRACE
18.12 x 3.00

LOWER TERRACE
25.01 x 3.00

JAYESSH A DALAL
PROJECT MANAGEMENT
CONSULTANT

PROJECT: PROPOSED E.W.S -II TYPE HOUSING AT
F.P.-63/10 , T.P.-32(RAIYA), DIST.:-RAJKOT.

CLIENT: RAJKOT MUNICIPAL CORPORATION

ELECTRICAL DRAWING

SCALE : N.T.S	TYPE :
REVISION :	DATE :

DRAWN BY	CHECK BY	SHEET NO	
SAGUNA		A-EL-28	28Y 19

283

2.2 LHP 2 Jharkhand

2.2.1 Location Map

Site Name	Land Details	Area in Acres
Bajra 485	Mauja – Bajra , Khata 103, Thana No. 140 ,Plot 485	7.13

Figure 17: Google Earth Image of the Site
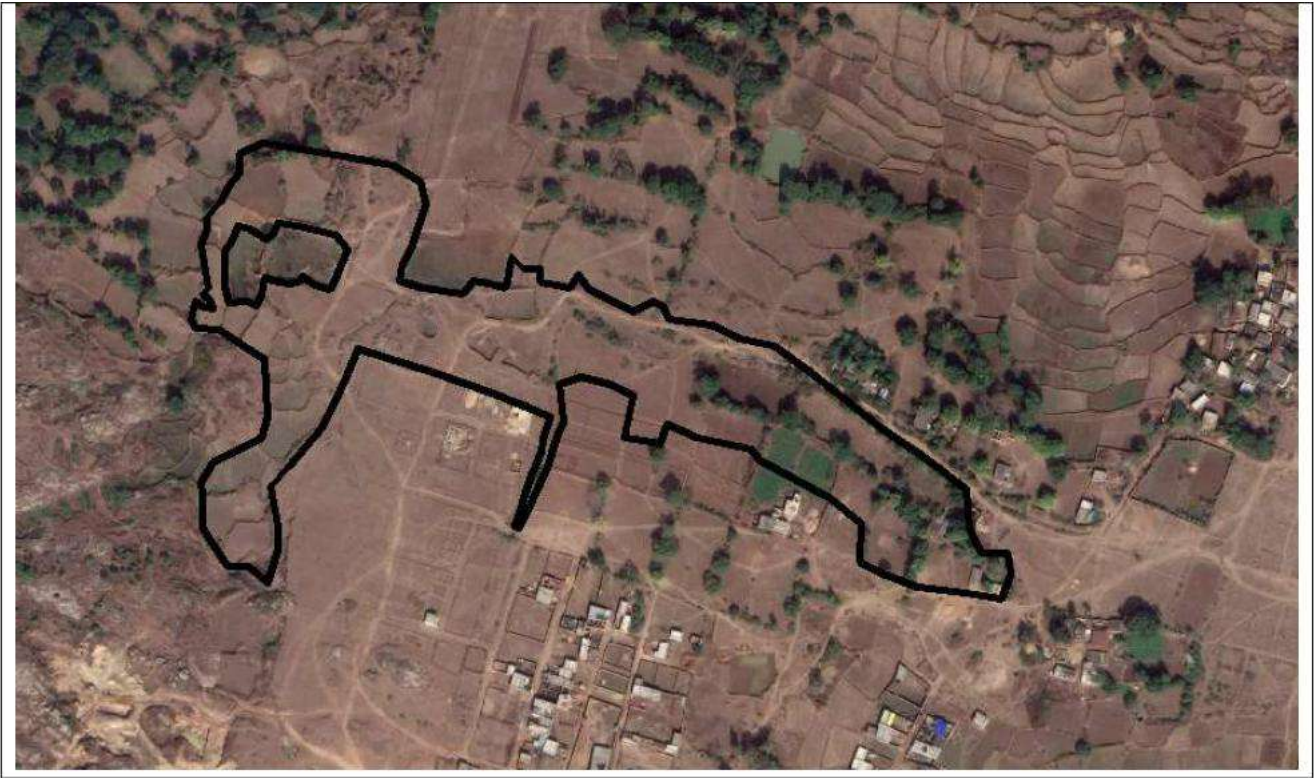
2.2.2 <u>Total Station Survey Map</u>

Plot
No—
486

BAJRA Plot NO.485 — 5.7 acres

Excluded Area — 0.26 acres
Remaining Area — 5.44 acres

686 m
687 m
688 m
690 m
684 m
683 m
682 m
688 m
693
694 m
686 m
685 m
687 m
695 m
696 m
697 m
700 m
699 m
698 m

LEGEND —
Contour Lines
Existing Rock
HT Lines
Excluded Area(0.26 acres)
Plot Boundary(485)
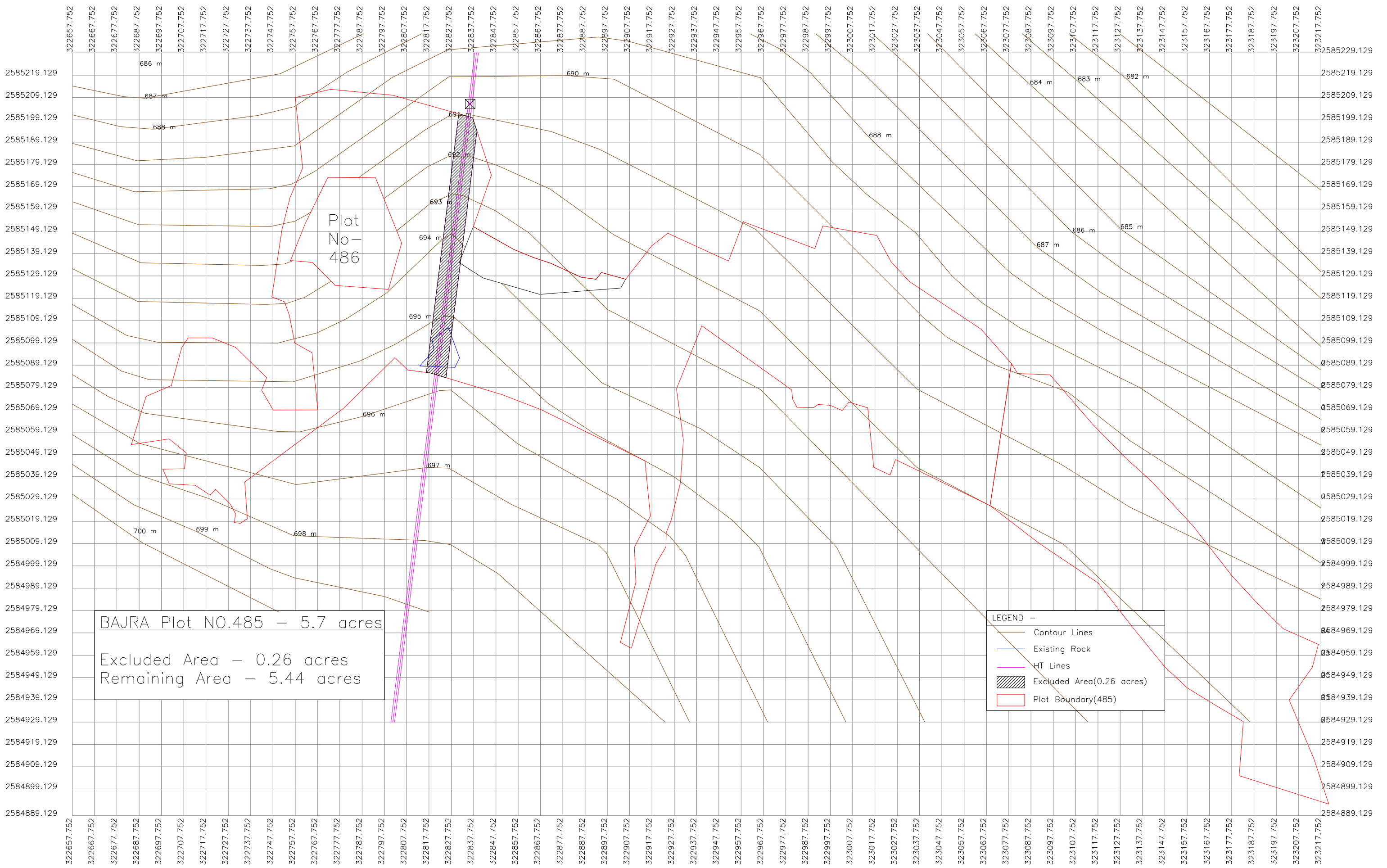
2.2.3   Soil Testing Report

A
REPORT ON
GEOTECHNICAL INVESTIGATION
FOR PREPARATION OF DETAILED PROJECT REPORT
AND PROJECT MANAGEMENT CONSULTANCY
UNDER PRADHAN MANTRI AWAS YOJNA
FOR "CLUSTER I" OF JHARKHAND
PROJECT : PLOT 485 BAJRA (RANCHI)

CONSULTANT / TECHNICAL ADVISOR
DARASHAW ENGINEERING COMPANY PVT. LTD.

SUBMITTED TO:
JHARKHAND URBAN INFRASTRUCTURE DEVELOPMENT COMPANY LTD.
(JUIDCO)
Pragati Sadan (RRDA Building), 3rd Floor,
Kutchery Chowk, Ranchi-834 001, Jharkhand

Executed By:

SPARSH ENGINEERING CO.(P)LTD.
Regd. Office :
Flat No. 504, Midland Apartment (West), Anantpur,
Near Overbridge, Doranda, Ranchi – 834 002

TABLE OF CONTENTS

1. INTRODUCTION :

Soil exploration, investigation and testing of soil and rock samples for the construction of proposed Plot-485 Bajra under Ranchi ULB, was entrusted to SPARSH ENGINEERING CO. (P) LTD. The objective was to ascertain the subsoil characteristics, stratification and other necessary data of underlying subsoil stratum at the site for the construction of proposed building. The sub soil investigation work consisted of the following operations:

(i) Sinking 16 nos. Bore holes varying in depths upto a maximum depth of 4.50m below the existing ground level at various locations including collection of undisturbed / disturbed soil samples and conducting Standard Penetration Tests at specified depths.

(ii) Drilling Sx & Nx size borehole in refusal strata (N > 100) in continuation of, including visual identification, collection and preservation of rock (including boulder) core samples in core boxes and determination of core recovery and RQD.

(iii) Reporting of formation at the site for various layers present at their respective depths along with their thickness including location of ground water table.

(iv) Conducting Laboratory Tests on Soil & Rock Samples collected during Boring/Drilling Operation and recommending type of foundation, depth of foundation, bearing capacity for open foundation and pile capacity for pile foundation.

During sinking of bore holes soil samples in disturbed and undisturbed conditions and rock core samples were collected for laboratory tests. The disturbed samples were subjected to tests to obtain soil index properties. The undisturbed soil samples, however, were used mainly for conducting tests to obtain shear strength parameters as well as consolidation characteristics of the soil representing the strata.

Since the investigation could not cover the regional sub-soil features, due weightage for the variations of sub-surface layers in its horizontal and vertical extent is to be given in selecting design basis. The consultant has prepared this report based on the field work and the samples collected from the site by the site in-charge.

2. FIELD WORK :

Geotechnical Investigation was envisaged in an attempt for optimization in the design of foundation for the proposed structures to be constructed at this site. The entire Investigation programmed had been divided mainly into two parts, (I) Field works & (II) Laboratory Tests.

(i) Field works unfold the sub-surface deposit types and their characteristics

(ii) Laboratory tests part would help determining the relevant physical and geotechnical properties of the sub-surface deposits leading to finalization of foundation depths of the structures and the bearing capacity with particular reference to the sub-surface types and their strength parameters and settlement potentials at the site.

2.1. Boring :

Boring was carried out by auger and rotary method as per IS 1892-1979 to sink nominal 150mm diameter boreholes to desired depths and operated by a team of experienced technicians. Flush jointed seamless casings were used to minimize the boreholes and prevent caving of the soil inside the boreholes. The casing pipes were advanced by turning in order to minimize the disturbance. Undisturbed soil samples were collected at suitable intervals or at change of strata whichever is

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met earlier by open drive sampling method since it was intended to ascertain the subsoil characteristics. The standing water table in each borehole was determined at least 24 hours after the termination of boring work.

For the boreholes when rock was encountered rotary core drilling technique was adopted down to the explored depth. Drilling was done with standard gravity operated rotary drilling machine as per IS : 6926-1973. In this method the hole was advanced by rotating a system, consisting of series of hollow drill rods to the bottom of which was attached a double tube core barrel with a diamond coring bit, means of a diesel operated engine. When the rod with the coring bit was rotated, downward pressure was applied to the system to obtain penetration in the rocky strata and water under pressure was introduced into the bottom of the hole through the hollow drill rods. Water comes up through the annular space between the drill rods and the bore hole and was collected in the water sump, from where it was re-circulated. Water serves the dual function of cooling the bit as it enters the hole and carrying the cuttings from the bottom of the bore hole on its return journey to the surface.

Seamless flush jointed steel casing of Sx and Nx sizes were used to prevent any caving and water loss from holes and they were inserted simultaneously with the advancement of boring / drilling operations.

2.2. Sampling :

Nominal 100mm diameter undisturbed samples were recovered. The sampling equipment used consists of a two-tier assembly of sample tubes 400mm in length fitted at its lower end. The sampling assembly was driven by means of a jarring link to its full length or as far down as was found practicable. After withdrawal the ends of the tubes were sealed with wax at both ends and capped before transmission to the laboratory. At close intervals in depth, disturbed samples were collected both from split spoon sampler after the standard penetration test and from cutting edge for identification and logging purpose. These were tagged and packed in polythene packets and transported to the laboratory. The depth wise locations of all the undisturbed and disturbed samples were used in the preparation of borehole log data and for general identification and classification purposes.

2.3. Standard Penetration Test :

Standard Penetration Tests were conducted in the boreholes at suitable intervals as per IS: 2131-1963 using a split spoon sampler. The split spoon sampler used is of a standard design having an outer diameter of 50.8 mm and inner diameter of 35mm, driving with a monkey weighing 63.5 kgs, falling freely from a height of 75 cm. A record of the number of blows required to penetrate every 15 cm to a maximum depth of 45 cm was made. The first 15 cm of drive was considered to be seating drive and was neglected. To total blows required to effect each 15 cm of penetration was recorded. The "N" values were obtained by counting the number of blows required to drive the spoon 15 cm to 45 cm. On completion of a test the split spoon sampler was opened and soil specimens were preserved in polythene bags for logging purpose.

All the boreholes were sunk with winch. However, raising of hammer for SPT was done manually. Hence there will not be any inertia loss and the efficiency of hammer blows should be considered as 100%.

2.4. Measurement of Water Table :

Level of water was noted when struck in. This is termed as observed water level. Standing water level was noted during initial stages of boring, intermediate stage of boring and after 24 hours of removal of casing was also noted and shown in the profile.

2.5. Measurement of % Core Recovery and RQD :

The total length of all the cores obtained from the barrel was measured and % core recovery was computed at site, while for measuring RQD, core length of size less than 100 mm in length was not taken into account, as per IS: 11315 (Part-11)-1987 .

The Bore logs has been enclosed as Annexure-A .

3. LABORATORY TESTING :

For proper identification and classification of the sub-soil deposits and for deriving adequate information regarding its relevant physical and geotechnical properties at the site under investigation, the soil samples from the sampling tubes were extracted in the laboratory by pushing out the core by using the extractor frame. The core was jacked out in a direction that corresponded with the soil movement within the tube during sampling. In general, the following laboratory tests were conducted on the soil samples collected from the exploratory bore holes and sampling points :

In general following tests were carried out in soil Samples :

(i) Visual Engineering Classification

(ii) Grain size analysis (Sieve as well as Hydrometer)

(iii) Consistency Limits

(iv) Determination of Natural Moisture Content (Water content)

(v) Determination of Specific Gravity

(vi) Determination of Bulk & Dry Unit Weight

(vii)Determination of Shear Parameters such as c & φ value

 The following tests were carried out in Rock Samples:

(i) Dry density and Bulk Density.

(ii) Water content

(iii) Porosity

(iv) Specific Gravity

(v) unconfined Compressive Strength

(vi) coefficient of softening

(vii)Point load strength index test

4. CRITERIA FOR CLASSIFICATION OF ROCK.

A.Rock Classification on the basis of Unconfined compressive strength as per Table.2(IRC-78-2014)

Rock Type	Description	Unconfined compressive Strength (Mpa)
Extremely Strong	Can not be scratched with knife or sharp pick. Breaking of specimen could be done by sledge hammer only.	>200
Very Strong	Can not be scratched with knife or sharp pick. Breaking of specimen required several hard blows of geologist's pick.	100 to 200
Strong	Can be scratched with knife or sharp pick with difficult. Hard blow of hammer required to detach hand specimen.	50 to 100
Moderately Strong	Can be scratched with knife or pick 6mm deep gouges or grooves can be made by hand blow of geologist 's pick. Hand specimen can be detached by moderate blow.	12.5 to 50
Moderately Weak	Can be grooved or gouged 1.5 mm deep by firm pressure of knife or pick point. Can be broken into pieces or chips of about 2.5mm max. size by hard blows of the points of geologist's pick.	5 to 12.5
Weak	Can be grooved or gouged easily with point of pick point. Can be break down in chips to pieces several cm's in size by moderate blows of pick point. Small thin pieces can be broken by finger pressure.	1.25 to 5
Very Weak	Can be carved with knife. Can be broken easily with point of pick. Pieces 25mm or more in thickness can be broken by finger pressure. Can be scratched easily by finger nail.	<1.25

B. **Physically** rock can be classified on following basis:

a) Based on color on examination of rock sample.

b) Based on grain of sample

i, Course Grained, ii. Medium grained, iii. Fine Grained

c) Based upon joint/fracture spacing .

i. Very widely, ii. Widely, iii. Medium, iv. Closely

d) Based upon the condition of weathering .

i. Fresh, ii. Slightly weathered, iii. Moderately weathered, iv. Highly weathered, V. Completely weathered, VI. Residual soil.
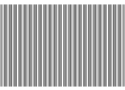
C. Based on **RQD** of Rock sample.
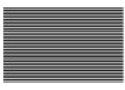
90-100	75-90	50-75	25-50
Excellent	Good	Fair	Very Poor

5. CRITERIA FOR CLASSIFICATION OF SOIL.

Classification and Identification of soil for general engineering Purpose as per IS 1498-1970.

Soil classification including field identification and description.

Division			Sub-Division	Group Letter Symbol	Hatching	Typical Name
COARSE-GRAINED SOIL More than half material is larger than 75 micron IS sieve Size The smallest partical visiable to the naked eyed.	**Gravels** More than half of coarse fraction is larger than 4.75 mm IS sieve size		Clean Gravells (Little or no fines)	GW		Well graded gravels, gravels – sand mixture. Little or no fines.
				GP		Poorely graded gravels, gravels –sand mixture. Little or no fines.
			Gravells with fines (Appreciable amount of fines fines)	GM		Silty gravels, poorely graded gravels -sand silt mixture
				GC		Clayey gravels, poorely graded gravels -sand clay mixture
	Sands More than half of coarse fraction is smaller than 4.75 mm IS sieve size		Clean Sands (Little or no fines)	SW		Well graded (sand-gravel and), little or no fines.
				SP		Poorely graded sand-gravely sand, little or no fines.
			Sands with fines (Appreciable amount of fines fines)	SM		Silty sands, poorely graded sand silt mixture
				SC		Clayey sands, poorely graded sand silt mixture

Division	Sub-Division	Group Letter Symbol	Hatching	Typical Name
FINE-GRAINED SOIL More than half material is smaller than 75 micron IS sieve Size The smallest particle visible to the naked eyed.	Silts and clays with low compressibility and liquid limit less than 35.	ML		Inorganic silts and very fined sands, rock flour, silts or clayey fine sands or clayey silt none to low plasticity.
		CL		Inorganic clays ,gravely clays, sandy clays, silty clays, lean clays of low plasticity.
		OL		Organic silt and organics silty clays of low plasticity.
	Silts and clays with medium compressibility and liquid limit greater than 35 & less than 50.	MI		Inorganic silts, silty or clayey fine sands or clayey silt of medium plasticity.
		CI		Inorganic clays, gravely clays, sandy clays, silty clays, lean clays of medium plasticity.
		OI		Organic silt and organics silty clays of medium plasticity.
	Silts and clays with high compressibility and liquid limit greater than 50.	MH		Inorganic silt of high compessibility, micaceous or diatomicaceous fine sandy or silty soil, plastic silt.
		CH		Inorganics clays with high plasticity, clays.
		OH		Organics clays with of medium to high plasticity .
Highly Organic soil		Pt		Peat and other highly organic soil with very high compressibility.

Classification of Coarse-Grained soil based **on laboratory Testing** of soil sample.

Group Symbol	Laboratory Classification Criteria		
GW	Cu greater than 4. Cc Between 1 and 3.	Uniformity Coefficient (Cu)	$Cu = D_{60}/D_{10}$
GP	Not meeting all gradation requirement for GW.	Coefficient of Curvature (Cc)	$(D_{30})^2$
GM	Plastic Index(Ip) less than 4.		$D_{60} \times D_{10}$
GC	Plastic Index(Ip) greater than7.	60% finer than size	D_{60}
SW	Cu greater than 6. Cc Between 1 and 3.	30% finer than size	D_{30}
SP	Not meeting all gradation requirement for SW.	10% finer than size	D_{10}
SM	Plastic Index(Ip) less than 4.	plastic Index	Ip
SC	Plastic Index(Ip) greater than7.		

6. COMPUTATION OF BEARING CAPACITY:

6.1. Computation of Bearing Capacity for Rocky Strata

A. Based upon the Clause 6.2 of IS:12070-1987

The computation of bearing capacity has been done as per the provision of clause 6.2 of IS:12070-1987.

The safe bearing pressure should be estimated from the equation:

$$qs = qc.Nf;$$

Where,

qs = safe bearing pressure
qc = average uniaxial compressive strength of rock cores,
Nf = empirical coefficient depending on the spacing of discontinuities or as per below table .

$$= (3+S/Bt)/(10\sqrt{(1+300§/s)}$$

Where,

§ = Thickness of discontinuities in cm.
S = Spacing of discontinuities in cm.
Bt = Footing width in cm.

Here, the equation included a factor of safety of 3.

The relation given is valid for a rock mass with a spacing of discontinuities greater than 0.3m, aperture (opening) of discontinuities less than 10mm (15mm if filled with soil or rock debris) and foundation width of greater than 0.3m.

Spacing or Discontinuities (cm)	Empirical coefficient (Nf)
300	0 .4
100-300	0.25
30-100	0.1

B. Based upon Clause no. 5.2 of IS:12070-1987

Net safe bearing capacity depending upon the Classification of rock mass is given in clause no.5.2 of IS:12070-1987 is as given below:

NET SAFE BEARING PRESSURE (qns) BASED ON CLASSIFICATION

MATERIAL	qns(t/sq.m)
Massive crystalline bedrock including granite, diorite, gneiss, trap rock	1000
Foliated rocks such as schist or slate in sound condition.	400
Bedded limestone in sound condition	400
Sedimentary rock, including hard shales and sandstones	250
Soft or broken bed rock(excluding shale),and soft limestone	100
Soft shale	40

C. Based upon Rock Mass Rating(RMR):

As per provision, clause 5.3 of IS:12070-1987,RMR may also be used to give net allowable pressure as per table given below .This will ensure settlement of raft foundation up to 6m thickness to be less than 12mm.

NET SAFE BEARING PRESSURE BASED ON RMR

Classification No.	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(t/sq.m)	600-448	440-288	280-151	145-90-58	55-45-40

The RMR of Rock mass can be determined as defined by Bieniawski & modified by Wickham, which is as given below:

	A.CLASSIFICATIO PARAMETERS AND THEIR RATINGS							
	Parameter		Range of Values					
1	Strength of intact rock material	Point-load strength index	>10Mpa	4-10Mpa	2-4Mpa	1-2Mpa	For this low range- uniaxial compressive test is preferred.	
		Uniaxial comp. strength	>250 Mpa	100-250 Mpa	50-100 Mpa	25-50 Mpa	5-25 Mpa	1-5 Mpa	<1 Mpa
	Rating		15	12	7	4	2	1	0
2	Drill core Quality RQD		90% -100%	75% -90%	50% -75%	25% -50%	<25%	
	Rating		20	17	13	8	3	
3	Spacing of discontinuities		>2m	0.6-2.0m	200-600mm	60-200mm	<60mm	
	Rating		20	15	10	8	5	
4	Condition of discontinuities (see-E)		Very rough surfaces Not continuous	Slightly rough surfaces Separation<1mm	Slightly rough surfaces Separation<1mm	Slickenside surfaces or Gouge <5mm	Soft gouge >5mm thick or Separation >5mm	

			No separation Untethered wall rock	Slightly weathered walls	Highly weathered walls	thick or Separation 1-5mm continuous	continuous
		Rating	30	25	20	10	0
5		Inflow per10m tunnel length(l/m)	None	<10	10 to 25	25-125	>125
	Ground Water	(Joint water press)/ (Major principal σ)	0	<0.1	0.1-0.2	0.2-0.5	>0.5
		General conditions	Completely dry	Damp	wet	Dripping	Flowing
		Rating	15	10	7	4	0
B.	RATING ADJUSTMENT FOR DISCONTINUITY ORIENTATIONS(See F)						
Strike and dip orientations			Very favorable	Favorable	Fair	Unfavorable	Very Unfavorable
Rating		Tunnels & mines	0	-2	-5	-10	-12
		Foundations	0	-2	-7	-15	-25
		Slopes	0	-5	-25	-50	
C.	ROCK MASS CLASSES DETERMINED FROM TOTAL RATING						
Rating			100 -81	80-61	60-41	40-21	<21
Class number			I	II	III	IV	V
Description			Very good rock	Good rock	Fair rock	Poor Rock	Very Poor Rock
D.	MEANING OF ROCK CLASSES						
Class number			I	II	III	IV	V
Average stand-up time			20 yrs for 15m span	1 yrs for 10m span	1 week for 5m span	10hrs for 2.5m span	30min for 1m span
Cohesion of rock mass(kpa)			>400	300-400	200-300	100-200	<100
Frictional angle of rock mass(deg)			>45	35-45	25-35	15-25	<15
E.	Guidelines for classification of Discontinuity condition						
Discontinuity length(persistence) Rating			<1m 6	1-3m 4	3-10m 2	10-20m 1	>20m 0
Separation (aperture) Rating			None 6	<0.1mm 5	0.1-1.0mm 4	1-5mm 1	>5mm 0
Roughness Rating			Very rough 6	Rough 5	Slightly rough 3	Smooth 1	Slicken sided 0
Infilling(gouge) Rating			None 6	Hard filling<5mm 4	Hard filling>5mm 2	Soft filling<5mm 2	Soft filling>5mm 0
Weathering Ratings			Unweathered 6	Slightly weathered 5	Moderately weathered 3	Highly weathered 1	Decomposed 0

Correction for submergence, cavities etc.

As per provision clause no.9.1 of IS:12070-1987;

For getting the allowable bearing pressure the safe bearing pressure should be multiplied with the correction factor, given below according to the geological condition .These correction are not applicable for the classification of RMR method.

Allowance should be made for submerged conditions, cavities and slope given below.