

**Report on
Geotechnical Investigation Work
for
Proposed Coalgas to Methanol Project
at
Sactoria, West Bardhaman (WB)**

**Principal Client
Eastern Coalfield Limited, Kolkata**

**Client
Projects & Development India Limited
PDIL Bhawan, A-14, Sector-1, Noida – 201 301
Dist: Gautam Budh Nagar, (UP), India**

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A. Introduction:

It has been proposed by Eastern Coalfield Limited, Kolkata, to construct Coalgas to Methanol Project at Sactoria, West Bardhaman (WB). A detailed geotechnical investigation was needed for this purpose and Eastern Coalfield Limited has appointed M/s Project & Development India Limited (PDIL), PDIL Bhawan, A-14, Sector 1, Noida – 201 301, Gautam Budh Nagar, UP for consultancy, Design & Engineering and site supervision services. M/s PDIL has entrusted M/s Centre for Advanced Engineering of 59/2, Bangur Avenue, Block-C, Kolkata – 700055, possessing their own **ISO/IEC 17025:2017** accredited laboratory by **NABL** as Geotechnical Consultant for carrying out Geotechnical Investigation and to provide recommendation for foundation system.

Location:

The proposed site is located at **Sactoria, West Bardhaman, West Bengal.**

B Scope of Investigation:

B1. Field Investigation:

Scope of field investigation work was indicated by **Projects & Development India Limited** vide W.O. No. : **GEMC-511687789798019/7200000729**, Dated: **26.04.2022**. It consists of sinking of fourteen (14) boreholes, two (2) Plate Load Test, two (2) Cyclic Plate Load Test, eleven (11) Electrical Resistivity Test and three (3) Static Cone Penetration Test.

B2. Laboratory Test:

Scope of laboratory test consists of determination of Natural Moisture Content, Bulk & Dry Density, Specific Gravity & Void Ratio, Liquid Limit & Plastic Limit, Grain Size Analysis (Sieve & Hydrometer), Unconfined Compression Test, Direct Shear Test, Triaxial Shear Test – (UU,

CU,CD), Consolidation Test, Swelling Pressure Test, Shrinkage Limit

Density Test, Chemical Test on Soil Sample and Chemical Test on Wat

B3. Recommendation of Foundation System:

Scope of work consists of analysis of soil characteristics based on result obtained from field exploration and laboratory test, recommendation of suitable foundation system.

C. Description of Subsoil:

The location of boreholes is shown in the enclosed sketch no: **PC276-0000-0002**. The bore-log indicates the sub-soil condition as encountered during field investigation considering laboratory test results on disturbed and undisturbed soil samples as well as soil samples obtained from split spoon of the Standard Penetration Test (SPT) apparatus. The SPT values (N Values) are indicated in the corresponding bore-log.

Sub- soil profile of the site

The entire area is divided into 18 zones as follows:-

1. Zone 1 – Pump House & Fire Water Storage. (BH-13)
2. Zone 2 – Storage Raw Water. (BH-12 & ERT-9)
3. Zone 3 – Methanol Storage. (ERT-8)
4. Zone 4 – RWTP. (BH-11)
5. Zone 5 – DM Water Plant. (ERT-7)
6. Zone 6 – Plant Methanol. (BH-10, PLT-1, SCPT-01)
7. Zone 7 – Office Maintenance Plant (ERT-11)
8. Zone 8 – ETP (ERT-6)
9. Zone 9 – Building Technical. (ERT-10)
10. Zone 10 – Building Administrative. (BH-14)
11. Zone 11 – Cooling Tower for Methanol Plant & Gasification. (BH-9 & SCPT-02)
12. Zone 12 – Air Separation Unit. (BH-08, CPLT-02 & ERT-5)
13. Zone 13 – Gasification Plant. (BH-6, CPLT-1, SCPT-03 & ERT-1)
14. Zone 14 – Gas Cleaning and Purification Plant. (BH-7)
15. Zone 15 – Steam Generation Plant. (BH-1, PLT-2 & ERT-2)
16. Zone 16 – Ash/ Slag Storage. (BH-2, BH-3 & ERT-3)
17. Zone 17 – Fire Station (BH-5)
18. Zone 18 – Truck Parking Area with Driver Rest Room. (BH-4 & ERT-4)

D. Field Investigation:

D1. Boring:

The exploratory boreholes were sunk using shell and auger/wash boring method. Casing was used up to a depth of 3.000 metres to protect the sides of boreholes against collapse. The boring was conducted as per the guidelines and provisions of IS: 1892. Standard Penetration Test was conducted in the boreholes at all the strata encountered. Undisturbed soil samples were collected from the boreholes. Disturbed samples were collected from the split spoon sampler at all the test depths and test location of Standard Penetration Test and from different typical strata.

The termination depth of the borehole and depth of water table as observed in the boreholes are indicated below:

Table 1

Bore Hole No.	Termination Depth below EGL (Mtr)	Depth of Water Table Below EGL (Mtr.) Explored during the period May 2022.
BH-1	15.000	2.600
BH-2	15.000	2.700
BH-3	15.000	2.500
BH-4	15.000	1.900
BH-5	15.000	2.300
BH-6	15.000	2.200
BH-7	15.000	1.200
BH-8	15.000	1.600
BH-9	15.000	1.900
BH-10	15.000	2.300
BH-11	15.000	1.670
BH-12	15.000	1.800
BH-13	15.000	2.100
BH-14	15.000	1.850

D.2. Sampling:

D.2.1 Undisturbed Sampling:

The collection of undisturbed soil sample was done, wherever possible depending on existing soil strata, as per the guidelines of IS: 1892 – Code of Practice for site Investigation for Foundation. The sampling system used was an assembly of sampling tube of 100 mm diameter and 450 mm long, connected with a jarring link. The specification of the tube is as per the provision of IS: 2132, Code of practice for thin walled sampling of soils.

After the samples are collected within the tubes, the tubes are taken out of the borehole. Both the ends of the tube were properly sealed with wax, properly labeled depth-wise and borehole-wise, capped and thus made ready for onward transmission for testing the soil samples in the laboratory.

D.2.2 Disturbed Sampling:

Disturbed samples were collected from cutting shoe and split spoon of the SPT sampler. These samples were collected in polythene bags, properly labeled depth-wise and borehole-wise and were used in the preparation of bore log as well as for general identification & classification purpose of soil as per IS: 1498. The same were then packed and sent to the laboratory for further test.

D3. Standard Penetration Test:

Standard Penetration Test was conducted as per the guidelines and provisions of IS: 2131- Method for standard penetration test for soil, in the borehole at regular intervals or at change of strata with the SPT sampler. In this test, the sampler was driven by falling a weight of 63.5 Kg hammer through a height of 750 mm. The sampler was driven through a depth of 450mm. The number of blows for every 150mm. of penetration was recorded. The first 150 mm. was taken as seating drive, the number of blows for subsequent 300 mm. is the **SPT N-value**. The observed N-values are indicated in the corresponding bore log.

D4. Recording of Ground Water Table:

The field exploration was carried out during the month of October and December 2019.

The recorded ground water table is indicated in Table 1 of the report.

E. Laboratory Testing:

Laboratory tests were conducted on the soil samples collected from . . . were conducted as per provisions and guidelines of Bureau of Indian Standard laid down in their different codes and as per requirements of the client.

All disturbed and undisturbed samples were opened up in the laboratory for further identification & classification of soil samples. Various tests were conducted for ascertaining the following engineering and physical properties of the sub-soil:

-  Natural Moisture Content
-  Bulk & Dry Density
-  Specific Gravity & Void Ratio.
-  Liquid Limit & Plastic Limit.
-  Grain Size Analysis (Sieve & Hydrometer)
-  Unconfined Compressive Strength.
-  Direct Shear Test
-  Tri-axial Shear Strength (UU, CU & CD)
-  Consolidation Properties.
-  Swelling Pressure.
-  Shrinkage Limit.
-  Modified Proctor Density Test.
-  Chemical Test on Soil Sample.
-  Chemical Test of Water Sample.

F. Discussion and Recommendation:-

F1. Foundation system:

In general the top soil is very stiff to hard silty clay/ clayey silt, thus this layer is suitable for resting shallow foundation. Location wise bearing capacity has been calculated for different size and shapes of foundation resting at different depth and the same has been presented in respective chapters.

F2. Ground Development:

Ground improvement is not suggested in the report as the founding r support foundation for medium to heavily loaded structures.

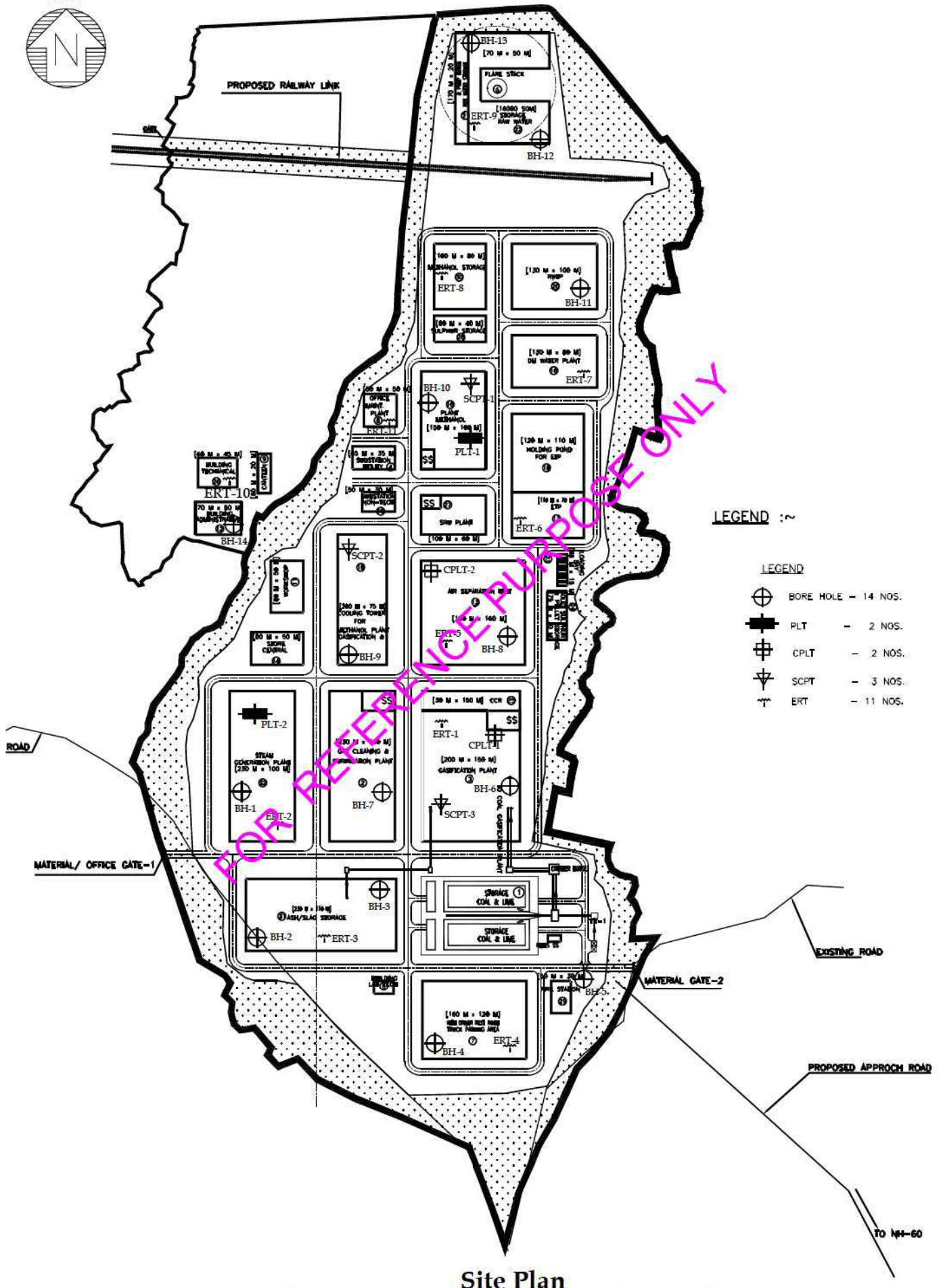
F3. Pile Foundation:

Bored Cast-in-situ Pile foundations have been recommended for structures with heavy load on foundations. Recommended pile capacities have been indicated for different zones in their corresponding chapters.

Chemical tests were performed on a few soil samples and water samples for determining the pH value, Sulphate & Chloride content. It is seen that the values are on a safe side and so no precaution will be required for foundation concrete. Either **Ordinary Portland cement** or **Portland slag cement** or **Portland Pozzolana cement** can be used for the purpose.

FOR REFERENCE PURPOSE ONLY

PLANT
NORTH



LEGEND ~

LEGEND

- BORE HOLE - 14 NOS.
- PLT - 2 NOS.
- CPLT - 2 NOS.
- SCPT - 3 NOS.
- ERT - 11 NOS.

ZONE-1

PUMP HOUSE
AND FIRE WATER
STORAGE

FOR REFERENCE PURPOSE ONLY

One (1) borehole was sunk in this area, viz borehole mark the general sub soil profile it has been observed that the top to hard brownish/ yellowish grey silty clay/ clayey silt with sand and traces of morrum. The second layer as encountered up to the explored depth is very dense reddish brown silty sand.

Discussion and Recommendation:

Based on the sub-soil condition, shallow foundation has been recommended for foundation system of medium to heavily loaded structures. Bearing capacities for different size and shapes of foundations are indicated in the Table-2A (Zone-1).

Pile Foundation has also been recommended for foundation of heavily loaded structures. Pile Capacities for different dia of pile are indicated in the Table-2B (Zone-1). It is further recommended to carry out initial pile load test for load under compression, pull-out and horizontal shear, in order to confirm the recommended pile capacities and to take corrective measures, if required.

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Table-2A (Zone-1).

ALLOWABLE BEARING CAPACITY FROM SHEAR SETTLEMENT CRITERIA

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Q _{net} safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
ISOLATED SQUARE FOOTINGS	1.00	1.00	1.00	56.1	24.20	56	56	56
	2.50	2.50	1.00	50.5	66.81	18	30	50
	5.00	5.00	1.00	48.6	136.51	8	14	26
	7.50	7.50	1.00	48.0	206.14	3	9	17
	10.00	10.00	1.00	47.7	275.72	4	6	12
	1.00	1.00	1.50	60.8	24.74	60	60	60
	2.50	2.50	1.50	52.3	64.92	20	32	52
	5.00	5.00	1.50	49.5	134.96	9	14	27
	7.50	7.50	1.50	48.6	204.72	5	9	17
	10.00	10.00	1.50	48.1	274.08	4	7	13
	1.00	1.00	2.00	65.4	25.62	63	65	65
	2.50	2.50	2.00	54.2	62.81	21	34	54
	5.00	5.00	2.00	50.5	133.56	9	15	28
	7.50	7.50	2.00	49.2	203.22	6	9	18
	10.00	10.00	2.00	48.6	272.95	4	7	13
	1.00	1.00	3.00	74.8	28.00	66	74	74
	2.50	2.50	3.00	57.9	57.64	25	40	57
	5.00	5.00	3.00	52.3	129.77	10	16	30
	7.50	7.50	3.00	50.5	200.34	6	10	18
	10.00	10.00	3.00	49.5	269.92	4	7	13

ALLOWABLE BEARING CAPACITY FROM SHEAR SETTLEMENT CRITERIA

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Q _{net} safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
ISOLATED RECTANGULAR FOOTINGS	1.50	1.00	1.00	48.9	27.38	44	48	48
	3.75	2.50	1.00	44.0	72.28	15	24	44
	7.50	5.00	1.00	42.4	146.17	7	11	21
	11.25	7.50	1.00	41.8	219.55	4	7	14
	15.00	10.00	1.00	41.5	292.87	3	5	10
	1.50	1.00	1.50	53.0	25.38	52	53	53
	3.75	2.50	1.50	45.6	71.21	16	25	45
	7.50	5.00	1.50	43.2	145.43	7	11	22
	11.25	7.50	1.50	42.4	219.26	4	7	14
	15.00	10.00	1.50	42.0	292.99	3	5	10
	1.50	1.00	2.00	57.0	22.67	57	57	57
	3.75	2.50	2.00	47.3	70.03	16	27	47
	7.50	5.00	2.00	44.0	144.56	7	12	22
	11.25	7.50	2.00	42.9	218.37	4	7	14
	15.00	10.00	2.00	42.4	292.35	3	5	10
	1.50	1.00	3.00	65.2	32.71	49	65	65
	3.75	2.50	3.00	50.5	66.58	18	30	50
	7.50	5.00	3.00	45.6	142.42	8	12	24
	11.25	7.50	3.00	44.0	216.84	5	8	15
	15.00	10.00	3.00	43.2	290.86	3	5	11

ALLOWABLE BEARING CAPACITY FROM SHEAR SETTLEMENT CRITERIA

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Q _{net} safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
CONTINUOUS STRIP FOOTINGS		1.00	1.00	43.1	47.58	22	36	43
		1.50	1.00	40.7	69.11	14	23	40
		2.00	1.00	39.5	90.55	10	17	32
		2.50	1.00	38.8	112.00	8	13	25
		1.00	1.50	46.7	49.58	23	37	46
		1.50	1.50	43.1	71.37	15	24	43
		2.00	1.50	41.3	92.93	11	17	33
		2.50	1.50	40.2	114.34	8	14	26
		1.00	2.00	50.3	51.29	24	39	50
		1.50	2.00	45.5	73.43	15	24	45
		2.00	2.00	43.1	95.16	11	18	33
		2.50	2.00	41.7	116.85	8	14	26
		1.00	3.00	57.5	53.77	26	42	57
		1.50	3.00	50.3	76.93	16	26	49
		2.00	3.00	46.7	99.17	11	18	35
		2.50	3.00	44.6	121.21	9	14	27

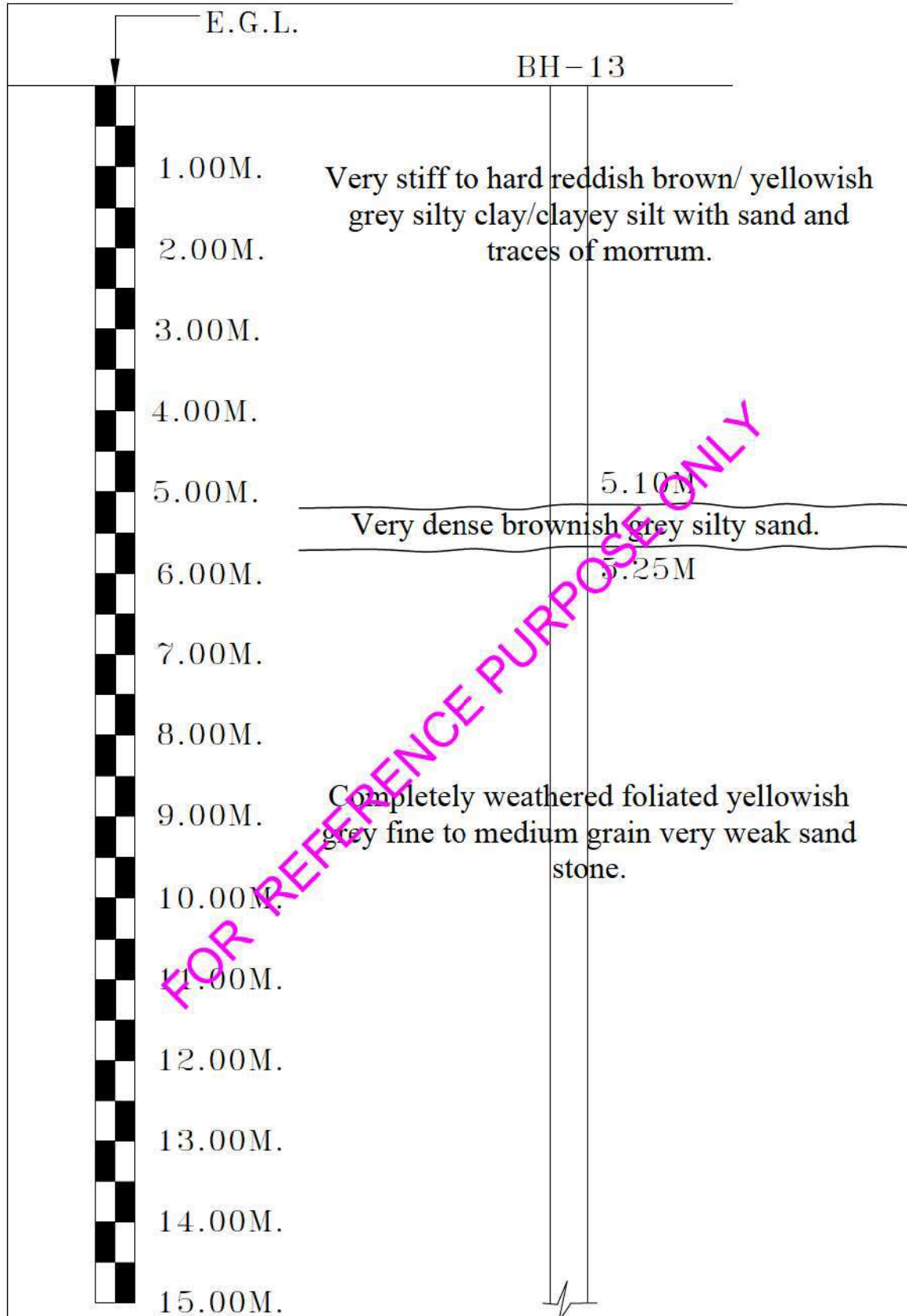
Table-2B (Zone-1).
Recommended Pile Capacity

Sl.No	Pile Dia , D	Total Length of Pile, L	Cut-off Level	Recommended Pile Capacity in Compression	Recommended Pile Capacity in Pull-Out	Recommended Pile Capacity in Horizontal Shear
	Mtr	Mtr.	Mtr.	T	T	T
1	0.600	10.000	2.000	49	29	6
2	0.750	10.000	2.000	72	38	8
3	1.000	10.000	2.000	113	51	11
4	1.500	10.000	2.000	220	76	16

FOR REFERENCE PURPOSE ONLY

BORE LOG SHEET		Centre for Advanced Engineering						Bore Hole
Project: SOIL PDIL ECL SANCTORIA								Job No.:
Co-ord:	E.G.L.:119.354	Unit: Pump House & Fire Water Storage.						Bore Hole
Type of Boring	Shell & Auger	FIELDTEST	NOS.	SAMPLES	NOS.	SAMPLES	NOS.	Commenc
Depth of Boring	5.250 M.	SPT	3	UDS	2	WS		Completed on : 24.05.2022
Type of Drilling		DCPT		DS	5	RCS	7	Water Struck At : 2.20M
Depth of Drilling	9.750 M.	VST		SCPT				Standing Water Table : 2.10M

D E S C R I P T I O N	SYMBOL	DEPTH	N-V A L U E	S A M P L E	
				NO.	DEPTH
Very stiff to hard brownish/ yellowish grey silty clay/clayey silt with sand and traces of morrum.		01 02 03 04	N = 37	DS1	0.50 M
				DS2	1.00 M
				SPT1	1.50-1.95M
				DS3	1.50-1.95M
				UDS1	2.00-2.45M
Very dense reddish brown silty sand.		05	N = 55	SPT2	3.00-3.45M
				DS4	3.00-3.45M
Completely weathered foliated yellowish grey fine to medium grain very weak sand stone.		06 07 08 09 10 11 12 13 14 15	N > 100	UDS2	4.50-4.95M
				SPT3	5.10-5.25M
				DS5	5.10-5.25M
				RUN1	5.25-6.50M TCR - 27% RQD - NIL
				RUN2	6.50-8.00M TCR - 41% RQD - NIL
				RUN3	8.00-9.50M TCR - 48% RQD - NIL
				RUN4	9.50-11.00M TCR - 57% RQD - NIL
				RUN5	11.00-12.50M TCR - 57% RQD - NIL
				RUN6	12.50-14.00M TCR - 62% RQD - NIL
				RUN7	14.00-15.00M TCR - 67% RQD - NIL
Termination Depth 15.000 Mtr.					



Termination depth 15.000 M.

Sub-Soil Profile through BH-13

Sketch No.-SK/PDIL/	Pump House & Fire Water Storage	1678	02	12 of 13
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SUMMARY OF LABORATORY TEST RESULTS

Table-4

Project: Geotechnical Investigation Work for Proposed Coalgas to Methanol Project at Sactoria, West Bardhaman (WB)

Layer No.	Description of layer	Bore Hole No.	Depth Meter	Sample Type - UD/D/ DN	SPT VALUE (N)	Atterberg Limits			Bulk Density in gm/cc	Water Content in %	Specific Gravity	Dry Density in gm/cc	Unconfined Test in Kg/sqcm	Shear Test		Pressure (Kg/sqcm)	Co-eff. of volume compressibility in sqcm/kg	Swelling Pressure in kg/sqcm	Grading				Modified Proctor Density	
						LL	PL	SL						Type of Test	Cohesion in kg/sqcm	Friction angle in degree			Gravel (>4.75 mm)	Sand (0.075 - 4.75 mm)	Silt (0.002 - 0.075 mm)	Clay (< 0.002 mm)	MDD	OMC
						%	%	%						UU/cu/ DS	C	φ								
I	Very stiff to hard brownish/ yellowish grey silty clay/clayey silt with sand and traces of morrum.	13	0.50	D						m	G	γ _d	q _u						1	39	41	19	1.81	12.59
		13	1.00	D		44	22	11											2	33	45	20	1.79	13.71
		13	1.50	DN	37	41	20	9											4	35	43	18		
														UU	1.75	0	0.00-0.10	0.0451						
																	0.10-0.20	0.0392						
																	0.20-0.40	0.0328						
																	0.40-0.80	0.0257	0	37	45	18		
		13	2.00	UD		43	21	10	1.91	16.23	2.68	1.64	2.44		0.14	14		0.000						
																	0.80-1.60	0.0204						
																	1.60-3.20	0.0114						
II	Very dense reddish brown silty sand	13	3.00	DN	55						2.57								0	39	44	17		
		13	4.50	UD		42	22	11		17.9	2.66			DS	0.13	32			0	40	45	15		
		13	5.10	DN	>100						2.65								0	85	11	4		

ZONE-2

STORAGE RAW
WATER

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Total one (1) borehole was sunk in this area, viz borehole the general sub soil profile it has been observed that the hard reddish brown/ yellowish grey silty clay/ clayey silt v morrumand the second layer as encountered up to the e dense brownish grey silty sand.

In addition the following field tests have been carried out at this zone and results are being indicated in this chapter.

1. Electrical Resistivity Test:

One (1) electrical resistivity tests has been carried out at this zone marked as ERT-9.

Discussion and Recommendation:

Based on the sub-soil condition, shallow foundation has been recommended for foundation system of medium to heavily loaded structures. Bearing capacities for different size and shapes of foundations are indicated in the Table-2A (Zone-2).

Pile Foundation has also been recommended for foundation of heavily loaded structures. Pile Capacities for different dia of pile are indicated in the Table-2B (Zone-2). It is further recommended to carry out initial pile load test for load under compression, pull-out and horizontal shear, in order to confirm the recommended pile capacities and to take corrective measures, if required.

FOR REFERENCE PURPOSE ONLY

Table-2A (Zone-2).

**ALLOWABLE BEARING CAPACITY FROM SHEAR
SETTLEMENT CRITERIA**

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Q _{net} safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
ISOLATED SQUARE FOOTINGS	1.00	1.00	1.00	36.8	19.39	36	36	36
	2.50	2.50	1.00	33.1	53.47	15	24	33
	5.00	5.00	1.00	31.9	109.40	7	11	21
	7.50	7.50	1.00	31.5	165.17	4	7	14
	10.00	10.00	1.00	31.3	220.90	3	5	10
	1.00	1.00	1.50	39.9	19.82	39	39	39
	2.50	2.50	1.50	34.4	52.14	16	26	34
	5.00	5.00	1.50	32.5	108.18	7	12	22
	7.50	7.50	1.50	31.9	164.05	4	7	14
	10.00	10.00	1.50	31.5	219.83	3	5	10
	1.00	1.00	2.00	43.0	20.56	43	43	43
	2.50	2.50	2.00	35.6	50.37	17	28	35
	5.00	5.00	2.00	33.1	106.88	7	12	23
	7.50	7.50	2.00	32.3	162.89	4	7	14
	10.00	10.00	2.00	31.9	218.74	3	5	10
	1.00	1.00	3.00	49.1	22.44	49	49	49
	2.50	2.50	3.00	38.1	46.31	20	32	38
	5.00	5.00	3.00	34.4	104.21	8	13	24
	7.50	7.50	3.00	33.1	160.32	5	8	15
	10.00	10.00	3.00	32.5	216.36	3	6	11

ALLOWABLE BEARING CAPACITY FROM SHEAR SETTLEMENT CRITERIA

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Q _{net} safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
ISOLATED RECTANGULAR FOOTINGS	1.50	1.00	1.00	32.1	21.98	32	32	32
	3.75	2.50	1.00	28.9	58.08	12	19	28
	7.50	5.00	1.00	27.8	117.25	5	9	17
	11.25	7.50	1.00	27.5	176.71	3	6	11
	15.00	10.00	1.00	27.3	235.70	2	4	8
	1.50	1.00	1.50	34.8	20.38	34	34	34
	3.75	2.50	1.50	30.0	57.32	13	20	30
	7.50	5.00	1.50	28.4	116.97	6	9	18
	11.25	7.50	1.50	27.8	175.88	3	6	11
	15.00	10.00	1.50	27.6	235.55	2	4	8
	1.50	1.00	2.00	37.5	18.25	37	37	37
	3.75	2.50	2.00	31.0	56.15	13	22	31
	7.50	5.00	2.00	28.9	116.16	6	9	18
	11.25	7.50	2.00	28.2	175.61	4	6	12
	15.00	10.00	2.00	27.8	234.50	2	4	8
	1.50	1.00	3.00	42.8	26.27	40	42	42
	3.75	2.50	3.00	33.2	53.55	15	24	33
	7.50	5.00	3.00	30.0	114.63	6	10	19
	11.25	7.50	3.00	28.9	174.24	4	6	12
	15.00	10.00	3.00	28.4	233.93	3	4	9

ALLOWABLE BEARING CAPACITY FROM SHEAR SETTLEMENT CRITERIA

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Q _{net} safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
CONTINUOUS STRIP FOOTINGS		1.00	1.00	28.3	38.55	18	28	28
		1.50	1.00	26.7	55.94	11	19	26
		2.00	1.00	26.0	73.54	8	14	26
		2.50	1.00	25.5	90.82	5	11	21
		1.00	1.50	30.7	40.22	19	30	30
		1.50	1.50	28.3	57.82	12	19	28
		2.00	1.50	27.1	75.24	9	14	27
		2.50	1.50	26.4	92.65	7	11	21
		1.00	2.00	33.1	41.64	19	31	33
		1.50	2.00	29.9	59.53	12	20	29
		2.00	2.00	28.3	77.09	9	14	27
		2.50	2.00	27.4	94.73	7	11	21
		1.00	3.00	37.8	43.62	21	34	37
		1.50	3.00	33.1	62.46	13	21	33
		2.00	3.00	30.7	80.44	9	15	28
		2.50	3.00	29.3	98.25	7	11	22

Table-2B (Zone-2).

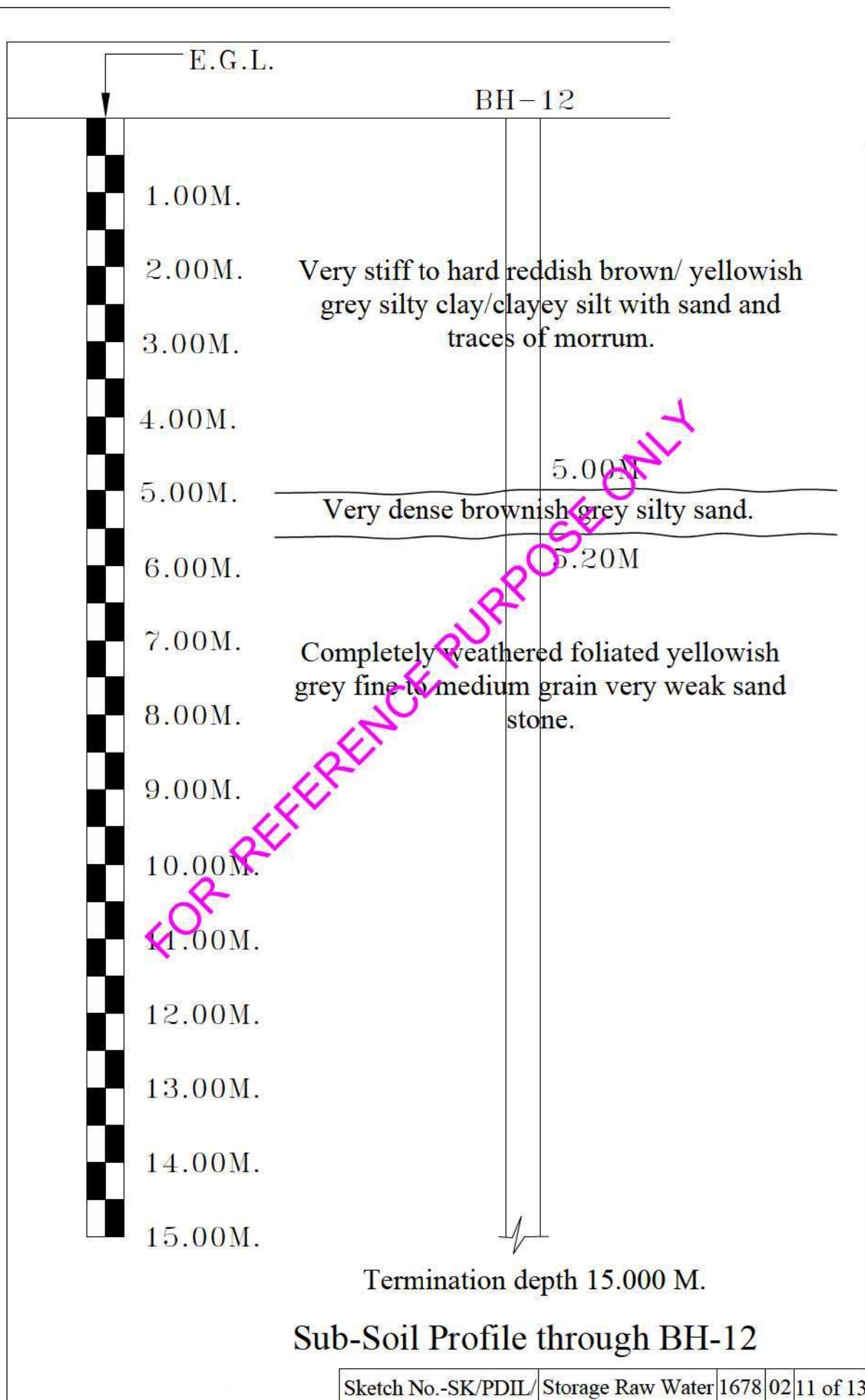
Recommended Pile Capacity

Sl.No	Pile Dia , D	Total Length of Pile, L	Cut-off Level	Recommended Pile Capacity in Compression	Recommended Pile Capacity in Pull-Out	Recommended Pile Capacity in Horizontal Shear
	Mtr	Mtr.	Mtr.	T	T	T
1	0.600	10.000	2.000	47	27	6
2	0.750	10.000	2.000	70	36	8
3	1.000	10.000	2.000	110	48	11
4	1.500	10.000	2.000	216	72	16

FOR REFERENCE PURPOSE ONLY

BORE LOG SHEET		Centre for Advanced Engineering						Bore Hol
								Job No.:
Project: SOIL PDIL ECL SANCTORIA								
Co-ord:		E.G.L.:118.411	Unit: Storage Raw Water				Bore Hol	
Type of Boring	Shell & Auger	FIELDTEST	NOS.	SAMPLES	NOS.	SAMPLES	NOS.	Commenc
Depth of Boring	5.200 M.	SPT	4	UDS	2	WS		Completed on : 24.05.2022
Type of Drilling		DCPT		DS	6	RCS	7	Water Struck At : 1.90M
Depth of Drilling	9.800 M.	VST		SCPT				Standing Water Table : 1.80M

D E S C R I P T I O N	SYMBOL	DEPTH	N-V A L U E	S A M P L E	
				NO.	DEPTH
Very stiff to hard reddish brown/ yellowish grey silty clay/clayey silt with sand and traces of morrum.		01	N = 18	DS1	0.50 M
				DS2	1.00 M
				SPT1	1.50-1.95M
				DS3	1.50-1.95M
				UDS1	2.00-2.45M
Very dense brownish grey silty sand.		02	N = 39	SPT2	3.00-3.45M
				DS4	3.00-3.45M
				UDS2	4.00-4.45M
Completely weathered foliated yellowish grey fine to medium grain very weak sand stone.		03	N = 46	SPT3	4.50-4.95M
				DS5	4.50-4.95M
				SPT4	5.00-5.20M
				DS6	5.00-5.20M
		04	N > 100	RUN1	5.20-6.50M TCR - 30% RQD - NIL
				RUN2	6.50-8.00M TCR - 35% RQD - NIL
				RUN3	8.00-9.50M TCR - 42% RQD - NIL
				RUN4	9.50-11.00M TCR - 53% RQD - NIL
				RUN5	11.00-12.50M TCR - 59% RQD - NIL
				RUN6	12.50-14.00M TCR - 68% RQD - NIL
				RUN7	14.00-15.00M TCR - 59% RQD - NIL
Termination Depth 15.000 Mtr.		15			



SUMMARY OF LABORATORY TEST RESULTS

Table-4

Project: Geotechnical Investigation Work for Proposed Coalgas to Methanol Project at Sactoria, West Bardhaman (WB)

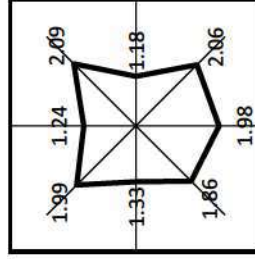
Layer No.	Description of layer	Bore Hole No.	Depth	Sample Type - UD/D/ DN	SPT VALUE (N)	Atterberg Limits			Bulk Density in gm/cc	Water Content In %	Specific Gravity	Dry Density in gm/cc	Unconfined Test in Kg/sqcm	Shear Test			Pressure (Kg/sqcm)	Co-eff. of volume compressibility in sqcm/kg	Swelling Pressure in kg/sqcm	Grading				Modified Proctor Density	
						LL	PL	SL						Type of Test	Cohesion in kg/sqcm	Friction angle in degree				Gravel (> 4.75 mm)	Sand (0.075 - 4.75 mm)	Silt (0.002 - 0.075 mm)	Clay (< 0.002 mm)	MDD	OMC
			Meter			%	%	%	γ_b	m	G	γ_d	q_u	UU/CU/ DS	C	ϕ				%	%	%	gm/cc	%	
		12	0.50	D																0	29	49	22	1.79	12.75
		12	1.00	D		45	20	11												0	32	49	19		
		12	1.50	DN	18						2.68									0	35	50	15		
														UU	1:15	0	0.00-0.10	0.0439							
																	0.10-0.20	0.0391							
																	0.20-0.40	0.0342	0.000	0	32	52	16		
		12	2.00	UD		46	21	13	1.94	14.29	2.69	1.70	2.24	CU	0.12	15	0.40-0.80	0.0288							
																	0.80-1.60	0.0221							
														CD	0.04	24	1.60-3.20	0.0132							
		12	3.00	DN	39	55	24	10												0	33	48	19		
														UU	1.57	0	0.00-0.10	0.0399							
																	0.10-0.20	0.0359							
		12	4	UD		47	22	12	1.92	12.29	2.67	1.71	2.99	CU	0.11	16	0.20-0.40	0.0301	0.000	0	31	55	14		
																	0.40-0.80	0.0242							
														CD	0.03	28	0.80-1.60	0.0179							
		12	4.50	DN	46	44	21	11									1.60-3.20	0.0116		0	30	48	22		
II	Very dense brownish grey silty sand	12	5.00	DN	>100				1.80					DS	0.15	33				0	76	18	6		

Table ERT - 9

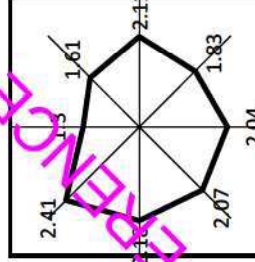
Project : Geo-Technical investigation work for proposed coalgas to methanol project at Sanctoria, West Bardhaman (W.B.)
 Location : Storage Raw Water
 Client : Project & Development India Limited
 Test Date : 03-06-2022
 Instrument : Metravi ERT-1501, SL. No.: 10109809

Sl. No.	Electrode Spacing 's' m	Measured Resistance "R" (Ω)								Apparent Resistivity "ρ" (Ω -m")							
		North	North-East	East	East-South	South	South-West	West	North-West	North	North-East	East	East-South	South	South-West	West	North-West
1	1.0	1.24	2.09	1.18	2.06	1.98	1.86	1.33	1.99	7.79	13.13	7.41	12.94	12.44	11.69	8.36	12.50
2	2.0	1.3	1.61	2.11	1.83	2.04	2.07	2.18	2.41	16.34	20.23	26.52	23.00	25.64	26.01	27.39	30.28
3	3.0	2.39	3.12	3.09	2.73	2.55	2.84	2.77	2.32	45.05	58.81	58.25	51.46	48.07	53.53	52.21	43.73
4	5.0	2.93	3.17	2.72	1.15	1.39	3.04	2.07	1.69	92.05	99.59	85.45	36.13	43.67	95.50	65.03	53.09
5	10.0	2.8	2.17	1.98	2.01	2.07	3.55	3.42	1.94	175.93	136.35	124.41	126.29	130.06	223.05	214.88	121.89
6	15.0	1.59	2.19	3.17	2.37	2.84	2.86	3.56	2.88	149.85	206.40	298.77	223.37	267.66	269.55	335.52	271.43
7	20.0	3.07	2.88	3.79	3.19	2.55	2.84	4.18	3.16	385.79	364.34	476.27	400.87	320.44	356.88	525.27	397.10

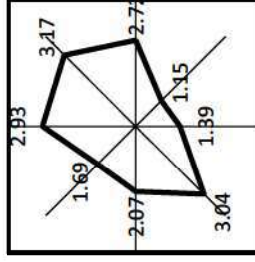
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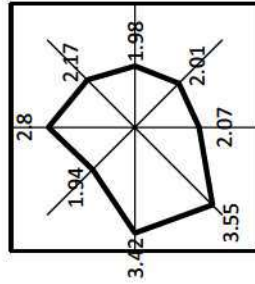
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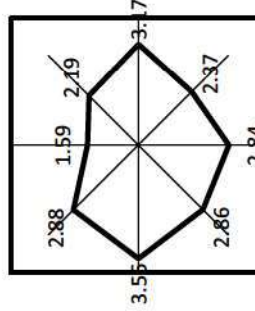
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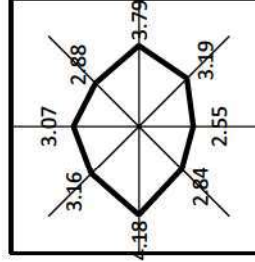
10.00Mtr.



15.00Mtr.



20.00Mtr.



ZONE-3

FOR REFERENCE PURPOSE ONLY

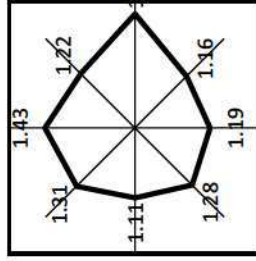
METHANOL STORAGE

Table ERT - 8

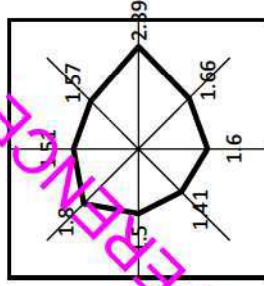
Project : Geo-Technical investigation work for proposed coalgas to methanol project at Sanctoria, West Bardhaman (W.B.)
 Location : Methanol Storage.
 Client : Project & Development India Limited
 Test Date : 04-06-2022
 Instrument : Metravi ERT-1501, SL. No.: 10109809

Sl. No.	Electrode Spacing 's' m	Measured Resistance "R" (Ω)								Apparent Resistivity "ρ" (Ω-m")							
		North	North-East	East	East-South	South	South-West	West	North-West	North	North-East	East	East-South	South	South-West	West	North-West
1	1.0	1.43	1.22	1.81	1.16	1.19	1.28	1.11	1.31	8.98	7.67	11.37	7.29	7.48	8.04	6.97	8.23
2	2.0	1.51	1.57	2.39	1.66	1.6	1.41	1.5	1.8	18.98	19.73	30.05	20.86	20.11	17.72	18.85	22.62
3	3.0	2.31	2.17	2.63	2.8	1.77	1.63	2.14	1.49	43.54	40.90	49.57	52.78	33.36	30.72	40.34	28.09
4	5.0	2.93	2.49	2.92	2.35	2.31	2.99	1.84	2.38	92.05	78.23	94.73	73.83	72.57	93.93	57.81	74.77
5	10.0	3.15	2.84	3.19	3.47	3.23	2.14	3.31	2.22	197.92	178.44	200.43	218.03	202.95	134.46	207.97	139.49
6	15.0	3.59	3.11	3.6	2.99	2.86	3.03	2.93	3.61	338.35	293.00	339.29	281.80	269.55	285.57	276.15	340.23
7	20.0	2.95	3.65	3.08	3.51	3.5	3.47	3.07	3.81	370.71	458.62	387.04	441.08	439.82	436.05	385.79	478.78

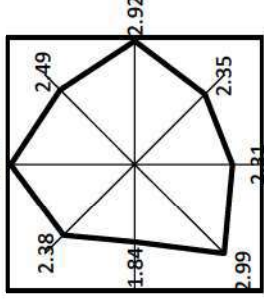
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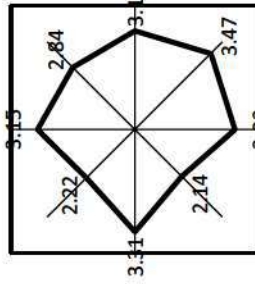
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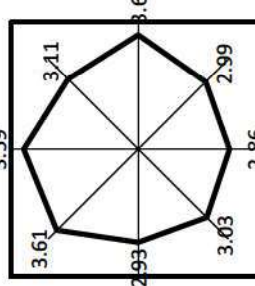
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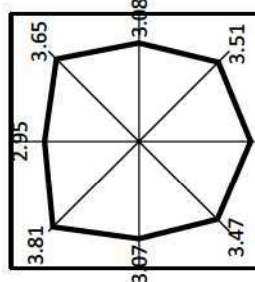
10.00Mtr.



15.00Mtr.



20.00Mtr.



ZONE-4

FOR REFERENCE PURPOSE ONLY

RWTP

One (1) borehole was sunk in this area, viz borehole mark the general sub soil profile it has been observed that the top to hard reddish brown/ brownish grey silty clay/ clayey silt with sand and traces of morrum and the second layer as encountered up to the explored depth is very dense reddish brown silty sand.

Discussion and Recommendation:

Based on the sub-soil condition, shallow foundation has been recommended for foundation system of medium to heavily loaded structures. Bearing capacities for different size and shapes of foundations are indicated in the Table-2A (Zone-4).

Pile Foundation has also been recommended for foundation of heavily loaded structures. Pile Capacities for different dia of pile are indicated in the Table-2B (Zone-4). It is further recommended to carry out initial pile load test for load under compression, pull-out and horizontal shear, in order to confirm the recommended pile capacities and to take corrective measures, if required.

FOR REFERENCE PURPOSE ONLY

Table-2A (Zone-4).

**ALLOWABLE BEARING CAPACITY FROM SHE/
SETTLEMENT CRITERIA**

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Qnet safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
ISOLATED SQUARE FOOTINGS	1.00	1.00	1.00	39.7	21.95	39	39	39
	2.50	2.50	1.00	35.7	60.53	14	23	35
	5.00	5.00	1.00	34.4	123.82	6	11	20
	7.50	7.50	1.00	34.0	187.12	4	7	13
	10.00	10.00	1.00	33.8	250.37	3	5	10
	1.00	1.00	1.50	43.0	23.42	43	43	43
	2.50	2.50	1.50	37.1	59.01	15	25	37
	5.00	5.00	1.50	35.1	122.63	7	11	21
	7.50	7.50	1.50	34.4	185.69	4	7	13
	10.00	10.00	1.50	34.1	248.99	3	5	10
	1.00	1.00	2.00	46.3	23.24	46	46	46
	2.50	2.50	2.00	38.4	57.03	16	26	38
	5.00	5.00	2.00	35.7	120.99	7	11	22
	7.50	7.50	2.00	34.9	184.73	4	7	14
	10.00	10.00	2.00	34.4	247.58	3	5	10
	1.00	1.00	3.00	53.0	25.43	52	53	53
	2.50	2.50	3.00	41.0	52.30	19	31	41
	5.00	5.00	3.00	37.1	117.97	7	12	23
	7.50	7.50	3.00	35.7	181.49	4	7	14
	10.00	10.00	3.00	35.1	245.27	3	5	10

ALLOWABLE BEARING CAPACITY FROM SHEAR SETTLEMENT CRITERIA

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Q _{net} safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
ISOLATED RECTANGULAR FOOTINGS	1.50	1.00	1.00	34.6	24.86	34	34	34
	3.75	2.50	1.00	31.2	65.77	11	18	31
	7.50	5.00	1.00	30.0	132.72	5	9	16
	11.25	7.50	1.00	29.6	199.50	3	5	11
	15.00	10.00	1.00	29.4	266.25	2	4	8
	1.50	1.00	1.50	37.5	23.04	37	37	37
	3.75	2.50	1.50	32.3	64.73	12	19	32
	7.50	5.00	1.50	30.6	132.19	5	9	17
	11.25	7.50	1.50	30.0	199.08	3	6	11
	15.00	10.00	1.50	29.7	265.87	2	4	8
	1.50	1.00	2.00	40.4	20.62	40	40	40
	3.75	2.50	2.00	33.5	63.65	13	21	33
	7.50	5.00	2.00	31.2	131.54	5	9	17
	11.25	7.50	2.00	30.4	198.57	3	6	11
	15.00	10.00	2.00	30.0	265.44	2	4	8
	1.50	1.00	3.00	46.2	29.74	38	46	46
	3.75	2.50	3.00	35.8	60.57	14	23	35
	7.50	5.00	3.00	32.3	129.46	6	9	18
	11.25	7.50	3.00	31.2	197.31	3	6	11
	15.00	10.00	3.00	30.6	264.38	2	4	8

ALLOWABLE BEARING CAPACITY FROM SHEAR SETTLEMENT CRITERIA

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Qnet safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
CONTINUOUS STRIP FOOTINGS		1.00	1.00	30.5	43.46	17	28	30
		1.50	1.00	28.8	63.12	11	18	28
		2.00	1.00	28.0	82.84	8	13	25
		2.50	1.00	27.5	102.45	6	10	20
		1.00	1.50	33.1	45.36	18	29	33
		1.50	1.50	30.5	65.18	11	18	30
		2.00	1.50	29.3	85.09	8	13	25
		2.50	1.50	28.5	104.62	6	10	20
		1.00	2.00	35.6	46.85	18	30	35
		1.50	2.00	32.2	67.06	12	19	32
		2.00	2.00	30.5	86.91	8	14	26
		2.50	2.00	29.5	106.69	6	11	20
		1.00	3.00	40.7	49.13	20	33	40
		1.50	3.00	35.6	70.27	12	20	35
		2.00	3.00	33.1	90.72	9	14	27
		2.50	3.00	31.6	110.84	7	11	21

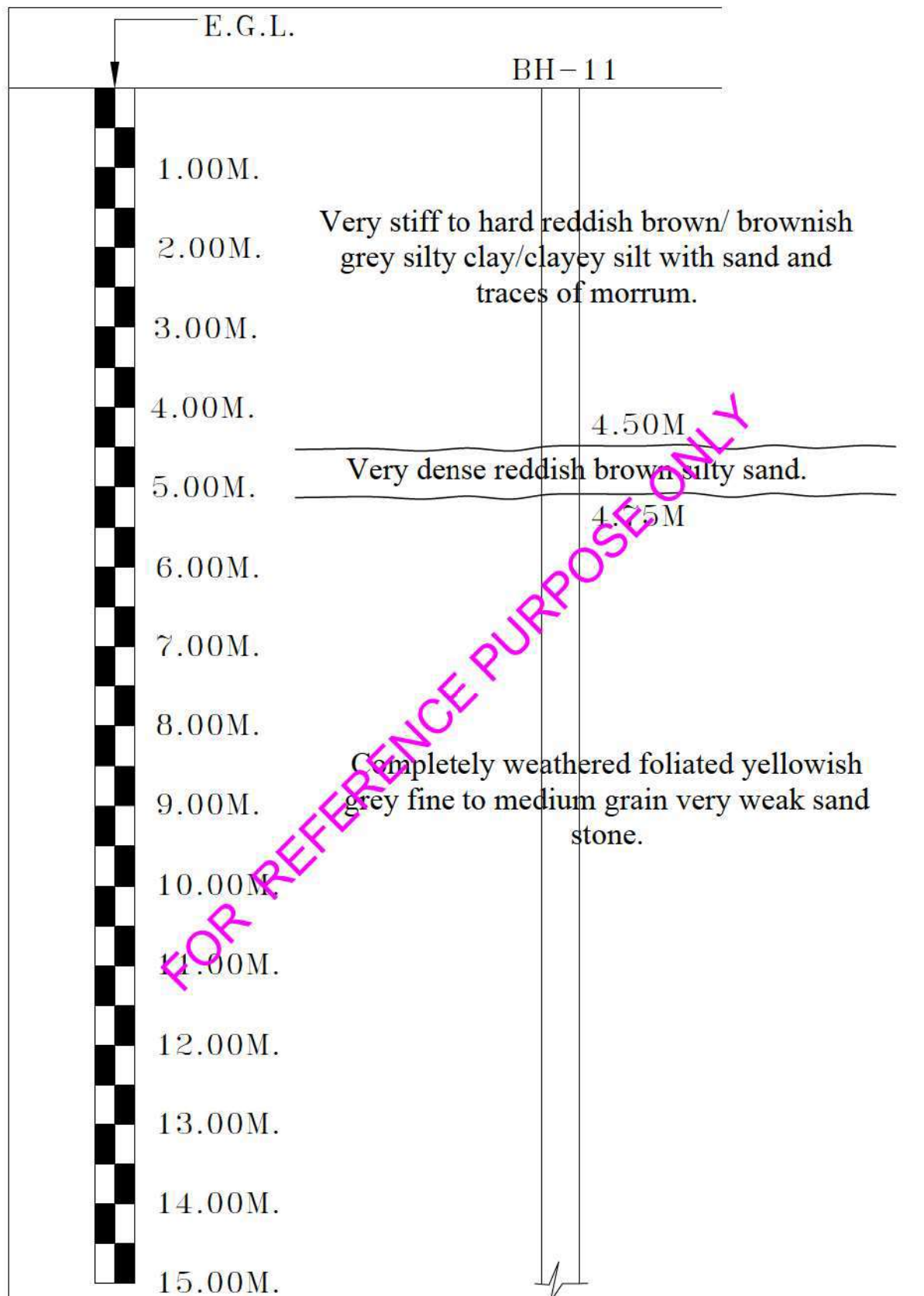
Table-2B (Zone-4).
Recommended Pile Capacity

Sl.No	Pile Dia , D	Total Length of Pile, L	Cut-off Level	Recommended Pile Capacity in Compression	Recommended Pile Capacity in Pull-Out	Recommended Pile Capacity in Horizontal Shear
	Mtr	Mtr.	Mtr.	T	T	T
1	0.600	10.000	2.000	47	27	6
2	0.750	10.000	2.000	70	36	8
3	1.000	10.000	2.000	110	48	11
4	1.500	10.000	2.000	217	73	16

FOR REFERENCE PURPOSE ONLY

BORE LOG SHEET		Centre for Advanced Engineering						Bore Hole
								Job No.:
Project: SOIL_PDIL_ECL SANCTORIA								
Co-ord:		E.G.L.:114.982		Unit: RWTP			Bore Hole	
Type of Boring	Shell & Auger	FIELDTEST	NOS.	SAMPLES	NOS.	SAMPLES	NOS.	Commenc
Depth of Boring	4.750 M.	SPT	3	UDS	2	WS		Completed on : 23.05.2022
Type of Drilling		DCPT		DS	5	RCS	7	Water Struck At :1.85M
Depth of Drilling	10.250 M.	VST		SCPT				Standing Water Table : 1.67M

D E S C R I P T I O N	SYMBOL	DEPTH	N-V A L U E	S A M P L E	
				NO.	DEPTH
Very stiff to hard reddish brown/ brownish grey silty clay/clayey silt with sand and traces of morrum.		01	N = 31	DS1	0.50 M
				DS2	1.00 M
				SPT1	1.50-1.95M
				DS3	1.50-1.95M
				UDS1	2.00-2.45M
		02	N = 45	SPT2	3.00-3.45M
				DS4	3.00-3.45M
				UDS2	4.00-4.45M
Very dense reddish brown silty sand.		03	N > 100	SPT3	4.50-4.75M
		04		DS5	4.50-4.75M
Completely weathered foliated yellowish grey fine to medium grain very weak sand stone.		05		RUN1	4.75-6.00M TCR - 27% RQD - NIL
		06		RUN2	6.00-7.50M TCR - 37% RQD - NIL
		07		RUN3	7.50-9.00M TCR - 44% RQD - NIL
		08		RUN4	9.00-10.50M TCR - 52% RQD - NIL
		09		RUN5	10.50-12.00M TCR - 62% RQD - NIL
		10		RUN6	12.00-13.50M TCR - 60% RQD - NIL
		11		RUN7	13.50-15.00M TCR - 57% RQD - NIL
Termination Depth 15.000 Mtr.		12			
		13			
		14			
		15			



Sub-Soil Profile through BH-11

Sketch No.-SK/PDIL/RWTP 1678 02 10 of 13

SUMMARY OF LABORATORY TEST RESULTS

Table-4

Project: Geotechnical Investigation Work for Proposed Coalgas to Methanol Project at Sactoria, West Bardhaman (WB)

Layer No.	Description of layer	Bore Hole No.	Depth	Sample Type - UD/D/ DN	SPT VALUE (N)	Atterberg Limits			Bulk Density in gm/cc	Water Content In %	Specific Gravity	Dry Density in gm/cc	Unconfine d Test in Kg/sqcm	Shear Test			Pressure (Kg/sqcm)	Co-eff. of volume compressibility in sqcm/kg	Swelling Pressure in kg/sqcm	Grading				Modified Proctor Density	
						LL	PL	SL						Type of Test	Cohesion in kg/sqcm	Friction angle in degree				Gravel (> 4.75 mm)	Sand (0.075 - 4.75 mm)	Silt (0.002 - 0.075 mm)	Clay (< 0.002 mm)	MDD	OMC
		11	0.50	D						m	G	γ_d	q_u	UU/cu/ DS	C	ϕ				0	28	53	19	1.77	13.05
		11	1.00	D															0	30	52	18			
		11	1.50	DN	31	46	23	10											0	33	45	22			
I	Very stiff to hard reddish brown/ brownish grey silty clay/dayey silt with sand and traces of morum.	11	2.00	UD		48	24	13	1.89	14.77	2.68	1.65	2.51	UU	1.29	0	0.00-0.10	0.0445	0.000	0	31	54	15		
																	0.10-0.20	0.0407							
																	0.20-0.40	0.0363							
																	0.40-0.80	0.0291							
																	0.80-1.60	0.0214							
																	1.60-3.20	0.0126							
11	3.00	DN	45	47	23	11												0	30	48	22				
		11	4.00	UD		43	21	12	1.88	13.52	2.67	1.66	2.43	CU	0.16	12	0.00-0.10	0.0419	0.000	0	35	48	17		
																	0.10-0.20	0.0390							
																	0.20-0.40	0.0351							
																	0.40-0.80	0.0294							
																	0.80-1.60	0.0211							
																	1.60-3.20	0.0141							
11	4.50	DN	>100				1.78		2.65				DS	0.16	32				0	79	15	6			
II	Very dense reddish brown silty sand																								

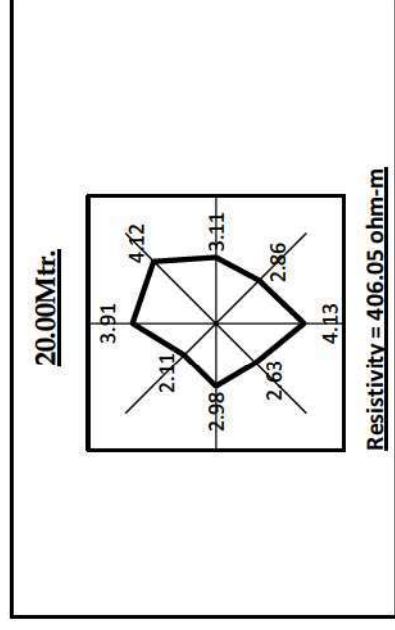
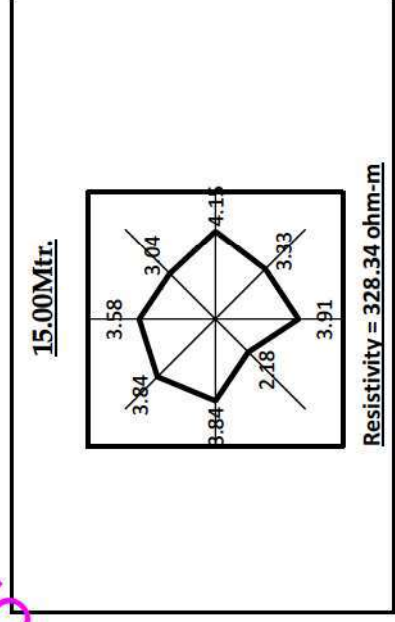
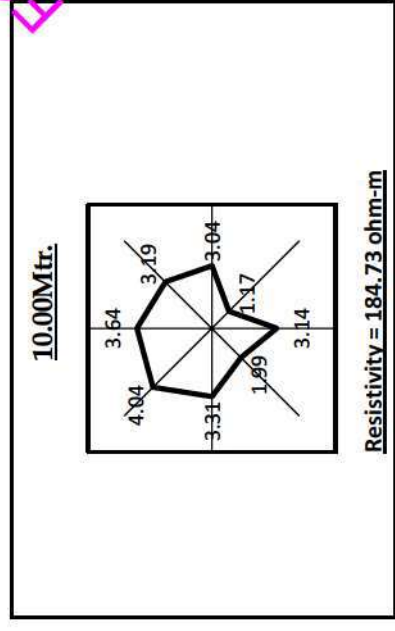
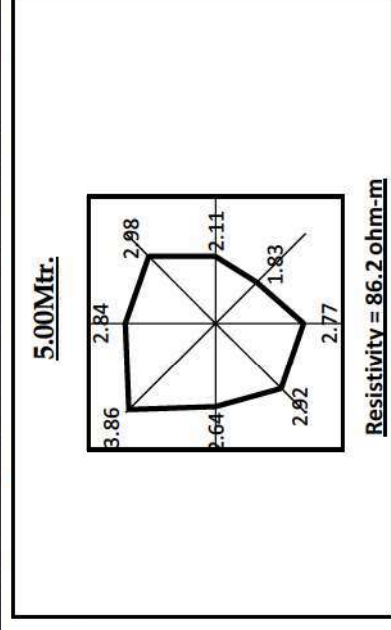
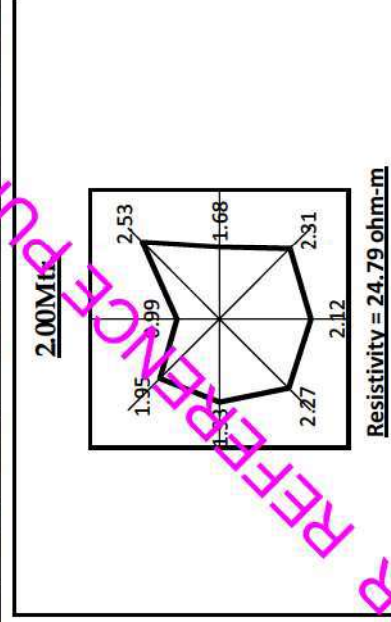
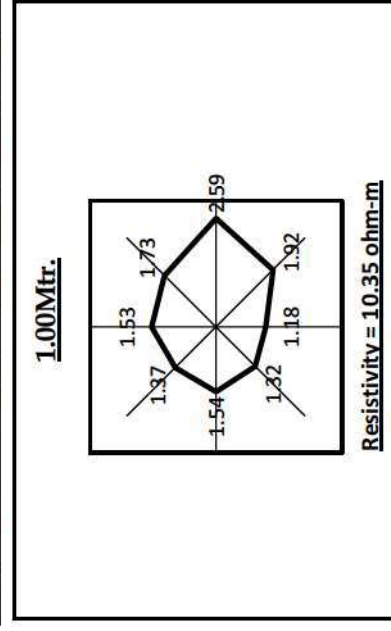
ZONE-5

DM WATERPLANT

FOR REFERENCE PURPOSE ONLY

Project	: Geo-Technical investigation work for proposed coalgas to methanol project at Sanctoria, West Bardhaman (W.B.)
Location	: DM Water Plant.
Client	: Project & Development India Limited
Test Date	: 03-06-2022
Instrument	: Metravi ERT-1501, SL. No.: 10109809

Sl. No.	Electrode Spacing 's' m	Measured Resistance "R" (Ω)								Apparent Resistivity "ρ" (Ω-m")							
		North	North-East	East	East-South	South	South-West	West	North-West	North	North-East	East	East-South	South	South-West	West	North-West
1	1.0	1.53	1.73	2.59	1.92	1.18	1.32	1.54	1.37	9.61	10.87	16.27	12.06	7.41	8.29	9.68	8.61
2	2.0	0.99	2.53	1.68	2.31	2.12	2.27	1.93	1.95	12.44	31.79	21.11	29.03	26.64	28.53	24.25	24.50
3	3.0	1.89	3.64	2.73	2.18	3.03	3.8	2.18	2.73	35.63	68.61	51.46	41.09	57.11	71.63	41.09	51.46
4	5.0	2.84	2.98	2.11	1.83	2.77	2.92	2.64	3.86	89.22	93.62	66.29	57.49	87.02	91.73	82.94	121.27
5	10.0	3.64	3.19	3.04	1.17	3.14	1.99	3.31	4.04	228.71	200.43	191.01	73.51	197.29	125.04	207.97	253.84
6	15.0	3.58	3.04	4.15	3.33	3.91	2.18	3.84	3.84	337.41	286.51	391.13	313.85	368.51	205.46	361.91	361.91
7	20.0	3.91	4.12	3.11	2.86	4.13	2.63	2.98	2.11	491.35	507.73	390.81	359.40	518.99	330.50	374.48	265.15



ZONE-6

FOR REFERENCE PURPOSE ONLY

PLANT

METHANOL

Total one (1) borehole was sunk in this area, viz borehole the general sub soil profile it has been observed that the dense yellowish/ brownish grey silty sand with clay bindersand continued up to the explored depth.

In addition the following field tests have been carried out at this zone and results are being indicated in this chapter.

1. Plate Load Test:

One (1) plate load test has been carried out at this zone marked as PLT-1.

2. Static Cone Penetration Test:

One (1) static cone penetration test has been carried out at this zone marked as SCPT-1.

Discussion and Recommendation:

Based on the sub-soil condition, shallow foundation has been recommended for foundation system of medium to heavily loaded structures. Bearing capacities for different size and shapes of foundations are indicated in the Table-2A (Zone-6).

Pile Foundation has also been recommended for foundation of heavily loaded structures. Pile Capacities for different dia of pile are indicated in the Table-2B (Zone-6). It is further recommended to carry out initial pile load test for load under compression, pull-out and horizontal shear, in order to confirm the recommended pile capacities and to take corrective measures, if required.

Table-2A (Zone-6).

**ALLOWABLE BEARING CAPACITY FROM SHE/
SETTLEMENT CRITERIA**

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Q _{net} safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
ISOLATED SQUARE FOOTINGS	1.00	1.00	1.00	11.3	2.30	11	11	11
	2.50	2.50	1.00	15.3	9.45	15	15	15
	5.00	5.00	1.00	23.0	30.09	19	23	23
	7.50	7.50	1.00	30.7	61.39	12	20	30
	10.00	10.00	1.00	38.6	103.88	9	14	27
	1.00	1.00	1.50	16.3	3.11	16	16	16
	2.50	2.50	1.50	19.4	11.23	19	19	19
	5.00	5.00	1.50	26.8	34.01	19	26	26
	7.50	7.50	1.50	34.5	67.64	12	20	34
	10.00	10.00	1.50	42.2	111.93	9	15	28
	1.00	1.00	2.00	21.8	3.97	21	21	21
	2.50	2.50	2.00	23.8	12.84	23	23	23
	5.00	5.00	2.00	30.7	37.79	20	30	30
	7.50	7.50	2.00	38.3	73.64	13	20	38
	10.00	10.00	2.00	46.0	120.26	9	15	28
	1.00	1.00	3.00	34.5	6.01	34	34	34
	2.50	2.50	3.00	33.1	15.34	33	33	33
	5.00	5.00	3.00	38.9	44.93	21	34	38
	7.50	7.50	3.00	46.1	85.13	13	21	40
	10.00	10.00	3.00	53.6	136.05	9	15	29

ALLOWABLE BEARING CAPACITY FROM SHEAR SETTLEMENT CRITERIA

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Q _{net} safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
ISOLATED RECTANGULAR FOOTINGS	1.50	1.00	1.00	10.6	2.87	10	10	10
	3.75	2.50	1.00	14.2	11.29	14	14	14
	7.50	5.00	1.00	21.2	35.38	14	21	21
	11.25	7.50	1.00	28.4	72.20	9	15	28
	15.00	10.00	1.00	35.5	121.27	7	11	21
	1.50	1.00	1.50	15.2	3.52	15	15	15
	3.75	2.50	1.50	18.1	13.68	18	18	18
	7.50	5.00	1.50	24.8	40.41	15	24	24
	11.25	7.50	1.50	31.9	79.85	9	15	29
	15.00	10.00	1.50	39.0	131.69	7	11	22
	1.50	1.00	2.00	20.4	3.93	20	20	20
	3.75	2.50	2.00	22.2	15.91	22	22	22
	7.50	5.00	2.00	28.5	45.32	15	25	28
	11.25	7.50	2.00	35.5	87.47	10	16	30
	15.00	10.00	2.00	42.5	141.84	7	11	22
	1.50	1.00	3.00	32.4	7.87	32	32	32
	3.75	2.50	3.00	31.0	19.78	31	31	31
	7.50	5.00	3.00	36.3	54.88	16	26	36
	11.25	7.50	3.00	42.8	102.10	10	16	31
	15.00	10.00	3.00	49.7	161.97	7	12	23

ALLOWABLE BEARING CAPACITY FROM SHEAR SETTLEMENT CRITERIA

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Q _{net} safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
CONTINUOUS STRIP FOOTINGS		1.00	1.00	10.9	6.75	10	10	10
		1.50	1.00	12.6	12.00	12	12	12
		2.00	1.00	14.4	18.52	14	14	14
		2.50	1.00	16.3	26.40	15	16	16
		1.00	1.50	15.2	9.05	15	15	15
		1.50	1.50	16.4	15.24	16	16	16
		2.00	1.50	18.1	22.85	18	18	18
		2.50	1.50	19.8	31.60	15	19	19
		1.00	2.00	19.9	11.38	19	19	19
		1.50	2.00	20.6	18.65	20	20	20
		2.00	2.00	21.9	27.13	20	21	21
		2.50	2.00	23.5	36.94	15	23	23
		1.00	3.00	30.7	16.11	30	30	30
		1.50	3.00	29.9	25.65	29	29	29
		2.00	3.00	30.4	36.22	20	30	30
		2.50	3.00	31.5	48.03	16	26	31

Table-2B (Zone-6).

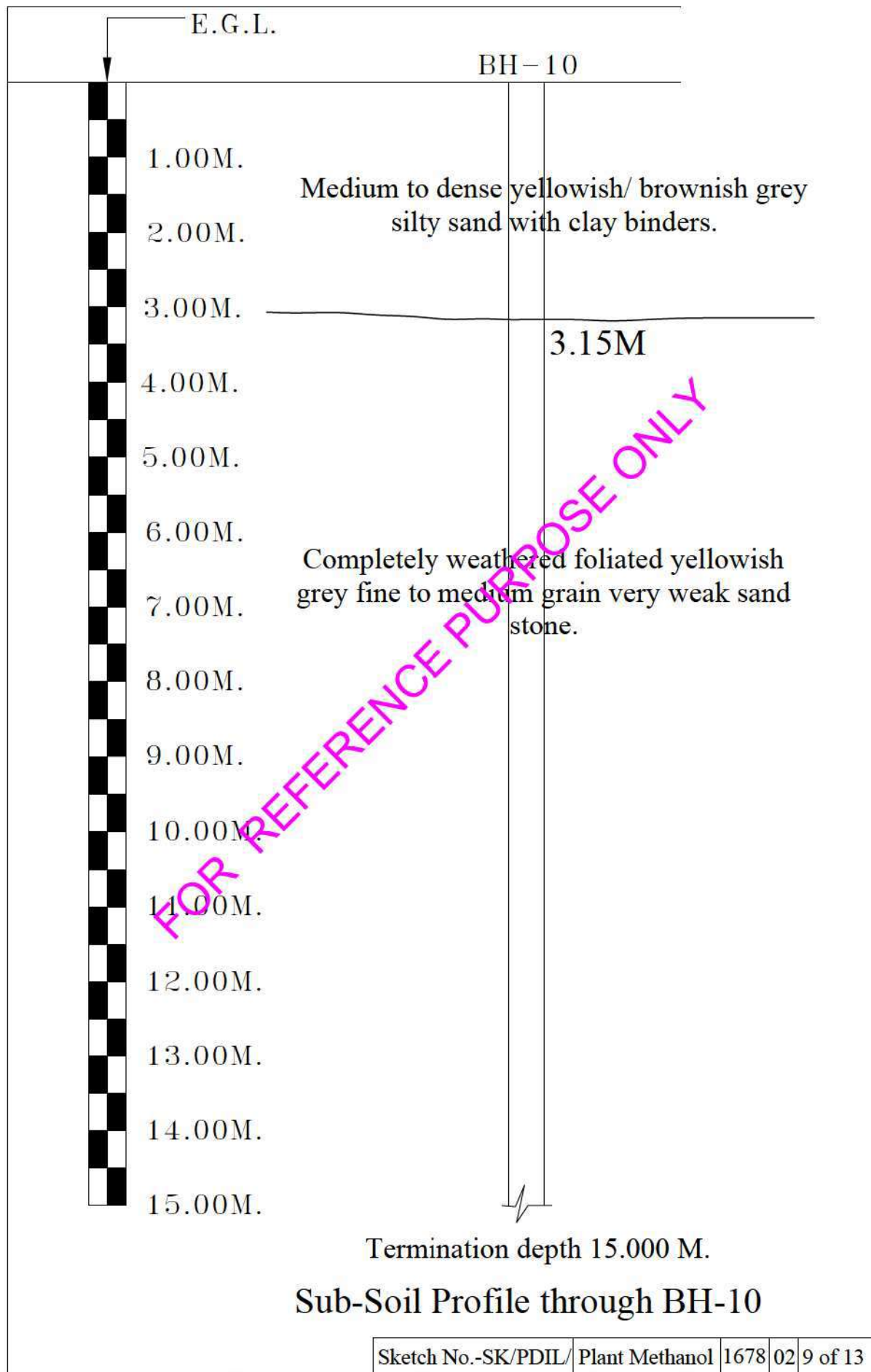
Recommended Pile Capacity

Sl.No	Pile Dia , D	Total Length of Pile, L	Cut-off Level	Recommended Pile Capacity in Compression	Recommended Pile Capacity in Pull-Out	Recommended I Capacity in Horiz Shear
	Mtr	Mtr.	Mtr.	T	T	T
1	0.600	10.000	2.000	41	21	5
2	0.750	10.000	2.000	63	29	7
3	1.000	10.000	2.000	101	39	12
4	1.500	10.000	2.000	202	58	23

FOR REFERENCE PURPOSE ONLY

BORE LOG SHEET		Centre for Advanced Engineering						Bore Ho
								Job No.:
Project: SOIL_PDIL_ECL SANCTORIA								
Co-ord:		E.G.L.:110.026		Unit: Plant Methanol			Bore Ho	
Type of Boring	Shell & Auger	FIELDTEST	NOS.	SAMPLES	NOS.	SAMPLES	NOS.	Commen
Depth of Boring	3.150 M.	SPT	2	UDS	1	WS		Completed on : 23.05.2022
Type of Drilling		DCPT		DS	4	RCS	8	Water Struck At : 2.40M
Depth of Drilling	11.850 M.	VST		SCPT				Standing Water Table : 2.30M

D E S C R I P T I O N	SYMBOL	DEPTH	N-V A L U E	S A M P L E	
				NO.	DEPTH
Medium to dense yellowish/ brownish grey silty sand with clay binders.		01 02 03	N = 40	DS1 DS2 SPT1 DS3 UDS1	0.50 M 1.00 M 1.50-1.95M 1.50-1.95M 2.00-2.45M
Completely weathered foliated yellowish grey fine to medium grain very weak sand stone.		04 05 06 07 08 09 10 11 12 13 14 15	N > 100	SPT2 DS4 RUN1 RUN2 RUN3 RUN4 RUN5 RUN6 RUN7 RUN8	3.00-3.15M 3.00-3.15M 3.15-4.50M TCR - 24% RQD - NIL 4.50-6.00M TCR - 30% RQD - NIL 6.00-7.50M TCR - 40% RQD - NIL 7.50-9.00M TCR - 49% RQD - NIL 9.00-10.50M TCR - 55% RQD - NIL 10.50-12.00M TCR - 51% RQD - NIL 12.00-13.50M TCR - 65% RQD - NIL 13.50-15.00M TCR - 57% RQD - NIL
Termination Depth 15.000 Mtr.					



SUMMARY OF LABORATORY TEST RESULTS

Table-4

Project: Geotechnical Investigation Work for Proposed Coalgas to Methanol Project at Sactoria, West Bardhaman (WB)

Layer No.	Description of layer	Bore Hole No.	Depth Meter	Sample Type - UD/D/ DN	SPT VALUE (N)	Atterberg Limits			Bulk Density in gm/cc	Water Content in %	Specific Gravity	Dry Density in gm/cc	Unconfined Test in Kg/sqcm	Shear Test			Pressure (Kg/sqcm)	Co-eff. of volume compressibility in sqcm/kg	Swelling Pressure in kg/sqcm	Grading				Modified Proctor Density	
						LL	PL	SL						Type of Test	Cohesion in kg/sqcm	Friction angle in degree				Gravel (>4.75 mm)	Sand (0.075 - 4.75 mm)	Silt (0.002 - 0.075 mm)	Clay (< 0.002 mm)	MDD	OMC
						%	%	%						UU/cu/ DS	C	ϕ				%	%	%	%	gm/cc	%
I	Medium to dense yellowish/ brownish grey silty sand with clay binders.	10	0.50	D						m	G	γ_d	q_u							0	59	26	15	1.75	13.69
		10	1.00	D		36	16	10												0	55	27	18		
		10	1.50	DN	40						2.65									0	64	24	12		
		10	2.00	UD		37	17	9	1.80	16.25	2.64	1.55		DS	0.19	33			0.000	0	60	30	10		
		10	3.00	DN	>100				1.79					DS	0.14	35				0	68	24	8		

Modulus of Subgrade Reaction and Modulus of Elasticity have been calculated for Plate Load

Calculation for Modulus of Subgrade Reaction (K) for PLT-1

From Load-Settlement curve of PLT-1, Pressure corresponding to settlement of 1.25mm is

$$\begin{aligned}\text{Hence, } K &= \text{Pressure} / \text{Settlement.} \\ &= 2.1 / 0.125 \text{ Kg/Cm}^3 \\ &= 16.8 \text{ Kg/Cm}^3\end{aligned}$$

Calculation for Modulus of Elasticity (Es) for PLT-1.

Modulus of Elasticity has been calculated for initial load of 18.3 T/M² and corresponding settlement of 0.101 cm.

$$\begin{aligned}E_s &= \{q \cdot (1 - \mu^2) \cdot B \cdot I_w\} / S \\ &= \{0.36 \cdot (1 - 0.3^2) \cdot 75 \cdot 0.82\} / 0.121 \\ &= 811.22 \text{ Kg/Cm}^2\end{aligned}$$

Where,

$$\begin{aligned}E_s &= \text{Modulus of Elasticity} \\ q &= \text{Pressure} = 1.83 \text{ Kg/Cm}^2 \\ \mu &= \text{Poisson's Ratio} = 0.3 \\ B &= \text{Least dimension of the plate} = 60 \text{ Cm} \\ I_w &= \text{Influence Factor} = 0.8 \\ S &= \text{Settlement} = 0.1 \text{ Cm}\end{aligned}$$

Modulus of Subgrade Reaction and Modulus of Elasticity, obtain from Plate Load Test.

Test No.	Depth of Test	Modulus of Subgrade Reaction, K	Modulus of Elasticity, Es
	(M)	(Kg/Cm ³)	(Kg/Cm ²)
PLT-1	2	16.8 Kg/Cm ³	811.22 Kg/Cm ²

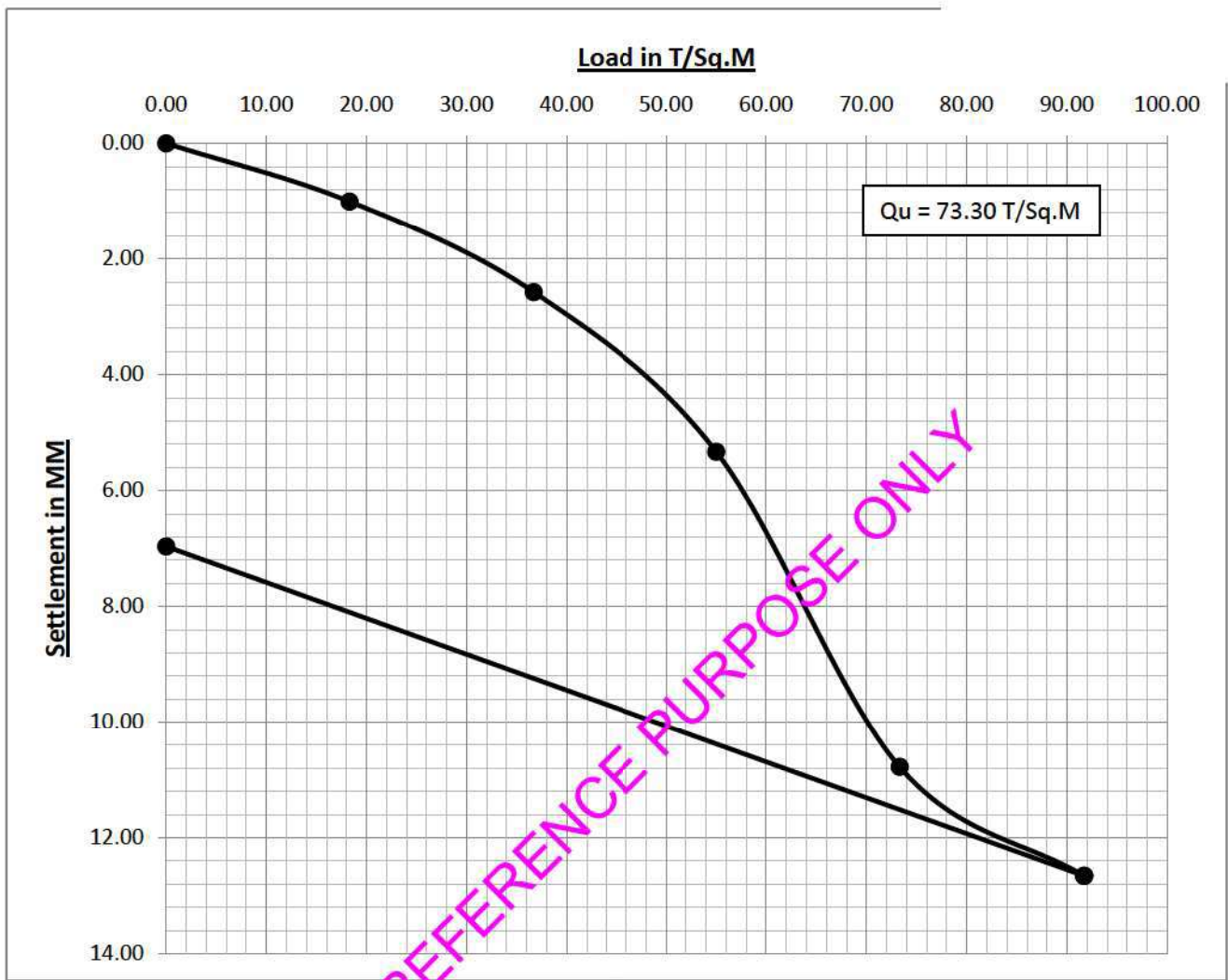
PLATE LOAD TEST SITE DATA SHEET

Client : Projects & Development India Limited
 Location : Plant Methanol.
 Test Number : PLT-1
 Plate Size : 60x60 3600 Sqcm
 Pit Size : 3.00M X 3.00M X 2.00M
 Ground Water Table : Not Encountered
 L.C. of Dial Guage : 0.01 mm
 Jack Ram Dia : 10.5 cm
 Jack Ram Area : 86.59 Sqcm

DATE	TIME (Hrs)	LOAD IN (KG)	PRESSURE IN Kg/Sqcm	DIAL GUAGE READING (mm)		SETTLEMENT (mm)		MEAN SETTLEMENT (mm)	REMARKS
				DIAL-1	DIAL-2	DIAL-1	DIAL-2		
27-05-2022	14:35:00	0.00	0	1750	2220	0.00	0.00	0.00	
	14:35:00	6600	1.83	1750	2220	0.00	0.00	0.00	
	14:36:00			1718	2189	0.32	0.31	0.32	
	14:37:15			1692	2167	0.58	0.53	0.56	
	14:39:00			1663	2149	0.87	0.71	0.79	
	14:41:15			1660	2140	0.90	0.80	0.85	
	14:44:00			1637	2136	0.93	0.84	0.89	
	14:51:00			1635	2128	0.95	0.92	0.94	
	15:00:00			1653	2120	0.97	1.00	0.99	
	15:35:00			1652	2117	0.98	1.03	1.01	
	15:35:00	13200	3.67	1652	2117	0.98	1.03	1.01	
	15:36:00			1613	2090	1.37	1.30	1.34	
	15:37:15			1589	2071	1.61	1.49	1.55	
	15:39:00			1568	2042	1.82	1.78	1.80	
	15:41:15			1542	1993	2.08	2.27	2.18	
	15:44:00			1522	1979	2.28	2.41	2.35	
	15:51:00			1511	1960	2.39	2.60	2.50	
	16:00:00			1505	1955	2.45	2.65	2.55	
	16:35:00			1502	1953	2.48	2.67	2.58	
	16:35:00	19800	5.50	1502	1953	2.48	2.67	2.58	
	16:36:00			1314	1780	4.36	4.40	4.38	
	16:37:15			1301	1768	4.49	4.52	4.51	
	16:39:00			1295	1764	4.55	4.56	4.56	
	16:41:15			1294	1762	4.56	4.58	4.57	
	16:44:00			1293	1760	4.57	4.60	4.59	
	16:51:00			1291	1759	4.59	4.61	4.60	
	17:00:00			1289	1757	4.61	4.63	4.62	
	17:35:00			1219	1685	5.31	5.35	5.33	

DATE	TIME (Hrs)	LOAD IN (KG)	PRESSURE IN Kg/Sqcm	DIAL GUAGE READING (mm)		SETTLEMENT (mm)			
				DIAL-1	DIAL-2	DIAL-1	DIAL-2		
	17:35:00	26400	7.33	1219	1685	5.31	5.35	5.33	
	17:36:00			811	1265	9.39	9.55	9.47	
	17:37:15			809	1260	9.41	9.60	9.51	
	17:39:00			804	1255	9.46	9.65	9.56	
	17:41:15			800	1252	9.50	9.68	9.59	
	17:44:00			798	1250	9.52	9.70	9.61	
	17:51:00			795	1247	9.55	9.73	9.64	
	18:00:00			790	1239	9.60	9.81	9.71	
	18:35:00			645	1170	11.05	10.50	10.78	
	18:35:00	33000	9.17	645	1170	11.05	10.50	10.78	
	18:36:00			480	1020	12.70	12.00	12.35	
	18:37:15			475	1017	12.75	12.03	12.39	
	18:39:00			469	1008	12.81	12.12	12.47	
	18:41:15			461	1003	12.89	12.17	12.53	
	18:44:00			458	1000	12.92	12.20	12.56	
	18:51:00			455	995	12.95	12.25	12.60	
	19:00:00			450	990	13.00	12.30	12.65	
	19:35:00			450	989	13.00	12.31	12.66	
	19:35:00	0	0	450	989	13.00	12.31	12.66	
	20:35:00			1137	1440	6.13	7.80	6.97	

FOR REFERENCE PURPOSE ONLY



Load Vs Settlement Curve for PLT-1

Table -1

Project: Proposed Coalgas to Methanol Project at Sactoria, West Bardhaman (WB)

Client.: Project & Development India Limited

Side ID :

Correction A		
1. Mass of Cone (m)	1.34 Kg	
2. Mass of each sounding rod (m1)	1.55 Kg	
3. Cone area at Base (b)	10 Sqcm	
4. Plunger Area (b')	20 Sqcm	
5. Correction factor to be added to gauge reading $C1 = (m+nm1)/10$	0.289 Kg	
6. No of Rod Used (n)	6	

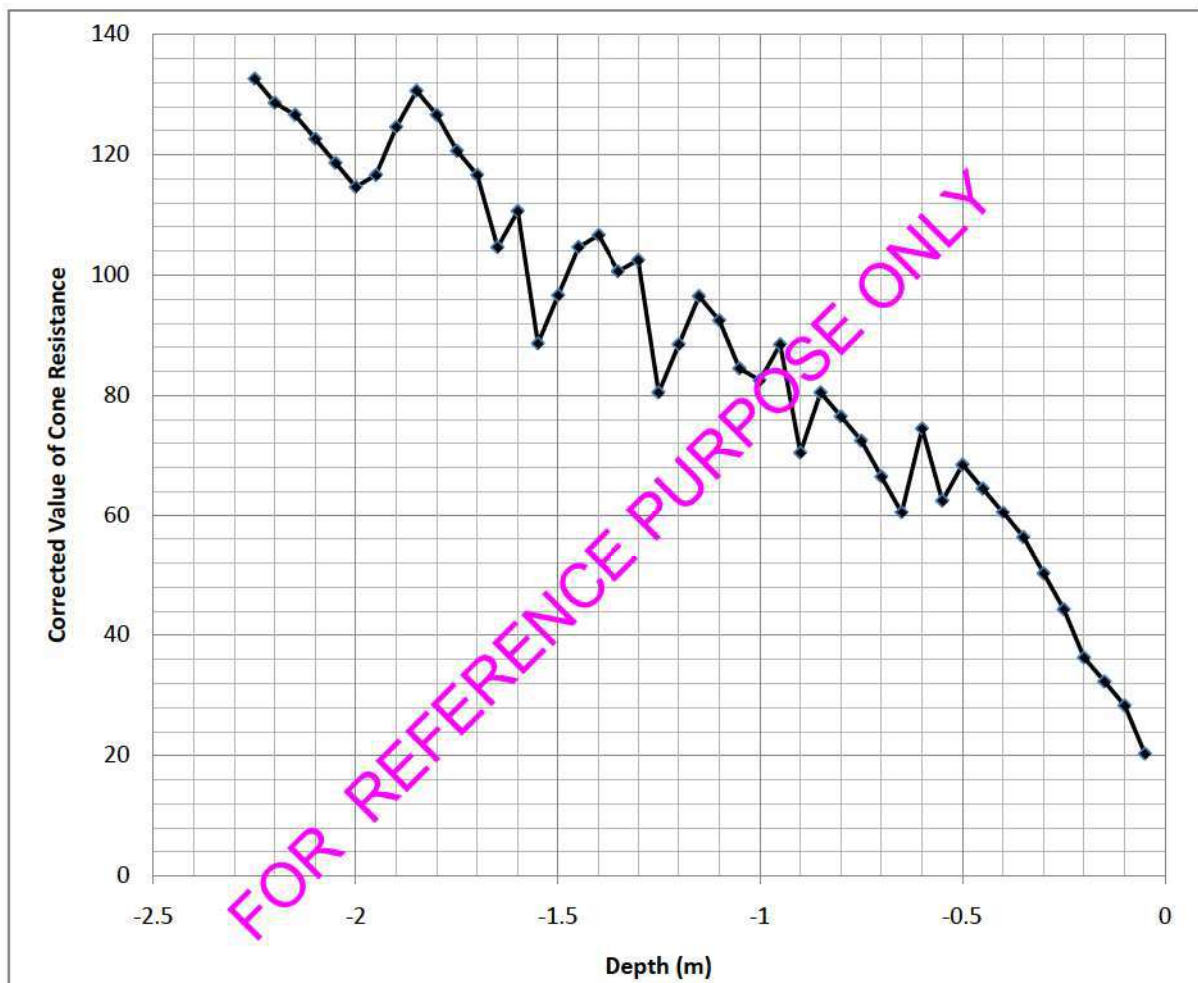
Correction B		
1. Mass of friction Jacket (m_f)	1.345 Kg	
2. Outer dia, of Friction Jacket (d)	3.6 cm	
3. Length of Friction Jacket (h)	13 Sqcm	
4. Surface area of friction jacket (a) = πdh	147 Sqcm	
5. Correction factor to be added to gauge reading $C2 = (m_f/a)$	0.01 Kg/ Sqcm	
Test Number	SCPT-1	

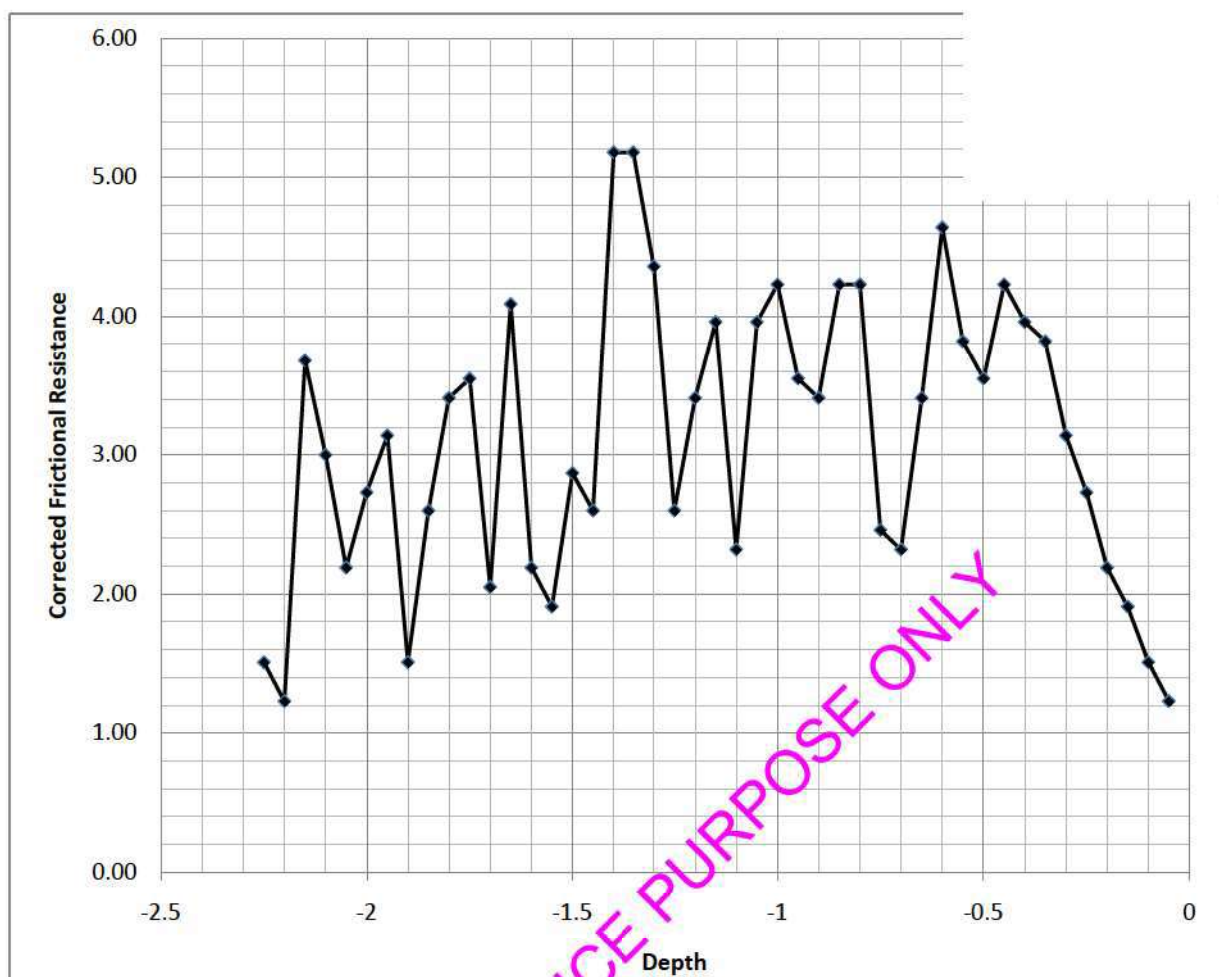
Depth	Number of Rod in Use	CONE				JACKET				
		Gauge Reading of Cone Penetration	Cone Penetration Resistance	Correction Factor	Corrected Value of Cone Resistance	Gauge Reading of Cone + Jacket Resistance	Cone + Jacket Resistance	Total Resistance - Cone Resistance	Frictional Resistance	Corrected Frictional Resistance
m	n	Kg/ Sqcm	Kg/ Sqcm	Kg/ Sqcm	Kg/ Sqcm	Kg/ Sqcm	Kg/ Sqcm	Kg/ Sqcm	Kg/ Sqcm	Kg/ Sqcm
		γ	$\gamma = \gamma'*(b'/b)$	$C1$	$R_c = \gamma + C1$	\times	$x = X*(b'/b)$	$x - y$	$Z = (x - y)*(b/a)$	$R_f = Z + (mf/a)$
-0.05	1	10	20	0.29	20.29	19	38	18	1.22	1.23
-0.10	1	14	28	0.29	28.29	25	50	22	1.5	1.51
-0.15	1	16	32	0.29	32.29	30	60	28	1.9	1.91
-0.20	1	18	36	0.29	36.29	34	68	32	2.18	2.19
-0.25	1	22	44	0.29	44.29	42	84	40	2.72	2.73
-0.30	1	25	50	0.29	50.29	48	96	46	3.13	3.14
-0.35	1	28	56	0.29	56.29	56	112	56	3.81	3.82
-0.40	2	30	60	0.44	60.44	59	118	58	3.95	3.96
-0.45	2	32	64	0.44	64.44	63	126	62	4.22	4.23
-0.50	2	34	68	0.44	68.44	60	120	52	3.54	3.55
-0.55	2	31	62	0.44	62.44	59	118	56	3.81	3.82
-0.60	2	37	74	0.44	74.44	71	142	68	4.63	4.64
-0.65	2	30	60	0.44	60.44	55	110	50	3.4	3.41
-0.70	2	33	66	0.44	66.44	50	100	34	2.31	2.32

Depth	Number of Rod in Use	Gauge Reading of Cone Penetration	Cone Penetration Resistance	Correction Factor	Corrected Value of Cone Resistance	Gauge Reading of Cone + Jacket Resistance	Cone + Jacket Resistance	Total Resistance - Cone Resistance	Frictional Resistance	Corrected Frictional Resistance
m	n	Kg/ Sqcm	Kg/ Sqcm	C1	R _c =Y+C1	Kg/ Sqcm	x=X*(b'/b)	Kg/ Sqcm	Z=(x-y)*(b/a)	Kg/ Sqcm
-0.75	2	36	72	0.44	72.44	54	108	36	2.45	2.46
-0.80	2	38	76	0.44	76.44	69	138	62	4.22	4.23
-0.85	2	40	80	0.44	80.44	71	142	62	4.22	4.23
-0.90	2	35	70	0.44	70.44	60	120	50	3.4	3.41
-0.95	2	44	88	0.44	88.44	70	140	52	3.54	3.55
-1.00	2	41	82	0.44	82.44	72	144	62	4.22	4.23
-1.05	2	42	84	0.44	84.44	71	142	58	3.95	3.96
-1.10	2	46	92	0.44	92.44	63	126	34	2.31	2.32
-1.15	2	48	96	0.44	96.44	77	154	58	3.95	3.96
-1.20	2	44	88	0.44	88.44	69	138	50	3.4	3.41
-1.25	2	40	80	0.44	80.44	59	118	38	2.59	2.60
-1.30	2	51	102	0.44	102.44	83	166	64	4.35	4.36
-1.35	3	50	100	0.6	100.6	88	176	76	5.17	5.18
-1.40	3	53	106	0.6	106.6	91	182	76	5.17	5.18
-1.45	3	52	104	0.6	104.6	71	142	38	2.59	2.60
-1.50	3	48	96	0.6	96.6	69	138	42	2.86	2.87
-1.55	3	44	88	0.6	88.6	58	116	28	1.9	1.91
-1.60	3	55	110	0.6	110.6	71	142	32	2.18	2.19
-1.65	3	52	104	0.6	104.6	82	164	60	4.08	4.09
-1.70	3	58	116	0.6	116.6	73	146	30	2.04	2.05
-1.75	3	60	120	0.6	120.6	86	172	52	3.54	3.55
-1.80	3	63	126	0.6	126.6	88	176	50	3.4	3.41
-1.85	3	65	130	0.6	130.6	84	168	38	2.59	2.6
-1.90	3	62	124	0.6	124.6	73	146	22	1.5	1.51
-1.95	3	58	116	0.6	116.6	81	162	46	3.13	3.14
-2.00	3	57	114	0.6	114.6	77	154	40	2.72	2.73
-2.05	3	59	118	0.6	118.6	75	150	32	2.18	2.19
-2.10	3	61	122	0.6	122.6	83	166	44	2.99	3
-2.15	3	63	126	0.6	126.6	90	180	54	3.67	3.68

Depth	Number of Rod in Use	Gauge Reading of Cone Penetration	Cone Penetration Resistance	Correction Factor	Corrected Value of Cone Resistance	Gauge Reading of Cone + Jacket Resistance	Cone + Jacket Resistance	Total Resistance - Cone Resistance	Frictional Resistance	Corrected Frictional Resistance
m	n	Kg/ Sqcm	Kg/ Sqcm	C1	R _c =v+C1	Kg/ Sqcm	Kg/ Sqcm	Kg/ Sqcm	Kg/ Sqcm	Kg/ Sqcm
-2.20	3	64	128	0.6	128.6	73	145	x-y	Z=(x-y)*(b/a)	Rf= Z+(mf/a)
-2.25	3	66	132	0.6	132.6	77	154			

FOR REFERENCE PURPOSE ONLY





FOR REFERENCE PURPOSE ONLY

ZONE-7

FOR REFERENCE PURPOSE ONLY

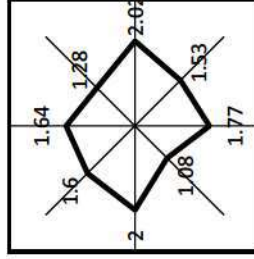
**OFFICE
MAINTENANCE PLANT**

Table ERT - 11

Project : Geo-Technical investigation work for proposed coalgas to methanol project at Sanctoria, West Bardhaman (W.B.)
 Location : Office Maintenance Plant.
 Client : Project & Development India Limited
 Test Date : 04-06-2022
 Instrument : Metravi ERT-1501, SL. No.: 10109809

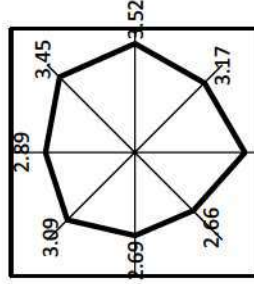
Sl. No.	Electrode Spacing 's' m	Measured Resistance "R" (Ω)								Apparent Resistivity "ρ" (Ω-m")							
		North	North-East	East	East-South	South	South-West	West	North-West	North	North-East	East	East-South	South	South-West	West	North-West
1	1.0	1.64	1.28	2.02	1.53	1.77	1.08	2.00	1.6	10.30	8.04	12.69	9.61	11.12	6.79	12.57	10.05
2	2.0	1.18	1.98	1.59	1.67	1.92	1.71	1.51	0.88	14.83	24.88	19.98	20.99	24.13	21.49	18.98	11.06
3	3.0	2.01	2.59	1.94	2.23	3.01	2.17	1.17	1.49	37.89	48.82	36.57	42.03	56.74	40.90	22.05	28.09
4	5.0	2.39	3.02	2.31	2.76	2.84	2.59	2.31	2.31	75.08	94.88	72.57	86.71	89.22	81.37	72.57	72.57
5	10.0	2.89	3.45	3.52	3.17	3.55	2.66	2.69	3.09	181.58	216.77	221.17	199.18	223.05	167.13	169.02	194.15
6	15.0	3.45	2.81	3.87	4.04	4.21	3.45	3.13	2.81	325.15	264.84	364.74	380.76	396.78	325.15	295.00	264.84
7	20.0	4.01	3.9	3.21	3.16	3.8	3.07	3.59	3.31	503.91	490.60	403.38	397.10	477.52	385.79	451.13	415.95

1.00Mtr.



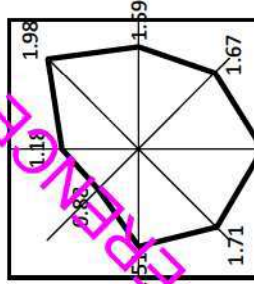
Resistivity = 10.15 ohm-m

10.00Mtr.



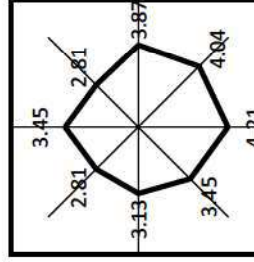
Resistivity = 196.51 ohm-m

2.00Mtr.



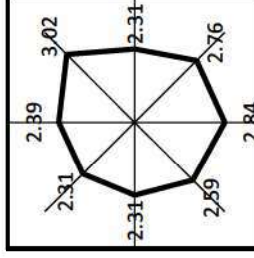
Resistivity = 219.54 ohm-m

15.00Mtr.



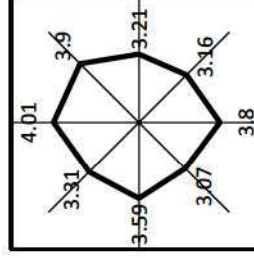
Resistivity = 327.16 ohm-m

5.00Mtr.



Resistivity = 80.62 ohm-m

20.00Mtr.



Resistivity = 440.61 ohm-m

ZONE-8

FOR REFERENCE PURPOSE ONLY

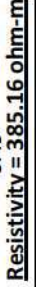
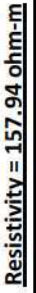
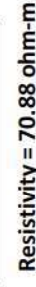
ETP

: Geo-Technical investigation work for proposed coalgas to methanol project at Sanctoria, West Bardhaman (W.B.)

Instrument

: Metravi ERT-1501, SL. No.: 10109809

<p><u>1.00Mtr.</u></p> <p><u>Resistivity = 6.64 ohm-m</u></p>	<p><u>2.00Mtr.</u></p> <p><u>Resistivity = 22.02 ohm-m</u></p>	<p><u>5.00Mtr.</u></p> <p><u>Resistivity = 70.88 ohm-m</u></p>
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ZONE-9

FOR REFERENCE PURPOSE ONLY

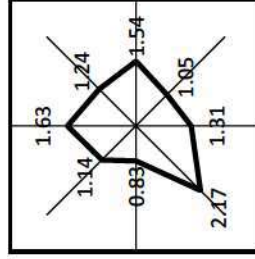
BUILDING TECHNICAL

Table ERT - 10

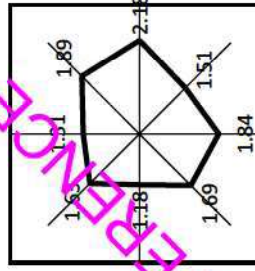
Project : Geo-Technical investigation work for proposed coalgas to methanol project at Sanctoria, West Bardhaman (W.B.)
 Location : Building Technical.
 Client : Project & Development India Limited
 Test Date : 04-06-2022
 Instrument : Metravi ERT-1501, SL. No.: 10109809

Sl. No.	Electrode Spacing 's' m	Measured Resistance "R" (Ω)								Apparent Resistivity "ρ" (Ω-m")							
		North	North-East	East	East-South	South	South-West	West	North-West	North	North-East	East	East-South	South	South-West	West	North-West
1	1.0	1.63	1.24	1.54	1.05	1.31	2.17	0.83	1.14	10.24	7.79	9.68	6.60	8.23	13.63	5.22	7.16
2	2.0	1.31	1.89	2.18	1.51	1.84	1.69	1.18	1.63	16.46	23.75	27.39	18.98	23.12	21.24	14.83	20.48
3	3.0	2.17	2.31	2.59	2.35	1.57	2.71	1.69	2.09	40.90	43.54	48.82	44.30	29.59	51.08	31.86	39.40
4	5.0	3.04	2.73	2.71	2.86	2.91	3.46	2.41	2.79	95.50	85.77	85.14	89.85	91.42	108.70	75.71	87.65
5	10.0	2.94	2.53	3.35	3.39	3.53	2.77	2.15	2.5	184.73	158.96	210.49	213.00	221.80	174.04	135.09	157.08
6	15.0	3.14	3.42	3.82	2.87	2.97	3.64	2.77	3.03	295.94	322.33	360.03	270.49	279.92	343.06	261.07	285.57
7	20.0	2.83	3.11	2.79	3.68	3.74	4.02	2.53	3.44	355.63	390.81	350.60	462.44	469.98	505.17	317.93	432.28

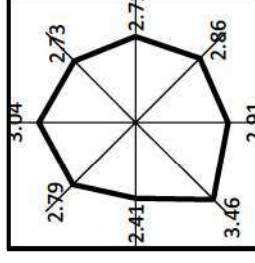
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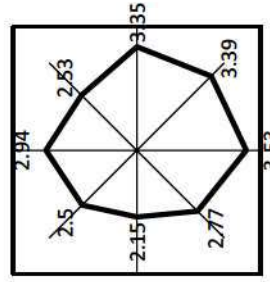
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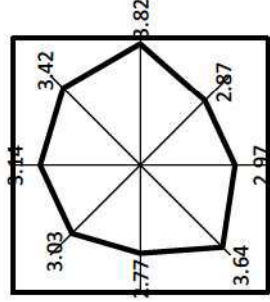
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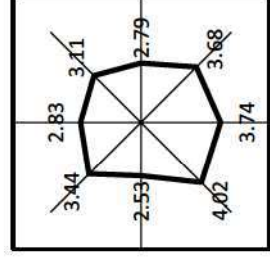
10.00Mtr.



15.00Mtr.



20.00Mtr.



ZONE-10

FOR REFERENCE PURPOSE ONLY

BUILDING

ADMINISTRATIVE

One (1) borehole was sunk in this area, viz borehole mark the general sub soil profile it has been observed that the top to hard yellowish grey silty clay/ clayey silt with sand and the second layer as encountered up to the explored depth is very dense yellowish greysilty sand.

Discussion and Recommendation:

Based on the sub-soil condition, shallow foundation has been recommended for foundation system of medium to heavily loaded structures. Bearing capacities for different size and shapes of foundations are indicated in the Table-2A (Zone-10).

Pile Foundation has also been recommended for foundation of heavily loaded structures. Pile Capacities for different dia of pile are indicated in the Table-2B (Zone-10). It is further recommended to carry out initial pile load test for load under compression, pull-out and horizontal shear, in order to confirm the recommended pile capacities and to take corrective measures, if required.

FOR REFERENCE PURPOSE ONLY

Table-2A (Zone-10).

**ALLOWABLE BEARING CAPACITY FROM SHE/
SETTLEMENT CRITERIA**

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Qnet safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
ISOLATED SQUARE FOOTINGS	1.00	1.00	1.00	43.9	24.52	43	43	43
	2.50	2.50	1.00	39.5	67.67	14	23	39
	5.00	5.00	1.00	38.0	138.21	6	10	20
	7.50	7.50	1.00	37.5	208.54	4	7	13
	10.00	10.00	1.00	37.3	279.20	3	5	10
	1.00	1.00	1.50	47.6	25.08	47	47	47
	2.50	2.50	1.50	41.0	65.90	15	24	41
	5.00	5.00	1.50	38.8	136.98	7	11	21
	7.50	7.50	1.50	38.0	207.27	4	7	13
	10.00	10.00	1.50	37.7	278.17	3	5	10
	1.00	1.00	2.00	51.2	25.97	49	51	51
	2.50	2.50	2.00	42.4	63.63	16	26	42
	5.00	5.00	2.00	39.5	135.28	7	11	21
	7.50	7.50	2.00	38.5	205.93	4	7	14
	10.00	10.00	2.00	38.0	276.36	3	5	10
	1.00	1.00	3.00	58.5	28.36	51	58	58
	2.50	2.50	3.00	45.4	58.52	19	31	45
	5.00	5.00	3.00	41.0	131.74	7	12	23
	7.50	7.50	3.00	39.5	202.91	4	7	14
	10.00	10.00	3.00	38.8	273.97	3	5	10

ALLOWABLE BEARING CAPACITY FROM SHEAR SETTLEMENT CRITERIA

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Q _{net} safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
ISOLATED RECTANGULAR FOOTINGS	1.50	1.00	1.00	38.3	27.80	34	38	38
	3.75	2.50	1.00	34.4	73.27	11	18	34
	7.50	5.00	1.00	33.1	147.95	5	8	16
	11.25	7.50	1.00	32.7	222.68	3	5	11
	15.00	10.00	1.00	32.5	297.37	2	4	8
	1.50	1.00	1.50	41.4	25.70	40	41	41
	3.75	2.50	1.50	35.7	72.28	12	19	35
	7.50	5.00	1.50	33.8	147.53	5	9	17
	11.25	7.50	1.50	33.1	221.93	3	5	11
	15.00	10.00	1.50	32.8	296.67	2	4	8
	1.50	1.00	2.00	44.6	23.00	44	44	44
	3.75	2.50	2.00	37.0	71.03	13	20	37
	7.50	5.00	2.00	34.4	146.53	5	9	17
	11.25	7.50	2.00	33.6	221.75	3	6	11
	15.00	10.00	2.00	33.1	295.90	2	4	8
	1.50	1.00	3.00	51.0	33.17	38	51	51
	3.75	2.50	3.00	39.5	67.53	14	23	39
	7.50	5.00	3.00	35.7	144.57	6	9	18
	11.25	7.50	3.00	34.4	219.80	3	6	11
	15.00	10.00	3.00	33.8	295.06	2	4	8

ALLOWABLE BEARING CAPACITY FROM SHEAR SETTLEMENT CRITERIA

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Q _{net} safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
CONTINUOUS STRIP FOOTINGS		1.00	1.00	33.8	48.63	17	27	33
		1.50	1.00	31.9	70.60	11	18	31
		2.00	1.00	30.9	92.31	8	13	25
		2.50	1.00	30.4	114.36	6	10	19
		1.00	1.50	36.6	50.65	18	28	36
		1.50	1.50	33.8	72.94	11	18	33
		2.00	1.50	32.3	94.73	8	13	25
		2.50	1.50	31.5	116.76	6	10	20
		1.00	2.00	39.4	52.35	18	30	39
		1.50	2.00	35.6	74.87	11	19	35
		2.00	2.00	33.8	97.26	8	13	26
		2.50	2.00	32.6	119.05	6	10	20
		1.00	3.00	45.0	54.85	20	32	45
		1.50	3.00	39.4	78.53	12	20	37
		2.00	3.00	36.6	101.29	9	14	27
		2.50	3.00	34.9	123.61	7	11	21

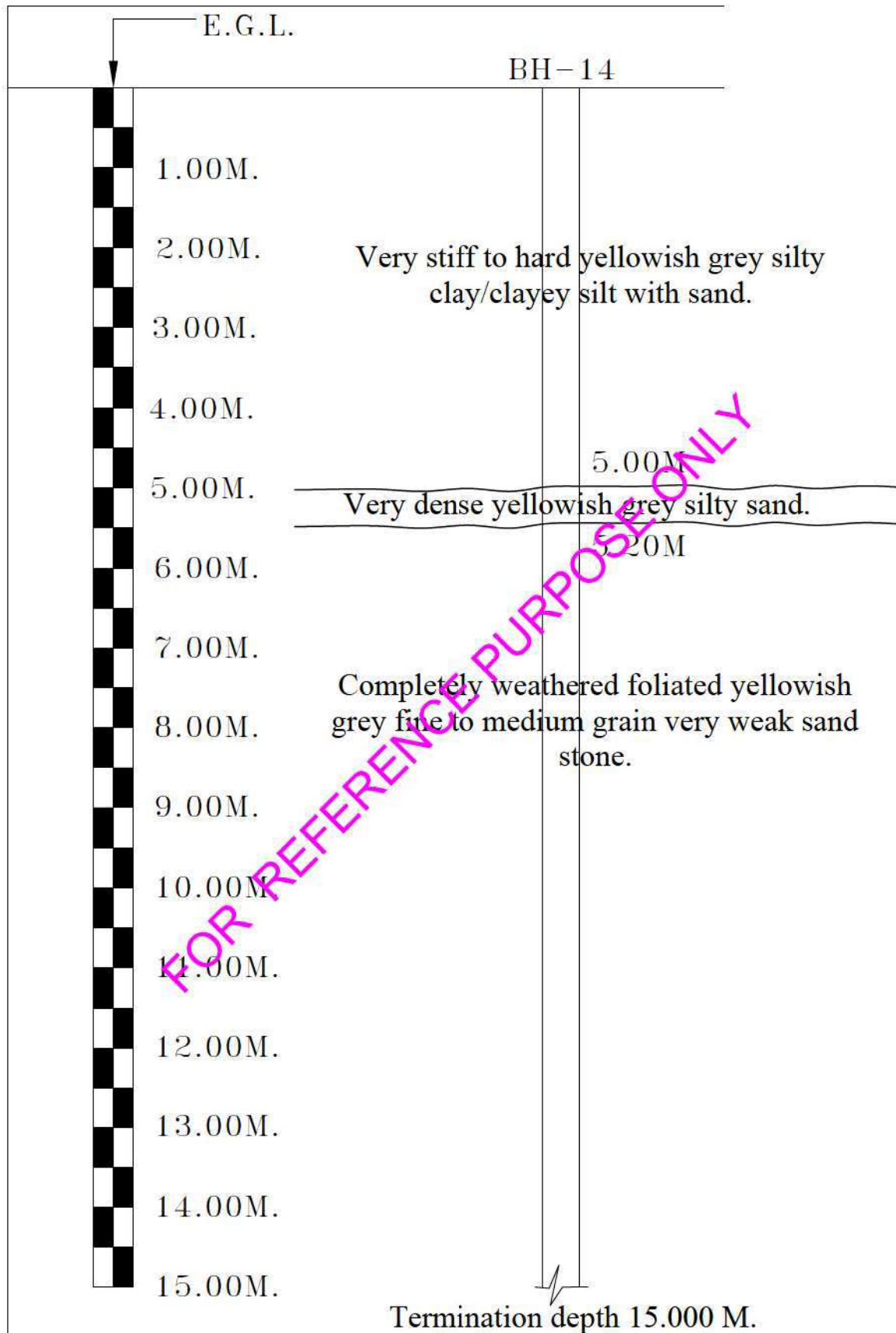
Table-2B (Zone-10).
Recommended Pile Capacity

Sl.No	Pile Dia , D	Total Length of Pile, L	Cut-off Level	Recommended Pile Capacity in Compression	Recommended Pile Capacity in Pull-Out	Recommended Pile Capacity in Horizontal Shear
	Mtr	Mtr.	Mtr.	T	T	T
1	0.600	10.000	2.000	49	29	6
2	0.750	10.000	2.000	72	38	8
3	1.000	10.000	2.000	113	51	11
4	1.500	10.000	2.000	220	76	16

FOR REFERENCE PURPOSE ONLY

BORE LOG SHEET		Centre for Advanced Engineering						Bore Hole
								Job No.:
Project: SOIL PDIL ECL SANCTORIA								
Co-ord:		E.G.L.: 112.090	Unit: Building Administrative					Bore Hole
Type of Boring	Shell & Auger	FIELDTEST	NOS.	SAMPLES	NOS.	SAMPLES	NOS.	Commence
Depth of Boring	5.200 M.	SPT	4	UDS	2	WS		Completed on : 24.05.2022
Type of Drilling		DCPT		DS	6	RCS	7	Water Struck At : 2.00M
Depth of Drilling	9.800 M.	VST		SCPT				Standing Water Table : 1.85M

DESCRIPTION	SYMBOL	DEPTH	N-V A L U E	S A M P L E	
				NO.	DEPTH
Very stiff to hard yellowish grey silty clay/clayey silt with sand.		01	N = 24	DS1	0.50 M
				DS2	1.00 M
				SPT1	1.50-1.95M
				DS3	1.50-1.95M
		02	N = 32	UDS1	2.00-2.45M
				SPT2	3.00-3.45M
				DS4	3.00-3.45M
				UDS2	4.00-4.45M
Very dense yellowish grey silty sand.		03	N = 40	SPT3	4.50-4.95M
				DS5	4.50-4.95M
				SPT4	5.00-5.20M
				DS6	5.00-5.20M
Completely weathered foliated yellowish grey fine to medium grain very weak sand stone.		04	N > 100	RUN1	5.20-6.50M
				TCR-22%	
				RQD-NIL	
				RUN2	6.50-8.00M
				TCR-35%	
				RQD-NIL	
				RUN3	8.00-9.50M
		05		TCR-45%	
				RQD-NIL	
				RUN4	9.50-11.00M
				TCR-49%	
				RQD-NIL	
				RUN5	11.00-12.50M
				TCR-44%	
		06		RQD-NIL	
				RUN6	12.50-14.00M
				TCR-53%	
				RQD-NIL	
				RUN7	14.00-15.00M
				TCR-63%	
				RQD-NIL	
Termination Depth 15.000 Mtr.		15			



Sub-Soil Profile through BH-14

Sketch No.-SK/PDIL/	Building Administrative	1678	02	13 of 13
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SUMMARY OF LABORATORY TEST RESULTS

Table-4

Project: Geotechnical Investigation Work for Proposed Coalgas to Methanol Project at Sactoria, West Bardhaman (WB)

Layer No.	Description of layer	Bore Hole No.	Depth	Sample Type - UD/D/ DN	SPT VALUE (N)	Atterberg Limits			Bulk Density in gm/cc	Water Content in %	Specific Gravity	Dry Density in gm/cc	Unconfine d Test in Kg/sqcm	Shear Test			Pressure (Kg/sqcm)	Co-eff. of volume compressibility in sqcm/kg	Swelling Pressure in kg/sqcm	Grading				Modified Proctor Density		
						LL	PL	SL						Type of Test	Cohesion in kg/sqcm	Friction angle in degree				Gravel (> 4.75 mm)	Sand (0.075 - 4.75 mm)	Silt (0.002 - 0.075 mm)	Clay (< 0.002 mm)	MDD	OMC	
I	Very stiff to hard yellowish grey silty clay/dayey silt with sand.	14	Meter			%	%	%	γ_b	m	G	γ_d	q_u	UU/CU/ DS	C	ϕ				%	%	%	%	gm/cc	%	
			0.50	D																0	27	50	23	1.79	14.00	
			1.00	D	45	21	10													0	30	48	22			
			1.50	DN				2.67												0	26	56	18			
															UU	1.37	0	0.00-0.10	0.0436							
																		0.10-0.20	0.0394							
																		0.20-0.40	0.0349	0.000	0	28	55	17		
																		0.40-0.80	0.0299							
																		0.80-1.60	0.0205							
																		1.60-3.20	0.0143							
		14	3.00	DN	32	46	21	12												0	33	43	24			
		14	4.00	UD		45	20	11			2.67									0	32	57	11			
		14	4.50	DN	40				1.81						DS	0.11	34			0	29	55	16			
		14	5.00	DN	>100				2.64											0	82	14	4			
II	Very dense yellowish grey silty sand	14																								

ZONE-11

COOLING TOWER
FOR METHANOL
PLANT AND
GASIFICATION

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Total one (1) borehole was sunk in this area, viz borehole n general sub soil profile it has been observed that the top s mottled yellowish/ bluish grey silty clay/ clayey silt with sand and continues up to the explored depth.

In addition the following field test has been carried out at this zone and results are being indicated in this chapter.

1. Static Cone Penetration Test:

One (1) static cone penetration test has been carried out at this zone marked as SCPT-2.

Discussion and Recommendation:

Based on the sub-soil condition, shallow foundation has been recommended for foundation system of medium to heavily loaded structures. Bearing capacities for different size and shapes of foundations are indicated in the Table-2A (Zone-11).

Pile Foundation has also been recommended for foundation of heavily loaded structures. Pile Capacities for different dia of pile are indicated in the Table-2B (Zone-11). It is further recommended to carry out initial pile load test for load under compression, pull-out and horizontal shear, in order to confirm the recommended pile capacities and to take corrective measures, if required.

Table-2A (Zone-11).

**ALLOWABLE BEARING CAPACITY FROM SHEAR
SETTLEMENT CRITERIA**

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Q _{net} safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
ISOLATED SQUARE FOOTINGS	1.00	1.00	1.00	45.2	21.19	45	45	45
	2.50	2.50	1.00	40.7	58.49	17	27	40
	5.00	5.00	1.00	39.1	119.30	8	13	24
	7.50	7.50	1.00	38.6	180.08	5	8	16
	10.00	10.00	1.00	38.4	241.12	3	6	11
	1.00	1.00	1.50	48.9	21.61	48	48	48
	2.50	2.50	1.50	42.2	56.90	18	29	42
	5.00	5.00	1.50	39.9	118.17	8	13	25
	7.50	7.50	1.50	39.1	178.91	5	8	16
	10.00	10.00	1.50	38.8	240.16	4	6	12
	1.00	1.00	2.00	52.7	22.42	52	52	52
	2.50	2.50	2.00	43.7	55.01	19	31	43
	5.00	5.00	2.00	40.7	116.93	8	13	26
	7.50	7.50	2.00	39.6	177.68	5	8	16
	10.00	10.00	2.00	39.1	238.55	4	6	12
	1.00	1.00	3.00	60.2	24.48	60	60	60
	2.50	2.50	3.00	46.7	50.50	23	36	46
	5.00	5.00	3.00	42.2	113.75	9	14	27
	7.50	7.50	3.00	40.7	175.39	5	9	17
	10.00	10.00	3.00	39.9	236.34	4	6	12

ALLOWABLE BEARING CAPACITY FROM SHEAR SETTLEMENT CRITERIA

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Q _{net} safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
ISOLATED RECTANGULAR FOOTINGS	1.50	1.00	1.00	39.4	24.05	39	39	39
	3.75	2.50	1.00	35.4	63.41	13	22	35
	7.50	5.00	1.00	34.1	128.19	6	10	19
	11.25	7.50	1.00	33.7	193.01	4	6	13
	15.00	10.00	1.00	33.5	257.73	3	5	9
	1.50	1.00	1.50	42.7	22.29	42	42	42
	3.75	2.50	1.50	36.7	62.50	14	23	36
	7.50	5.00	1.50	34.8	127.75	6	10	20
	11.25	7.50	1.50	34.1	192.29	4	7	13
	15.00	10.00	1.50	33.8	257.11	3	5	9
	1.50	1.00	2.00	45.9	19.91	45	45	45
	3.75	2.50	2.00	38.1	61.51	15	24	38
	7.50	5.00	2.00	35.4	126.82	6	11	20
	11.25	7.50	2.00	34.6	192.05	4	7	13
	15.00	10.00	2.00	34.1	256.38	3	5	9
	1.50	1.00	3.00	52.5	28.72	45	52	52
	3.75	2.50	3.00	40.7	58.52	17	27	40
	7.50	5.00	3.00	36.7	124.99	7	11	22
	11.25	7.50	3.00	35.4	190.23	4	7	13
	15.00	10.00	3.00	34.8	255.49	3	5	10

ALLOWABLE BEARING CAPACITY FROM SHEAR SETTLEMENT CRITERIA

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Q _{net} safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
CONTINUOUS STRIP FOOTINGS		1.00	1.00	34.7	42.43	20	32	34
		1.50	1.00	32.8	61.69	13	21	32
		2.00	1.00	31.8	80.74	9	15	29
		2.50	1.00	31.3	100.07	7	12	23
		1.00	1.50	37.6	44.22	21	34	37
		1.50	1.50	34.7	63.64	13	21	34
		2.00	1.50	33.3	82.99	10	16	30
		2.50	1.50	32.4	102.07	7	12	23
		1.00	2.00	40.5	45.74	22	35	40
		1.50	2.00	36.7	65.60	13	22	36
		2.00	2.00	34.7	84.86	10	16	30
		2.50	2.00	33.6	104.28	8	12	24
		1.00	3.00	46.3	47.96	24	38	46
		1.50	3.00	40.5	68.60	14	23	40
		2.00	3.00	37.6	88.44	10	17	31
		2.50	3.00	35.9	108.06	8	13	24

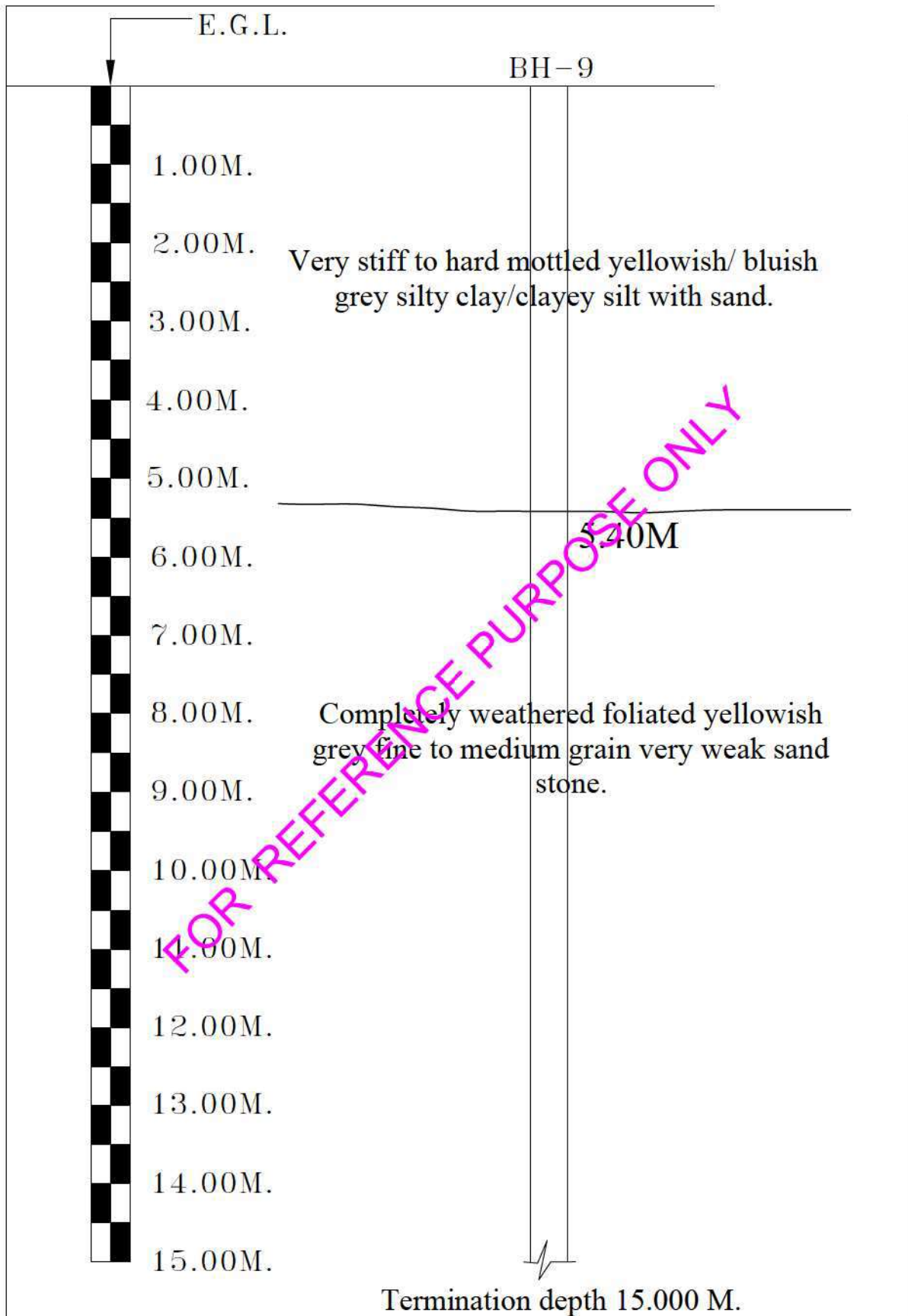
Table-2B (Zone-11).**Recommended Pile Capacity**

Sl.No	Pile Dia , D	Total Length of Pile, L	Cut-off Level	Recommended Pile Capacity in Compression	Recommended Pile Capacity in Pull-Out	Recommended Pile Capacity in Horizontal Shear
	Mtr	Mtr.	Mtr.	T	T	T
1	0.600	10.000	2.000	50	30	6
2	0.750	10.000	2.000	74	39	8
3	1.000	10.000	2.000	115	53	11
4	1.500	10.000	2.000	223	79	16

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BORE LOG SHEET		Centre for Advanced Engineering						Bore Hole
								Job No.:
Project: SOIL PDIL ECL SANCTORIA								
Co-ord:		E.G.L.:114.304		Unit: Cooling Tower			Bore Hole	
Type of Boring	Shell & Auger	FIELDTEST	NOS.	SAMPLES	NOS.	SAMPLES	NOS.	Commence
Depth of Boring	5.400 M.	SPT	4	UDS	2	WS		Completed on : 23.05.2022
Type of Drilling		DCPT		DS	6	RCS	7	Water Struck At : 2.00M
Depth of Drilling	9.600 M.	VST		SCPT				Standing Water Table : 1.90M

D E S C R I P T I O N	SYMBOL	DEPTH	N-V A L U E	S A M P L E	
				NO.	DEPTH
Very stiff to hard mottled yellowish/ bluish grey silty clay/clayey silt with sand.		<div><div></div><div>01</div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><di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Sub-Soil Profile through BH-9

SUMMARY OF LABORATORY TEST RESULTS

Table-4

Project: Geotechnical Investigation Work for Proposed Coalgas to Methanol Project at Sactoria, West Bardhaman (WB)

Layer No.	Description of layer	Bore Hole No.	Depth	Sample Type - UD/D/ DN	SPT VALUE (N)	Atterberg Limits			Bulk Density in gm/cc	Water Content In %	Specific Gravity	Dry Density in gm/cc	Unconfine d Test in Kg/sqcm	Shear Test			Pressure (Kg/sqcm)	Co-eff. of volume compressibility in sqcm/kg	Swelling Pressure in kg/sqcm	Grading				Modified Proctor Density	
						LL	PL	SL						Type of Test	Cohesion in kg/sqcm	Friction angle in degree				Gravel (> 4.75 mm)	Sand (0.075 - 4.75 mm)	Silt (0.002 - 0.075 mm)	Clay (< 0.002 mm)	MDD	OMC
		9	0.50	D				%	γ_b	m	G	γ_d	q_u	UU/cu/ DS	C	ϕ				%	%	%	gm/cc	%	
		9	1.00	D		46	19	10												0	28	49	23	1.76	12.64
		9	1.50	DN	24						2.67									0	24	51	25	1.77	13.27
														UU	1.41	0	0.00-0.10	0.0457							
		9	2.00	UD		43	18	11	1.94	15.25	2.66	1.68	2.76	CU	0.12	14	0.20-0.40	0.0345	0.000	0	37	41	22		
																	0.40-0.80	0.0269							
														CD	0.04	27	0.80-1.60	0.0194							
		9	3.00	DN	28	45	17	9									1.60-3.20	0.0112		0	31	43	26		
														UU	1.55	0	0.00-0.10	0.0429							
		9	4.00	UD		44	20	12	1.91	18.36	2.66	1.61	3.00	CU	0.11	12	0.20-0.40	0.0308	0.000	0	42	39	19		
																	0.40-0.80	0.0246							
														CD	0.01	26	0.80-1.60	0.0179							
		9	4.50	DN	41				1.82					DS	0.18	34	1.60-3.20	0.0108		0	38	48	14		
		9	5.20	DN	N>100						2.67									0	48	36	16		

Very stiff to hard mottled yellowish/ bluish grey silty clay/clayey silt with sand.

I

Very stiff to hard mottled yellowish/ bluish grey silty clay/clayey silt with sand.

Table -1

Project: Proposed Coalgas to Methanol Project at Sactoria, West Bardhaman (WB)

Client.: Project & Development India Limited

Side ID :

Correction A		
1. Mass of Cone (m)	1.34 Kg	
2. Mass of each sounding rod (m1)	1.55 Kg	
3. Cone area at Base (b)	10 Sqcm	
4. Plunger Area (b')	20 Sqcm	
5. Correction factor to be added to gauge reading $C1 = (m+nm1)/10$	0.289 Kg	
6. No of Rod Used (n)	6	

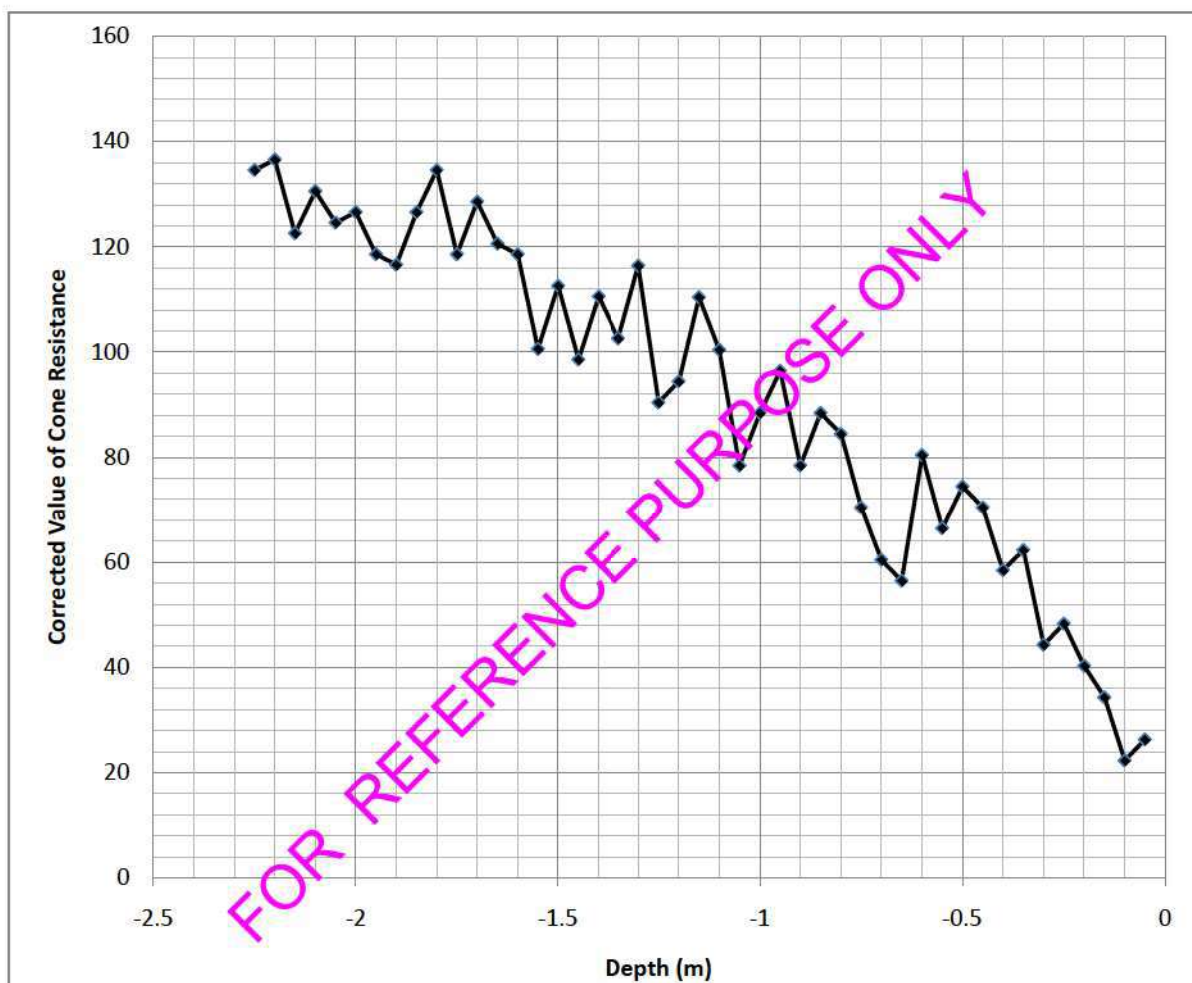
Correction B		
1. Mass of friction Jacket (m_f)	1.345 Kg	
2. Outer dia, of Friction Jacket (d)	3.6 cm	
3. Length of Friction Jacket (h)	13 Sqcm	
4. Surface area of friction jacket (a) = πdh	147 Sqcm	
5. Correction factor to be added to gauge reading $C2 = (m_f/a)$	0.01 Kg/ Sqcm	
Test Number	SCPT-2	

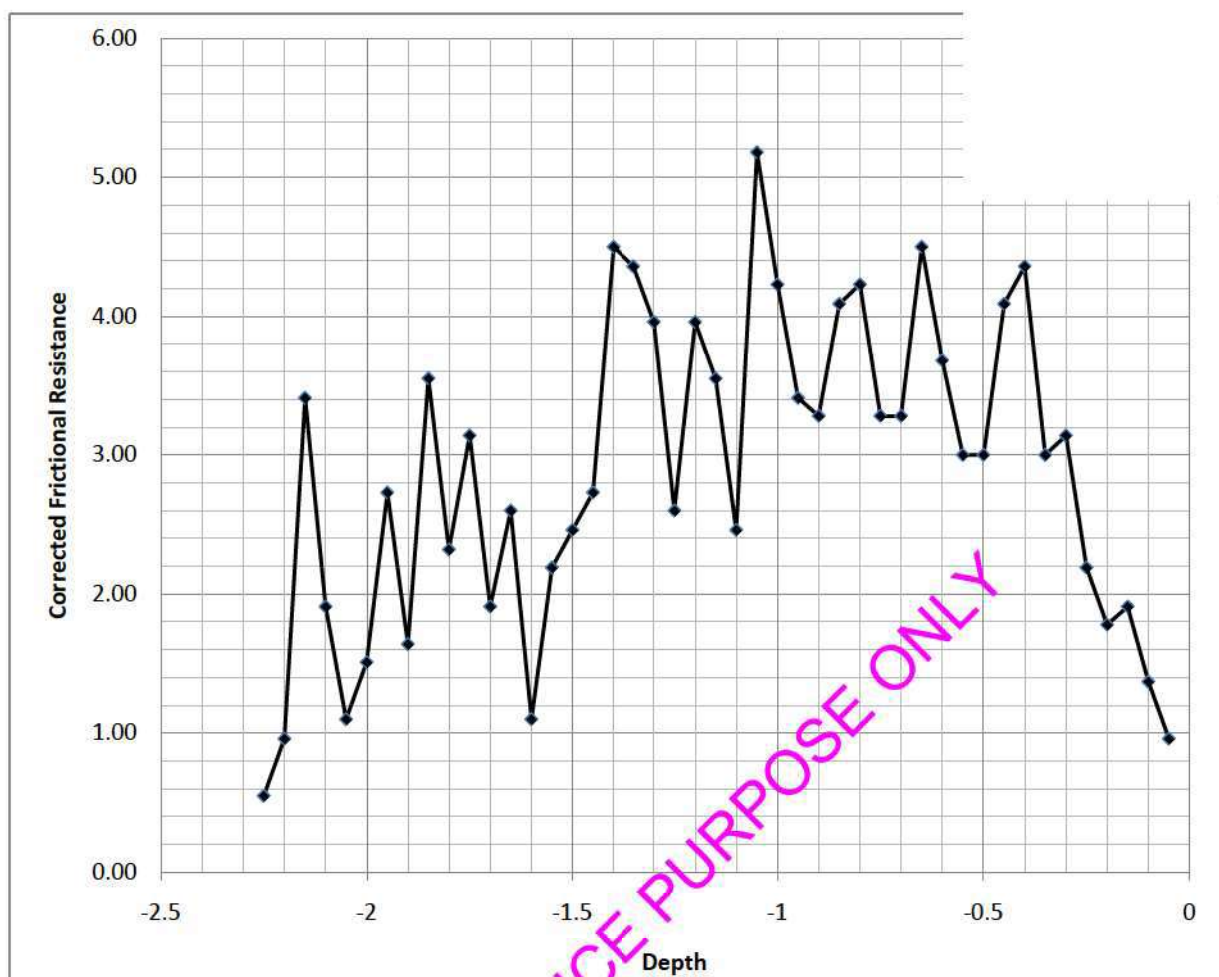
Depth	Number of Rod in Use	CONE				JACKET				
		Gauge Reading of Cone Penetration	Cone Penetration Resistance	Correction Factor	Corrected Value of Cone Resistance	Gauge Reading of Cone + Jacket Resistance	Cone + Jacket Resistance	Total Resistance - Cone Resistance	Frictional Resistance	Corrected Frictional Resistance
m	n	Kg/ Sqcm	Kg/ Sqcm	Kg/ Sqcm	Kg/ Sqcm	Kg/ Sqcm	Kg/ Sqcm	Kg/ Sqcm	Kg/ Sqcm	Kg/ Sqcm
		Y	$y=Y*(b'/b)$	$C1$	$R_c=Y+C1$	X	$x=X*(b'/b)$	$x-y$	$Z=(x-y)*(b/a)$	$R_f=Z+(mf/a)$
-0.05	1	13	26	0.29	26.29	20	40	14	0.95	0.96
-0.10	1	11	22	0.29	22.29	21	42	20	1.36	1.37
-0.15	1	17	34	0.29	34.29	31	62	28	1.9	1.91
-0.20	1	20	40	0.29	40.29	33	66	26	1.77	1.78
-0.25	1	24	48	0.29	48.29	40	80	32	2.18	2.19
-0.30	1	22	44	0.29	44.29	45	90	46	3.13	3.14
-0.35	1	31	62	0.29	62.29	53	106	44	2.99	3.00
-0.40	2	29	58	0.44	58.44	61	122	64	4.35	4.36
-0.45	2	35	70	0.44	70.44	65	130	60	4.08	4.09
-0.50	2	37	74	0.44	74.44	59	118	44	2.99	3.00
-0.55	2	33	66	0.44	66.44	55	110	44	2.99	3.00
-0.60	2	40	80	0.44	80.44	67	134	54	3.67	3.68
-0.65	2	28	56	0.44	56.44	61	122	66	4.49	4.50
-0.70	2	30	60	0.44	60.44	54	108	48	3.27	3.28

Depth	Number of Rod in Use	Gauge Reading of Cone Penetration	Cone Penetration Resistance	Correction Factor	Corrected Value of Cone Resistance	Gauge Reading of Cone + Jacket Resistance	Cone + Jacket Resistance	Total Resistance - Cone Resistance	Frictional Resistance	Corrected Frictional Resistance
m	n	Kg/ Sqcm	Kg/ Sqcm	C1	R _c =Y+C1	Kg/ Sqcm	x=X*(b'/b)	x-y	Z=(x-y)*(b/a)	Rf= Z+(mf/a)
-0.75	2	35	70	0.44	70.44	59	113	48	3.27	3.28
-0.80	2	42	84	0.44	84.44	73	146	62	4.22	4.23
-0.85	2	44	88	0.44	88.44	74	148	60	4.08	4.09
-0.90	2	39	78	0.44	78.44	63	126	48	3.27	3.28
-0.95	2	48	96	0.44	96.44	73	146	50	3.4	3.41
-1.00	2	44	88	0.44	88.44	73	150	62	4.22	4.23
-1.05	2	39	78	0.44	78.44	77	154	76	5.17	5.18
-1.10	2	50	100	0.44	100.44	68	136	36	2.45	2.46
-1.15	2	55	110	0.44	110.44	81	162	52	3.54	3.55
-1.20	2	47	94	0.44	94.44	76	152	58	3.95	3.96
-1.25	2	45	90	0.44	90.44	64	128	38	2.59	2.60
-1.30	2	58	116	0.44	116.44	87	174	58	3.95	3.96
-1.35	3	51	102	0.6	102.6	83	166	64	4.35	4.36
-1.40	3	55	110	0.6	110.6	88	176	66	4.49	4.50
-1.45	3	49	98	0.6	98.6	69	138	40	2.72	2.73
-1.50	3	56	112	0.6	112.6	74	148	36	2.45	2.46
-1.55	3	50	100	0.6	100.6	66	132	32	2.18	2.19
-1.60	3	59	118	0.6	118.6	67	134	16	1.09	1.10
-1.65	3	60	120	0.6	120.6	79	158	38	2.59	2.60
-1.70	3	64	128	0.6	128.6	78	156	28	1.9	1.91
-1.75	3	59	118	0.6	118.6	82	164	46	3.13	3.14
-1.80	3	67	134	0.6	134.6	84	168	34	2.31	2.32
-1.85	3	63	126	0.6	126.6	89	178	52	3.54	3.55
-1.90	3	58	116	0.6	116.6	70	140	24	1.63	1.64
-1.95	3	59	118	0.6	118.6	79	158	40	2.72	2.73
-2.00	3	63	126	0.6	126.6	74	148	22	1.5	1.51
-2.05	3	62	124	0.6	124.6	70	140	16	1.09	1.1
-2.10	3	65	130	0.6	130.6	79	158	28	1.9	1.91
-2.15	3	61	122	0.6	122.6	86	172	50	3.4	3.41

Depth	Number of Rod in Use	Gauge Reading of Cone Penetration	Cone Penetration Resistance	Correction Factor	Corrected Value of Cone Resistance	Gauge Reading of Cone + Jacket Resistance	Cone + Jacket Resistance	Total Resistance - Cone Resistance	Frictional Resistance	Corrected Frictional Resistance
m	n	Kg/ Sqcm	Kg/ Sqcm	C1	R _c =v+C1	Kg/ Sqcm	x=X*(b'/b)	Kg/ Sqcm	Kg/ Sqcm	R _f = Z+(mf/a)
-2.20	3	68	136	0.6	136.6	75	150	14	0.95	0.96
-2.25	3	67	134	0.6	134.6	71	142	8	0.54	0.55

FOR REFERENCE PURPOSE ONLY





FOR REFERENCE PURPOSE ONLY

ZONE-12

FOR REFERENCE PURPOSE ONLY

AIR SEPARATION UNIT

Total one (1) borehole was sunk in this area, viz borehole n
general sub soil profile it has been observed that the top s
yellowish grey silty clay/ clayey silt with grass roots, morrum, sand and traces of
coal and continues up to the explored depth.

In addition the following field test has been carried out at this zone and results
are being indicated in this chapter.

1. Cyclic Plate Load Test:

One (1) cyclic plate load test has been carried out at this zone marked as
CPLT-2.

2. Electrical Resistivity Test:

One (1) electrical resistivity test has been carried out at this zone marked
as ERT-5.

Discussion and Recommendation:

Based on the sub-soil condition, shallow foundation has been recommended for
foundation system of medium to heavily loaded structures. Bearing capacities for
different size and shapes of foundations are indicated in the Table-2A (Zone-12).

Pile Foundation has also been recommended for foundation of heavily loaded
structures. Pile Capacities for different dia of pile are indicated in the Table-2B
(Zone-12). It is further recommended to carry out initial pile load test for load
under compression, pull-out and horizontal shear, in order to confirm the
recommended pile capacities and to take corrective measures, if required.

Table-2A (Zone-12).

**ALLOWABLE BEARING CAPACITY FROM SHEAR
SETTLEMENT CRITERIA**

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Q _{net} safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
ISOLATED SQUARE FOOTINGS	1.00	1.00	1.00	35.6	17.42	35	35	35
	2.50	2.50	1.00	32.0	47.99	16	26	32
	5.00	5.00	1.00	30.8	98.06	7	12	23
	7.50	7.50	1.00	30.4	147.98	5	8	15
	10.00	10.00	1.00	30.2	197.86	3	6	11
	1.00	1.00	1.50	38.5	17.76	38	38	38
	2.50	2.50	1.50	33.2	46.71	17	28	33
	5.00	5.00	1.50	31.4	97.03	8	12	24
	7.50	7.50	1.50	30.8	147.04	5	8	15
	10.00	10.00	1.50	30.5	196.97	3	6	11
	1.00	1.00	2.00	41.5	18.42	41	41	41
	2.50	2.50	2.00	34.4	45.19	19	30	34
	5.00	5.00	2.00	32.0	95.92	8	13	25
	7.50	7.50	2.00	31.2	146.06	5	8	16
	10.00	10.00	2.00	30.8	196.06	3	6	11
	1.00	1.00	3.00	47.4	20.11	47	47	47
	2.50	2.50	3.00	36.7	41.41	22	35	36
	5.00	5.00	3.00	33.2	93.37	8	14	26
	7.50	7.50	3.00	32.0	143.88	5	8	16
	10.00	10.00	3.00	31.4	194.06	4	6	12

ALLOWABLE BEARING CAPACITY FROM SHEAR SETTLEMENT CRITERIA

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Q _{net} safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
ISOLATED RECTANGULAR FOOTINGS	1.50	1.00	1.00	31.0	19.73	31	31	31
	3.75	2.50	1.00	27.9	52.11	13	21	27
	7.50	5.00	1.00	26.8	105.05	6	10	19
	11.25	7.50	1.00	26.5	158.25	4	6	12
	15.00	10.00	1.00	26.3	211.02	3	4	9
	1.50	1.00	1.50	33.6	13.29	33	33	33
	3.75	2.50	1.50	28.9	51.31	14	22	28
	7.50	5.00	1.50	27.4	104.87	6	10	19
	11.25	7.50	1.50	26.8	157.57	4	6	12
	15.00	10.00	1.50	26.6	210.98	3	5	9
	1.50	1.00	2.00	36.2	16.37	36	36	36
	3.75	2.50	2.00	30.0	50.50	14	23	30
	7.50	5.00	2.00	27.9	104.22	6	10	20
	11.25	7.50	2.00	27.2	157.42	4	6	12
	15.00	10.00	2.00	26.8	210.10	3	5	9
	1.50	1.00	3.00	41.3	23.55	41	41	41
	3.75	2.50	3.00	32.0	47.97	16	26	32
	7.50	5.00	3.00	28.9	102.63	7	11	21
	11.25	7.50	3.00	27.9	156.33	4	7	13
	15.00	10.00	3.00	27.4	209.75	3	5	9

ALLOWABLE BEARING CAPACITY FROM SHEAR SETTLEMENT CRITERIA

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Qnet safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
CONTINUOUS STRIP FOOTINGS		1.00	1.00	27.3	34.71	19	27	27
		1.50	1.00	25.8	50.46	12	20	25
		2.00	1.00	25.1	66.27	9	15	25
		2.50	1.00	24.6	81.78	7	12	22
		1.00	1.50	29.6	36.20	20	29	29
		1.50	1.50	27.3	52.07	13	20	27
		2.00	1.50	26.2	67.90	9	15	26
		2.50	1.50	25.5	83.54	7	12	22
		1.00	2.00	31.9	37.46	21	31	31
		1.50	2.00	28.9	53.72	13	21	28
		2.00	2.00	27.3	69.42	9	15	27
		2.50	2.00	26.4	85.20	7	12	23
		1.00	3.00	36.5	39.32	23	36	36
		1.50	3.00	31.9	56.19	14	22	31
		2.00	3.00	29.6	72.40	10	16	29
		2.50	3.00	28.2	88.27	7	12	23

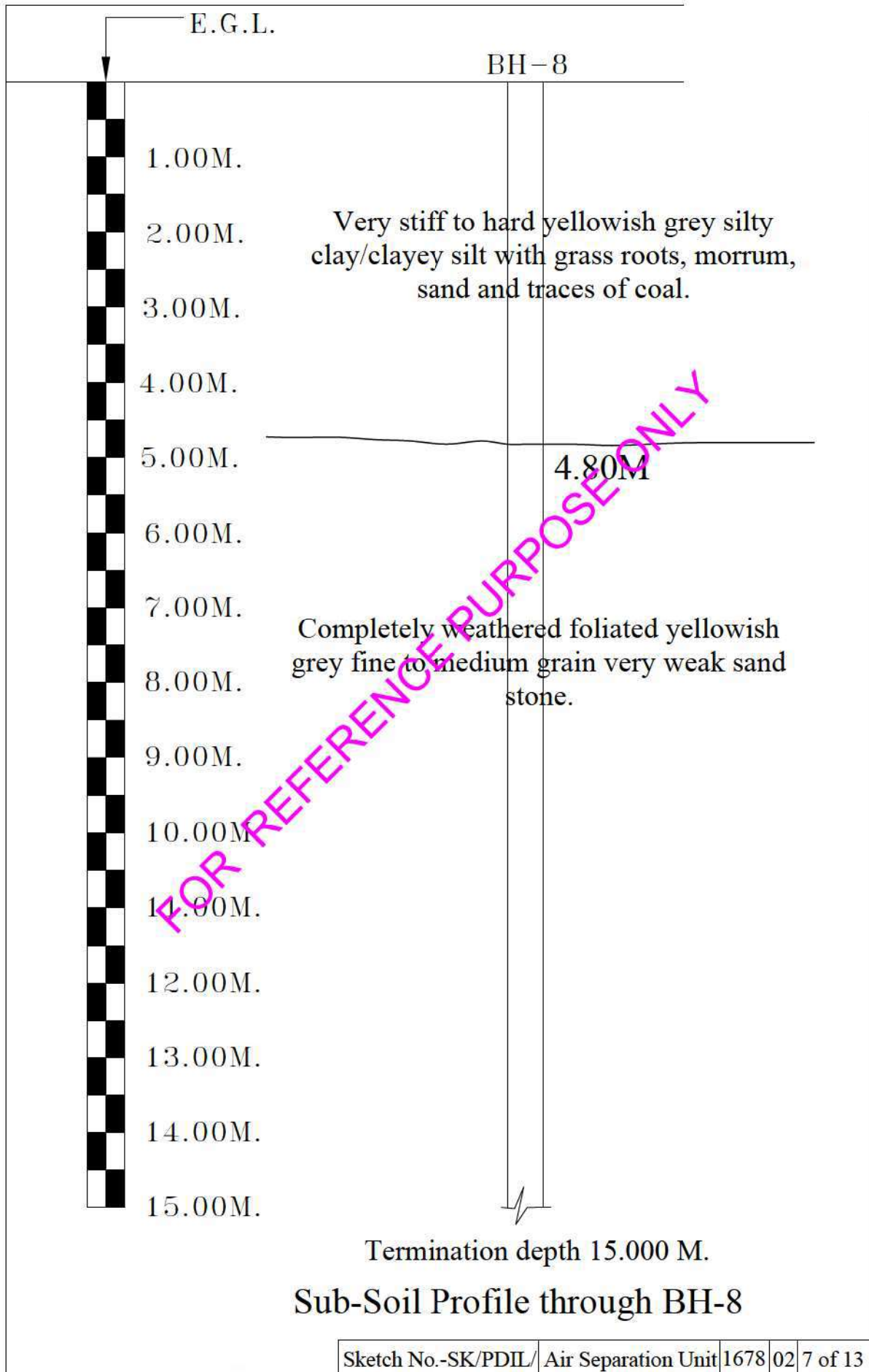
Table-2B (Zone-12).**Recommended Pile Capacity**

Sl.No	Pile Dia , D	Total Length of Pile, L	Cut-off Level	Recommended Pile Capacity in Compression	Recommended Pile Capacity in Pull-Out	Recommended Pile Capacity in Horizontal Shear
	Mtr	Mtr.	Mtr.	T	T	T
1	0.600	10.000	2.000	46	26	6
2	0.750	10.000	2.000	69	35	8
3	1.000	10.000	2.000	109	47	11
4	1.500	10.000	2.000	214	70	16

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BORE LOG SHEET		Centre for Advanced Engineering					Bore Hole	
							Job No.: 9	
Project: SOIL_PDIL_ECL SANCTORIA								
Co-ord:		E.G.L.:111.890	Unit: Air Separation Unit			Bore Hole		
Type of Boring	Shell & Auger	FIELDTEST	NOS.	SAMPLES	NOS.	SAMPLES	NOS.	Commence
Depth of Boring	4.800 M.	SPT	3	UDS	2	WS		Completed on : 22.05.2022
Type of Drilling		DCPT		DS	5	RCS	8	Water Struck At :1.70M
Depth of Drilling	10.200 M.	VST		SCPT				Standing Water Table : 1.60M

D E S C R I P T I O N	SYMBOL	DEPTH	N-V A L U E	S A M P L E			
				NO.	DEPTH		
Very stiff to hard yellowish grey silty clay/clayey silt with grass roots, morrum, sand and traces of coal.		01	N = 28	DS1	0.50 M		
				DS2	1.00 M		
				SPT1	1.50-1.95M		
				DS3	1.50-1.95M		
		02	N = 39	UDS1	2.00-2.45M		
				SPT2	3.00-3.45M		
		03		DS4	3.00-3.45M		
				UDS2	4.00-4.45M		
		04	N = 100	SPT3	4.50-4.80M		
				DS5	4.50-4.80M		
Completely weathered foliated yellowish grey fine to medium grain very weak sand stone.		05		RUN1	4.80-5.50M TCR-17% RQD-NIL		
		06		RUN2	5.50-7.00M TCR-26% RQD-NIL		
		07		RUN3	7.00-8.50M TCR-34% RQD-NIL		
		08					
		09		RUN4	8.50-10.00M TCR-41% RQD-NIL		
		10		RUN5	10.00-11.50M TCR-51% RQD-NIL		
		11					
		12		RUN6	11.50-13.00M TCR-47% RQD-NIL		
		13		RUN7	13.00-14.50M TCR-63% RQD-NIL		
		14		RUN8	14.50-15.00M TCR-71% RQD-NIL		
		Termination Depth 15.000 Mtr.			15		



SUMMARY OF LABORATORY TEST RESULTS

Table-4

Project: Geotechnical Investigation Work for Proposed Coalgas to Methanol Project at Sactoria, West Bardhaman (WB)

Layer No.	Description of layer	Bore Hole No.	Depth	Sample Type - UD/D/ DN	SPT VALUE (N)	Atterberg Limits			Bulk Density in gm/cc	Water Content in %	Specific Gravity	Dry Density in gm/cc	Unconfine d Test in Kg/sqcm	Shear Test			Pressure (Kg/sqcm)	Co-eff. of volume compressibility in sqcm/kg	Swelling Pressure in kg/sqcm	Grading				Modified Proctor Density		
						LL	PL	SL						Type of Test	Cohesion in kg/sqcm	Friction angle in degree				Gravel (> 4.75 mm)	Sand (0.075 - 4.75 mm)	Silt (0.002 - 0.075 mm)	Clay (< 0.002 mm)	MDD	OMC	
			%	%	%	UU/CU/ DS	C	φ	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	
		8	0.50	D										UU	1:11	0	0.00-0.10	0.0467			2	34	46	18	1.74	14.88
		8	1.00	D		44	19	11									0.10-0.20	0.0408			4	30	44	22		
		8	1.50	DN	28	48	21	10									0.20-0.40	0.0354			4	32	40	24		
		8	2.00	UD		46	22	14	1.95	17.55	2.67	1.66	2.44	CU	0.13	15	0.40-0.80	0.0281	0.000		8	31	40	21		
		8	3.00	DN	39						2.56						0.80-1.60	0.0190			7	32	43	18		
		8	4.00	UD		45	21	13	1.88	16.34	2.68	1.62	2.74	CU	0.09	16	0.20-0.40	0.0337	0.000		5	37	42	16		
		8	4.50	DN	N>100						2.66			CD	0.03	30	0.80-1.60	0.0180			0	48	35	17		
																	1.60-3.20	0.0106								

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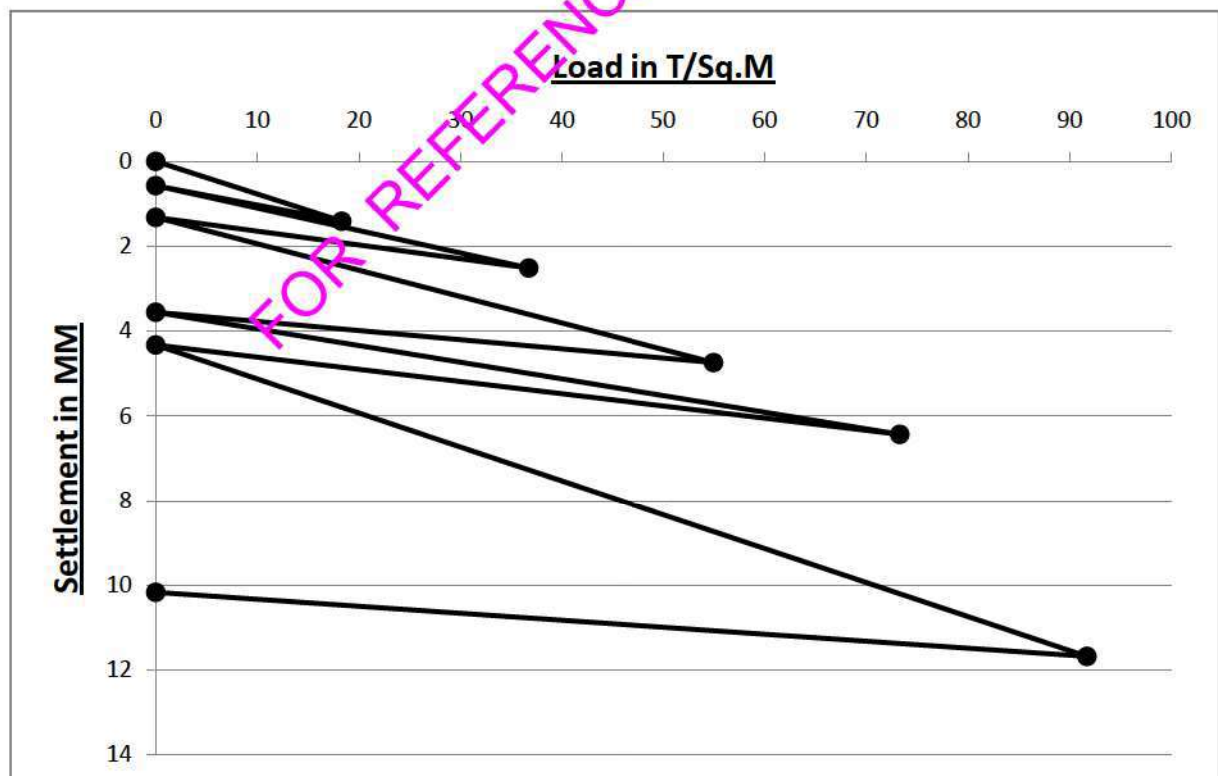
Very stiff to hard yellowish grey silty clay/dayey silt with grass roots, morrum, sand and traces of coal.

CYCLIC PLATE LOAD TEST SITE DATA SHEET

Client : Projects & Development India Limited
 Location : Air Separation Unit.
 Test Number : CPLT-2
 Plate Size : 60 X 60 = 3600 Sqcm
 Pit Size : 3.00M X 3.00M X 2.50M
 Ground Water Table : Not Encountered
 L.C. of Dial Guage : 0.01 mm
 Jack Ram Dia : 10.5 cm
 Jack Ram Area : 86.59 Sqcm

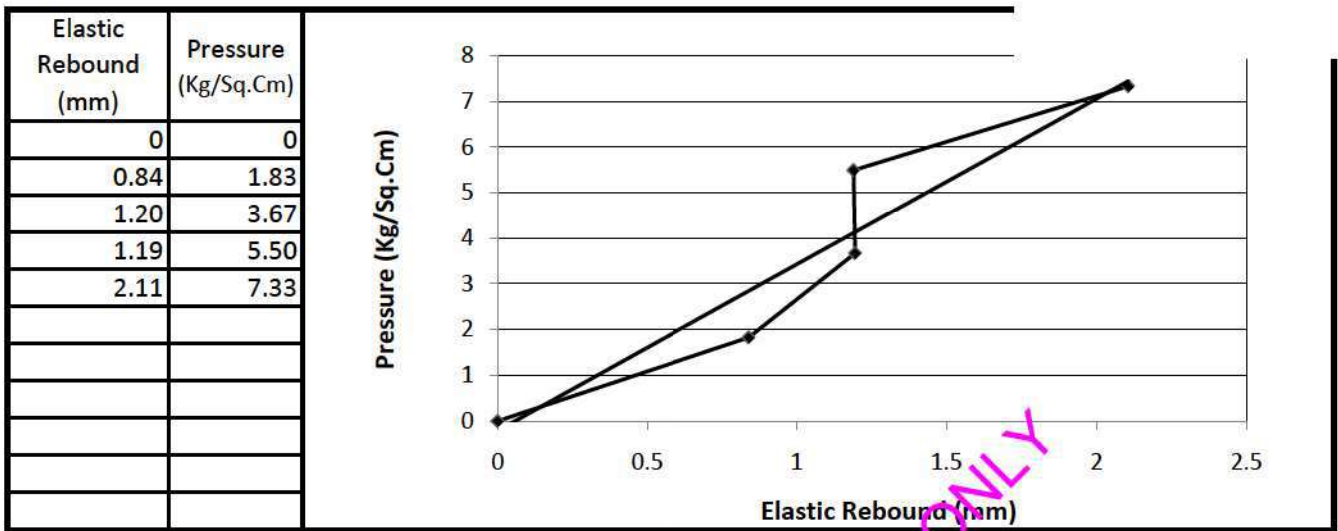
DATE	TIME (Hrs)	LOAD IN (KG)	PRESSURE IN Kg/Sqcm	DIAL GUAGE READING (mm)		SETTLEMENT (mm)		MEAN SETTLEMENT (mm)	REMARKS
				DIAL-1	DIAL-2	DIAL-1	DIAL-2		
30-05-2022	11:00:00	0.00	0	2431	2352	0.00	0.00	0.00	
	11:00:00	6600	1.83	2431	2352	0.00	0.00	0.00	
	11:01:00			2381	2293	0.50	0.59	0.55	
	11:02:15			2352	2271	0.79	0.81	0.80	
	11:04:00			2321	2260	1.10	0.92	1.01	
	11:06:15			2296	2241	1.35	1.11	1.23	
	11:09:00			2284	2230	1.47	1.22	1.35	
	11:16:00			2282	2236	1.49	1.26	1.38	
	11:25:00			2280	2223	1.51	1.29	1.40	
	12:01:00			2279	2221	1.52	1.31	1.42	
	12:01:00	0	0	2279	2221	1.52	1.31	1.42	
	13:01:00			2357	2311	0.74	0.41	0.58	
	13:01:00	13200	3.67	2357	2311	0.74	0.41	0.58	
	13:02:00			2268	2259	1.63	0.93	1.28	
	13:03:15			2233	2217	1.98	1.35	1.67	
	13:05:00			2198	2183	2.33	1.69	2.01	
	13:07:15			2176	2157	2.55	1.95	2.25	
	13:10:00			2163	2139	2.68	2.13	2.41	
	13:17:00			2155	2134	2.76	2.18	2.47	
	13:26:00			2150	2132	2.81	2.20	2.51	
	14:01:00			2149	2131	2.82	2.21	2.52	
	14:01:00	0	0	2149	2131	2.82	2.21	2.52	
	15:01:00			2277	2242	1.54	1.10	1.32	
	15:01:00	19800	5.50	2277	2242	1.54	1.10	1.32	
	15:02:00			2148	2070	2.83	2.82	2.83	
	15:03:15			2040	2014	3.91	3.38	3.65	
	15:05:00			1979	1982	4.52	3.70	4.11	
	15:07:15			1967	1956	4.64	3.96	4.30	
	15:10:00			1957	1921	4.74	4.31	4.53	
	15:17:00			1949	1899	4.82	4.53	4.68	
	15:26:00			1946	1890	4.85	4.62	4.74	
	16:01:00			1945	1889	4.86	4.63	4.75	
	16:01:00	0	0	1945	1889	4.86	4.63	4.75	

DATE	TIME (Hrs)	LOAD IN (KG)	PRESSURE IN Kg/Sqcm	DIAL GUAGE READING (mm)		SETTLEMENT (mm)	
				DIAL-1	DIAL-2	DIAL-1	DIAL-2
	17:01:00			2058	2014	3.73	3.38
	17:01:00	26400	7.33	2058	2014	3.73	3.38
	17:02:00			1961	1890	4.70	4.62
	17:03:15			1889	1809	5.42	5.43
	17:05:00			1853	1784	5.78	5.68
	17:07:15			1814	1753	6.17	5.99
	17:10:00			1797	1733	6.34	6.19
	17:17:00			1786	1723	6.45	6.29
	17:26:00			1780	1719	6.51	6.33
	18:01:00			1779	1718	6.52	6.34
	18:01:00	0	0	1779	1718	6.52	6.34
	19:01:00			2042	1876	3.89	4.76
	19:01:00	33000	9.17	2042	1876	3.89	4.76
	19:02:00			1821	1711	6.10	6.41
	19:03:15			1620	1537	8.11	8.15
	19:05:00			1264	1277	11.67	10.75
	19:07:15			1240	1262	11.91	10.90
	19:10:00			1229	1250	12.02	11.02
	19:17:00			1218	1244	12.13	11.08
	19:26:00			1214	1232	12.17	11.14
	20:01:00			1213	1234	12.18	11.18
	20:01:00	0	0	1213	1234	12.18	11.18
	21:01:00			1420	1329	10.11	10.23



Load Vs Settlement Curve for CPLT-2

Evaluation of Dynamic Properties of Soil



Computed dynamic properties of soil	
Coefficient of elastic uniform compression (C_u) kg/cm ³	34.822
Coefficient of elastic uniform shear (C_t) kg/cm ³	17.411
Coefficient of elastic non-uniform compression (C_ϕ) kg/cm ³	60.242
Coefficient of elastic non-uniform shear (C_ψ) kg/cm ³	26.117

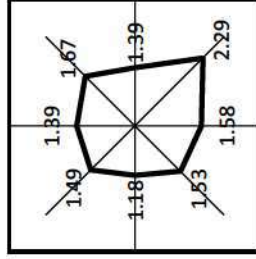
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Table ERT - 5

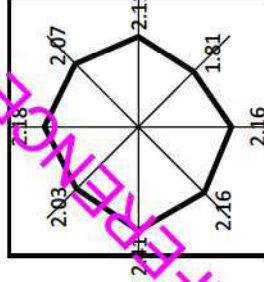
Project : Geo-Technical investigation work for proposed coalgas to methanol project at Sanctoria, West Bardhaman (W.B.)
 Location : Air Separation Unit.
 Client : Project & Development India Limited
 Test Date : 01-06-2022
 Instrument : Metravi ERT-1501, SL. No.: 10109809

Sl. No.	Electrode Spacing 's' m	Measured Resistance "R" (Ω)								Apparent Resistivity "ρ" (Ω-m")							
		North	North-East	East	East-South	South	South-West	West	North-West	North	North-East	East	East-South	South	South-West	West	North-West
1	1.0	1.39	1.67	1.39	2.29	1.58	1.53	1.18	1.49	8.73	10.49	8.73	14.39	9.93	9.61	7.41	9.36
2	2.0	2.18	2.07	2.11	1.81	2.16	2.16	2.41	2.03	27.39	26.01	26.52	22.75	27.14	27.14	30.28	25.51
3	3.0	2.16	2.87	1.65	2.35	3.02	3.08	2.65	1.54	40.72	54.10	31.10	44.30	56.93	58.06	49.95	29.03
4	5.0	2.81	3.52	2.13	4.02	2.96	2.14	2.93	2.77	88.28	110.58	66.92	126.29	92.99	67.23	92.05	87.02
5	10.0	3.36	3.98	3.57	3.16	2.19	3.54	4.00	3.19	211.12	250.07	224.31	198.55	137.60	222.42	251.33	200.43
6	15.0	3.54	4.09	2.59	3.22	3.24	2.39	3.85	3.88	333.64	385.47	244.10	303.48	305.36	225.25	362.85	365.68
7	20.0	3.88	2.63	3.85	2.91	2.88	3.14	2.70	2.98	487.58	330.50	483.81	365.68	361.91	394.58	339.29	374.48

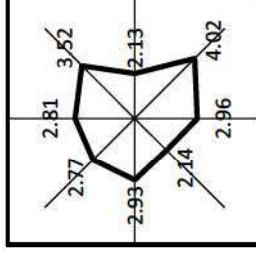
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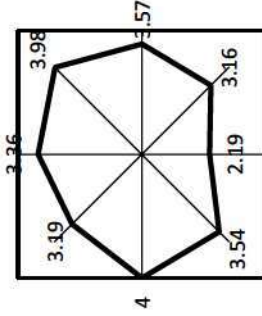
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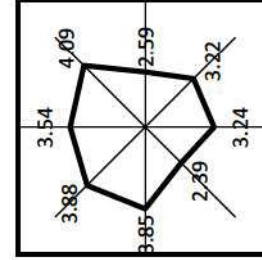
5.00Mtr.



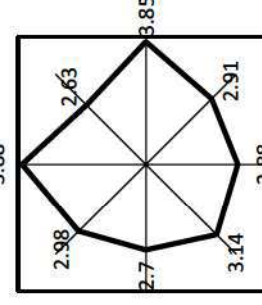
10.00Mtr.



15.00Mtr.



20.00Mtr.



ZONE-13

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GASIFICATION PLANT

Total one (1) borehole was sunk in this area, viz borehole n
general sub soil profile it has been observed that the top s
reddish brown/ brownish grey silty clay/ clayey silt with kankar and sand and the
second layer as encountered up to the explored depth is dense reddish brown
silty sand with clay binders.

In addition the following field test has been carried out at this zone and results
are being indicated in this chapter.

1. Cyclic Plate Load Test:

One (1) cyclic plate load test has been carried out at this zone marked as
CPLT-1.

2. Static Cone Penetration Test:

One (1) static cone penetration test has been carried out at this zone
marked as SCPT-3.

3. Electrical Resistivity Test:

One (1) electrical resistivity test has been carried out at this zone marked
as ERT-1.

Discussion and Recommendation:

Based on the sub-soil condition, shallow foundation has been recommended for
foundation system of medium to heavily loaded structures. Bearing capacities for
different size and shapes of foundations are indicated in the Table-2A (Zone-13).

Pile Foundation has also been recommended for foundation of heavily loaded
structures. Pile Capacities for different dia of pile are indicated in the Table-2B
(Zone-13). It is further recommended to carry out initial pile load test for load
under compression, pull-out and horizontal shear, in order to confirm the
recommended pile capacities and to take corrective measures, if required.

Table-2A (Zone-13).

**ALLOWABLE BEARING CAPACITY FROM SHEAR
SETTLEMENT CRITERIA**

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Q _{net} safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
ISOLATED SQUARE FOOTINGS	1.00	1.00	1.00	48.4	21.12	48	48	48
	2.50	2.50	1.00	43.5	58.19	18	29	43
	5.00	5.00	1.00	41.9	118.99	8	14	26
	7.50	7.50	1.00	41.4	179.57	5	9	17
	10.00	10.00	1.00	41.1	240.21	4	6	12
	1.00	1.00	1.50	52.4	21.56	52	52	52
	2.50	2.50	1.50	45.2	56.73	19	31	45
	5.00	5.00	1.50	42.7	117.71	9	14	27
	7.50	7.50	1.50	41.9	178.45	5	9	17
	10.00	10.00	1.50	41.5	239.09	4	6	13
	1.00	1.00	2.00	56.5	22.38	56	56	56
	2.50	2.50	2.00	46.8	54.84	21	34	46
	5.00	5.00	2.00	43.5	116.32	9	14	28
	7.50	7.50	2.00	42.5	177.49	5	9	17
	10.00	10.00	2.00	41.9	237.93	4	7	13
	1.00	1.00	3.00	64.5	24.41	64	64	64
	2.50	2.50	3.00	50.0	50.33	24	39	50
	5.00	5.00	3.00	45.2	113.40	9	15	29
	7.50	7.50	3.00	43.5	174.48	6	9	18
	10.00	10.00	3.00	42.7	235.42	4	7	13

ALLOWABLE BEARING CAPACITY FROM SHEAR SETTLEMENT CRITERIA

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Q _{net} safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
ISOLATED RECTANGULAR FOOTINGS	1.50	1.00	1.00	42.2	23.95	42	42	42
	3.75	2.50	1.00	37.9	63.13	15	24	37
	7.50	5.00	1.00	36.5	127.59	7	11	21
	11.25	7.50	1.00	36.1	192.26	4	7	14
	15.00	10.00	1.00	35.8	256.17	3	5	10
	1.50	1.00	1.50	45.7	22.19	45	45	45
	3.75	2.50	1.50	39.4	62.39	15	25	39
	7.50	5.00	1.50	37.2	126.98	7	11	21
	11.25	7.50	1.50	36.5	191.39	4	7	14
	15.00	10.00	1.50	36.2	256.06	3	5	10
	1.50	1.00	2.00	49.2	19.84	49	49	49
	3.75	2.50	2.00	40.8	61.25	16	26	40
	7.50	5.00	2.00	37.9	126.26	7	12	22
	11.25	7.50	2.00	37.0	190.97	4	7	14
	15.00	10.00	2.00	36.5	255.18	3	5	10
	1.50	1.00	3.00	56.2	28.59	49	56	56
	3.75	2.50	3.00	43.6	58.29	18	29	43
	7.50	5.00	3.00	39.4	124.78	7	12	23
	11.25	7.50	3.00	37.9	189.38	5	8	15
	15.00	10.00	3.00	37.2	253.96	3	5	10

ALLOWABLE BEARING CAPACITY FROM SHEAR SETTLEMENT CRITERIA

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Q _{net} safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
CONTINUOUS STRIP FOOTINGS		1.00	1.00	37.2	42.13	22	35	37
		1.50	1.00	35.1	61.15	14	22	35
		2.00	1.00	34.1	80.20	10	17	31
		2.50	1.00	33.5	99.21	8	13	25
		1.00	1.50	40.3	43.90	22	36	40
		1.50	1.50	37.2	63.20	14	23	37
		2.00	1.50	35.7	82.41	10	17	32
		2.50	1.50	34.7	101.26	8	13	25
		1.00	2.00	43.4	45.40	23	38	43
		1.50	2.00	39.3	65.07	15	24	39
		2.00	2.00	37.2	84.27	11	17	33
		2.50	2.00	36.0	103.49	8	13	26
		1.00	3.00	49.6	47.59	26	41	49
		1.50	3.00	43.4	68.10	15	25	43
		2.00	3.00	40.3	87.80	11	18	34
		2.50	3.00	38.4	107.07	8	14	26

Table-2B (Zone-13).

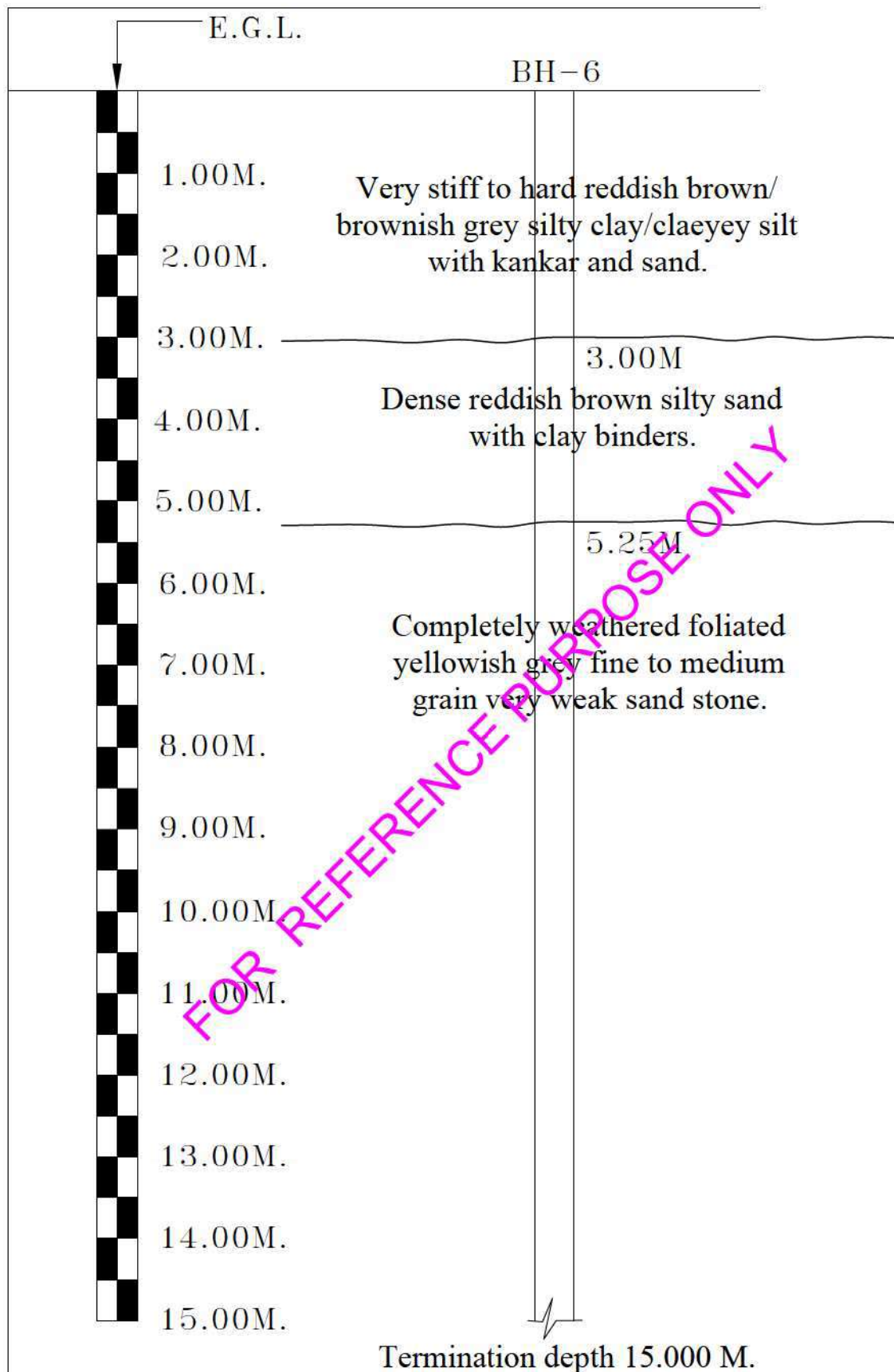
Recommended Pile Capacity

Sl.No	Pile Dia , D	Total Length of Pile, L	Cut-off Level	Recommended Pile Capacity in Compression	Recommended Pile Capacity in Pull-Out	Recommended Pile Capacity in Horizontal Shear
	Mtr	Mtr.	Mtr.	T	T	T
1	0.600	10.000	2.000	43	23	6
2	0.750	10.000	2.000	66	32	8
3	1.000	10.000	2.000	104	42	11
4	1.500	10.000	2.000	208	64	16

FOR REFERENCE PURPOSE ONLY

BORE LOG SHEET		Centre for Advanced Engineering						Bore Hole
								Job No.: 5
Project: SOIL PDIL ECL SANCTORIA								
Co-ord:		E.G.L.:114.116		Unit: Gasification Plant			Bore Hole	
Type of Boring	Shell & Auger	FIELDTEST NOS.	SAMPLES NOS.	SAMPLES NOS.	NOS.	Commenced		
Depth of Boring	5.250 M.	SPT	4	UDS	2	WS	Completed on : 22.05.2022	
Type of Drilling		DCPT		DS	6	RCS	7	Water Struck At : 2.30M
Depth of Drilling	9.750 M.	VST		SCPT				Standing Water Table : 2.20M

D E S C R I P T I O N	SYMBOL	DEPTH	N-V A L U E	S A M P L E	
				NO.	DEPTH
Very stiff to hard reddish brown/ brownish grey silty clay/clayey silt with kankar and sand.		01	N = 37	DS1	0.50 M
				DS2	1.00 M
				SPT1	1.50-1.95M
				DS3	1.50-1.95M
				UDS1	2.00-2.45M
Dense reddish brown silty sand with clay binders.		02	N = 42	SPT2	3.00-3.45M
				DS4	3.00-3.45M
				UDS2	4.00-4.45M
				SPT3	4.50-4.95M
				DS5	4.50-4.95M
Completely weathered foliated yellowish grey fine to medium grain very weak sand stone.		03	N = 45 N > 100	SPT4	5.00-5.25M
				DS6	5.00-5.25M
				RUN1	5.25-6.50M TCR-20% RQD-NIL
				RUN2	6.50-8.00M TCR-31% RQD-NIL
				RUN3	8.00-9.50M TCR-40% RQD-NIL
				RUN4	9.50-11.00M TCR-47% RQD-NIL
				RUN5	11.00-12.50M TCR-40% RQD-NIL
				RUN6	12.50-14.00M TCR-65% RQD-NIL
				RUN7	14.00-15.00M TCR-68% RQD-NIL
Termination Depth 15.000 Mtr.		15			



Sub-Soil Profile through BH-6

Sketch No.-SK/PDIL/	Gasification Plant	1678	02	5 of 13
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SUMMARY OF LABORATORY TEST RESULTS

Table-4

Project: Geotechnical Investigation Work for Proposed Coalgas to Methanol Project at Sactoria, West Bardhaman (WB)

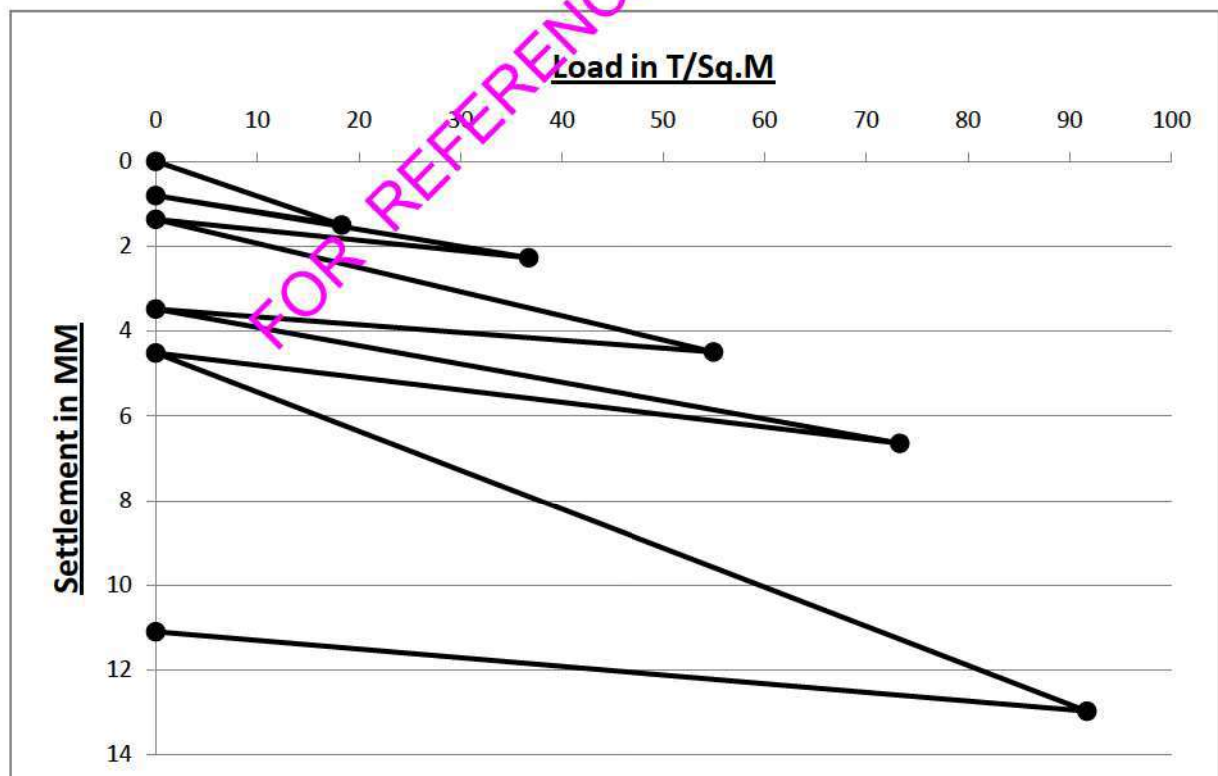
Layer No.	Description of layer	Bore Hole No.	Depth	Sample Type - UD/D/ DN	SPT VALUE (N)	Atterberg Limits			Bulk Density in gm/cc	Water Content in %	Specific Gravity	Dry Density in gm/cc	Unconfined Test in Kg/sqcm	Shear Test			Pressure (Kg/sqcm)	Co-eff. of volume compressibility in sqcm/kg	Swelling Pressure in kg/sqcm	Grading				Modified Proctor Density	
						LL	PL	SL						Type of Test	Cohesion in kg/sqcm	Friction angle in degree				Gravel (> 4.75 mm)	Sand (0.075 - 4.75 mm)	Silt (0.002 - 0.075 mm)	Clay (< 0.002 mm)	MDD	OMC
						%	%	%	γ_b	m	G	γ_d	q_u	UU/CU/ DS	C	ϕ				%	%	%	gm/cc	%	
		6	0.50	D															6	25	51	18	1.78	12.5	
		6	1.00	D							2.69								9	28	52	11			
		6	1.50	DN	37	46	18												7	30	43	20			
I	Very stiff to hard reddish brown/ brownish grey silty clay/clayey silt with kankar and sand.													UU	1.31	0	0.00-0.10	0.0441							
																	0.10-0.20	0.0386							
																	0.20-0.40	0.0319	0.000						
																	0.40-0.80	0.0231				32	50	18	
																	0.80-1.60	0.0159							
															CD	0.04	31	1.60-3.20	0.0107						
II	Dense reddish brown silty sand with clay	6	3.00	DN	42						2.55									0	77	17	6		
		6	4.00	UD		40	17		1.82	15.47	2.65			DS	0.13	33				0	75	18	7		
		6	4.50	DN	45						2.64									0	77	18	5		
		6	5.00	DN	N>100				1.79						DS	0.14	32				0	72	21	7	

CYCLIC PLATE LOAD TEST SITE DATA SHEET

Client : Projects & Development India Limited
 Location : Gassification Plant
 Test Number : CPLT-1
 Plate Size : 60 X 60 = 3600 Sqcm
 Pit Size : 3.00M X 3.00M X 2.50M
 Ground Water Table : Not Encountered
 L.C. of Dial Guage : 0.01 mm
 Jack Ram Dia : 10.5 cm
 Jack Ram Area : 86.59 Sqcm

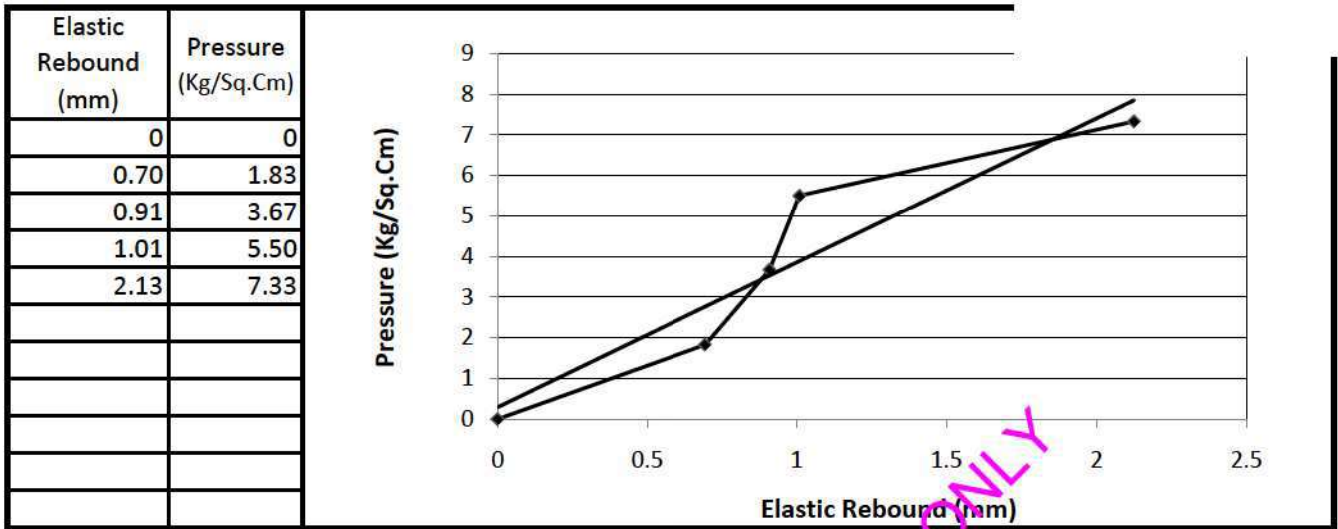
DATE	TIME (Hrs)	LOAD IN (KG)	PRESSURE IN Kg/Sqcm	DIAL GUAGE READING (mm)		SETTLEMENT (mm)		MEAN SETTLEMENT (mm)	REMARKS
				DIAL-1	DIAL-2	DIAL-1	DIAL-2		
28-05-2022	14:00:00	0.00	0	2069	2089	0.00	0.00	0.00	
	14:00:00	6600	1.83	2069	2089	0.00	0.00	0.00	
	14:01:00			1965	1907	1.04	1.82	1.43	
	14:02:15			1962	1903	1.07	1.86	1.47	
	14:04:00			1961	1901	1.08	1.88	1.48	
	14:06:15			1961	1901	1.08	1.88	1.48	
	14:09:00			1960	1900	1.09	1.89	1.49	
	14:16:00			1959	1900	1.10	1.89	1.50	
	14:25:00			1958	1899	1.11	1.90	1.51	
	15:01:00			1958	1899	1.11	1.90	1.51	
	15:01:00	0	0	1958	1899	1.11	1.90	1.51	
	16:01:00			2022	1974	0.47	1.15	0.81	
	16:01:00	13200	3.67	2022	1974	0.47	1.15	0.81	
	16:02:00			1833	1894	2.36	1.95	2.16	
	16:03:15			1830	1890	2.39	1.99	2.19	
	16:05:00			1828	1888	2.41	2.01	2.21	
	16:07:15			1826	1886	2.43	2.03	2.23	
	16:10:00			1824	1884	2.45	2.05	2.25	
	16:17:00			1823	1883	2.46	2.06	2.26	
	16:26:00			1822	1882	2.47	2.07	2.27	
	17:01:00			1821	1882	2.48	2.07	2.28	
	17:01:00	0	0	1821	1882	2.48	2.07	2.28	
	18:01:00			1918	1967	1.51	1.22	1.37	
	18:01:00	19800	5.50	1918	1967	1.51	1.22	1.37	
	18:02:00			1632	1721	4.37	3.68	4.03	
	18:03:15			1626	1714	4.43	3.75	4.09	
	18:05:00			1616	1705	4.53	3.84	4.19	
	18:07:15			1614	1703	4.55	3.86	4.21	
	18:10:00			1612	1701	4.57	3.88	4.23	
	18:17:00			1610	1699	4.59	3.90	4.25	
	18:26:00			1608	1697	4.61	3.92	4.27	
	19:01:00			1585	1675	4.84	4.14	4.49	
	19:01:00	0	0	1585	1675	4.84	4.14	4.49	

DATE	TIME (Hrs)	LOAD IN (KG)	PRESSURE IN Kg/Sqcm	DIAL GUAGE READING (mm)		SETTLEMENT (mm)	
				DIAL-1	DIAL-2	DIAL-1	DIAL-2
	20:01:00			1696	1766	3.73	3.23
	20:01:00	26400	7.33	1696	1766	3.73	3.23
	20:02:00			1445	1452	6.24	6.37
	20:03:15			1435	1441	6.34	6.48
	20:05:00			1429	1436	6.40	6.53
	20:07:15			1425	1432	6.44	6.57
	20:10:00			1421	1425	6.48	6.64
	20:17:00			1419	1423	6.50	6.66
	20:26:00			1417	1421	6.52	6.68
	21:01:00			1413	1417	6.56	6.72
	21:01:00	0	0	1413	1417	6.56	6.72
	22:01:00			1591	1664	4.78	4.25
	22:01:00	33000	9.17	1591	1664	4.78	4.25
	22:02:00			945	1080	11.24	10.09
	22:03:15			924	1062	11.45	10.27
	22:05:00			913	1050	11.56	10.39
	22:07:15			809	947	12.60	11.42
	22:10:00			742	885	13.27	12.04
	22:17:00			717	862	13.52	12.27
	22:26:00			714	858	13.55	12.31
	23:01:00			710	855	13.59	12.34
	23:01:00	0	0	710	855	13.59	12.34
	0:01:00			903	1037	11.66	10.52



Load Vs Settlement Curve for CPLT-1

Evaluation of Dynamic Properties of Soil



<u>Computed dynamic properties of soil</u>	
Coefficient of elastic uniform compression (C_u) kg/cm ³	34.494
Coefficient of elastic uniform shear (C_τ) kg/cm ³	17.247
Coefficient of elastic non-uniform compression (C_ϕ) kg/cm ³	59.675
Coefficient of elastic non-uniform shear (C_ψ) kg/cm ³	25.871

Table -1

Project: Proposed Coalgas to Methanol Project at Sactoria, West Bardhaman (WB)

Client.: Project & Development India Limited

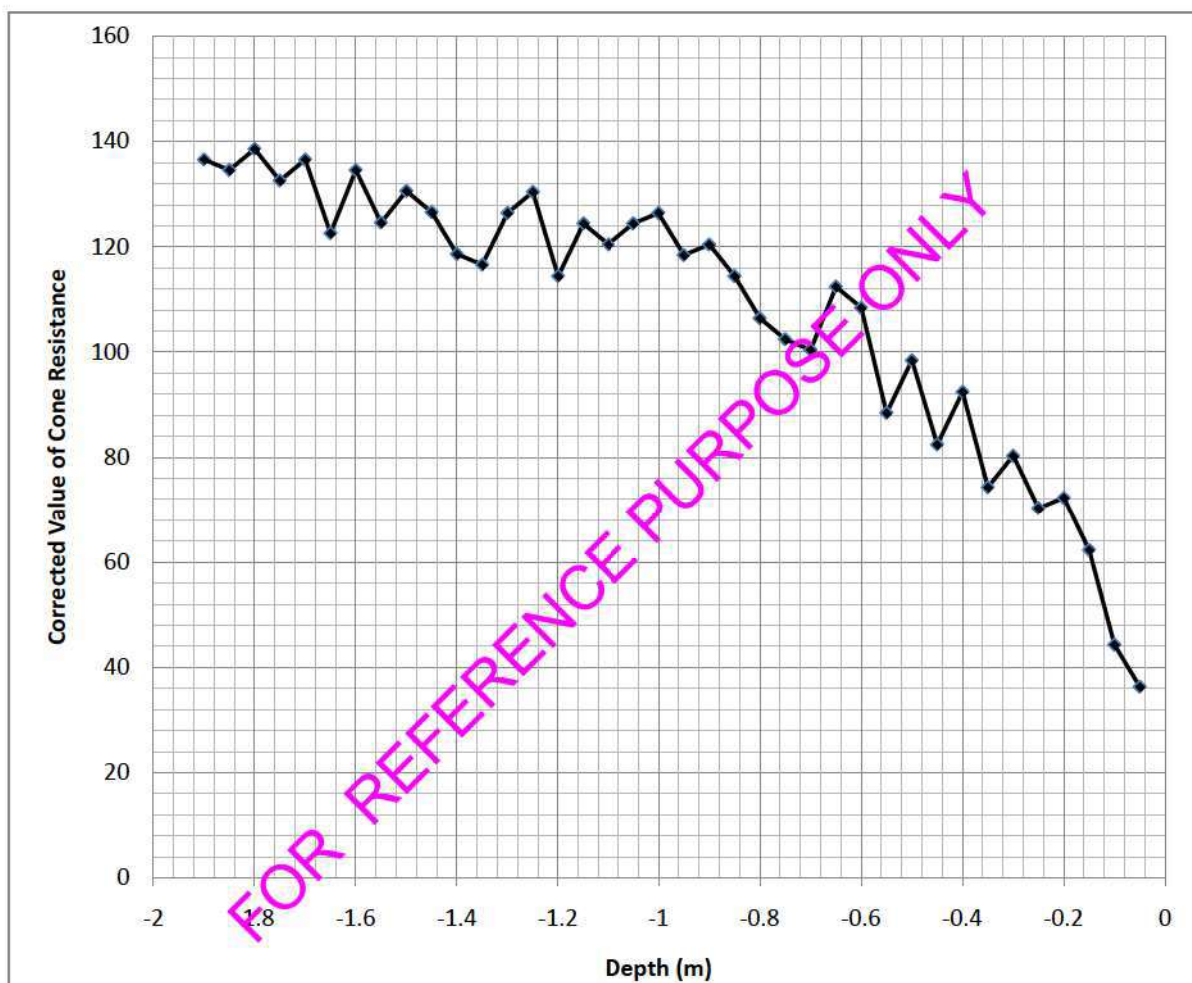
Side ID :

Correction A		
1. Mass of Cone (m)	1.34 Kg	
2. Mass of each sounding rod (m1)	1.55 Kg	
3. Cone area at Base (b)	10 Sqcm	
4. Plunger Area (b')	20 Sqcm	
5. Correction factor to be added to gauge reading $C1 = (m+nm1)/10$	0.289 Kg	
6. No of Rod Used (n)	6	

Correction B		
1. Mass of friction Jacket (m_f)	1.345 Kg	
2. Outer dia, of Friction Jacket (d)	3.6 cm	
3. Length of Friction Jacket (h)	13 Sqcm	
4. Surface area of friction jacket (a) = πdh	147 Sqcm	
5. Correction factor to be added to gauge reading $C2 = (m_f/a)$	0.01 Kg/ Sqcm	
Test Number	SCPT-3	

Depth	Number of Rod in Use	CONE				JACKET				
		Gauge Reading of Cone Penetration	Cone Penetration Resistance	Correction Factor	Corrected Value of Cone Resistance	Gauge Reading of Cone + Jacket Resistance	Cone + Jacket Resistance	Total Resistance - Cone Resistance	Frictional Resistance	Corrected Frictional Resistance
m	n	Kg/ Sqcm	Kg/ Sqcm	Kg/ Sqcm	Kg/ Sqcm	Kg/ Sqcm	Kg/ Sqcm	Kg/ Sqcm	Kg/ Sqcm	Kg/ Sqcm
		y	$y = Y^*(b'/b)$	$C1$	$R_c = y + C1$	x	$x = X^*(b'/b)$	$x - y$	$Z = (x - y) * (b/a)$	$R_f = Z + (mf/a)$
-0.05	1	18	36	0.29	36.29	34	68	32	2.18	2.19
-0.10	1	22	44	0.29	44.29	40	80	36	2.45	2.46
-0.15	1	31	62	0.29	62.29	53	106	44	2.99	3.00
-0.20	1	36	72	0.29	72.29	66	132	60	4.08	4.09
-0.25	1	35	70	0.29	70.29	68	136	66	4.49	4.50
-0.30	1	40	80	0.29	80.29	72	144	64	4.35	4.36
-0.35	1	37	74	0.29	74.29	59	118	44	2.99	3.00
-0.40	2	46	92	0.44	92.44	67	134	42	2.86	2.87
-0.45	2	41	82	0.44	82.44	69	138	56	3.81	3.82
-0.50	2	49	98	0.44	98.44	83	166	68	4.63	4.64
-0.55	2	44	88	0.44	88.44	69	138	50	3.4	3.41
-0.60	2	54	108	0.44	108.44	69	138	30	2.04	2.05
-0.65	2	56	112	0.44	112.44	71	142	30	2.04	2.05
-0.70	2	50	100	0.44	100.44	74	148	48	3.27	3.28

Depth	Number of Rod in Use	Gauge Reading of Cone Penetration	Cone Penetration Resistance	Correction Factor	Corrected Value of Cone Resistance	Gauge Reading of Cone + Jacket Resistance	Cone + Jacket Resistance	Total Resistance - Cone Resistance	Frictional Resistance	Corrected Frictional Resistance
m	n	Kg/ Sqcm	Kg/ Sqcm	C1	Kg/ Sqcm	Kg/ Sqcm	Kg/ Sqcm	Kg/ Sqcm	Kg/ Sqcm	Kg/ Sqcm
-0.75	2	51	102	0.44	102.44	72	144	42	2.86	2.87
-0.80	2	53	106	0.44	106.44	80	160	54	3.67	3.68
-0.85	2	57	114	0.44	114.44	79	158	44	2.99	3.00
-0.90	2	60	120	0.44	120.44	84	168	48	3.27	3.28
-0.95	2	59	118	0.44	118.44	78	156	38	2.59	2.60
-1.00	2	63	126	0.44	126.44	85	170	28	1.9	1.91
-1.05	2	62	124	0.44	124.44	80	160	36	2.45	2.46
-1.10	2	60	120	0.44	120.44	89	178	58	3.95	3.96
-1.15	2	62	124	0.44	124.44	85	170	46	3.13	3.14
-1.20	2	57	114	0.44	114.44	83	166	52	3.54	3.55
-1.25	2	65	130	0.44	130.44	86	172	42	2.86	2.87
-1.30	2	63	126	0.44	126.44	85	170	44	2.99	3.00
-1.35	3	58	116	0.6	116.6	79	158	42	2.86	2.87
-1.40	3	59	118	0.6	118.6	78	156	38	2.59	2.60
-1.45	3	63	126	0.6	126.6	73	146	20	1.36	1.37
-1.50	3	65	130	0.6	130.6	78	156	26	1.77	1.78
-1.55	3	62	124	0.6	124.6	75	150	26	1.77	1.78
-1.60	3	67	134	0.6	134.6	81	162	28	1.9	1.91
-1.65	3	61	122	0.6	122.6	82	164	42	2.86	2.87
-1.70	3	68	136	0.6	136.6	80	160	24	1.63	1.64
-1.75	3	66	132	0.6	132.6	85	170	38	2.59	2.6
-1.80	3	69	138	0.6	138.6	91	182	44	2.99	3
-1.85	3	67	134	0.6	134.6	90	180	46	3.13	3.14
-1.90	3	68	136	0.6	136.6	89	178	42	2.86	2.87



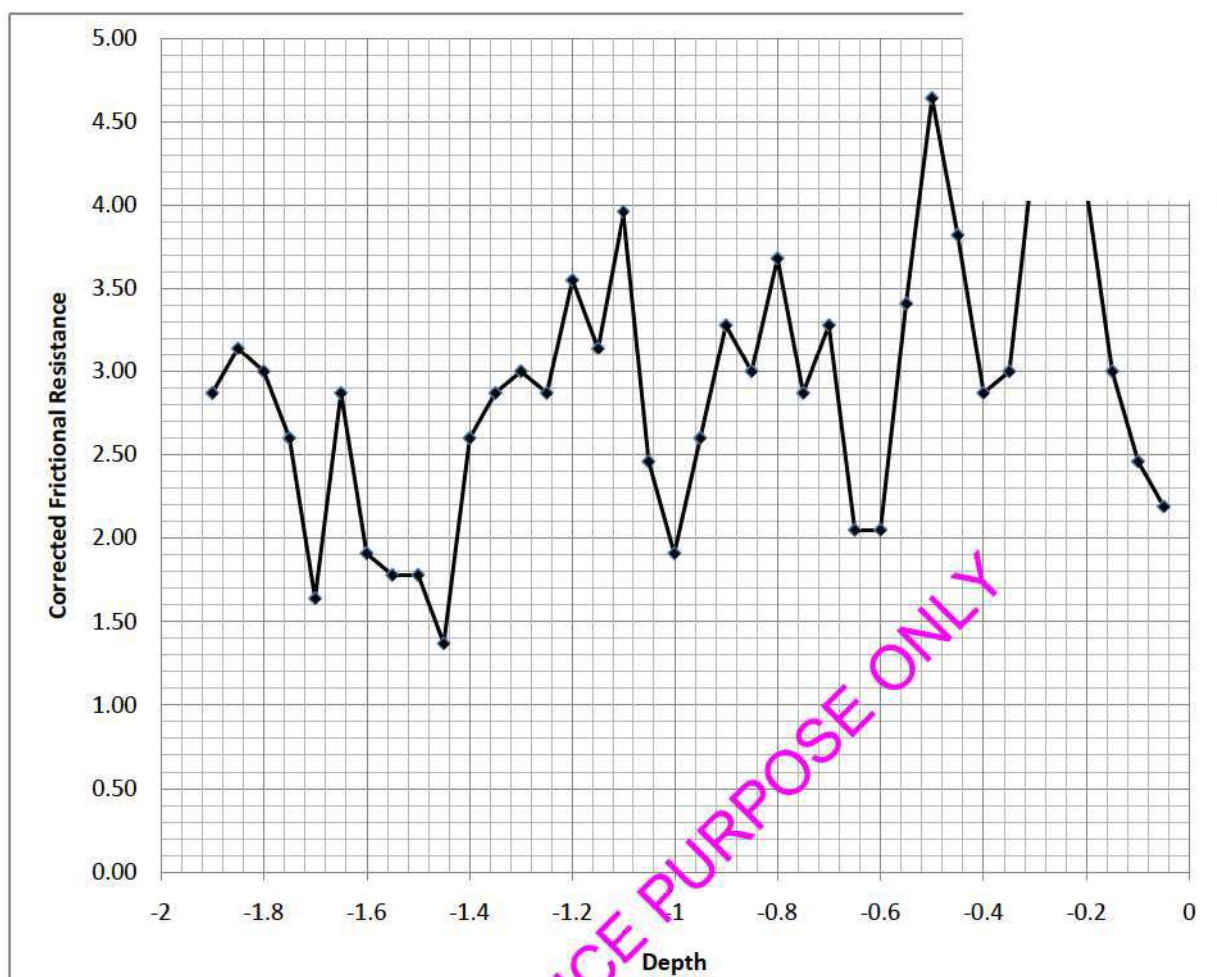
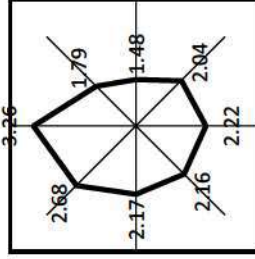


Table ERT - 1

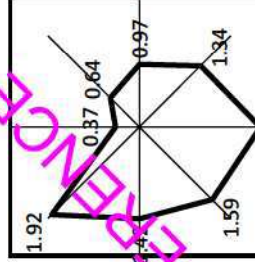
Project : Geo-Technical investigation work for proposed coalgas to methanol project at Sanctoria, West Bardhaman (W.B.)
 Location : Gasification Plant.
 Client : Project & Development India Limited
 Test Date : 01-06-2022
 Instrument : Metravi ERT-1501, SL. No.: 10109809

Sl. No.	Electrode Spacing 's' m	Measured Resistance "R" (Ω)								Apparent Resistivity "ρ" (Ω-m")							
		North	North-East	East	East-South	South	South-West	West	North-West	North	North-East	East	East-South	South	South-West	West	North-West
1	1.0	3.26	1.79	1.48	2.04	2.22	2.16	2.17	2.68	20.48	11.25	9.30	12.82	13.95	13.57	13.63	16.84
2	2.0	0.37	0.64	0.97	1.34	1.87	1.59	1.42	1.92	4.65	8.04	12.19	16.84	23.50	19.98	17.84	24.13
3	3.0	3.40	2.92	2.22	2.44	1.97	1.39	1.53	3.66	64.09	55.04	41.85	45.99	37.13	26.20	28.84	68.99
4	5.0	3.43	2.57	2.02	1.49	1.16	1.94	2.62	2.78	107.76	80.74	63.46	46.81	36.44	60.95	82.31	87.34
5	10.0	3.35	2.28	1.61	1.31	1.08	1.79	2.49	0.97	210.49	143.26	101.16	82.31	67.86	112.47	156.45	60.95
6	15.0	0.61	1.68	2.62	1.92	1.34	1.72	2.25	0.96	57.49	158.34	246.93	180.96	126.29	162.11	212.06	90.48
7	20.0	4.74	3.18	2.75	2.94	1.75	3.17	4.06	1.21	595.65	399.61	345.58	369.45	219.91	398.35	510.19	152.05

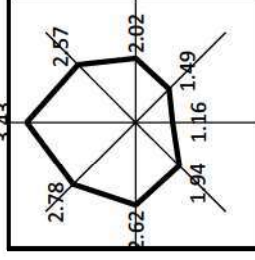
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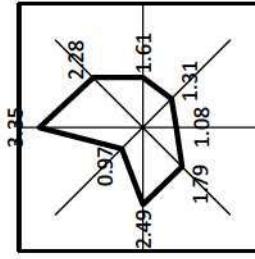
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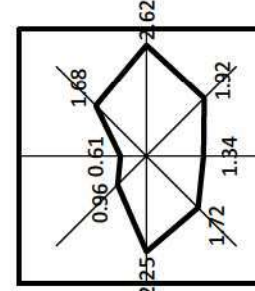
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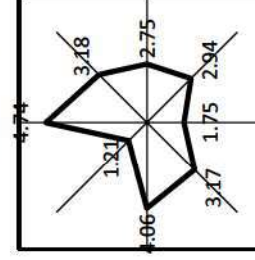
10.00Mtr.



15.00Mtr.



20.00Mtr.



ZONE-14

GAS CLEANING AND PURIFICATION PLANT

FOR REFERENCE PURPOSE ONLY

One (1) borehole was sunk in this area, viz borehole mar the general sub soil profile it has been observed that the top to hard reddish brown/ brownish grey silty clay/ clayey silt with kankar and sand. The second layer as encountered up to the explored depth is dense reddish brown silty sand with clay binders.

Discussion and Recommendation:

Based on the sub-soil condition, shallow foundation has been recommended for foundation system of medium to heavily loaded structures. Bearing capacities for different size and shapes of foundations are indicated in the Table-2A (Zone-14).

Pile Foundation has also been recommended for foundation of heavily loaded structures. Pile Capacities for different dia of pile are indicated in the Table-2B (Zone-14). It is further recommended to carry out initial pile load test for load under compression, pull-out and horizontal shear, in order to confirm the recommended pile capacities and to take corrective measures, if required.

FOR REFERENCE PURPOSE ONLY

Table-2A (Zone-14).

**ALLOWABLE BEARING CAPACITY FROM SHE/
SETTLEMENT CRITERIA**

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Q _{net} safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
ISOLATED SQUARE FOOTINGS	1.00	1.00	1.00	43.2	21.00	43	43	43
	2.50	2.50	1.00	38.9	57.99	16	26	38
	5.00	5.00	1.00	37.5	118.67	7	12	23
	7.50	7.50	1.00	37.0	179.03	5	8	15
	10.00	10.00	1.00	36.8	239.67	3	6	11
	1.00	1.00	1.50	46.9	21.50	46	46	46
	2.50	2.50	1.50	40.4	56.50	17	28	40
	5.00	5.00	1.50	38.2	117.34	8	13	24
	7.50	7.50	1.50	37.5	177.97	5	8	15
	10.00	10.00	1.50	37.1	238.17	3	6	11
	1.00	1.00	2.00	50.5	22.29	50	50	50
	2.50	2.50	2.00	41.8	54.58	19	30	41
	5.00	5.00	2.00	38.9	115.91	8	13	25
	7.50	7.50	2.00	38.0	176.84	5	8	16
	10.00	10.00	2.00	37.5	237.29	3	6	11
	1.00	1.00	3.00	57.7	24.34	57	57	57
	2.50	2.50	3.00	44.7	50.13	22	35	44
	5.00	5.00	3.00	40.4	112.94	8	14	26
	7.50	7.50	3.00	38.9	173.87	5	8	16
	10.00	10.00	3.00	38.2	234.68	4	6	12

ALLOWABLE BEARING CAPACITY FROM SHEAR SETTLEMENT CRITERIA

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Q _{net} safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
ISOLATED RECTANGULAR FOOTINGS	1.50	1.00	1.00	37.7	23.86	37	37	37
	3.75	2.50	1.00	33.9	62.94	13	21	33
	7.50	5.00	1.00	32.7	127.42	6	10	19
	11.25	7.50	1.00	32.2	191.16	4	6	12
	15.00	10.00	1.00	32.0	255.26	3	5	9
	1.50	1.00	1.50	40.8	22.08	40	40	40
	3.75	2.50	1.50	35.2	62.13	14	22	35
	7.50	5.00	1.50	33.3	126.71	6	10	19
	11.25	7.50	1.50	32.7	191.14	4	6	12
	15.00	10.00	1.50	32.4	255.48	3	5	9
	1.50	1.00	2.00	44.0	19.78	44	44	44
	3.75	2.50	2.00	36.4	60.92	14	23	36
	7.50	5.00	2.00	33.9	125.89	6	10	20
	11.25	7.50	2.00	33.1	190.44	4	6	13
	15.00	10.00	2.00	32.7	254.85	3	5	9
	1.50	1.00	3.00	50.3	28.52	44	50	50
	3.75	2.50	3.00	39.0	58.12	16	26	39
	7.50	5.00	3.00	35.2	124.27	7	11	21
	11.25	7.50	3.00	33.9	188.83	4	7	13
	15.00	10.00	3.00	33.3	253.42	3	5	9

ALLOWABLE BEARING CAPACITY FROM SHEAR SETTLEMENT CRITERIA

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Q _{net} safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
CONTINUOUS STRIP FOOTINGS		1.00	1.00	33.3	42.11	19	31	33
		1.50	1.00	31.4	61.08	12	20	31
		2.00	1.00	30.5	80.09	9	15	28
		2.50	1.00	29.9	98.86	7	12	22
		1.00	1.50	36.0	43.78	20	32	36
		1.50	1.50	33.3	63.16	13	21	33
		2.00	1.50	31.9	82.22	9	15	29
		2.50	1.50	31.0	101.00	7	12	23
		1.00	2.00	38.8	45.31	21	34	38
		1.50	2.00	35.1	64.88	13	21	35
		2.00	2.00	33.3	84.22	9	15	29
		2.50	2.00	32.1	103.03	7	12	23
		1.00	3.00	44.4	47.56	23	37	44
		1.50	3.00	38.8	67.97	14	22	38
		2.00	3.00	36.0	87.57	10	16	30
		2.50	3.00	34.4	107.09	8	12	24

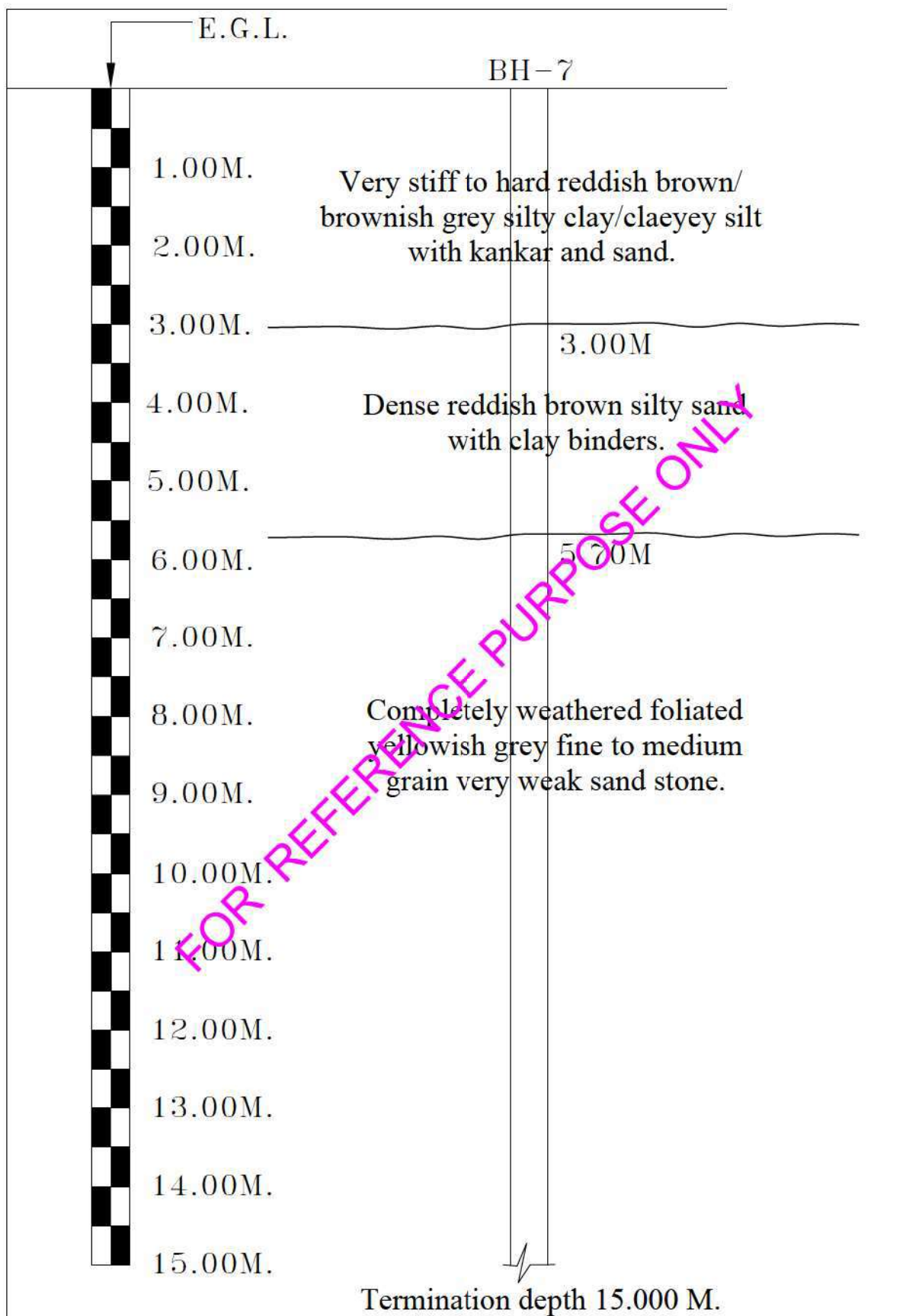
Table-2B (Zone-14).
Recommended Pile Capacity

Sl.No	Pile Dia , D	Total Length of Pile, L	Cut-off Level	Recommended Pile Capacity in Compression	Recommended Pile Capacity in Pull-Out	Recommended Pile Capacity in Horizontal Shear
	Mtr	Mtr.	Mtr.	T	T	T
1	0.600	10.000	2.000	44	24	6
2	0.750	10.000	2.000	67	32	8
3	1.000	10.000	2.000	105	43	11
4	1.500	10.000	2.000	209	65	16

FOR REFERENCE PURPOSE ONLY

BORE LOG SHEET		Centre for Advanced Engineering						Bore Hole
								Job No.: 9
Project: SOIL PDIL ECL SANCTORIA								
Co-ord:	E.G.L.:116.414	Unit: Gas Cleaning & Purification Plant.						Bore Hole
Type of Boring	Shell & Auger	FIELDTEST	NOS.	SAMPLES	NOS.	SAMPLES	NOS.	Commence
Depth of Boring	5.700 M.	SPT	4	UDS	3	WS		Completed on : 22.05.2022
Type of Drilling		DCPT		DS	6	RCS	7	Water Struck At :1.40M
Depth of Drilling	9.300 M.	VST		SCPT				Standing Water Table : 1.30M

D E S C R I P T I O N	SYMBOL	DEPTH	N-V A L U E	S A M P L E	
				NO.	DEPTH
Very stiff to hard reddish brown/ brownish grey silty clay/claeyey silt with kankar and sand.		01	N = 39	DS1	0.50 M
				DS2	1.00 M
				SPT1	1.50-1.95M
				DS3	1.50-1.95M
				UDS1	2.00-2.45M
Dense reddish brown silty sand with clay binders.		02	N = 41	SPT2	3.00-3.45M
				DS4	3.00-3.45M
				UDS2	4.00-4.45M
				SPT3	4.50-4.95M
				DS5	4.50-4.95M
Completely weathered foliated yellowish grey fine to medium grain very weak sand stone.		03	N = 45	UDS3	5.00-5.45M
				SPT4	5.55-5.70M
				DS6	5.55-5.70M
			N > 100	RUN1	5.70-7.00M TCR-22% RQD-NIL
				RUN2	7.00-8.50M TCR-32% RQD-NIL
				RUN3	8.50-10.00M TCR-41% RQD-NIL
				RUN4	10.00-11.50M TCR-49% RQD-NIL
				RUN5	11.50-13.00M TCR-55% RQD-NIL
				RUN6	13.00-14.50M TCR-51% RQD-NIL
				RUN7	14.50-15.00M TCR-61% RQD-NIL
Termination Depth 15.000 Mtr.		15			



Sub-Soil Profile through BH-7

Sketch No.-SK/PDIL/	Gas Cleaning & Purification Plant	1678	02	6 of 13
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SUMMARY OF LABORATORY TEST RESULTS

Table-4

Project: Geotechnical Investigation Work for Proposed Coalgas to Methanol Project at Sactoria, West Bardhaman (WB)

Layer No.	Description of layer	Bore Hole No.	Depth	Sample Type - UD/D/ DN	SPT VALUE (N)	Atterberg Limits			Bulk Density in gm/cc	Water Content in %	Specific Gravity	Dry Density in gm/cc	Unconfined Test in Kg/sqcm	Shear Test			Pressure (Kg/sqcm)	Co-eff. of compressibility in sqcm/kg	Swelling Pressure in kg/sqcm	Grading				Modified Proctor Density			
						LL	PL	SL						Type of Test	Cohesion in kg/sqcm	Friction angle in degree				Gravel (> 4.75 mm)	Sand (0.075 - 4.75 mm)	Silt (0.002 - 0.075 mm)	Clay (< 0.002 mm)	MDD	OMC		
I	Very stiff to hard reddish brown/ brownish grey silty clay/ clayey silt with kankar and sand.	7	0.50	D																							
		7	1.00	D		47	21	11													0	26	54	20	1.82	11.27	
		7	1.50	DN	39							2.67									0	28	49	23	1.78	12.00	
															UU	13	0	0.00-0.10	0.0448								
																		0.10-0.20	0.0390								
II	Dense reddish brown silty sand with clay binders.	7	2.00	UD		46	20	12	1.90	14.98	2.68	1.65	2.64	CU	0.09	12	0.20-0.40	0.0319	0.000	0	27	57	16				
																		0.40-0.80	0.0265								
															CD	0.03	27	0.80-1.60	0.0189								
																		1.60-3.20	0.0118								
																					0	76	18	6			
		7	3.00	DN	41																0	74	16	10			
		7	4.00	UD		37	17	10	1.89	13.74	2.65	1.66	2.48	DS	0.04	34			0.000	0	68	18	14				
		7	4.50	DN	45				1.83					DS	0.08	35				0	71	17	12				
		7	5.00	UD						12.12	2.65									0	77	15	8				
		7	5.55	DN	N>100				1.81						DS	0.11	36				0						

ZONE-15

FOR REFERENCE PURPOSE ONLY

STEAM GENERATION PLANT

Total one (1) borehole was sunk in this area, viz borehole n
general sub soil profile it has been observed that the top soil is medium to dense reddish brown silty sand with clay binders and continues up to the explored depth.

In addition the following field test has been carried out at this zone and results are being indicated in this chapter.

1. Plate Load Test:

One (1) plate load test has been carried out at this zone marked as PLT-2.

2. Electrical Resistivity Test:

One (1) electrical resistivity test has been carried out at this zone marked as ERT-2.

Discussion and Recommendation:

Based on the sub-soil condition, shallow foundation has been recommended for foundation system of medium to heavily loaded structures. Bearing capacities for different size and shapes of foundations are indicated in the Table-2A (Zone-15).

Pile Foundation has also been recommended for foundation of heavily loaded structures. Pile Capacities for different dia of pile are indicated in the Table-2B (Zone-15). It is further recommended to carry out initial pile load test for load under compression, pull-out and horizontal shear, in order to confirm the recommended pile capacities and to take corrective measures, if required.

Table-2A (Zone-15).

**ALLOWABLE BEARING CAPACITY FROM SHE/
SETTLEMENT CRITERIA**

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Q _{net} safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
ISOLATED SQUARE FOOTINGS	1.00	1.00	1.00	8.7	1.77	8	8	8
	2.50	2.50	1.00	11.7	7.23	11	11	11
	5.00	5.00	1.00	17.4	22.77	17	17	17
	7.50	7.50	1.00	23.2	46.40	12	19	23
	10.00	10.00	1.00	29.0	75.03	9	14	27
	1.00	1.00	1.50	12.6	2.41	12	12	12
	2.50	2.50	1.50	14.9	8.63	14	14	14
	5.00	5.00	1.50	20.4	25.89	19	20	20
	7.50	7.50	1.50	26.1	51.17	12	20	26
	10.00	10.00	1.50	31.9	84.61	9	15	28
	1.00	1.00	2.00	16.9	3.08	16	16	16
	2.50	2.50	2.00	18.3	9.87	18	18	18
	5.00	5.00	2.00	23.5	28.93	20	23	23
	7.50	7.50	2.00	29.1	55.95	13	20	29
	10.00	10.00	2.00	34.8	90.98	9	15	28
	1.00	1.00	3.00	26.7	4.65	26	26	26
	2.50	2.50	3.00	25.6	11.86	25	25	25
	5.00	5.00	3.00	29.9	34.53	21	29	29
	7.50	7.50	3.00	35.2	65.00	13	21	35
	10.00	10.00	3.00	40.8	103.56	9	15	29

ALLOWABLE BEARING CAPACITY FROM SHEAR SETTLEMENT CRITERIA

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Qnet safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
ISOLATED RECTANGULAR FOOTINGS	1.50	1.00	1.00	8.2	2.22	8	8	8
	3.75	2.50	1.00	10.9	8.67	10	10	10
	7.50	5.00	1.00	16.1	26.87	14	16	16
	11.25	7.50	1.00	21.4	54.41	9	15	21
	15.00	10.00	1.00	26.7	91.21	7	11	21
	1.50	1.00	1.50	11.8	2.73	11	11	11
	3.75	2.50	1.50	13.9	10.51	13	13	13
	7.50	5.00	1.50	18.9	30.80	15	18	18
	11.25	7.50	1.50	24.1	60.32	9	15	24
	15.00	10.00	1.50	29.4	99.28	7	11	22
	1.50	1.00	2.00	15.8	3.04	15	15	15
	3.75	2.50	2.00	17.1	12.26	17	17	17
	7.50	5.00	2.00	21.8	34.67	15	21	21
	11.25	7.50	2.00	27.0	66.52	10	16	27
	15.00	10.00	2.00	32.2	107.47	7	11	22
	1.50	1.00	3.00	25.1	6.09	25	25	25
	3.75	2.50	3.00	24.0	15.32	24	24	24
	7.50	5.00	3.00	27.9	42.18	16	26	27
	11.25	7.50	3.00	32.7	78.00	10	16	31
	15.00	10.00	3.00	37.9	123.52	7	12	23

ALLOWABLE BEARING CAPACITY FROM SHEAR SETTLEMENT CRITERIA

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Q _{net} safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
CONTINUOUS STRIP FOOTINGS		1.00	1.00	8.4	5.20	8	8	8
		1.50	1.00	9.6	9.15	9	9	9
		2.00	1.00	11.0	14.15	11	11	11
		2.50	1.00	12.3	19.92	12	12	12
		1.00	1.50	11.7	6.97	11	11	11
		1.50	1.50	12.6	11.71	12	12	12
		2.00	1.50	13.8	17.42	13	13	13
		2.50	1.50	15.1	24.10	15	15	15
		1.00	2.00	15.3	8.75	15	15	15
		1.50	2.00	15.9	14.40	15	15	15
		2.00	2.00	16.8	20.81	16	16	16
		2.50	2.00	18.0	28.30	15	18	18
		1.00	3.00	23.7	12.43	23	23	23
		1.50	3.00	23.0	19.73	23	23	23
		2.00	3.00	23.4	27.88	20	23	23
		2.50	3.00	24.2	36.90	16	24	24

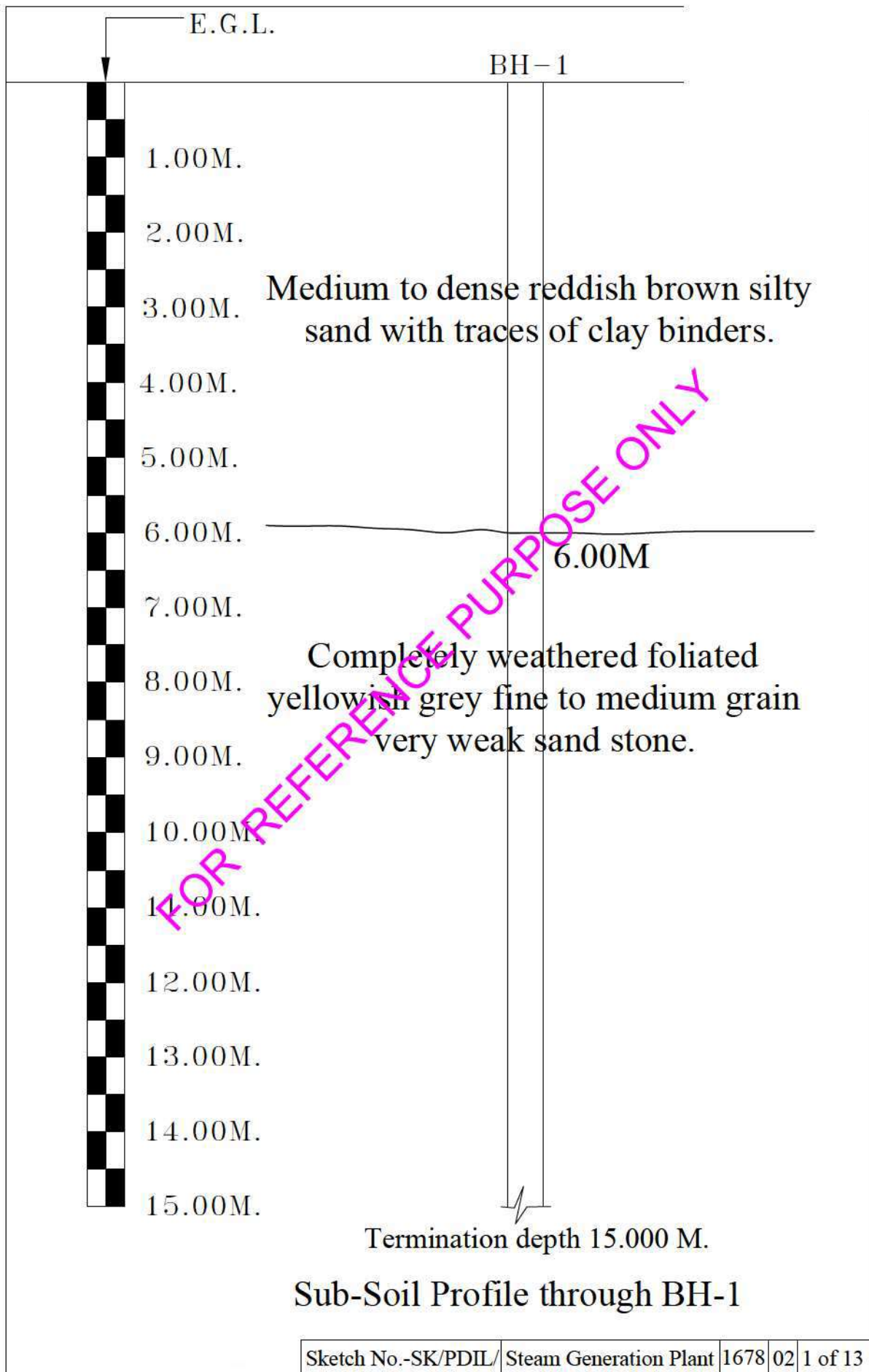
Table-2B (Zone-15).**Recommended Pile Capacity**

Sl.No	Pile Dia , D	Total Length of Pile, L	Cut-off Level	Recommended Pile Capacity in Compression	Recommended Pile Capacity in Pull-Out	Recommended Pile Capacity in Horizontal Shear
	Mtr	Mtr.	Mtr.	T	T	T
1	0.600	10.000	2.000	34	14	5
2	0.750	10.000	2.000	54	19	7
3	1.000	10.000	2.000	88	26	12
4	1.500	10.000	2.000	183	39	23

FOR REFERENCE PURPOSE ONLY

BORE LOG SHEET		Centre for Advanced Engineering					Bore Hol	
Project: SOIL_PDIL_ECL SANCTORIA							Job No.:	
Co-ord:		E.G.L.: 119.511	Unit: Steam Generation Plant				Bore Hol	
Type of Boring	Shell & Auger	FIELDTEST	NOS.	SAMPLES	NOS.	SAMPLES	NOS.	Commenc
Depth of Boring	6.000 M.	SPT	4	UDS	3	WS		Completed on : 19.05.2022
Type of Drilling		DCPT		DS	6	RCS	6	Water Struck At : 2.70M.
Depth of Drilling	9.000 M.	VST		SCPT				Standing Water Table : 2.60M

D E S C R I P T I O N	SYMBOL	DEPTH	N-V A L U E	S A M P L E	
				NO.	DEPTH
Medium to dense reddish brown silty sand with clay binders.		01	N = 28	DS1	0.50 M
				DS2	1.00 M
				SPT1	1.50-1.95M
				DS3	1.50-1.95M
				UDS1	2.00-2.45M
Completely weathered foliated yellowish grey fine to medium grain very weak sand stone.		02	N = 34	SPT2	3.00-3.45M
				DS4	3.00-3.45M
				UDS2	4.00-4.45M
		03	N = 43	SPT3	4.50-4.95M
				DS5	4.50-4.95M
				UDS3	5.00-5.45M
		04	N > 100	SPT4	5.80-6.00M
				DS6	5.80-6.00M
		05		RUN1	6.00-7.50M TCR-28% RQD-NIL
				RUN2	7.50-9.00M TCR-38% RQD-NIL
		06		RUN3	9.00-10.50M TCR-55% RQD-NIL
		07		RUN4	10.50-12.00M TCR-63% RQD-NIL
		08		RUN5	12.00-13.50M TCR-73% RQD-NIL
		09		RUN6	13.50-15.00M TCR-68% RQD-NIL
Termination Depth 15.000 Mtr.		10			



SUMMARY OF LABORATORY TEST RESULTS

Table-4

Project: Geotechnical Investigation Work for Proposed Coalgas to Methanol Project at Sactoria, West Bardhaman (WB)

Layer No.	Description of layer	Bore Hole No.	Depth	Sample Type - UD/D/ DN	SPT VALUE (N)	Atterberg Limits			Bulk Density in gm/cc	Water Content In %	Specific Gravity	Dry Density in gm/cc	Unconfined Test in Kg/sqcm	Shear Test				Pressure (Kg/sqcm)	Co-eff. of volume compressibility in sqcm/kg	Swelling Pressure in kg/sqcm	Grading				Modified Proctor Density	
						LL	PL	SL						Type of Test	Cohesion in kg/sqcm	Friction angle in degree	Gravel (> 4.75 mm)				Silt (0.002 - 0.075 mm)	Clay (< 0.002 mm)	MDD	OMC		
			Meter			%	%	%	γ _b	m	G	γ _d	q _u	UU/cu/ DS	C	φ				%	%	%	gm/cc	%		
I	Medium to dense reddish brown silty sand with clay binders.	1	0.50	D		NP														0	58	24	18	1.78	13.00	
		1	1.00	D		NP													0	61	23	16	1.79	12.58		
		1	1.50	DN	28	NP													0	60	25	15				
		1	2.00	UD		NP			1.81	16.26	2.66	1.56		DS	0.33	32			0	55	25	20				
		1	3.00	DN	34	NP													0	67	21	12				
		1	4.00	UD		NP			1.78	17.00	2.65	1.52		DS	0.08	35			0	61	26	13				
		1	4.50	DN	43	NP					2.65								0	80	15	5				
		1	5.00	UD		NP			1.82	13.25	2.64			DS	0.18	34			0	78	17	5				
		1	5.80	DN	>100	NP			1.81		2.66			DS	0.17	33			0	77	16	7				

Modulus of Subgrade Reaction and Modulus of Elasticity have been calculated for Plate Load

Calculation for Modulus of Subgrade Reaction (K) for PLT-2

From Load-Settlement curve of PLT-2, Pressure corresponding to settlement of 1.25mm is

$$\begin{aligned}\text{Hence, } K &= \text{Pressure} / \text{Settlement.} \\ &= 1.06 / 0.125 \text{ Kg/Cm}^3 \\ &= 8.48 \text{ Kg/Cm}^3\end{aligned}$$

Calculation for Modulus of Elasticity (Es) for PLT-2.

Modulus of Elasticity has been calculated for initial load of 18.3 T/M² and corresponding settlement of 0.137 cm.

$$\begin{aligned}E_s &= \{q \cdot (1 - \mu^2) \cdot B \cdot I_w\} / S \\ &= \{0.36 \cdot (1 - 0.3^2) \cdot 75 \cdot 0.82\} / 0.121 \\ &= 598.05 \text{ Kg/Cm}^2\end{aligned}$$

Where,

$$\begin{aligned}E_s &= \text{Modulus of Elasticity} \\ q &= \text{Pressure} = 1.83 \text{ Kg/Cm}^2 \\ \mu &= \text{Poisson's Ratio} = 0.3 \\ B &= \text{Least dimension of the plate} = 60 \text{ Cm} \\ I_w &= \text{Influence Factor} = 0.8 \\ S &= \text{Settlement} = 0.1 \text{ Cm}\end{aligned}$$

Modulus of Subgrade Reaction and Modulus of Elasticity, obtain from Plate Load Test.

Test No.	Depth of Test	Modulus of Subgrade Reaction, K	Modulus of Elasticity, Es
	(M)	(Kg/Cm ³)	(Kg/Cm ²)
PLT-2	2	8.48 Kg/Cm ³	598.05 Kg/Cm ²

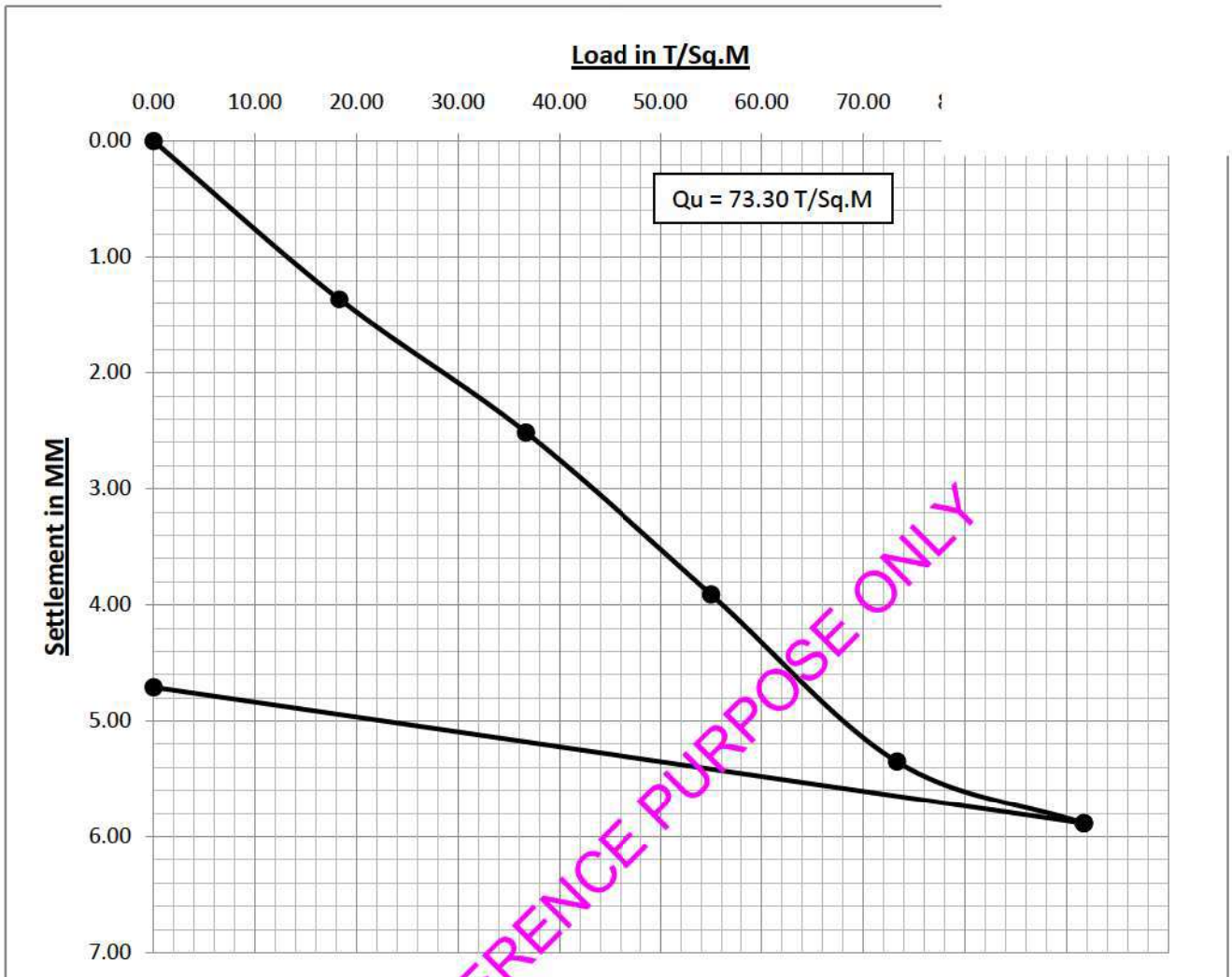
PLATE LOAD TEST SITE DATA SHEET

Client : Projects & Development India Limited
 Location : Steam Generation Plant
 Test Number : PLT-2
 Plate Size : 60x60 3600 Sqcm
 Pit Size : 3.00M X 3.00M X 2.00M
 Ground Water Table : Not Encountered
 L.C. of Dial Guage : 0.01 mm
 Jack Ram Dia : 10.5 cm
 Jack Ram Area : 86.59 Sqcm

DATE	TIME (Hrs)	LOAD IN (KG)	PRESSURE IN Kg/Sqcm	DIAL GUAGE READING (mm)		SETTLEMENT (mm)		MEAN SETTLEMENT (mm)	REMARKS
				DIAL-1	DIAL-2	DIAL-1	DIAL-2		
29-05-2022	13:40:00	0.00	0	2245	2267	0.00	0.00	0.00	
	13:40:00	6600	1.83	2245	2267	0.00	0.00	0.00	
	13:41:00			2069	2197	1.76	0.70	1.23	
	13:42:15			2066	2190	1.79	0.77	1.28	
	13:44:00			2065	2189	1.80	0.78	1.29	
	13:46:15			2065	2182	1.80	0.79	1.30	
	13:49:00			2064	2187	1.81	0.80	1.31	
	13:56:00			2063	2186	1.82	0.81	1.32	
	14:05:00			2062	2184	1.83	0.83	1.33	
	14:40:00			2038	2181	1.87	0.86	1.37	
	14:40:00	13200	3.67	2058	2181	1.87	0.86	1.37	
	14:41:00			2000	2026	2.45	2.41	2.43	
	14:42:15			1998	2024	2.47	2.43	2.45	
	14:44:00			1997	2022	2.48	2.45	2.47	
	14:46:15			1996	2021	2.49	2.46	2.48	
	14:49:00			1995	2020	2.50	2.47	2.49	
	14:56:00			1995	2018	2.50	2.49	2.50	
	15:05:00			1995	2016	2.50	2.51	2.51	
	15:40:00			1994	2015	2.51	2.52	2.52	
	15:40:00	19800	5.50	1994	2015	2.51	2.52	2.52	
	15:41:00			1932	1856	3.13	4.11	3.62	
	15:42:15			1931	1854	3.14	4.13	3.64	
	15:44:00			1915	1842	3.30	4.25	3.78	
	15:46:15			1908	1834	3.37	4.33	3.85	
	15:49:00			1907	1831	3.38	4.36	3.87	
	15:56:00			1907	1831	3.38	4.36	3.87	
	16:05:00			1905	1829	3.40	4.38	3.89	
	16:40:00			1903	1827	3.42	4.40	3.91	
	16:40:00	26400	7.33	1903	1827	3.42	4.40	3.91	
	16:41:00			1801	1740	4.44	5.27	4.86	

DATE	TIME (Hrs)	LOAD IN (KG)	PRESSURE IN Kg/Sqcm	DIAL GUAGE READING (mm)		SETTLEMENT (mm)	
				DIAL-1	DIAL-2	DIAL-1	DIAL-2
	16:42:15			1798	1725	4.47	5.42
	16:44:00			1781	1714	4.64	5.53
	16:46:15			1765	1705	4.80	5.62
	16:49:00			1760	1701	4.85	5.66
	16:56:00			1758	1698	4.87	5.69
	17:05:00			1755	1694	4.90	5.73
	17:40:00			1751	1691	4.94	5.76
	17:40:00	33000	9.17	1751	1691	4.94	5.76
	17:41:00			1718	1658	5.27	6.09
	17:42:15			1715	1655	5.30	6.12
	17:44:00			1713	1652	5.32	6.15
	17:46:15			1708	1644	5.37	6.23
	17:49:00			1706	1641	5.39	6.26
	17:56:00			1704	1638	5.41	6.29
	18:05:00			1703	1636	5.42	6.31
	18:40:00			1701	1634	5.44	6.33
	18:40:00	0	0	1701	1634	5.44	6.33
	19:40:00			1802	1768	4.43	4.99

FOR REFERENCE PURPOSE ONLY



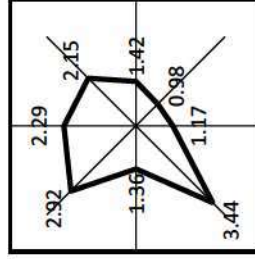
Load Vs Settlement Curve for PLT-2

Table ERT - 2

Project : Geo-Technical investigation work for proposed coalgas to methanol project at Sanctoria, West Bardhaman (W.B.)
 Location : Steam Generation Plant.
 Client : Project & Development India Limited
 Test Date : 01-06-2022
 Instrument : Metravi ERT-1501, SL. No.: 10109809

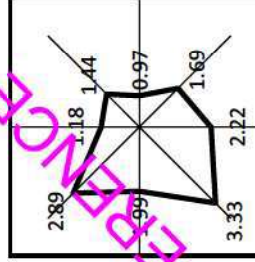
Sl. No.	Electrode Spacing 's' m	Measured Resistance "R" (Ω)								Apparent Resistivity "ρ" (Ω-m")							
		North	North-East	East	East-South	South	South-West	West	North-West	North	North-East	East	East-South	South	South-West	West	North-West
1	1.0	2.29	2.15	1.42	0.98	1.17	3.44	1.36	2.92	14.39	13.51	8.92	6.16	7.35	21.61	8.55	18.35
2	2.0	1.18	1.44	0.97	1.69	2.22	3.33	1.99	2.89	14.83	18.10	12.19	21.24	27.90	41.85	25.01	36.32
3	3.0	2.45	2.18	2.22	2.13	1.51	1.31	2.34	3.11	46.18	41.09	41.85	40.15	28.46	24.69	44.11	58.62
4	5.0	3.18	1.77	2.02	2.7	1.39	2.89	3.62	2.59	99.90	55.61	63.46	84.82	43.67	90.79	113.73	81.37
5	10.0	3.57	2.09	1.61	1.63	0.95	1.62	1.45	1.29	224.31	131.32	101.16	102.42	59.69	101.79	91.11	81.05
6	15.0	1.19	1.59	2.62	1.08	2.62	2.38	1.17	2.08	112.15	149.55	246.93	101.79	246.93	224.31	110.27	196.04
7	20.0	3.29	4.72	2.75	3.17	3.46	2.72	3.92	2.89	413.43	593.43	345.58	398.35	434.80	341.81	492.60	363.17

1.00Mtr.



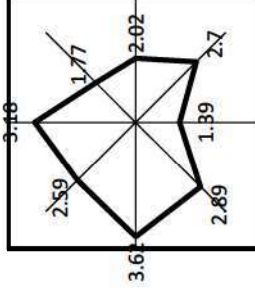
Resistivity = 12.35 ohm-m

2.00Mtr.



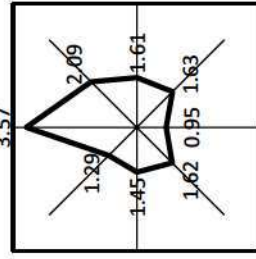
Resistivity = 24.68 ohm-m

5.00Mtr.



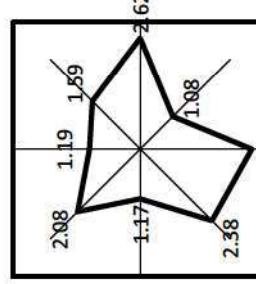
Resistivity = 79.17 ohm-m

10.00Mtr.



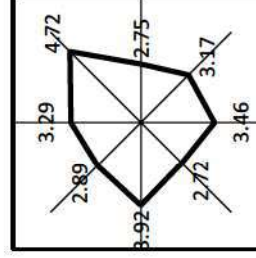
Resistivity = 111.61 ohm-m

15.00Mtr.



Resistivity = 173.53 ohm-m

20.00Mtr.



Resistivity = 422.86 ohm-m

ZONE-16

FOR REFERENCE PURPOSE ONLY

ASH/ SLAG

STORAGE

Total two (2) boreholes were sunk in this area, viz borehole BH-3. From the general sub soil profile it has been observed that reddish brown silty clay/ clayey silt with morrum is present up to 1.50M depth at the location of BH-2, however this layer is absent at the location of BH-3. Dense silty sand layer has been observed at both the location and continues up to the explored depth.

In addition the following field test has been carried out at this zone and results are being indicated in this chapter.

1. Electrical Resistivity Test:

One (1) electrical resistivity test has been carried out at this zone marked as ERT-3.

Discussion and Recommendation:

Based on the sub-soil condition, shallow foundation has been recommended for foundation system of medium to heavily loaded structures. Bearing capacities for different size and shapes of foundations are indicated in the Table-2A (Zone-16).

Pile Foundation has also been recommended for foundation of heavily loaded structures. Pile Capacities for different dia of pile are indicated in the Table-2B (Zone-16). It is further recommended to carry out initial pile load test for load under compression, pull-out and horizontal shear, in order to confirm the recommended pile capacities and to take corrective measures, if required.

Table-2A (Zone-16).

**ALLOWABLE BEARING CAPACITY FROM SHEAR
SETTLEMENT CRITERIA**

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Q _{net} safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
ISOLATED SQUARE FOOTINGS	1.00	1.00	1.00	11.4	1.94	11	11	11
	2.50	2.50	1.00	15.5	7.98	15	15	15
	5.00	5.00	1.00	23.1	25.19	22	23	23
	7.50	7.50	1.00	31.0	51.66	15	24	31
	10.00	10.00	1.00	38.8	87.02	11	17	33
	1.00	1.00	1.50	16.4	2.61	16	16	16
	2.50	2.50	1.50	19.6	9.46	19	19	19
	5.00	5.00	1.50	27.0	28.55	23	27	27
	7.50	7.50	1.50	34.7	56.70	15	24	34
	10.00	10.00	1.50	42.5	93.94	11	18	33
	1.00	1.00	2.00	22.0	3.34	22	22	22
	2.50	2.50	2.00	24.0	10.79	24	24	24
	5.00	5.00	2.00	31.0	31.80	24	31	31
	7.50	7.50	2.00	38.6	61.85	15	24	38
	10.00	10.00	2.00	46.3	100.87	11	18	34
	1.00	1.00	3.00	34.9	5.07	34	34	34
	2.50	2.50	3.00	33.5	12.94	33	33	33
	5.00	5.00	3.00	39.3	37.83	25	39	39
	7.50	7.50	3.00	46.5	71.55	16	25	46
	10.00	10.00	3.00	54.1	114.43	11	18	35

ALLOWABLE BEARING CAPACITY FROM SHEAR SETTLEMENT CRITERIA

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Q _{net} safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
ISOLATED RECTANGULAR FOOTINGS	1.50	1.00	1.00	10.7	2.42	10	10	10
	3.75	2.50	1.00	14.4	9.54	14	14	14
	7.50	5.00	1.00	21.4	29.76	17	21	21
	11.25	7.50	1.00	28.6	60.59	11	18	28
	15.00	10.00	1.00	35.8	101.91	8	14	26
	1.50	1.00	1.50	15.4	2.97	15	15	15
	3.75	2.50	1.50	18.3	11.53	18	18	18
	7.50	5.00	1.50	25.0	33.95	18	25	25
	11.25	7.50	1.50	32.1	66.96	11	19	32
	15.00	10.00	1.50	39.3	110.59	8	14	26
	1.50	1.00	2.00	20.7	3.32	20	20	20
	3.75	2.50	2.00	22.4	13.38	22	22	22
	7.50	5.00	2.00	28.8	38.17	18	28	28
	11.25	7.50	2.00	35.7	73.30	12	19	35
	15.00	10.00	2.00	42.8	119.04	8	14	26
	1.50	1.00	3.00	32.8	6.64	32	32	32
	3.75	2.50	3.00	31.3	16.65	31	31	31
	7.50	5.00	3.00	36.6	46.11	19	31	36
	11.25	7.50	3.00	43.2	85.87	12	20	37
	15.00	10.00	3.00	50.1	136.06	9	14	27

ALLOWABLE BEARING CAPACITY FROM SHEAR SETTLEMENT CRITERIA

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Qnet safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
CONTINUOUS STRIP FOOTINGS		1.00	1.00	11.0	5.68	11	11	11
		1.50	1.00	12.7	10.08	12	12	12
		2.00	1.00	14.5	15.54	14	14	14
		2.50	1.00	16.4	22.13	16	16	16
		1.00	1.50	15.3	7.59	15	15	15
		1.50	1.50	16.6	12.85	16	16	16
		2.00	1.50	18.2	19.15	18	18	18
		2.50	1.50	20.0	26.60	18	20	20
		1.00	2.00	20.1	9.58	20	20	20
		1.50	2.00	20.8	15.69	20	20	20
		2.00	2.00	22.1	22.81	22	22	22
		2.50	2.00	23.7	31.05	19	23	23
		1.00	3.00	31.1	13.60	31	31	31
		1.50	3.00	30.2	21.59	30	30	30
		2.00	3.00	30.7	30.48	25	30	30
		2.50	3.00	31.8	40.40	19	31	31

Table-2B (Zone-16).

Recommended Pile Capacity

Sl.No	Pile Dia , D	Total Length of Pile, L	Cut-off Level	Recommended Pile Capacity in Compression	Recommended Pile Capacity in Pull-Out	Recommended Pile Capacity in Horizontal Shear
	Mtr	Mtr.	Mtr.	T	T	T
1	0.600	10.000	2.000	33	13	5
2	0.750	10.000	2.000	52	18	7
3	1.000	10.000	2.000	86	24	12
4	1.500	10.000	2.000	130	36	23

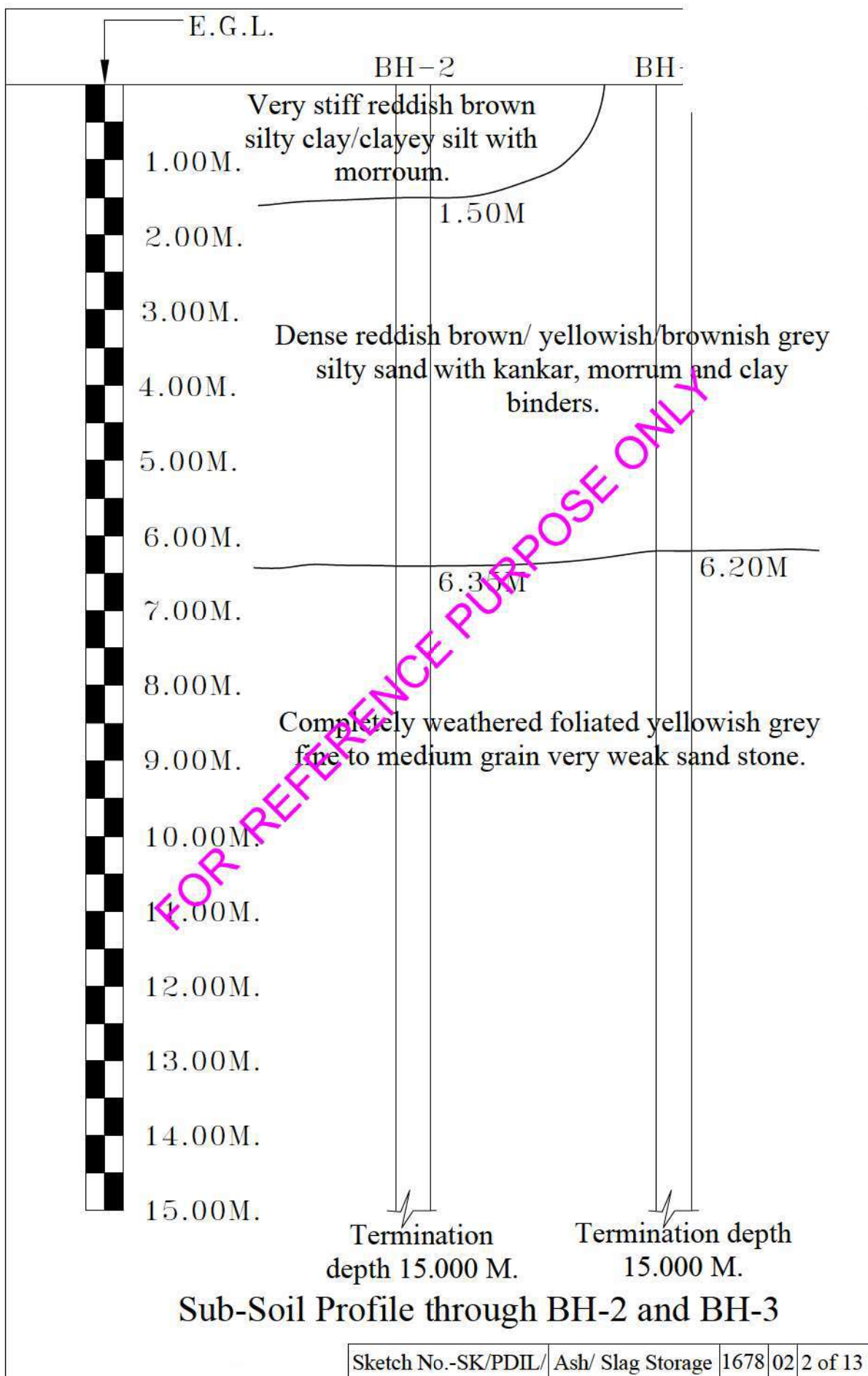
FOR REFERENCE PURPOSE ONLY

BORE LOG SHEET		Centre for Advanced Engineering						Bore Hole
								Job No.:
Project: SOIL_PDIL_ECL SANCTORIA								
Co-ord:		E.G.L.:117.204	Unit: Ash/ Slag Storage				Bore Hole	
Type of Boring	Shell & Auger	FIELDTEST	NOS.	SAMPLES	NOS.	SAMPLES	NOS.	Commence
Depth of Boring	6.350 M.	SPT	4	UDS	3	WS		Completed on : 20.05.2022
Type of Drilling		DCPT		DS	6	RCS	6	Water Struck At : 2.80M
Depth of Drilling	8.650 M.	VST		SCPT				Standing Water Table : 2.70M

D E S C R I P T I O N	SYMBOL	DEPTH	N-V A L U E	S A M P L E	
				NO.	DEPTH
Very stiff reddish brown silty clay/clayey silt with morroum.		01		DS1	0.50 M
				DS2	1.00 M
Dense reddish brown silty sand with traces of clay binders.		02	N = 38	SPT1	1.50-1.95M
				DS3	1.50-1.95M
				UDS1	2.00-2.45M
		03	N = 40	SPT2	3.00-3.45M
				DS4	3.00-3.45M
		04		UDS2	4.00-4.45M
		05	N = 42	SPT3	4.50-4.95M
				DS5	4.50-4.95M
				UDS3	5.00-5.45M
		06	N > 100	SPT4	6.00-6.35M
				DS6	6.00-6.35M
Completely weathered foliated yellowish grey fine to medium grain very weak sand stone.		07		RUN1	6.35-7.50M TCR-23% RQD-NIL
		08		RUN2	7.50-9.00M TCR-40% RQD-NIL
		09		RUN3	9.00-10.50M TCR-53% RQD-NIL
		10		RUN4	10.50-12.00M TCR-58% RQD-NIL
		11			
		12		RUN5	12.00-13.50M TCR-65% RQD-NIL
		13			
		14		RUN6	13.50-15.00M TCR-73% RQD-NIL
Termination Depth 15.000 Mtr.		15			

BORE LOG SHEET		Centre for Advanced Engineering						Bore Hole
								Job No.:
Project:SOIL_PDIL_ECL SANCTORIA								
Co-ord:		E.G.L.:118.006		Unit: Ash/ Slag Storage			Bore Hole	
Type of Boring	Shell & Auger	FIELDTEST	NOS.	SAMPLES	NOS.	SAMPLES	NOS.	Commence
Depth of Boring	6.200 M.	SPT	4	UDS	3	WS		Completed on : 20.05.2022
Type of Drilling		DCPT		DS	6	RCS	6	Water Struck At :2.60M
Depth of Drilling	8.800 M.	VST		SCPT				Standing Water Table : 2.50M

D E S C R I P T I O N	SYMBOL	DEPTH	N-V A L U E	S A M P L E	
				NO.	DEPTH
Dense yellowish/brownish grey silty sand with kankar, morrum and clay binders.		01 02 03 04 05 06	N = 32	DS1	0.50 M
				DS2	1.00 M
				SPT1	1.50-1.95M
				DS3	1.50-1.95M
			N = 38	UDS1	2.00-2.45M
				SPT2	3.00-3.45M
				DS4	3.00-3.45M
				UDS2	4.00-4.45M
			N = 42	SPT3	4.50-4.95M
				DS5	4.50-4.95M
				UDS3	5.00-5.45M
Completely weathered foliated yellowish grey fine to medium grain very weak sand stone.		06 07 08 09 10 11 12 13 14 15	N >100	SPT4	6.00-6.20M
				DS6	6.00-6.20M
				RUN1	6.20-7.50M TCR-27% RQD-NIL
				RUN2	7.50-9.00M TCR-37% RQD-NIL
				RUN3	9.00-10.50M TCR-50% RQD-NIL
				RUN4	10.50-12.00M TCR-55% RQD-NIL
				RUN5	12.00-13.50M TCR-61% RQD-NIL
				RUN6	13.50-15.00M TCR-60% RQD-NIL
Termination Depth 15.000 Mtr.					



SUMMARY OF LABORATORY TEST RESULTS

Table-4

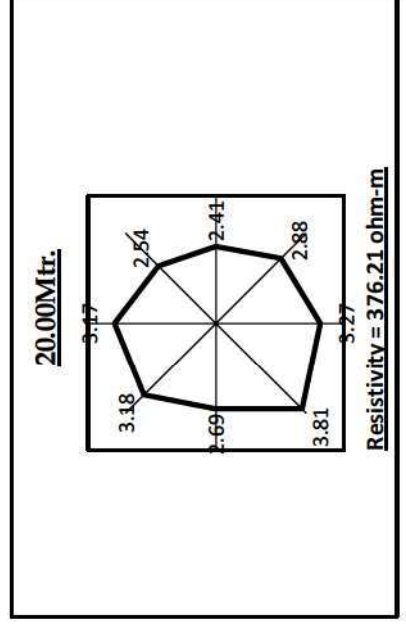
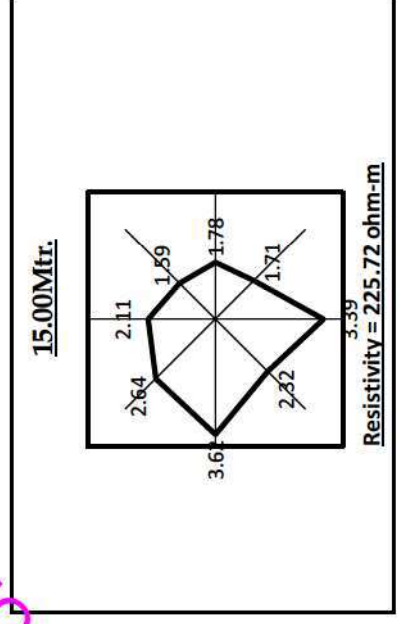
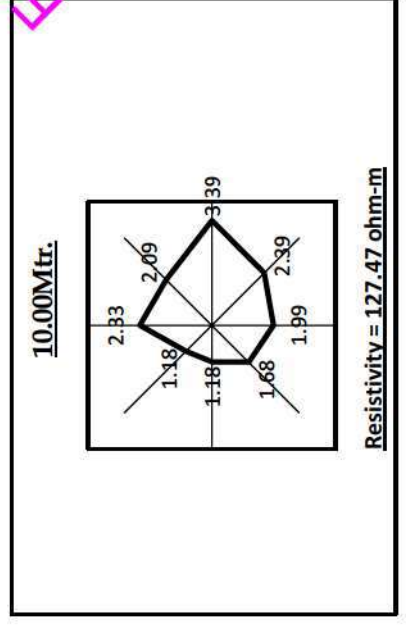
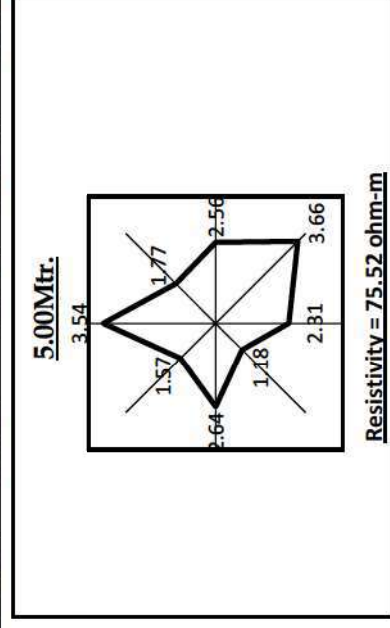
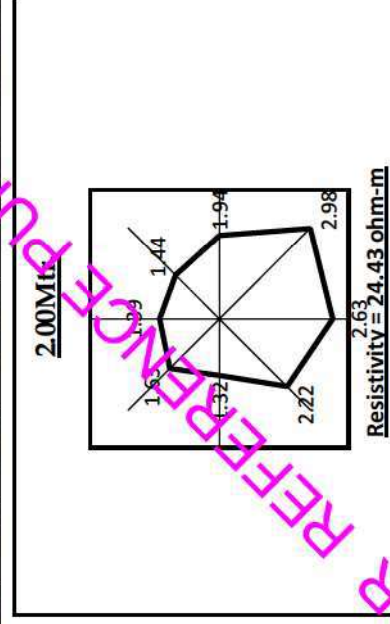
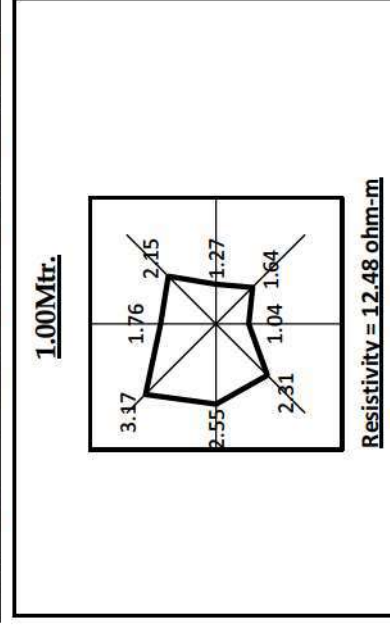
Project: Geotechnical Investigation Work for Proposed Coalgas to Methanol Project at Sactoria, West Bardhaman (WB)

Layer No.	Description of layer	Bore Hole No.	Depth	Sample Type - UD/D/ DN	SPT VALUE (N)	Atterberg Limits			Bulk Density in gm/cc	Water Content in %	Specific Gravity	Dry Density in gm/cc	Unconfine d Test in Kg/sqcm	Shear Test			Pressure (Kg/sqcm)	Co-eff. of volume compressibility in sqcm/Kg	Swelling Pressure in kg/sqcm	Grading				Modified Proctor Density																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
						LL	PL	SL						Type of Test	Cohesion in kg/sqcm	Friction angle in degree				Gravel (> 4.75 mm)	Sand (0.075 - 4.75 mm)	Silt (0.002 - 0.075 mm)	Clay (< 0.002 mm)	MDD	OMC																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
I	Very stiff reddish brown silty clay/clayey silt with morrum.	2	Meter	0.50	D				γ _b	m	G	γ _d	q _u	UU/cu/ DS	C	φ				%	%	%	%	gm/cc	%																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												

Table ERT -3
: Geo-Technical investigation work for proposed coalgas to methanol project at Sanctoria, West Bardhaman (W.B.)

Project	Location	Client	Test Date	Instrument
1	2	3	4	5

Sl. No.	Electrode Spacing 's' m	Measured Resistance "R" (Ω)								Apparent Resistivity "ρ" (Ω-m")							
		North	North-East	East	East-South	South	South-West	West	North-West	North	North-East	East	East-South	South	South-West	West	North-West
1	1.0	1.76	2.15	1.27	1.64	1.04	2.31	2.55	3.17	11.06	13.51	7.98	10.30	6.53	14.51	16.02	19.92
2	2.0	1.39	1.44	1.94	2.98	2.63	2.22	1.32	1.63	17.47	18.10	24.38	37.45	33.05	27.90	16.59	20.48
3	3.0	2.48	2.18	1.62	1.77	1.48	1.94	3.38	2.07	46.75	41.09	30.54	33.36	27.90	36.57	63.71	39.02
4	5.0	3.54	1.77	2.56	3.66	2.31	1.18	2.64	1.57	111.21	55.61	80.42	114.98	72.57	37.07	82.94	49.32
5	10.0	2.33	2.09	3.39	2.39	1.99	1.68	1.18	1.18	146.40	131.32	213.00	150.17	125.04	105.56	74.14	74.14
6	15.0	2.11	1.59	1.78	1.71	3.39	2.32	3.62	2.64	198.86	149.85	167.76	161.16	319.50	218.65	341.18	248.81
7	20.0	3.17	2.54	2.41	2.88	3.27	3.81	2.69	3.18	398.35	319.19	302.85	361.91	410.92	478.78	338.04	399.61



ZONE-17

FOR REFERENCE PURPOSE ONLY

FIRE STATION

One (1) borehole was sunk in this area, viz borehole mar the general sub soil profile it has been observed that the to very dense yellowish grey silty sand with clay binders and continues up to the explored depth.

Discussion and Recommendation:

Based on the sub-soil condition, shallow foundation has been recommended for foundation system of medium to heavily loaded structures. Bearing capacities for different size and shapes of foundations are indicated in the Table-2A (Zone-17).

Pile Foundation has also been recommended for foundation of heavily loaded structures. Pile Capacities for different dia of pile are indicated in the Table-2B (Zone-17). It is further recommended to carry out initial pile load test for load under compression, pull-out and horizontal shear, in order to confirm the recommended pile capacities and to take corrective measures, if required.

FOR REFERENCE PURPOSE ONLY

Table-2A (Zone-17).

**ALLOWABLE BEARING CAPACITY FROM SHE/
SETTLEMENT CRITERIA**

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Q _{net} safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
ISOLATED SQUARE FOOTINGS	1.00	1.00	1.00	11.2	1.90	11	11	11
	2.50	2.50	1.00	15.2	7.83	15	15	15
	5.00	5.00	1.00	22.8	24.87	22	22	22
	7.50	7.50	1.00	30.5	50.83	15	24	30
	10.00	10.00	1.00	38.3	85.90	11	17	33
	1.00	1.00	1.50	16.1	2.57	16	16	16
	2.50	2.50	1.50	19.3	9.32	19	19	19
	5.00	5.00	1.50	26.6	28.13	23	26	26
	7.50	7.50	1.50	34.2	55.88	15	24	34
	10.00	10.00	1.50	41.9	92.61	11	18	33
	1.00	1.00	2.00	21.5	3.27	21	21	21
	2.50	2.50	2.00	23.5	10.56	23	23	23
	5.00	5.00	2.00	30.5	31.29	24	30	30
	7.50	7.50	2.00	38.0	60.88	15	24	38
	10.00	10.00	2.00	45.6	99.34	11	18	34
	1.00	1.00	3.00	34.1	4.95	34	34	34
	2.50	2.50	3.00	32.8	12.67	32	32	32
	5.00	5.00	3.00	38.6	37.15	25	38	38
	7.50	7.50	3.00	45.7	70.32	16	25	45
	10.00	10.00	3.00	53.2	112.53	11	18	35

ALLOWABLE BEARING CAPACITY FROM SHEAR SETTLEMENT CRITERIA

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Q _{net} safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
ISOLATED RECTANGULAR FOOTINGS	1.50	1.00	1.00	10.5	2.37	10	10	10
	3.75	2.50	1.00	14.1	9.34	14	14	14
	7.50	5.00	1.00	21.1	29.34	17	21	21
	11.25	7.50	1.00	28.2	59.74	11	18	28
	15.00	10.00	1.00	35.3	100.49	8	14	26
	1.50	1.00	1.50	15.1	2.92	15	15	15
	3.75	2.50	1.50	17.9	11.28	17	17	17
	7.50	5.00	1.50	24.6	33.40	18	24	24
	11.25	7.50	1.50	31.6	65.92	11	19	31
	15.00	10.00	1.50	38.7	108.90	8	14	26
	1.50	1.00	2.00	20.2	3.24	20	20	20
	3.75	2.50	2.00	22.0	13.14	22	22	22
	7.50	5.00	2.00	28.3	37.50	18	28	28
	11.25	7.50	2.00	35.2	72.27	12	19	35
	15.00	10.00	2.00	42.2	117.37	8	14	26
	1.50	1.00	3.00	32.1	6.50	32	32	32
	3.75	2.50	3.00	30.7	16.33	30	30	30
	7.50	5.00	3.00	35.9	45.23	19	31	35
	11.25	7.50	3.00	42.5	84.48	12	20	37
	15.00	10.00	3.00	49.3	133.89	9	14	27

ALLOWABLE BEARING CAPACITY FROM SHEAR SETTLEMENT CRITERIA

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Q _{net} safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
CONTINUOUS STRIP FOOTINGS		1.00	1.00	10.8	5.57	10	10	10
		1.50	1.00	12.5	9.92	12	12	12
		2.00	1.00	14.3	15.33	14	14	14
		2.50	1.00	16.1	21.73	16	16	16
		1.00	1.50	15.0	7.45	15	15	15
		1.50	1.50	16.3	12.62	16	16	16
		2.00	1.50	17.9	18.83	17	17	17
		2.50	1.50	19.6	26.06	18	19	19
		1.00	2.00	19.7	9.39	19	19	19
		1.50	2.00	20.4	15.39	20	20	20
		2.00	2.00	21.7	22.40	21	21	21
		2.50	2.00	23.3	30.52	19	23	23
		1.00	3.00	30.4	13.29	30	30	30
		1.50	3.00	29.5	21.09	29	29	29
		2.00	3.00	30.1	29.88	25	30	30
		2.50	3.00	31.2	39.64	19	31	31

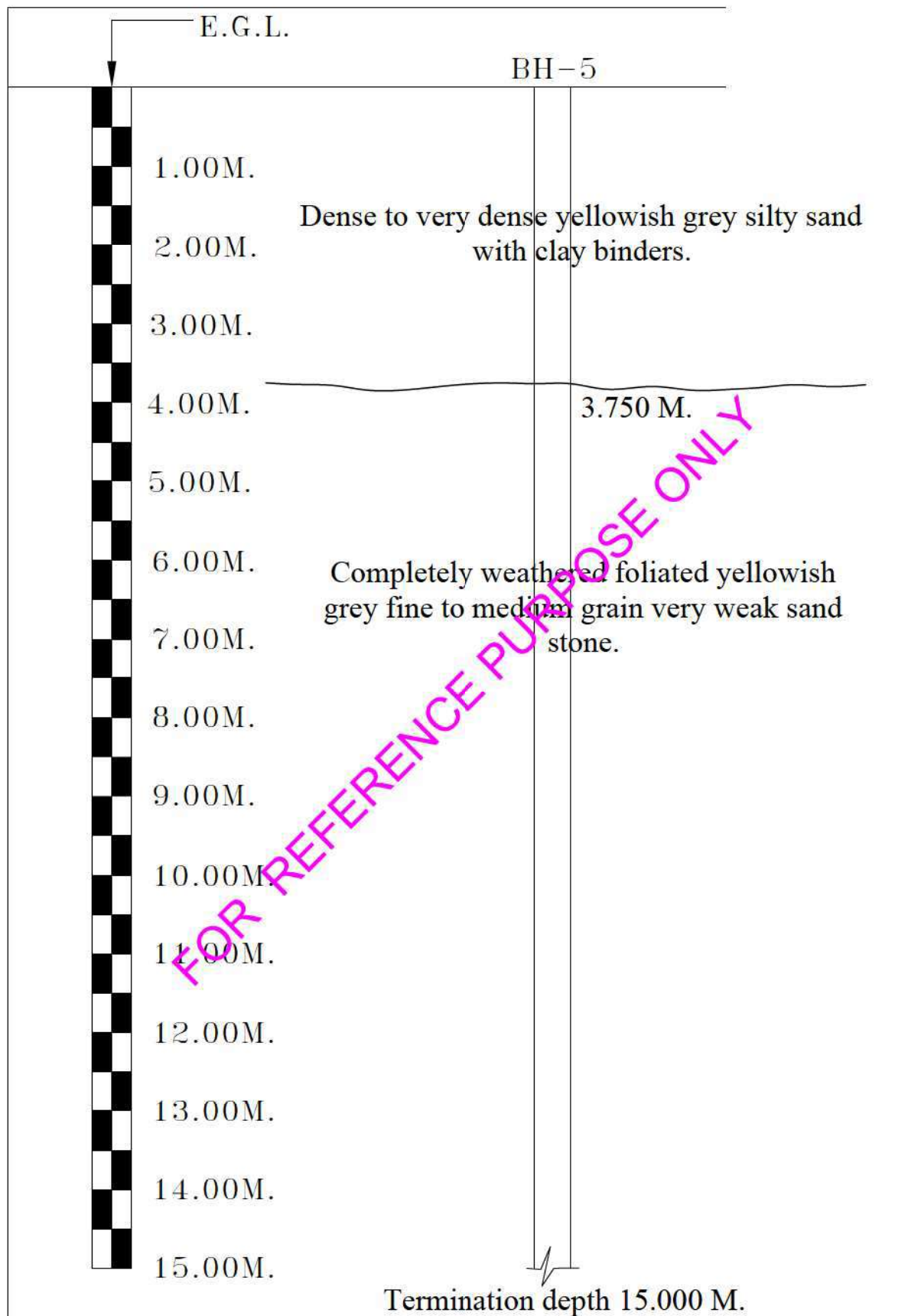
Table-2B (Zone-17).
Recommended Pile Capacity

Sl.No	Pile Dia , D	Total Length of Pile, L	Cut-off Level	Recommended Pile Capacity in Compression	Recommended Pile Capacity in Pull-Out	Recommended Pile Capacity in Horizontal Shear
	Mtr	Mtr.	Mtr.	T	T	T
1	0.600	10.000	2.000	39	19	5
2	0.750	10.000	2.000	60	26	7
3	1.000	10.000	2.000	97	35	12
4	1.500	10.000	2.000	196	52	23

FOR REFERENCE PURPOSE ONLY

BORE LOG SHEET		Centre for Advanced Engineering						Bore Hol
								Job No.:
Project: SOIL_PDIL_ECL SANCTORIA								
Co-ord:		E.G.L.:112.094		Unit: Fire Station.			Bore Hol	
Type of Boring	Shell & Auger	FIELDTEST	NOS.	SAMPLES	NOS.	SAMPLES	NOS.	Commenc
Depth of Boring	3.750 M.	SPT	3	UDS	1	WS		Completed on : 20.05.2022
Type of Drilling		DCPT		DS	5	RCS	5	Water Struck At : 2.40M
Depth of Drilling	11.250 M.	VST		SCPT				Standing Water Table : 2.30M

D E S C R I P T I O N	SYMBOL	DEPTH	N-V A L U E	S A M P L E	
				NO.	DEPTH
Dense to very dense yellowish grey silty sand with clay binders.		01	N = 48	DS1	0.50 M
				DS2	1.00 M
				SPT1	1.50-1.95M
				DS3	1.50-1.95M
				UDS1	2.00-2.45M
		02	N = 70	SPT2	3.00-3.45M
				DS4	3.00-3.45M
				SPT3	3.60-3.75M
				DS5	3.60-3.75M
Completely weathered foliated yellowish grey fine to medium grain very weak sand stone.		03	N > 100		
		04		RUN1	3.75-5.00M TCR-18% RQD-NIL
				RUN2	5.00-6.50M TCR-25% RQD-NIL
				RUN3	6.50-8.00M TCR-37% RQD-NIL
				RUN4	8.00-9.50M TCR-47% RQD-NIL
				RUN5	9.50-11.00M TCR-54% RQD-NIL
				RUN6	11.00-12.50M TCR-58% RQD-NIL
				RUN7	12.50-14.00M TCR-66% RQD-NIL
				RUN8	14.00-15.00M TCR-74% RQD-NIL
Termination Depth 15.000 Mtr.		05			



Sub-Soil Profile through BH-5

Sketch No.-SK/PDIL/	Fire Station	1678	02	4 of 13
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SUMMARY OF LABORATORY TEST RESULTS

Table-4

Project: Geotechnical Investigation Work for Proposed Coalgas to Methanol Project at Sactoria, West Bardhaman (WB)

Layer No.	Description of layer	Bore Hole No.	Depth	Sample Type - UD/D/ DN	SPT VALUE (N)	Atterberg Limits			Bulk Density in gm/cc	Water Content in %	Specific Gravity	Dry Density in gm/cc	Unconfined Test in Kg/sqcm	Shear Test			Pressure (Kg/sqcm)	Co-eff. of volume compressibility in sqcm/kg	Swelling Pressure in kg/sqcm	Grading				Modified Proctor Density	
						LL	PL	SL						Type of Test	Cohesion in kg/sqcm	Friction angle in degree				Gravel (> 4.75 mm)	Sand (0.075 - 4.75 mm)	Silt (0.002 - 0.075 mm)	Clay (< 0.002 mm)	MDD	OMC
I	Dense to very dense yellowish grey silty sand with clay binders.	5	0.50	D																					
		5	1.00	D																					
		5	1.50	DN	48															0	62	29	9		
		5	2.00	UD					1.79	17.44	2.68	1.52	3.05	DS	0.17	33				0	59	30	11		
		5	3.00	DN	70						2.65									0	74	18	8		
		5	3.60	DN	>100				1.80		2.64			DS	0.15	36				0	75	19	6		

ZONE-18

TRUCK PARKING
AREA WITH
DRIVER REST
ROOM

FOR REFERENCE PURPOSE ONLY

Total one (1) borehole was sunk in this area, viz borehole n
general sub soil profile it has been observed that the top s
brown silty clay/ clayey silt with sand and the second layer as encountered up to
the explored depth is very dense yellowish grey silty sand with clay binders.

In addition the following field tests have been carried out at this zone and results
are being indicated in this chapter.

1. Electrical Resistivity Test:

One (1) electrical resistivity tests has been carried out at this zone marked
as ERT-4.

Discussion and Recommendation:

Based on the sub-soil condition, shallow foundation has been recommended for
foundation system of medium to heavily loaded structures. Bearing capacities for
different size and shapes of foundations are indicated in the Table-2A (Zone-18).

Pile Foundation has also been recommended for foundation of heavily loaded
structures. Pile Capacities for different dia of pile are indicated in the Table-2B
(Zone-18). It is further recommended to carry out initial pile load test for load
under compression, pull-out and horizontal shear, in order to confirm the
recommended pile capacities and to take corrective measures, if required.

Table-2A (Zone-18).

**ALLOWABLE BEARING CAPACITY FROM SHE/
SETTLEMENT CRITERIA**

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Qnet safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
ISOLATED SQUARE FOOTINGS	1.00	1.00	1.00	51.9	24.62	51	51	51
	2.50	2.50	1.00	46.7	67.94	17	27	46
	5.00	5.00	1.00	45.0	128.23	8	14	26
	7.50	7.50	1.00	44.4	173.13	6	10	19
	10.00	10.00	1.00	44.1	209.94	5	8	15
	1.00	1.00	1.50	56.2	25.14	55	56	56
	2.50	2.50	1.50	48.4	65.94	18	29	48
	5.00	5.00	1.50	45.8	123.54	9	14	27
	7.50	7.50	1.50	45.0	166.29	6	10	20
	10.00	10.00	1.50	44.5	200.99	5	8	16
	1.00	1.00	2.00	60.6	26.11	58	60	60
	2.50	2.50	2.00	50.2	63.43	19	31	50
	5.00	5.00	2.00	46.7	118.42	9	15	29
	7.50	7.50	2.00	45.6	158.70	7	11	21
	10.00	10.00	2.00	45.0	191.76	5	9	17
	1.00	1.00	3.00	69.2	28.49	60	69	69
	2.50	2.50	3.00	53.6	56.12	23	38	53
	5.00	5.00	3.00	48.4	105.36	11	18	34
	7.50	7.50	3.00	46.7	140.57	8	13	24
	10.00	10.00	3.00	45.8	169.97	6	10	20

ALLOWABLE BEARING CAPACITY FROM SHEAR SETTLEMENT CRITERIA

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Q _{net} safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
ISOLATED RECTANGULAR FOOTINGS	1.50	1.00	1.00	45.2	27.93	40	45	45
	3.75	2.50	1.00	40.7	73.79	13	22	40
	7.50	5.00	1.00	39.2	132.09	7	11	22
	11.25	7.50	1.00	38.7	175.33	5	8	16
	15.00	10.00	1.00	38.5	211.62	4	7	13
	1.50	1.00	1.50	49.0	25.89	47	49	49
	3.75	2.50	1.50	42.2	72.08	14	23	42
	7.50	5.00	1.50	40.0	127.78	7	12	23
	11.25	7.50	1.50	39.2	168.58	5	9	17
	15.00	10.00	1.50	38.8	202.81	4	7	14
	1.50	1.00	2.00	52.8	23.18	52	52	52
	3.75	2.50	2.00	43.7	69.76	15	25	43
	7.50	5.00	2.00	40.7	122.44	8	13	24
	11.25	7.50	2.00	39.7	161.13	6	9	18
	15.00	10.00	2.00	39.2	193.88	5	8	15
	1.50	1.00	3.00	60.3	33.39	45	60	60
	3.75	2.50	3.00	46.8	63.10	18	29	46
	7.50	5.00	3.00	42.2	109.61	9	15	28
	11.25	7.50	3.00	40.7	143.87	7	11	21
	15.00	10.00	3.00	40.0	173.80	5	9	17

ALLOWABLE BEARING CAPACITY FROM SHEAR SETTLEMENT CRITERIA

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Q _{net} safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
CONTINUOUS STRIP FOOTINGS		1.00	1.00	39.9	49.34	20	22	39
		1.50	1.00	37.7	71.72	13	21	37
		2.00	1.00	36.6	93.98	9	15	29
		2.50	1.00	35.9	116.08	8	12	23
		1.00	1.50	43.2	51.38	21	33	43
		1.50	1.50	39.9	74.02	13	21	39
		2.00	1.50	38.3	96.54	9	15	29
		2.50	1.50	37.3	115.28	8	12	24
		1.00	2.00	46.6	53.22	21	35	46
		1.50	2.00	42.1	76.11	13	22	41
		2.00	2.00	39.9	98.69	10	16	30
		2.50	2.00	38.6	113.39	8	13	25
		1.00	3.00	53.2	55.73	23	38	53
		1.50	3.00	46.6	79.84	14	23	43
		2.00	3.00	43.2	94.23	11	18	34
		2.50	3.00	41.3	107.10	9	15	28

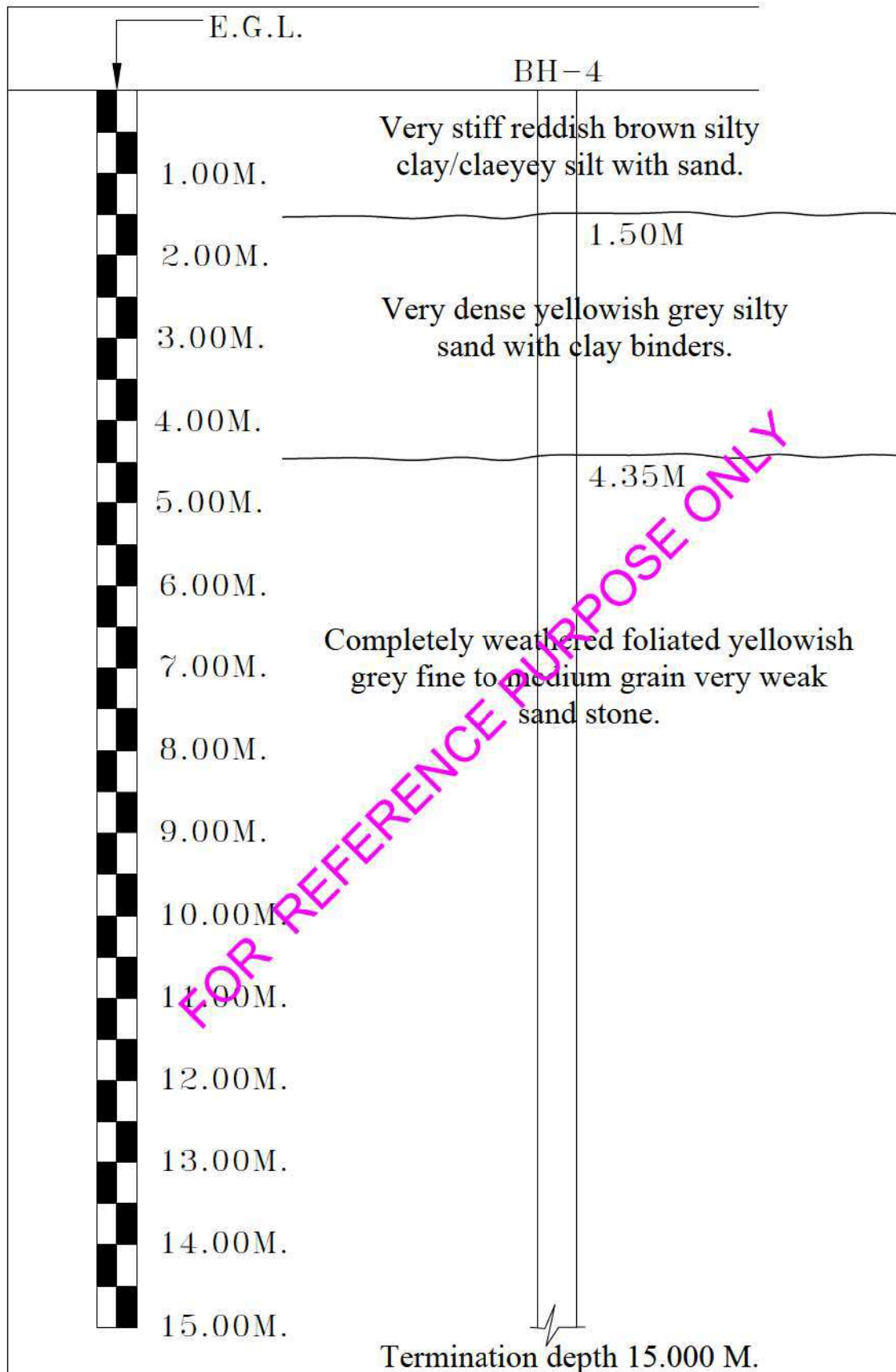
Table-2B (Zone-18).**Recommended Pile Capacity**

Sl.No	Pile Dia , D	Total Length of Pile, L	Cut-off Level	Recommended Pile Capacity in Compression	Recommended Pile Capacity in Pull-Out	Recommended Pile Capacity in Horizontal Shear
	Mtr	Mtr.	Mtr.	T	T	T
1	0.600	10.000	2.000	38	18	5
2	0.750	10.000	2.000	59	25	7
3	1.000	10.000	2.000	95	33	12
4	1.500	10.000	2.000	193	49	23

FOR REFERENCE PURPOSE ONLY

BORE LOG SHEET		Centre for Advanced Engineering						Bore Hole
								Job No.:
Project: SOIL PDIL ECL SANCTORIA								
Co-ord:	E.G.L.: 117.107	Unit: Truck Parking with Rest Room.						Bore Hole
Type of Boring	Shell & Auger	FIELDTEST	NOS.	SAMPLES	NOS.	SAMPLES	NOS.	Commence
Depth of Boring	4.350 M.	SPT	3	UDS	1	WS		Completed on : 20.05.2022
Type of Drilling		DCPT		DS	5	RCS	8	Water Struck At : 2.00M
Depth of Drilling	10.650 M.	VST		SCPT				Standing Water Table : 1.90M

D E S C R I P T I O N	SYMBOL	DEPTH	N-V A L U E	S A M P L E	
				NO.	DEPTH
Very stiff reddish brown silty clay/claeyey silt with sand.		01		DS1	0.50 M
				DS2	1.00 M
Very dense yellowish grey silty sand with clay binders.		02	N = 59	SPT1	1.50-1.95M
				DS3	1.50-1.95M
				UDS1	2.00-2.45M
		03	N = 68	SPT2	3.00-3.45M
				DS4	3.00-3.45M
		04	N > 100	SPT3	4.00-4.35M
				DS5	4.00-4.35M
Completely weathered foliated yellowish grey fine to medium grain very weak sand stone.		05		RUN1	4.35-5.50M TCR-22% RQD-NIL
				RUN2	5.50-7.00M TCR-30% RQD-NIL
				RUN3	7.00-8.50M TCR-43% RQD-NIL
				RUN4	8.50-10.00M TCR-59% RQD-NIL
				RUN5	10.00-11.50M TCR-52% RQD-NIL
				RUN6	11.50-13.00M TCR-66% RQD-NIL
				RUN7	13.00-14.50M TCR-70% RQD-NIL
				RUN8	14.50-15.00M TCR-60% RQD-NIL
Termination Depth 15.000 Mtr.		15			



Sub-Soil Profile through BH-4

SUMMARY OF LABORATORY TEST RESULTS

Table-4

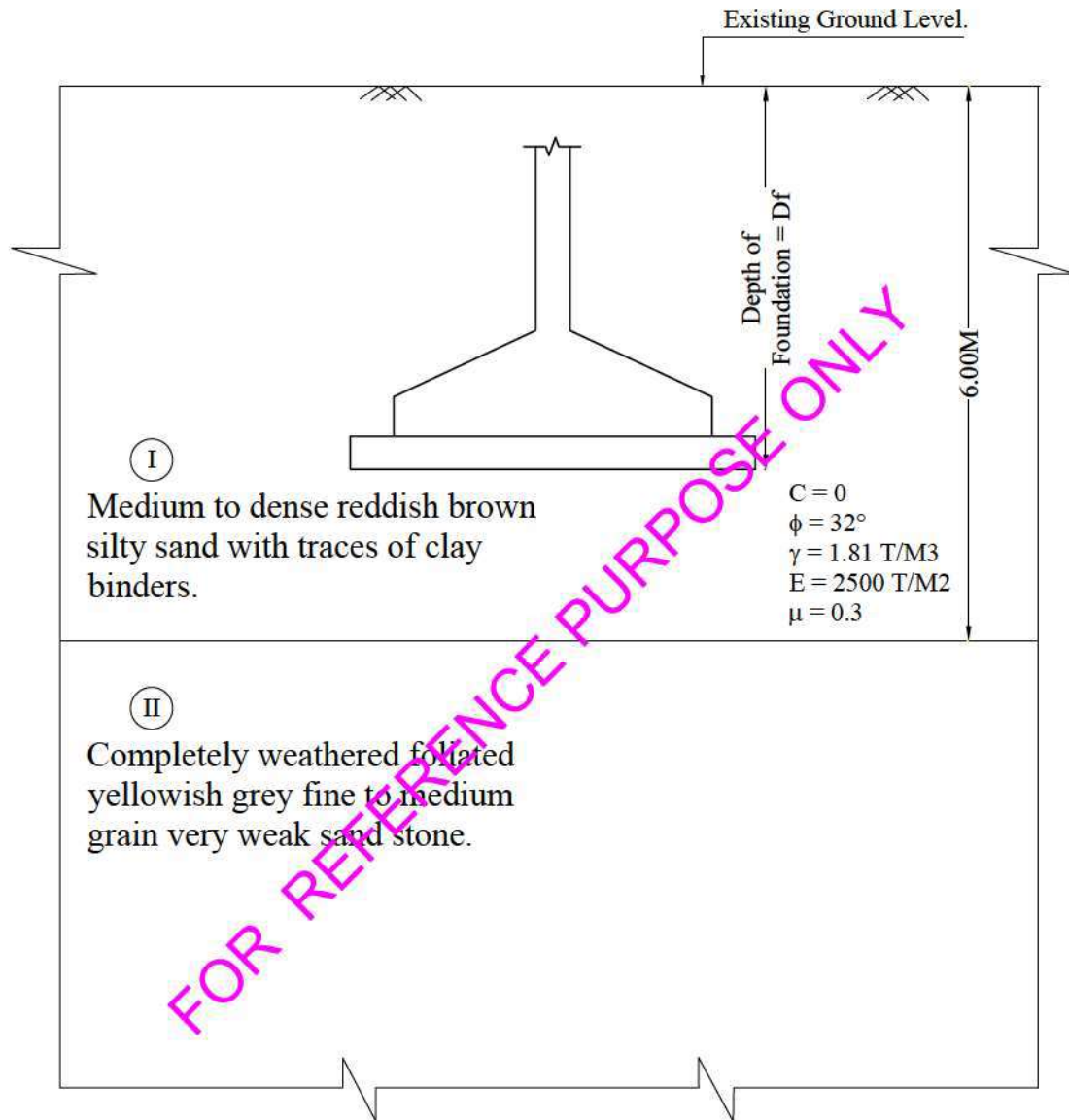
Project: Geotechnical Investigation Work for Proposed Coalgas to Methanol Project at Sactoria, West Bardhaman (WB)

Layer No.	Description of layer	Bore Hole No.	Depth	Sample Type - UD/D/ DN	SPT VALUE (N)	Atterberg Limits			Bulk Density in gm/cc	Water Content in %	Specific Gravity	Dry Density in gm/cc	Unconfined Test in Kg/sqcm	Shear Test			Pressure (Kg/sqcm)	Co-eff. of volume compressibility in sqm/kg	Sweling Pressure in kg/sqcm	Void Ratio	Grading				Modified Proctor Density		
						LL	PL	SL						Type of Test	Cohesion in kg/sqcm	Friction angle in degree					Gravel (> 4.75 mm)	Sand (0.075 - 4.75 mm)	Silt (0.002 - 0.075 mm)	Clay (< 0.002 mm)	MDD	OMC	
I	Very stiff reddish brown silty clay/ clayey silt with sand	4	0.50	D					γ_b	m	G	γ_d	q_u	UU/cu/ DS	C	ϕ				e				gm/cc	%		
		4	1.00	D								2.66									1.80			12.79			
II	Very dense yellowish grey silty sand with clay binders.	4	1.50	DN	59	37	21	7						UU	1.50	0	0.00-0.10	0.0419	0.000								
																	0.10-0.20	0.0381									
																	0.20-0.40	0.0317									
																	0.40-0.80	0.0259									
																	0.80-1.60	0.0169									
																		1.60-3.20		0.0114							
4											2.67											0	45	43	12		
4											2.65		DS	0.14	32							0	71	22	7		

Project	: Geo-Technical investigation work for proposed coalgas to methanol project at Sanctoria, West Bardhaman (W.B.)
Location	: Truck Parking Area with Driver Rest Room.
Client	: Project & Development India Limited
Test Date	: 01-06-2022
Instrument	: Metravi ERT-1501, SL. No.: 10109809

<p><u>1.00Mtr.</u></p> <p>Resistivity = 11.33 ohm-m</p>	<p><u>2.00Mtr.</u></p> <p>Resistivity = 22.89 ohm-m</p>	<p><u>5.00Mtr.</u></p> <p>Resistivity = 86.24 ohm-m</p>
<p><u>10.00Mtr.</u></p> <p>Resistivity = 194.86 ohm-m</p>	<p><u>15.00Mtr.</u></p> <p>Resistivity = 312.78 ohm-m</p>	<p><u>20.00Mtr.</u></p> <p>Resistivity = 411.55 ohm-m</p>

SAMPLE CALCULATION OF BEARING CAPACITY AT THE LOCATION OF STEAM GENERATION PLANT



Foundation Model at the Location of BH-1

Scale :- N.T.S.

SUMMARY OF FIELD/LABORATORY DATA AND CONSIDERED DATA

Sub-soil Stratification & Properties considered in foundation model

	Description of layer	Layer Thickness Meter	Field & Observed		Corrected & Value
			Depth	Value	
			Meter		
Strata1	Medium to dense reddish brown silty sand with clay binders.	6.00	1.50	28	41
Strata 2	Completely weathered foliated yellowish grey fine to medium grain very weak sand stone.	9.00			
Strata 3	Not explored				
Strata4	Not explored				
Strata5	Not explored				
Strata6	Not explored				
Strata7	Not explored				
Strata8	Not explored				

Depth of water Table from EGL = 2.600 Meter

LABORATORY RESULTS

	Description of layer	Cohesion in T/sqm	Friction angle in degree	Bulk Density in T/cum	Co-eff. of volume compressibility in sqm/T
		c	ϕ	γ	m_v
Strata1	Medium to dense reddish brown silty sand with clay binders.	0	32	1.81	
Strata 2	Completely weathered foliated yellowish grey fine to medium grain very weak sand stone.				
Strata 3	NA				
Strata4	NA				
Strata5	NA				
Strata6	NA				
Strata7	NA				
Strata8	NA				

DESIGN PARAMETERS

c	ϕ	Depth of Water Table from EGL*	γ	m_v	E	μ
T/sqm	Degrees	meter	T/Cum	Sqm/T	T/sqm	
0	32	0	1.81	0.00000	2500	0.3

* For design purpose, Ground Water Table has been considered as at EGL due to seasonal variation in GWT

CHECK FOR TYPE OF SHEAR FAILURE

Design value of ϕ , in degrees = 32

Friction Angle ≥ 32 degrees, General Shear Failure

As per IS 6403-1981, cl. No. 5.1.2, the Ultimate Net Safe Bearing Capacity (Net q_{ult})

1 For General Shear Failure, $q_{ult} = cN_cscdcic + q(N_q-1)sqdqiq + 0.5\gamma BN'\gamma s\gamma d\gamma i\gamma W'$

2 For Local Shear Failure, $q_{ult} = c'N'cscdcic + q(N'q-1)sqdqiq + 0.5\gamma BN'\gamma s\gamma d\gamma i\gamma W'$

3 For Intermediate Shear Failure, q_{ult} = Value in between the General & Local Shear Failure

CALCULATION OF NET SAFE BEARING CAPACITY FROM SHEAR CRITERIA

	FOOTING DIMENSIONS			SOIL PARAMETERS				Load inclination w.r.t. Vertical (α)		BEARING CAPACITY FACTORS										SHAPE FACTORS				DEPTH FACTORS				INCLINATION FACTORS			Water Table Correction Factor	Factor of safety	NET SAFE BEARING CAPACITY																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
	L	B	Df	C	C'	φ	φ'	γ	Degree	T/sqm	Deg.	T/cum	BEARING CAPACITY FACTORS			SHAPE FACTORS				DEPTH FACTORS			INCLINATION FACTORS			W'	F	Qnet safe in T/sqm																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
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ISOLATED SQUARE FOOTINGS		Meter	Meter																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					

ISOLATED SQUARE FOOTINGS

CALCULATION OF NET SAFE BEARING CAPACITY FROM SHEAR CRITERIA

FOOTING DIMENSIONS				SOIL PARAMETERS				Load inclination w.r.t. Vertical (α)			BEARING CAPACITY FACTORS			SHAPE FACTORS			DEPTH FACTORS			INCLINATION FACTORS			Water Table Correction Factor	Factor of safety	NET SAFE BEARING CAPACITY
L	B	Df		C	C'	φ	φ'	γ			Nc	Nq	Nγ	Sc	Sq	sy	dc	dq	dy	ic	iq	iy	W'	F	Qnet safe in T/sqm
1.50	1.00	1.00		0	0.00	32	27.76	1.81	0	0	25.34	14.34	16.14	1.13	1.13	0.73	1.33	1.17	1.17	1	1	1	0.5	2.5	8.2
3.75	2.50	1.00		0	0.00	32	27.76	1.81	0	0	25.34	14.34	16.14	1.13	1.13	0.73	1.13	1.07	1.07	1	1	1	0.5	2.5	10.9
7.50	5.00	1.00		0	0.00	32	27.76	1.81	0	0	25.34	14.34	16.14	1.13	1.13	0.73	1.07	1.03	1.03	1	1	1	0.5	2.5	16.1
11.25	7.50	1.00		0	0.00	32	27.76	1.81	0	0	25.34	14.34	16.14	1.13	1.13	0.73	1.04	1.02	1.02	1	1	1	0.5	2.5	21.4
15.00	10.00	1.00		0	0.00	32	27.76	1.81	0	0	25.34	14.34	16.14	1.13	1.13	0.73	1.03	1.02	1.02	1	1	1	0.5	2.5	26.7
1.50	1.00	1.50		0	0.00	32	27.76	1.81	0	0	25.34	14.34	16.14	1.13	1.13	0.73	1.50	1.25	1.25	1	1	1	0.5	2.5	11.8
3.75	2.50	1.50		0	0.00	32	27.76	1.81	0	0	25.34	14.34	16.14	1.13	1.13	0.73	1.20	1.10	1.10	1	1	1	0.5	2.5	13.9
7.50	5.00	1.50		0	0.00	32	27.76	1.81	0	0	25.34	14.34	16.14	1.13	1.13	0.73	1.10	1.05	1.05	1	1	1	0.5	2.5	18.9
11.25	7.50	1.50		0	0.00	32	27.76	1.81	0	0	25.34	14.34	16.14	1.13	1.13	0.73	1.07	1.03	1.03	1	1	1	0.5	2.5	24.1
15.00	10.00	1.50		0	0.00	32	27.76	1.81	0	0	25.34	14.34	16.14	1.13	1.13	0.73	1.05	1.02	1.02	1	1	1	0.5	2.5	29.4
1.50	1.00	2.00		0	0.00	32	27.76	1.81	0	0	25.34	14.34	16.14	1.13	1.13	0.73	1.66	1.33	1.33	1	1	1	0.5	2.5	15.8
3.75	2.50	2.00		0	0.00	32	27.76	1.81	0	0	25.34	14.34	16.14	1.13	1.13	0.73	1.27	1.13	1.13	1	1	1	0.5	2.5	17.1
7.50	5.00	2.00		0	0.00	32	27.76	1.81	0	0	25.34	14.34	16.14	1.13	1.13	0.73	1.13	1.07	1.07	1	1	1	0.5	2.5	21.8
11.25	7.50	2.00		0	0.00	32	27.76	1.81	0	0	25.34	14.34	16.14	1.13	1.13	0.73	1.09	1.04	1.04	1	1	1	0.5	2.5	27.0
15.00	10.00	2.00		0	0.00	32	27.76	1.81	0	0	25.34	14.34	16.14	1.13	1.13	0.73	1.07	1.03	1.03	1	1	1	0.5	2.5	32.2
1.50	1.00	3.00		0	0.00	32	27.76	1.81	0	0	25.34	14.34	16.14	1.13	1.13	0.73	1.99	1.50	1.50	1	1	1	0.5	2.5	25.1
3.75	2.50	3.00		0	0.00	32	27.76	1.81	0	0	25.34	14.34	16.14	1.13	1.13	0.73	1.40	1.20	1.20	1	1	1	0.5	2.5	24.0
7.50	5.00	3.00		0	0.00	32	27.76	1.81	0	0	25.34	14.34	16.14	1.13	1.13	0.73	1.20	1.10	1.10	1	1	1	0.5	2.5	27.9
11.25	7.50	3.00		0	0.00	32	27.76	1.81	0	0	25.34	14.34	16.14	1.13	1.13	0.73	1.13	1.07	1.07	1	1	1	0.5	2.5	32.7
15.00	10.00	3.00		0	0.00	32	27.76	1.81	0	0	25.34	14.34	16.14	1.13	1.13	0.73	1.10	1.05	1.05	1	1	1	0.5	2.5	37.9

ISOLATED RECTANGULAR FOOTINGS

CALCULATION OF NET SAFE BEARING CAPACITY FROM SHEAR CRITERIA

FOOTING DIMENSIONS			SOIL PARAMETERS					Load inclination w.r.t. Vertical (α)			BEARING CAPACITY FACTORS			SHAPE FACTORS			DEPTH FACTORS			INCLINATION FACTORS			Water Table Correction Factor	Factor of safety	NET SAFE BEARING CAPACITY
L	B	Df	C	C'	ϕ	ϕ'	γ	Degree	T/sqm	T/sqm	Nc	Nq	N _y	S _c	S _q	S _y	d _c	d _q	d _y	i _c	i _q	i _y	W'	F	Q _{net} safe in T/sqm
CONTINUOUS STRIP FOOTINGS	Meter	Meter																							
	1.00	1.00	0	0	0.00	32	27.76	1.81	25.34	14.34	16.14	1.00	1.00	1.00	1.00	1.00	1.33	1.17	1.17	1	1	1	0.5	2.5	8.4
	1.50	1.00	0	0	0.00	32	27.76	1.81	25.34	14.34	16.14	1.00	1.00	1.00	1.00	1.00	1.22	1.11	1.11	1	1	1	0.5	2.5	9.6
	2.00	1.00	0	0	0.00	32	27.76	1.81	25.34	14.34	16.14	1.00	1.00	1.00	1.00	1.00	1.17	1.08	1.08	1	1	1	0.5	2.5	11.0
	2.50	1.00	0	0	0.00	32	27.76	1.81	25.34	14.34	16.14	1.00	1.00	1.00	1.00	1.00	1.13	1.07	1.07	1	1	1	0.5	2.5	12.3
	1.00	1.50	0	0	0.00	32	27.76	1.81	25.34	14.34	16.14	1.00	1.00	1.00	1.00	1.00	1.50	1.25	1.25	1	1	1	0.5	2.5	11.7
	1.50	1.50	0	0	0.00	32	27.76	1.81	25.34	14.34	16.14	1.00	1.00	1.00	1.00	1.00	1.33	1.17	1.17	1	1	1	0.5	2.5	12.6
	2.00	1.50	0	0	0.00	32	27.76	1.81	25.34	14.34	16.14	1.00	1.00	1.00	1.00	1.00	1.25	1.12	1.12	1	1	1	0.5	2.5	13.8
	2.50	1.50	0	0	0.00	32	27.76	1.81	25.34	14.34	16.14	1.00	1.00	1.00	1.00	1.00	1.20	1.10	1.10	1	1	1	0.5	2.5	15.1
	1.00	2.00	0	0	0.00	32	27.76	1.81	25.34	14.34	16.14	1.00	1.00	1.00	1.00	1.00	1.66	1.33	1.33	1	1	1	0.5	2.5	15.3
	1.50	2.00	0	0	0.00	32	27.76	1.81	25.34	14.34	16.14	1.00	1.00	1.00	1.00	1.00	1.44	1.22	1.22	1	1	1	0.5	2.5	15.9
	2.00	2.00	0	0	0.00	32	27.76	1.81	25.34	14.34	16.14	1.00	1.00	1.00	1.00	1.00	1.33	1.17	1.17	1	1	1	0.5	2.5	16.8
	2.50	2.00	0	0	0.00	32	27.76	1.81	25.34	14.34	16.14	1.00	1.00	1.00	1.00	1.00	1.27	1.13	1.13	1	1	1	0.5	2.5	18.0
	1.00	3.00	0	0	0.00	32	27.76	1.81	25.34	14.34	16.14	1.00	1.00	1.00	1.00	1.00	1.99	1.50	1.50	1	1	1	0.5	2.5	23.7
	1.50	3.00	0	0	0.00	32	27.76	1.81	25.34	14.34	16.14	1.00	1.00	1.00	1.00	1.00	1.66	1.33	1.33	1	1	1	0.5	2.5	23.0
	2.00	3.00	0	0	0.00	32	27.76	1.81	25.34	14.34	16.14	1.00	1.00	1.00	1.00	1.00	1.50	1.25	1.25	1	1	1	0.5	2.5	23.4
	2.50	3.00	0	0	0.00	32	27.76	1.81	25.34	14.34	16.14	1.00	1.00	1.00	1.00	1.00	1.40	1.20	1.20	1	1	1	0.5	2.5	24.2

CALCULATION OF FOUNDATION SETTLEMENT

FOOTING DIMENSIONS			ISOLATED SQUARE FOOTINGS												
L	B	Df	Foundation pressure, p	Poisson's Ratio μ	Youngs Modulus, E	Coefficient of consolidation, m_v	pressure increment, Δp	Layer thickness H	Influence Factor I	Elastic settlement $S_i = \frac{pB(1-\mu^2)}{E}$	Consolidation Settlement $S_c = m_v \Delta p H$	total settlement, $S_t = S_i + S_c$	Depth Factor Dfact	Rigidity factor Rfact	total corrected settlement, $S_{t(correct)} = S_t + S_{t(Rfact)}$
Meter	Meter	Meter	T/m ²		T/M ²	m ² /T	T/m ²	Meter		mm	mm	mm			mm
1.00	1.00	1.00	8.7	0.3	2500	0.000	2.18	2.00	0.95	3.01	0.00	3.01	0.725	0.8	1.77
2.50	2.50	1.00	11.7	0.3	2500	0.000	2.93	5.00	0.95	10.11	0.00	10.11	0.89	0.8	7.23
5.00	5.00	1.00	17.4	0.3	2500	0.000	7.73	5.00	0.95	30.08	0.00	30.08	0.945	0.8	22.77
7.50	7.50	1.00	23.2	0.3	2500	0.000	13.05	5.00	0.95	60.17	0.00	60.17	0.963	0.8	46.40
10.00	10.00	1.00	29	0.3	2500	0.000	18.66	5.00	0.95	100.28	0.00	100.28	0.973	0.8	78.05
1.00	1.00	1.50	12.6	0.3	2500	0.000	3.75	2.00	0.95	4.36	0.00	4.36	0.684	0.8	2.41
2.50	2.50	1.50	14.9	0.3	2500	0.000	4.13	4.50	0.95	12.88	0.00	12.88	0.835	0.8	8.63
5.00	5.00	1.50	20.4	0.3	2500	0.000	9.70	4.50	0.95	35.27	0.00	35.27	0.918	0.8	25.89
7.50	7.50	1.50	26.1	0.3	2500	0.000	15.44	4.50	0.95	67.69	0.00	67.69	0.945	0.8	51.17
10.00	10.00	1.50	31.9	0.3	2500	0.000	21.26	4.50	0.95	110.31	0.00	110.31	0.959	0.8	84.61
1.00	1.00	2.00	16.9	0.3	2500	0.000	4.23	2.00	0.95	5.84	0.00	5.84	0.659	0.8	3.08
2.50	2.50	2.00	18.3	0.3	2500	0.000	5.65	4.00	0.95	15.82	0.00	15.82	0.78	0.8	9.87
5.00	5.00	2.00	23.5	0.3	2500	0.000	11.99	4.00	0.95	40.63	0.00	40.63	0.89	0.8	28.93
7.50	7.50	2.00	29.1	0.3	2500	0.000	18.14	4.00	0.95	75.47	0.00	75.47	0.927	0.8	55.95
10.00	10.00	2.00	34.8	0.3	2500	0.000	24.17	4.00	0.95	120.34	0.00	120.34	0.945	0.8	90.98
1.00	1.00	3.00	26.7	0.3	2500	0.000	6.68	2.00	0.95	9.23	0.00	9.23	0.63	0.8	4.65
2.50	2.50	3.00	25.6	0.3	2500	0.000	10.00	3.00	0.95	22.13	0.00	22.13	0.67	0.8	11.86
5.00	5.00	3.00	29.9	0.3	2500	0.000	17.69	3.00	0.95	51.70	0.00	51.70	0.835	0.8	34.53
7.50	7.50	3.00	35.2	0.3	2500	0.000	24.44	3.00	0.95	91.29	0.00	91.29	0.89	0.8	65.00
10.00	10.00	3.00	40.8	0.3	2500	0.000	30.85	3.00	0.95	141.09	0.00	141.09	0.918	0.8	103.56

ISOLATED SQUARE FOOTINGS

CALCULATION OF FOUNDATION SETTLEMENT

FOOTING DIMENSIONS			ISOLATED RECTANGULAR FOOTINGS												
L	B	Df	Foundation pressure, p	Poisson's Ratio μ	Youngs Modulus, E	Coefficient of consolidation, m_v	pressure increment, Δp	Layer thickness H	Influence Factor I	Elastic settlement $S_i = \frac{pB(1-\mu^2)}{E_s}$	Consolidation Settlement $S_c = m_v \Delta p H$	total settlement, $S_t = S_i + S_c$	Depth Factor Dfact	Rigidity factor Rfact	total corrected settlement, $S_{t(correct)} = S_t^*$
Meter	Meter	Meter	T/m ²		T/M ²	m ² /T	T/m ²	Meter		mm	mm	mm			mm
1.50	1.00	1.00	8.2	0.3	2500	0.000	2.46	2.00	1.2	3.58	0.00	3.58	0.775	0.8	2.22
3.75	2.50	1.00	10.9	0.3	2500	0.000	3.27	5.00	1.2	11.90	0.00	11.90	0.91	0.8	8.67
7.50	5.00	1.00	16.1	0.3	2500	0.000	8.05	5.00	1.2	35.16	0.00	35.16	0.955	0.8	26.87
11.25	7.50	1.00	21.4	0.3	2500	0.000	13.13	5.00	1.2	70.11	0.00	70.11	0.97	0.8	54.41
15.00	10.00	1.00	26.7	0.3	2500	0.000	18.31	5.00	1.2	116.63	0.00	116.63	0.978	0.8	91.21
1.50	1.00	1.50	11.8	0.3	2500	0.000	3.34	2.00	1.2	5.15	0.00	5.15	0.663	0.8	2.73
3.75	2.50	1.50	13.9	0.3	2500	0.000	4.57	4.50	1.2	15.18	0.00	15.18	0.865	0.8	10.51
7.50	5.00	1.50	18.9	0.3	2500	0.000	10.03	4.50	1.2	41.28	0.00	41.28	0.933	0.8	30.80
11.25	7.50	1.50	24.1	0.3	2500	0.000	15.45	4.50	1.2	78.95	0.00	78.95	0.955	0.8	60.32
15.00	10.00	1.50	29.4	0.3	2500	0.000	20.87	4.50	1.2	128.42	0.00	128.42	0.966	0.8	99.28
1.50	1.00	2.00	15.8	0.3	2500	0.000	4.74	2.00	1.2	6.90	0.00	6.90	0.551	0.8	3.04
3.75	2.50	2.00	17.1	0.3	2500	0.000	6.20	4.00	1.2	18.67	0.00	18.67	0.82	0.8	12.26
7.50	5.00	2.00	21.8	0.3	2500	0.000	12.29	4.00	1.2	47.61	0.00	47.61	0.91	0.8	34.67
11.25	7.50	2.00	27	0.3	2500	0.000	18.10	4.00	1.2	88.45	0.00	88.45	0.94	0.8	66.52
15.00	10.00	2.00	32.2	0.3	2500	0.000	23.68	4.00	1.2	140.65	0.00	140.65	0.955	0.8	107.47
1.50	1.00	3.00	25.1	0.3	2500	0.000	7.53	2.00	1.2	10.96	0.00	10.96	0.695	0.8	6.09
3.75	2.50	3.00	24	0.3	2500	0.000	10.71	3.00	1.2	26.21	0.00	26.21	0.731	0.8	15.32
7.50	5.00	3.00	27.9	0.3	2500	0.000	17.88	3.00	1.2	60.93	0.00	60.93	0.865	0.8	42.18
11.25	7.50	3.00	32.7	0.3	2500	0.000	24.04	3.00	1.2	107.13	0.00	107.13	0.91	0.8	78.00
15.00	10.00	3.00	37.9	0.3	2500	0.000	29.96	3.00	1.2	165.55	0.00	165.55	0.933	0.8	123.52

ISOLATED RECTANGULAR FOOTINGS

CALCULATION OF FOUNDATION SETTLEMENT

FOOTING DIMENSIONS			CONTINUOUS STRIP FOOTINGS												
L	B	Df	Foundation pressure, p	Poisson's Ratio μ	Youngs Modulus, E	Coefficient of consolidation, m_v	pressure increment, Δp	Layer thickness H	Influence Factor I	Elastic settlement $S_i = \frac{pB(1-\mu^2)}{E_s}$	Consolidation Settlement $S_c = m_v \Delta p H$	total settlement, $S_t = S_i + S_c$	Depth Factor Df _{act}	Rigidity factor Rf _{act}	total corrected settlement, $S_{t(correct)} = S_t^*$
Meter	Meter	Meter	T/m ²		T/M ²	m ² /T	T/m ²	Meter		mm	mm	mm			mm
	1.00	1.00	8.4	0.3	2500	0.000	3.94	2.00	2.289	7.00	0.00	7.00	0.929	0.8	5.20
	1.50	1.00	9.6	0.3	2500	0.000	4.50	3.00	2.289	12.00	0.00	12.00	0.953	0.8	9.15
	2.00	1.00	11	0.3	2500	0.000	5.16	4.00	2.289	18.33	0.00	18.33	0.964	0.8	14.15
	2.50	1.00	12.3	0.3	2500	0.000	5.77	5.00	2.289	25.63	0.00	25.63	0.972	0.8	19.92
	1.00	1.50	11.7	0.3	2500	0.000	5.48	2.00	2.289	9.75	0.00	9.75	0.893	0.8	6.97
	1.50	1.50	12.6	0.3	2500	0.000	5.31	3.00	2.289	15.75	0.00	15.75	0.929	0.8	11.71
	2.00	1.50	13.8	0.3	2500	0.000	6.47	4.00	2.289	23.00	0.00	23.00	0.947	0.8	17.42
	2.50	1.50	15.1	0.3	2500	0.000	7.50	4.50	2.289	31.46	0.00	31.46	0.957	0.8	24.10
	1.00	2.00	15.3	0.3	2500	0.000	7.17	2.00	2.289	12.75	0.00	12.75	0.858	0.8	8.75
	1.50	2.00	15.9	0.3	2500	0.000	7.45	3.00	2.289	19.88	0.00	19.88	0.905	0.8	14.40
	2.00	2.00	16.8	0.3	2500	0.000	7.88	4.00	2.289	28.00	0.00	28.00	0.929	0.8	20.81
	2.50	2.00	18	0.3	2500	0.000	9.49	4.00	2.289	37.50	0.00	37.50	0.943	0.8	28.30
	1.00	3.00	23.7	0.3	2500	0.000	11.11	2.00	2.289	19.75	0.00	19.75	0.787	0.8	12.43
	1.50	3.00	23	0.3	2500	0.000	10.78	3.00	2.289	28.75	0.00	28.75	0.858	0.8	19.73
	2.00	3.00	23.4	0.3	2500	0.000	12.73	3.00	2.289	39.00	0.00	39.00	0.893	0.8	27.88
	2.50	3.00	24.2	0.3	2500	0.000	14.54	3.00	2.289	50.42	0.00	50.42	0.915	0.8	36.90

CONTINUOUS STRIP FOOTINGS

ALLOWABLE BEARING CAPACITY FROM SHE SETTLEMENT CRITERIA

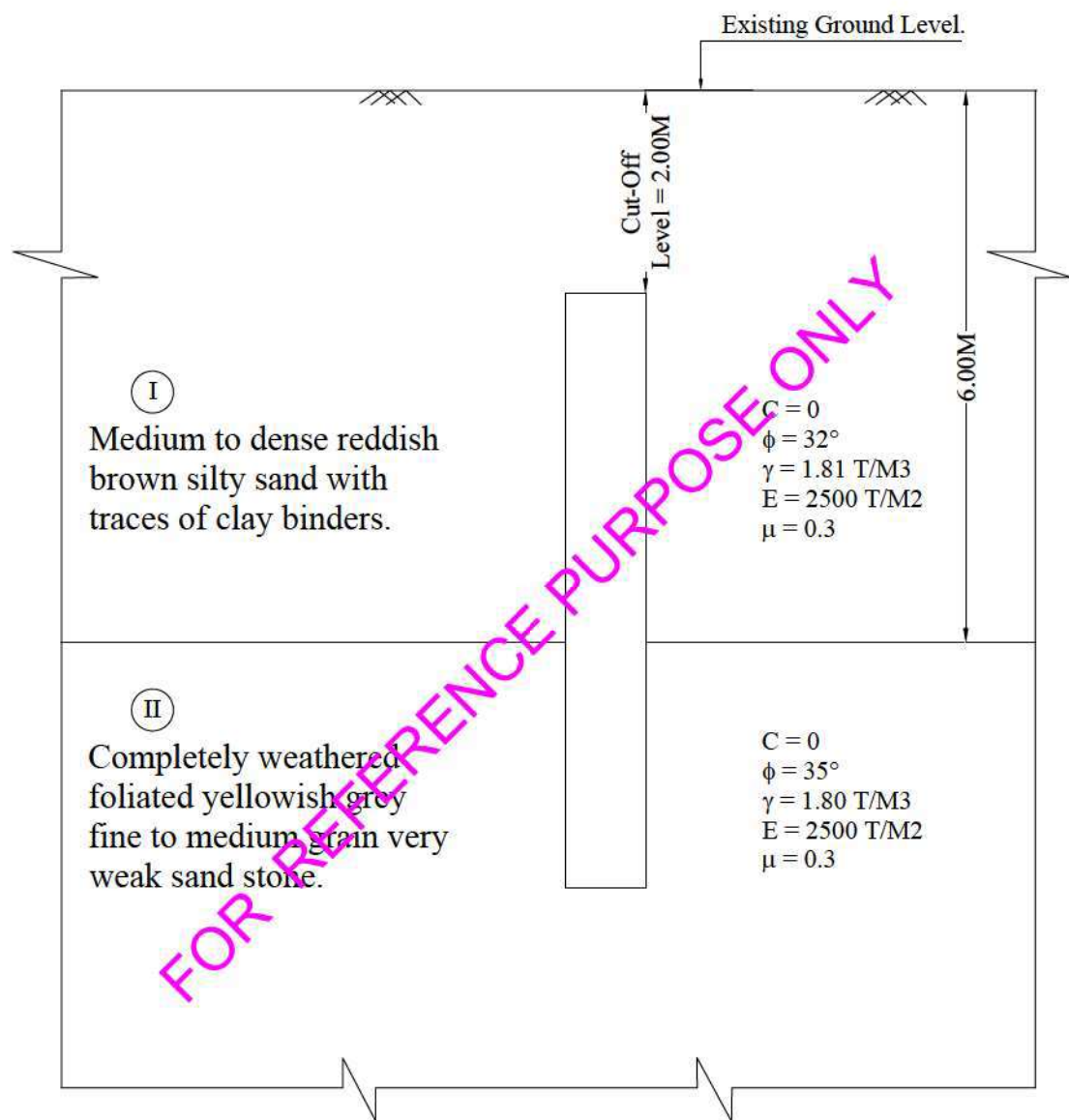
FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Qnet safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
ISOLATED SQUARE FOOTINGS	1.00	1.00	1.00	8.7	1.77	8	8	8
	2.50	2.50	1.00	11.7	7.23	11	11	11
	5.00	5.00	1.00	17.4	22.77	17	17	17
	7.50	7.50	1.00	23.2	46.40	12	19	23
	10.00	10.00	1.00	29.0	78.95	9	14	27
	1.00	1.00	1.50	12.6	2.41	12	12	12
	2.50	2.50	1.50	14.9	8.63	14	14	14
	5.00	5.00	1.50	20.4	25.89	19	20	20
	7.50	7.50	1.50	26.1	51.17	12	20	26
	10.00	10.00	1.50	31.9	84.61	9	15	28
	1.00	1.00	2.00	16.9	3.08	16	16	16
	2.50	2.50	2.00	18.3	9.87	18	18	18
	5.00	5.00	2.00	23.5	28.93	20	23	23
	7.50	7.50	2.00	29.1	55.95	13	20	29
	10.00	10.00	2.00	34.8	90.98	9	15	28
	1.00	1.00	3.00	26.7	4.65	26	26	26
	2.50	2.50	3.00	25.6	11.86	25	25	25
	5.00	5.00	3.00	29.9	34.53	21	29	29
	7.50	7.50	3.00	35.2	65.00	13	21	35
	10.00	10.00	3.00	40.8	103.56	9	15	29

ALLOWABLE BEARING CAPACITY FROM SHEAR SETTLEMENT CRITERIA

FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY		
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm
	Meter	Meter	Meter	Qnet safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm
ISOLATED RECTANGULAR FOOTINGS	1.50	1.00	1.00	8.2	2.22	8	8	8
	3.75	2.50	1.00	10.9	8.67	10	10	10
	7.50	5.00	1.00	16.1	26.87	14	16	16
	11.25	7.50	1.00	21.4	54.41	9	15	21
	15.00	10.00	1.00	26.7	91.21	7	11	21
	1.50	1.00	1.50	11.8	2.73	11	11	11
	3.75	2.50	1.50	13.9	10.51	13	13	13
	7.50	5.00	1.50	18.9	30.80	15	18	18
	11.25	7.50	1.50	24.1	60.32	9	15	24
	15.00	10.00	1.50	29.4	99.28	7	11	22
	1.50	1.00	2.00	15.8	3.04	15	15	15
	3.75	2.50	2.00	17.1	12.26	17	17	17
	7.50	5.00	2.00	21.8	34.67	15	21	21
	11.25	7.50	2.00	27.0	66.52	10	16	27
	15.00	10.00	2.00	32.2	107.47	7	11	22
	1.50	1.00	3.00	25.1	6.09	25	25	25
	3.75	2.50	3.00	24.0	15.32	24	24	24
	7.50	5.00	3.00	27.9	42.18	16	26	27
	11.25	7.50	3.00	32.7	78.00	10	16	31
	15.00	10.00	3.00	37.9	123.52	7	12	23
CONTINUOUS STRIP FOOTINGS		1.00	1.00	8.4	5.20	8	8	8
		1.50	1.00	9.6	9.15	9	9	9
		2.00	1.00	11.0	14.15	11	11	11
		2.50	1.00	12.3	19.92	12	12	12
		1.00	1.50	11.7	6.97	11	11	11
		1.50	1.50	12.6	11.71	12	12	12
		2.00	1.50	13.8	17.42	13	13	13
		2.50	1.50	15.1	24.10	15	15	15
		1.00	2.00	15.3	8.75	15	15	15
		1.50	2.00	15.9	14.40	15	15	15
		2.00	2.00	16.8	20.81	16	16	16
		2.50	2.00	18.0	28.30	15	18	18
		1.00	3.00	23.7	12.43	23	23	23
		1.50	3.00	23.0	19.73	23	23	23
		2.00	3.00	23.4	27.88	20	23	23
		2.50	3.00	24.2	36.90	16	24	24

SAMPLE CALCULATION OF PILE CAPACITY AT THE LOCATION OF STEAM GENERATION PLANT

FOR REFERENCE PURPOSE ONLY



Pile Model at the Location of BH-1

Scale :- N.T.S.

Ultimate skin friction capacity

Project: Proposed Coalgas to Methanol Project.

Location: Sactoria, West Bardhaman (WB)

Layer No: 1

Soil Description : Medium to dense reddish brown silty sand with traces of clay binders.

Sl.No	Pile Dia , D	Total Length of Pile, L	Depth of layer top, from EGL	Depth of layer bottom, from EGL	Water table	ϕ	ϕ adopted = (ϕ -3°) considering loosening effect	N_c	N_q	N_γ	Unit weight, γ	T/M ³	Effective unit weight, γ'	k- Value, as per note 3 & 2011 part 1/ Sec2-1979	Limiting L/D for calcn. Of maxm. Effective overburden press. At pile tip	T/M ²	P_{dl} at layer top	$\delta = \phi$	Unit friction, $f_s = K \cdot P_{dl} \cdot \tan \delta$ - at layer top, maximum = 10T/M ²	T/M ²	P_{dl} at layer bottom	Unit friction, $f_s = K \cdot P_{dl} \cdot \tan \delta$ - at layer bottom, maximum = 10T/M ²	T/M ²	Average unit friction, adopted for shaft friction capacity.	M²	A_{si}	T
1	0.600	10.000	2.000	6.000	1.000	32	29	27.86	16.44	19.34	1.81	0.81	1.3	15	1.62	4.86	4.86	0.51	1.167	4.86	4.86	3.502	2.335	7.540	17.604		
2	0.750	10.000	2.000	6.000	1.000	32	29	27.86	16.44	19.34	1.81	0.81	1.3	15	1.62	4.86	4.86	0.51	1.167	4.86	4.86	3.502	2.335	9.425	22.004		
3	1.000	10.000	2.000	6.000	1.000	32	29	27.86	16.44	19.34	1.81	0.81	1.3	15	1.62	4.86	4.86	0.51	1.167	4.86	4.86	3.502	2.335	12.566	29.339		
4	1.500	10.000	2.000	6.000	1.000	32	29	27.86	16.44	19.34	1.81	0.81	1.3	15	1.62	4.86	4.86	0.51	1.167	4.86	4.86	3.502	2.335	18.850	44.009		

Ultimate skin friction capacity

Project: Proposed Coalgas to Methanol Project.

Location: Sactoria, West Bardhaman (WB)

Layer No: 2

Soil Description : Completely weathered foliated yellowish grey fine to medium grain very weak sand stone.

Sl.No	Pile Dia , D	Total Length of Pile, L	Depth of layer top, from EGL	Depth of layer bottom, from EGL	Water table	ϕ	ϕ adopted =(ϕ -3 $^\circ$)considering loosening effect	N_c	N_q	N_γ	Unit weight, γ	Effective unit weight, γ'	k- Value, as per note 3.15 2311 part 1/ Sec2-1979	Limiting L/D for calcul. Of maxm Effective overburden press. At pile tip	T/M^2	P_{Di} at layer top	$\delta = \phi$	T/M^2	Unit friction, $f_s = K*Pd_i*\tan\delta$ - at layer top, maximum = 10T/M ²	T/M^2	P_{Di} at layer bottom	Unit friction, $f_s = K*Pd_i*\tan\delta$ - at layer bottom, maximum = 10T/M ²	T/M^2	Average unit friction, adopted for shaft friction capacity.	M²	A_{sl}	T	Shaft friction, F
1	0.600	10.000	6.000	10.000	1.000	35	32	35.49	23.18	30.21	1.80	0.8	1.3	15	4.8	4.8	0.56	3.899	3.899	7.2	5.849	4.874	7.540	36.749				
2	0.750	10.000	6.000	10.000	1.000	35	32	35.49	23.18	30.21	1.80	0.8	1.3	15	4.8	4.8	0.56	3.899	3.899	8	6.499	5.199	9.425	48.999				
3	1.000	10.000	6.000	10.000	1.000	35	32	35.49	23.18	30.21	1.80	0.8	1.3	15	4.8	4.8	0.56	3.899	3.899	8	6.499	5.199	12.566	65.331				
4	1.500	10.000	6.000	10.000	1.000	35	32	35.49	23.18	30.21	1.80	0.8	1.3	15	4.8	4.8	0.56	3.899	3.899	8	6.499	5.199	18.850	97.997				

Ultimate end bearing capacity

Project: Proposed Coalgas to Methanol Project.

Location: Sactoria, West Bardhaman (WB)

Layer No: 2

Soil Description : Completely weathered foliated yellowish grey fine to medium grain very weak sand stone.

Sl.No	Pile Dia , D	Total Length of Pile, L	Depth of layer top, from EGL	Depth of layer bottom, from EGL	Water table	ϕ	ϕ adopted $= (\phi - 3)^\circ$ considering loosening effect	N_c	N_q	N_γ	Unit weight, γ	Effective unit weight, γ'	Limiting L/D for calcn. Of maxm. Effective overburden press. At pile tip	Poi at pile tip	A_p	End Bearing
	Mtr	Mtr.	Mtr.	Mtr.	Mtr.	Degree	Degree				T/M ³	T/M ³			M ²	T
1	0.600	10.000	6.000	10.000	1.000	35	32	35.49	23.18	30.21	1.8	0.8	15	7.2	0.283	49.232
2	0.750	10.000	6.000	10.000	1.000	35	32	35.49	23.18	30.21	1.8	0.8	15	8	0.442	85.918
3	1.000	10.000	6.000	10.000	1.000	35	32	35.49	23.18	30.21	1.8	0.8	15	8	0.785	155.116
4	1.500	10.000	6.000	10.000	1.000	35	32	35.49	23.18	30.21	1.8	0.8	15	8	1.767	359.690

Horizontal Shear Capacity of Pile

Reference : Code of Practice for Design and Construction of Pile Foundation - IS 2911

Sample Calculation:-

L (Length of Pile)	=	10.00 Mtr.	
Cut-off Level of Pile	=	2.00 Mtr.	
Dia of Pile (D)	=	0.600 Mtr.	
f_{ck}	=	25 N/MM ²	
E=E _{conc} =Young's modulus	=	25000 MN/M ²	
I (Moment of inertia of the pile cross-section)	=	0.00636 M ⁴	
Neglecting the effect of steel we get EI	=	159 KN/M ⁶	
n_h = Modulus of Subgrade Reaction (if top of the soil is sand) (Table 3)	=	1.400 MN/M ³	
T (Stiffness Factor)	=	2.577 Mtr.	[Where T = (EI/n _h) ^{1/5}]
L_e (Embedment Length of the Pile)	=	8.00 Mtr.	
Hence, As per Table-5 pile is a SHORT RIGID PILE			Since L _e < 4T
Where L₁ = free head of Pile above ground	=	0.000 Mtr.	
And for fixed head pile L_f/T (as per IS Code)	=	2.200	
Where L_f is the length of fixity below cut-off level of pile =	=	5.669 Mtr.	
Therefore,	L_f	=	5.669 Mtr.
	L₁	=	0.000 Mtr.
For Fixed Head Pile, deflection at the pile head,			
Y = H(e+zf)³ / 12EI	=	0.005 Mtr.	(Adopt)
Lateral Load = H	=	52.35 Kn	
Horizontal Shear Capacity = H_{design}	=	5.34 T	

FOR REFERENCE PURPOSE ONLY

Recommended Pile Capacity

Project: Proposed Coalgas to Methanol Project.

Location: Sactoria, West Bardhaman (WB)

Sl.No	Pile Dia , D	Total Length of Pile, L	Skin friction from layer 1	Skin friction from layer 2	End Bearing	Total	F.O.S	Allowable Pile Capacity	Recommended Pile Capacity in Compression	Recommended Pile Capacity in Pull-Out	Recommended Pile Capacity in Horizontal Shear
	Mtr	Mtr.	T	T	T	T	T	T	T	T	T
1	0.600	10.000	0.506	36.749	49.232	86.488	2.5	34.595	34	14	5
2	0.750	10.000	0.506	48.999	85.918	135.423	2.5	54.169	54	19	7
3	1.000	10.000	0.506	65.331	155.116	220.954	2.5	88.382	88	26	12
4	1.500	10.000	0.506	97.997	359.690	458.194	2.5	183.277	183	39	23

CHEMICAL TEST RESULT

FOR REFERENCE PURPOSE ONLY

Chemical Test on Soil Samples

PROJECT: Proposed Coalgas to Methanol Project at Sactoria, West Bardham

Location	Description of Soil	Type of Chemical Test	Result
BH-1 Depth: 1.50-1.95M	Medium to dense reddish brown silty sand with traces of clay binders.	pH Value	6.5
		Sulphite Content as SO ₃	Absent
		Chloride Content as Cl	0.041%
BH-1 Depth: 3.00-3.45M	Medium to dense reddish brown silty sand with traces of clay binders.	pH Value	6.7
		Sulphite Content as SO ₃	Absent
		Chloride Content as Cl	0.048%
BH-2 Depth: 1.50-1.95M	Dense reddish brown silty sand with traces of clay binders.	pH Value	7.0
		Sulphite Content as SO ₃	Absent
		Chloride Content as Cl	0.043%
BH-2 Depth: 3.00-3.45M	Dense reddish brown silty sand with traces of clay binders.	pH Value	6.6
		Sulphite Content as SO ₃	Absent
		Chloride Content as Cl	0.045%
BH-3 Depth: 1.50-1.95M	Dense yellowish/brownish grey silty sand with kankar, morrum and clay binders.	pH Value	6.7
		Sulphite Content as SO ₃	Absent
		Chloride Content as Cl	0.051%
BH-3 Depth: 3.00-3.45M	Dense yellowish/brownish grey silty sand with kankar, morrum and clay binders.	pH Value	7.0
		Sulphite Content as SO ₃	Absent
		Chloride Content as Cl	0.054%
BH-4 Depth: 1.50-1.95M	Very dense yellowish grey silty sand with clay binders.	pH Value	6.8
		Sulphite Content as SO ₃	Absent
		Chloride Content as Cl	0.038%
BH-4 Depth: 3.00-3.45M	Very dense yellowish grey silty sand with clay binders.	pH Value	6.9
		Sulphite Content as SO ₃	Absent
		Chloride Content as Cl	0.043%
BH-5 Depth: 1.50-1.95M	Dense to very dense yellowish grey silty sand with clay binders.	pH Value	7.0
		Sulphite Content as SO ₃	Absent
		Chloride Content as Cl	0.043%
BH-5 Depth: 3.00-3.45M	Dense to very dense yellowish grey silty sand with clay binders.	pH Value	6.8
		Sulphite Content as SO ₃	Absent
		Chloride Content as Cl	0.048%

Location	Description of Soil	Type of Chemicals	
BH-6 Depth: 1.50-1.95M	Very stiff to hard reddish brown/ brownish grey silty clay/clayey silt with kankar and sand.	pH Value	
		Sulphite Content	
		Chloride Content	
BH-6 Depth: 3.00-3.45M	Dense reddish brown silty sand with clay binders.	pH Value	7.0
		Sulphite Content as SO ₃	Absent
		Chloride Content as Cl	0.039%
BH-7 Depth: 1.50-1.95M	Very stiff to hard reddish brown/ brownish grey silty clay/clayey silt with kankar and sand.	pH Value	6.6
		Sulphite Content as SO ₃	Absent
		Chloride Content as Cl	0.044%
BH-7 Depth: 3.00-3.45M	Dense reddish brown silty sand with clay binders.	pH Value	7.0
		Sulphite Content as SO ₃	Absent
		Chloride Content as Cl	0.046%
BH-8 Depth: 1.50-1.95M	Very stiff to hard yellowish grey silty clay/clayey silt with grass roots, morrum, sand and traces of coal.	pH Value	7.0
		Sulphite Content as SO ₃	Absent
		Chloride Content as Cl	0.049%
BH-8 Depth: 3.00-3.45M	Very stiff to hard yellowish grey silty clay/clayey silt with grass roots, morrum, sand and traces of coal.	pH Value	7.0
		Sulphite Content as SO ₃	Absent
		Chloride Content as Cl	0.039%
BH-9 Depth: 2.00-2.45M	Very stiff to hard mottled yellowish/ bluish grey silty clay/clayey silt with sand.	pH Value	6.7
		Sulphite Content as SO ₃	Absent
		Chloride Content as Cl	0.038%
BH-9 Depth: 4.00-4.45M	Very stiff to hard mottled yellowish/ bluish grey silty clay/clayey silt with sand.	pH Value	6.8
		Sulphite Content as SO ₃	Absent
		Chloride Content as Cl	0.049%
BH-10 Depth: 1.50-1.95M	Medium to dense yellowish/ brownish grey silty sand with clay binders.	pH Value	6.7
		Sulphite Content as SO ₃	Absent
		Chloride Content as Cl	0.048%
BH-10 Depth: 2.00-2.45M	Medium to dense yellowish/ brownish grey silty sand with clay binders.	pH Value	6.9
		Sulphite Content as SO ₃	Absent
		Chloride Content as Cl	0.046%
BH-11 Depth: 1.50-1.95M	Very stiff to hard reddish brown/ brownish grey silty clay/clayey silt with sand and traces of morrum.	pH Value	7.0
		Sulphite Content as SO ₃	Absent
		Chloride Content as Cl	0.040%

Location	Description of Soil	Type of Chemicals	
BH-11 Depth: 3.00-3.45M	Very stiff to hard reddish brown/ brownish grey silty clay/clayey silt with sand and traces of morrum.	pH Value	
		Sulphite Content	
		Chloride Content	
BH-11 Depth: 4.00-4.45M	Very stiff to hard reddish brown/ brownish grey silty clay/clayey silt with sand and traces of morrum.	pH Value	6.9
		Sulphite Content as SO ₃	Absent
		Chloride Content as Cl	0.048%
BH-12 Depth: 1.50-1.95M	Very stiff to hard reddish brown/ yellowish grey silty clay/clayey silt with sand and traces of morrum.	pH Value	7.0
		Sulphite Content as SO ₃	Absent
		Chloride Content as Cl	0.044%
BH-12 Depth: 3.00-3.45M	Very stiff to hard reddish brown/ yellowish grey silty clay/clayey silt with sand and traces of morrum.	pH Value	6.9
		Sulphite Content as SO ₃	Absent
		Chloride Content as Cl	0.049%
BH-13 Depth: 1.50-1.95M	Very stiff to hard brownish/ yellowish grey silty clay/clayey silt with sand and traces of morrum.	pH Value	7.0
		Sulphite Content as SO ₃	Absent
		Chloride Content as Cl	0.051%
BH-13 Depth: 3.00-3.45M	Very stiff to hard brownish/ yellowish grey silty clay/clayey silt with sand and traces of morrum.	pH Value	7.0
		Sulphite Content as SO ₃	Absent
		Chloride Content as Cl	0.053%
BH-14 Depth: 1.50-1.95M	Very stiff to hard yellowish grey silty clay/clayey silt with sand.	pH Value	6.7
		Sulphite Content as SO ₃	Absent
		Chloride Content as Cl	0.045%
BH-14 Depth: 3.00-3.45M	Very stiff to hard yellowish grey silty clay/clayey silt with sand.	pH Value	6.8
		Sulphite Content as SO ₃	Absent
		Chloride Content as Cl	0.048%

Chemical Test on Water Samples

PROJECT: Proposed Coalgas to Methanol Project at Sactoria, West Bardhama

Location	Description	Type of Chemical Test	Result
BH-1	Water Collected from Borehole Marked BH-1	pH value	6.9
		Sulphate SO ₃	13.2
		Chloride as Cl	16.4
BH-2	Water Collected from Borehole Marked BH-2	pH value	7.0
		Sulphate SO ₃	12.4
		Chloride as Cl	16.9
BH-3	Water Collected from Borehole Marked BH-3	pH value	7.1
		Sulphate SO ₃	13.4
		Chloride as Cl	18.2
BH-4	Water Collected from Borehole Marked BH-4	pH value	7.2
		Sulphate SO ₃	13.2
		Chloride as Cl	16.9
BH-5	Water Collected from Borehole Marked BH-5	pH value	7.4
		Sulphate SO ₃	13.1
		Chloride as Cl	17.1
BH-6	Water Collected from Borehole Marked BH-6	pH value	7.3
		Sulphate SO ₃	12.8
		Chloride as Cl	18.1
BH-7	Water Collected from Borehole Marked BH-7	pH value	7.2
		Sulphate SO ₃	12.9
		Chloride as Cl	17.4
BH-8	Water Collected from Borehole Marked BH-8	pH value	7.5
		Sulphate SO ₃	13.4
		Chloride as Cl	16.8
BH-9	Water Collected from Borehole Marked BH-9	pH value	7.4
		Sulphate SO ₃	13.5
		Chloride as Cl	17.3

Location	Description	Type of Chemical Test	
BH-10	Water Collected from Borehole Marked BH-10	pH value	
		Sulphate SO ₃	
		Chloride as Cl	
BH-11	Water Collected from Borehole Marked BH-11	pH value	7.1
		Sulphate SO ₃	13.2
		Chloride as Cl	17.5
BH-12	Water Collected from Borehole Marked BH-12	pH value	7.6
		Sulphate SO ₃	13.3
		Chloride as Cl	18.0
BH-13	Water Collected from Borehole Marked BH-13	pH value	7.2
		Sulphate SO ₃	13.4
		Chloride as Cl	17.9
BH-14	Water Collected from Borehole Marked BH-14	pH value	7.4
		Sulphate SO ₃	14.1
		Chloride as Cl	17.4

FOR REFERENCE PURPOSE ONLY

SAMPLE CALCULATION OF BEARING CAPACITY FOR RAFT AT THE LOCATION OF STEAM GENERATION PLANT

FOR REFERENCE PURPOSE ONLY

SUMMARY OF FIELD/LABORATORY DATA AND CONSIDERED DATA

Sub-soil Stratification & Properties considered in foundation model

	Description of layer	Layer Thickness Meter	Field & Observed		Corrected Value
			Depth	Value	
			Meter		
Strata1	Medium to dense reddish brown silty sand with clay binders.	6.00	1.50	28	41
Strata 2	Completely weathered foliated yellowish grey fine to medium grain very weak sand stone.	9.00			
Strata 3	Not explored				
Strata4	Not explored				
Strata5	Not explored				
Strata6	Not explored				
Strata7	Not explored				
Strata8	Not explored				

Depth of water Table from EGL = 2.600 Meter

LABORATORY RESULTS

	Description of layer	Cohesion in T/sqm	Friction angle in degree	Bulk Density in T/cum	Co-eff. of volume compressibility in sqm/T
		c	ϕ	γ	m_v
Strata1	Medium to dense reddish brown silty sand with clay binders.	0	32	1.81	
Strata 2	Completely weathered foliated yellowish grey fine to medium grain very weak sand stone.				
Strata 3	NA				
Strata4	NA				
Strata5	NA				
Strata6	NA				
Strata7	NA				
Strata8	NA				

DESIGN PARAMETERS

c	ϕ	Depth of Water Table from EGL*	γ	m_v	E	μ
T/sqm	Degrees	meter	T/Cum	Sqm/T	T/sqm	
0	32	0	1.81	0.00000	2500	0.3

* For design purpose, Ground Water Table has been considered as at EGL due to seasonal variation in GWT

CHECK FOR TYPE OF SHEAR FAILURE

Design value of ϕ , in degrees = 32

Friction Angle ≥ 32 degrees, General Shear Failure

As per IS 6403-1981, cl. No. 5.1.2, the Ultimate Net Safe Bearing Capacity (Net q_{ult})

1 For General Shear Failure, $q_{ult} = cN_cscdcic + q(N_q-1)sqdqiq + 0.5\gamma BN'\gamma s\gamma d\gamma i\gamma W'$

2 For Local Shear Failure, $q_{ult} = c'N'cscdcic + q(N'q-1)sqdqiq + 0.5\gamma BN'\gamma s\gamma d\gamma i\gamma W'$

3 For Intermediate Shear Failure, q_{ult} = Value in between the General & Local Shear Failure

CALCULATION OF NET SAFE BEARING CAPACITY FROM SHEAR CRITERIA

FOOTING DIMENSIONS			SOIL PARAMETERS				Load inclination w.r.t. Vertical (α)		BEARING CAPACITY FACTORS										SHAPE FACTORS				DEPTH FACTORS				INCLINATION FACTORS				Water Table Correction Factor	Factor of safety	NET SAFE BEARING CAPACITY
L	B	Df	C	C'	φ	φ'	γ	Degree	T/sqm	T/sqm	Deg.	T/cum	Nc	Nq	Ny	Sc	Sq	Sy	dc	dq	dy	ic	iq	iy	W'	F	Qnet safe in T/sqm						
ISOLATED SQUARE FOOTINGS	10.00	10.00	1.00	0	0	0.00	27.76	1.81	25.34	14.34	16.14	1.30	1.20	0.80	1.03	1.02	1.02	1	1	1	0.5	2.5	29.0										
	15.00	15.00	1.00	0	0	0.00	27.76	1.81	25.34	14.34	16.14	1.30	1.20	0.80	1.02	1.01	1.01	1	1	1	0.5	2.5	40.6										
	20.00	20.00	1.00	0	0	0.00	27.76	1.81	25.34	14.34	16.14	1.30	1.20	0.80	1.02	1.01	1.01	1	1	1	0.5	2.5	52.3										
	10.00	10.00	1.50	0	0	0.00	27.76	1.81	25.34	14.34	16.14	1.30	1.20	0.80	1.05	1.02	1.02	1	1	1	0.5	2.5	31.9										
	15.00	15.00	1.50	0	0	0.00	27.76	1.81	25.34	14.34	16.14	1.30	1.20	0.80	1.03	1.02	1.02	1	1	1	0.5	2.5	43.5										
	20.00	20.00	1.50	0	0	0.00	27.76	1.81	25.34	14.34	16.14	1.30	1.20	0.80	1.02	1.01	1.01	1	1	1	0.5	2.5	55.2										
	10.00	10.00	2.00	0	0	0.00	27.76	1.81	25.34	14.34	16.14	1.30	1.20	0.80	1.07	1.03	1.03	1	1	1	0.5	2.5	34.8										
	15.00	15.00	2.00	0	0	0.00	27.76	1.81	25.34	14.34	16.14	1.30	1.20	0.80	1.04	1.02	1.02	1	1	1	0.5	2.5	46.4										
	20.00	20.00	2.00	0	0	0.00	27.76	1.81	25.34	14.34	16.14	1.30	1.20	0.80	1.03	1.02	1.02	1	1	1	0.5	2.5	58.0										
	10.00	10.00	3.00	0	0	0.00	27.76	1.81	25.34	14.34	16.14	1.30	1.20	0.80	1.10	1.05	1.05	1	1	1	0.5	2.5	40.8										
	15.00	15.00	3.00	0	0	0.00	27.76	1.81	25.34	14.34	16.14	1.30	1.20	0.80	1.07	1.03	1.03	1	1	1	0.5	2.5	52.2										
	20.00	20.00	3.00	0	0	0.00	27.76	1.81	25.34	14.34	16.14	1.30	1.20	0.80	1.05	1.02	1.02	1	1	1	0.5	2.5	63.8										
ISOLATED RECTANGULAR FOOTINGS	10.00	5.00	1.00	0	0	0.00	27.76	1.81	25.34	14.34	16.14	1.10	1.10	0.80	1.07	1.03	1.03	1	1	1	0.5	2.5	16.9										
	30.00	20.00	1.00	0	0	0.00	27.76	1.81	25.34	14.34	16.14	1.13	1.13	0.73	1.02	1.01	1.01	1	1	1	0.5	2.5	48.1										
	10.00	5.00	1.50	0	0	0.00	27.76	1.81	25.34	14.34	16.14	1.10	1.10	0.80	1.10	1.05	1.05	1	1	1	0.5	2.5	19.7										
	30.00	20.00	1.50	0	0	0.00	27.76	1.81	25.34	14.34	16.14	1.13	1.13	0.73	1.02	1.01	1.01	1	1	1	0.5	2.5	50.8										
	10.00	5.00	2.00	0	0	0.00	27.76	1.81	25.34	14.34	16.14	1.10	1.10	0.80	1.13	1.07	1.07	1	1	1	0.5	2.5	22.5										
	30.00	20.00	2.00	0	0	0.00	27.76	1.81	25.34	14.34	16.14	1.13	1.13	0.73	1.03	1.02	1.02	1	1	1	0.5	2.5	53.5										
	10.00	5.00	3.00	0	0	0.00	27.76	1.81	25.34	14.34	16.14	1.10	1.10	0.80	1.20	1.10	1.10	1	1	1	0.5	2.5	28.5										
	30.00	20.00	3.00	0	0	0.00	27.76	1.81	25.34	14.34	16.14	1.13	1.13	0.73	1.05	1.02	1.02	1	1	1	0.5	2.5	58.9										

CALCULATION OF FOUNDATION SETTLEMENT

FOOTING DIMENSIONS															
L	B	Df	Foundation pressure, p	Poisson's Ratio μ	Youngs Modulus, E	Coefficient of consolidation, m_v	pressure increment, Δp	Layer thickness H	Influence Factor I	Elastic settlement $S_e = pB(1 - \nu^2)/E$	Consolidation Settlement $S_c = m_v \Delta p H$	total settlement, $S_t = S_e + S_c$	Depth Factor Df _{act}	Rigidity factor Rf _{act}	total corrected settlement, $S_{t(correct)} = S_t \cdot Rf_{act}$
Meter	Meter	Meter	T/m ²		T/M ²	m ² /T	T/m ²	Meter		mm	mm	mm			mm
10.00	10.00	1.00	29	0.3	2500	0.000	13.79	9.00	0.95	100.28	0.00	100.28	0.973	0.8	78.05
15.00	15.00	1.00	40.6	0.3	2500	0.000	24.02	9.00	0.95	210.59	0.00	210.59	0.982	0.8	165.42
20.00	20.00	1.00	52.3	0.3	2500	0.000	34.85	9.00	0.95	361.71	0.00	361.71	0.986	0.8	285.42
10.00	10.00	1.50	31.9	0.3	2500	0.000	15.71	8.50	0.95	110.31	0.00	110.31	0.959	0.8	84.64
15.00	15.00	1.50	43.5	0.3	2500	0.000	26.41	8.50	0.95	225.63	0.00	225.63	0.973	0.8	175.57
20.00	20.00	1.50	55.2	0.3	2500	0.000	37.55	8.50	0.95	381.76	0.00	381.76	0.979	0.8	299.11
10.00	10.00	2.00	34.8	0.3	2500	0.000	17.76	8.00	0.95	120.34	0.00	120.34	0.945	0.8	90.98
15.00	15.00	2.00	46.4	0.3	2500	0.000	28.92	8.00	0.95	240.68	0.00	240.68	0.963	0.8	185.48
20.00	20.00	2.00	58	0.3	2500	0.000	40.28	8.00	0.95	401.13	0.00	401.13	0.973	0.8	312.08
10.00	10.00	3.00	40.8	0.3	2500	0.000	22.39	7.00	0.95	141.09	0.00	141.09	0.918	0.8	103.56
15.00	15.00	3.00	52.2	0.3	2500	0.000	34.32	7.00	0.95	270.76	0.00	270.76	0.945	0.8	204.70
20.00	20.00	3.00	63.8	0.3	2500	0.000	46.21	7.00	0.95	441.24	0.00	441.24	0.959	0.8	338.43
10.00	5.00	1.00	16.9	0.3	2500	0.000	6.13	9.00	1.31	40.29	0.00	40.29	0.961	0.8	30.98
30.00	20.00	1.00	48.1	0.3	2500	0.000	34.14	9.00	1.2	420.20	0.00	420.20	0.989	0.8	332.39
10.00	5.00	1.50	19.7	0.3	2500	0.000	7.47	8.50	1.31	46.97	0.00	46.97	0.942	0.8	35.38
30.00	20.00	1.50	50.8	0.3	2500	0.000	36.70	8.50	1.2	443.79	0.00	443.79	0.983	0.8	349.05
10.00	5.00	2.00	22.5	0.3	2500	0.000	8.93	8.00	1.31	53.64	0.00	53.64	0.922	0.8	39.58
30.00	20.00	2.00	53.5	0.3	2500	0.000	39.34	8.00	1.2	467.38	0.00	467.38	0.978	0.8	365.51
10.00	5.00	3.00	28.5	0.3	2500	0.000	12.42	7.00	1.31	67.95	0.00	67.95	0.883	0.8	48.02
30.00	20.00	3.00	58.9	0.3	2500	0.000	44.89	7.00	1.2	514.55	0.00	514.55	0.966	0.8	397.78
			ISOLATED SQUARE FOOTINGS												
			ISOLATED RECTANGULAR FOOTINGS												

ALLOWABLE BEARING CAPACITY FROM SHEAR AND CRITERIA

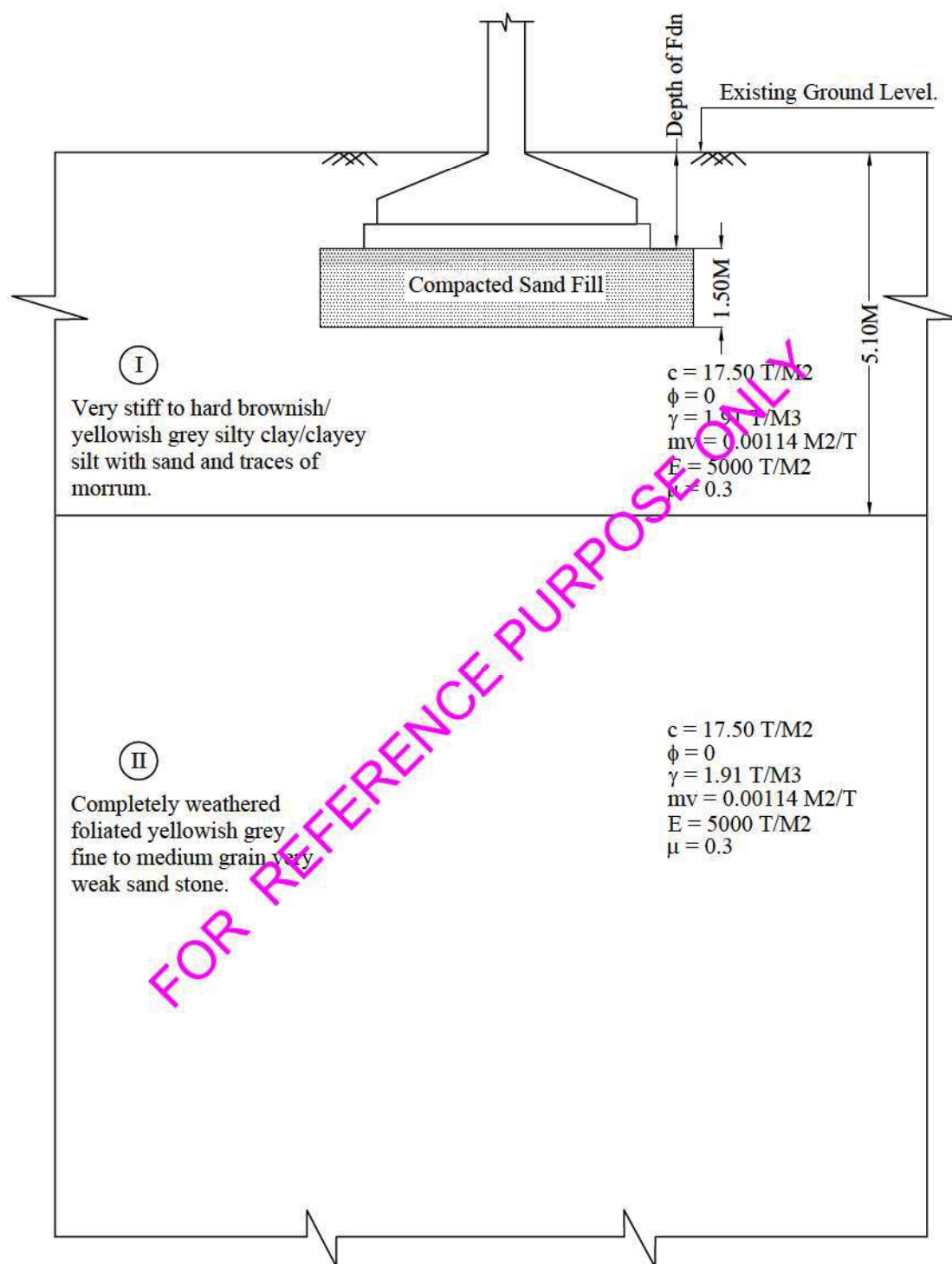
FOUNDATION TYPE	FOOTING DIMENSIONS			NET SAFE BEARING CAPACITY	total corrected settlement, $S_{correct}$	ALLOWABLE BEARING CAPACITY			
	L	B	Df			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm	For allowable settlement 175 mm
	Meter	Meter	Meter	Qnet safe in T/sqm	mm	T/Sqm	T/Sqm	T/Sqm	T/Sqm
ISOLATED SQUARE FOOTINGS	10.00	10.00	1.00	29.0	78.05	9	14	27	29
	15.00	15.00	1.00	40.6	165.42	6	9	18	30
	20.00	20.00	1.00	52.3	285.42	4	7	13	22
	10.00	10.00	1.50	31.9	84.64	9	15	28	31
	15.00	15.00	1.50	43.5	175.57	6	9	18	30
	20.00	20.00	1.50	55.2	299.11	4	7	13	23
	10.00	10.00	2.00	34.8	90.99	9	15	28	34
	15.00	15.00	2.00	46.4	185.48	6	10	18	31
	20.00	20.00	2.00	58.0	312.08	4	7	13	23
	10.00	10.00	3.00	40.8	103.56	9	15	29	40
	15.00	15.00	3.00	52.2	204.70	6	10	19	31
	20.00	20.00	3.00	63.6	338.43	4	7	14	23
ISOLATED RECTANGULAR FOOTINGS	10.00	5.00	1.00	16.9	30.98	13	16	16	16
	30.00	20.00	1.00	48.1	332.39	3	5	10	18
	10.00	5.00	1.50	19.7	35.38	13	19	19	19
	30.00	20.00	1.50	50.8	349.05	3	5	10	18
	10.00	5.00	2.00	22.5	39.58	14	22	22	22
	30.00	20.00	2.00	53.5	365.51	3	5	10	18
	10.00	5.00	3.00	28.5	48.02	14	23	28	28
	30.00	20.00	3.00	58.9	397.78	3	5	11	18

ALLOWABLE BEARING CAPACITY (In T/Sqm)																								
Footing Dimensions (in Mtr)			Zone-1 Pump House & Fire Water Storage				Zone-2 Storage Raw Water				Zone-4 RWTP				Zone-6 Plant Methanol				Zone-10 Building Administrative					
			For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm	For allowable settlement 125 mm	For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm	For allowable settlement 125 mm	For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm	For allowable settlement 125 mm	For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm	For allowable settlement 125 mm						
Sl.	No.	L	B	Df	4	7	14	24	3	6	11	19	3	6	11	18	9	14	27	38	3	5	11	18
1	10.00	10.00		1.00	4	7	14	24	3	6	11	19	3	6	11	18	9	14	27	38	3	5	11	18
2	15.00	15.00		1.00	3	5	11	18	2	4	8	14	2	4	8	14	6	9	18	30	2	4	8	14
3	20.00	20.00		1.00	3	4	9	15	2	3	7	12	2	3	7	11	4	7	13	22	2	3	7	11
4	10.00	10.00		1.50	5	8	15	25	4	6	12	20	3	6	11	19	9	15	28	42	3	6	11	19
5	15.00	15.00		1.50	3	6	11	18	3	4	9	15	2	4	8	14	6	9	18	30	2	4	8	14
6	20.00	20.00		1.50	3	5	9	15	2	4	7	12	2	3	7	12	4	7	13	23	2	3	7	12
7	10.00	10.00		2.00	5	8	15	25	4	6	12	21	4	6	12	20	9	15	28	46	3	6	11	19
8	15.00	15.00		2.00	3	6	11	19	3	5	9	15	3	4	9	15	6	10	18	31	2	4	8	14
9	20.00	20.00		2.00	3	5	9	16	2	4	7	13	2	4	7	12	4	7	13	23	2	3	7	12
10	10.00	10.00		3.00	5	8	16	27	4	7	13	21	4	6	12	21	9	15	29	49	4	6	12	21
11	15.00	15.00		3.00	4	6	12	21	3	5	10	16	3	5	9	16	6	10	19	31	3	5	9	16
12	20.00	20.00		3.00	3	5	10	17	2	4	8	14	2	4	8	13	4	7	14	23	2	4	8	13
13	10.00	5.00		1.00	6	10	19	27	5	8	16	18	5	8	15	19	13	21	22	22	5	8	15	21
14	30.00	20.00		1.00	2	4	8	13	2	3	6	10	2	3	6	10	3	5	10	18	2	3	6	10
15	10.00	5.00		1.50	6	10	20	27	5	8	16	18	5	8	15	19	13	22	25	25	5	8	15	21
16	30.00	20.00		1.50	2	4	8	13	2	3	6	11	2	3	6	10	3	5	10	18	2	3	6	10
17	10.00	5.00		2.00	7	11	21	28	5	9	17	18	5	8	16	20	14	22	29	29	5	8	16	22
18	30.00	20.00		2.00	2	4	8	14	2	3	6	11	2	3	6	10	3	5	10	18	2	3	6	10
19	10.00	5.00		3.00	7	12	22	29	6	9	18	19	5	9	17	20	14	23	37	37	5	9	17	23
20	30.00	20.00		3.00	3	4	9	15	2	3	7	12	2	3	7	11	3	5	11	18	2	3	6	11

ALLOWABLE BEARING CAPACITY (In T/Sqm)																							
Footing Dimensions (in Mtr)			Zone-11				Zone-12				Zone-13				Zone-14				Zone-15				
			Cooling Tower for Methanol Plant & Gasification				Air Separation Unit				Gasification Plant				Gas Cleaning & Purification Plant				Steam Generation Plant				
Sl. No.	L	B	Df	For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm	For allowable settlement 125 mm	For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm	For allowable settlement 125 mm	For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm	For allowable settlement 125 mm	For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm	For allowable settlement 125 mm	For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm	For allowable settlement 125 mm
				For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm	For allowable settlement 125 mm	For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm	For allowable settlement 125 mm	For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm	For allowable settlement 125 mm	For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm	For allowable settlement 125 mm	For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm	For allowable settlement 125 mm
1	10.00	10.00	1.00	4	7	13	22	4	6	12	20	4	7	14	23	4	6	12	21	9	14	27	29
2	15.00	15.00	1.00	3	5	9	16	3	5	9	15	3	5	10	17	3	5	9	15	6	9	18	30
3	20.00	20.00	1.00	2	4	8	13	2	4	7	13	2	4	8	14	2	4	7	13	4	7	13	22
4	10.00	10.00	1.50	4	7	13	22	4	6	13	20	4	7	14	24	4	7	13	21	9	15	28	31
5	15.00	15.00	1.50	3	5	10	16	3	5	9	16	3	5	10	18	3	5	9	16	6	9	18	30
6	20.00	20.00	1.50	2	4	8	13	2	4	8	13	3	4	9	15	2	4	8	13	4	7	13	23
7	10.00	10.00	2.00	4	7	14	23	4	7	13	20	5	8	15	25	4	7	13	22	9	15	28	34
8	15.00	15.00	2.00	3	5	10	17	3	5	10	16	3	6	11	18	3	5	10	16	6	10	18	31
9	20.00	20.00	2.00	2	4	8	14	2	4	8	13	3	5	9	15	2	4	8	13	4	7	13	23
10	10.00	10.00	3.00	5	8	15	25	4	7	14	20	5	8	16	27	4	7	14	24	9	15	29	40
11	15.00	15.00	3.00	3	5	11	18	3	5	10	18	4	6	12	20	3	5	10	18	6	10	19	31
12	20.00	20.00	3.00	3	4	9	15	3	4	8	14	3	5	10	16	2	4	8	14	4	7	14	23
13	10.00	5.00	1.00	6	9	18	22	3	9	17	17	6	10	19	23	5	9	17	21	13	16	16	16
14	30.00	20.00	1.00	2	3	7	11	2	3	6	11	2	4	7	12	2	3	6	11	3	5	10	18
15	10.00	5.00	1.50	6	9	18	22	5	9	17	17	6	10	20	24	6	9	18	21	13	19	19	19
16	30.00	20.00	1.50	2	3	7	12	2	3	7	11	2	4	7	13	2	3	7	11	3	5	10	18
17	10.00	5.00	2.00	6	10	19	22	6	9	18	18	6	11	20	24	6	9	18	21	14	22	22	22
18	30.00	20.00	2.00	2	3	7	12	2	3	7	12	2	4	8	13	2	3	7	12	3	5	10	18
19	10.00	5.00	3.00	6	11	20	23	6	10	18	18	7	11	22	25	6	10	20	22	14	23	28	28
20	30.00	20.00	3.00	2	4	7	13	2	4	7	12	2	4	8	14	2	4	7	12	3	5	11	18

Sl. No.	Footing Dimensions (in Mtr)			ALLOWABLE BEARING CAPACITY (In T/Sqm)											
				Zone-16 Ash Slag Storage				Zone-17 Fire Station				Zone-18 Truck Parking Area with Driver Rest Room			
				For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm	For allowable settlement 125 mm	For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm	For allowable settlement 125 mm	For allowable settlement 25 mm	For allowable settlement 40 mm	For allowable settlement 75 mm	For allowable settlement 125 mm
1	10.00	10.00	Df	11	17	33	38	11	17	33	38	4	6	13	21
2	15.00	15.00	B	7	11	22	36	7	11	22	36	3	5	9	16
3	20.00	20.00	L	5	8	16	27	5	8	16	27	2	4	8	13
4	10.00	10.00	Df	11	18	33	42	11	18	33	41	4	7	13	22
5	15.00	15.00	B	7	11	22	37	7	11	22	37	3	5	10	16
6	20.00	20.00	L	5	8	16	27	5	8	16	27	2	4	8	13
7	10.00	10.00	Df	11	18	34	46	11	18	34	45	4	7	13	23
8	15.00	15.00	B	7	12	22	37	7	12	22	37	3	5	10	17
9	20.00	20.00	L	5	8	16	27	5	8	16	27	2	4	8	14
10	10.00	10.00	Df	11	18	35	54	11	18	35	53	4	7	14	24
11	15.00	15.00	B	7	12	22	38	7	12	22	38	3	5	11	18
12	20.00	20.00	L	5	9	16	28	5	9	16	28	3	4	9	15
13	10.00	5.00	Df	16	22	22	22	16	22	22	22	5	9	17	25
14	30.00	20.00	B	4	6	13	21	4	6	13	21	2	3	7	11
15	10.00	5.00	L	16	26	26	26	16	25	25	25	6	9	18	25
16	30.00	20.00	Df	4	6	13	21	4	6	13	21	2	3	7	12
17	10.00	5.00	B	17	27	29	29	17	27	29	29	6	10	19	26
18	30.00	20.00	L	4	7	13	21	4	7	13	21	2	3	7	12
19	10.00	5.00	Df	17	28	37	37	17	28	36	36	6	10	20	27
20	30.00	20.00	B	4	7	13	22	4	7	13	22	2	4	7	13

SAMPLE CALCULATION FOR SHALLOW FOUNDATION ON IMPROVED SOIL BY SAND REPLACEMENT



Foundation Model on Improved Soil

Scale :- N.T.S.

Sketch No.-SK/PDIL	SACTORIA	1678	04
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COMPUTATION OF BEARING CAPACITY WITH SAND BA

Square Footing

Size (m x m)	2.00 x 2.00	2.50 x 2.50	3.00 x 3.00
B (m)	2.00	2.50	3.00
D _f (m)	1.50	1.50	1.50
C (T/M ²)	0.00	0.00	0.00
φ (degree)	33	33	33
φ' (degree)	29.82	29.82	29.82
γ (T/M ³)	1.80	1.80	1.80
q (T/M ²)	1.20	1.20	1.20
α (Degree)	0.00	0.00	0.00
<u>Bearing Capacity Factor</u>			
N _c	29.71	29.71	29.71
N _q	18.03	18.03	18.03
N _γ	21.81	21.81	21.81
<u>Shape Factor</u>			
S _c	1.30	1.30	1.30
S _q	1.20	1.20	1.20
S _γ	0.80	0.80	0.80
<u>Depth Factor</u>			
d _c	1.26	1.21	1.17
d _q	1.13	1.10	1.09
d _γ	1.13	1.10	1.09
<u>Inclination</u>			
i _c	1.00	1.00	1.00
i _q	1.00	1.00	1.00
i _γ	1.00	1.00	1.00
W'	0.50	0.50	0.50
0.67cN _c S _c d _c i _c	0.00	0.00	0.00
q(N _q -1)S _q d _q i _q	27.69	27.06	26.64
0.5B _γ N _γ s _γ d _γ i _γ W'	17.74	21.66	25.59
N.U.B.C	45.43	48.72	52.23
F.O.S	2.50	2.50	2.50
N.S.B.C	18.17	19.49	20.89

FOR REFERENCE PURPOSE ONLY

Rectangular Footing

Size (m x m)	2.00 x 3.00	2.50 x 3	
L (m)	3.00	3.75	4.50
B (m)	2.00	2.50	3.00
D _f (m)	1.50	1.50	1.50
C (T/M ²)	0.00	0.00	0.00
φ (degree)	33	33	33
φ' (degree)	29.82	29.82	29.82
γ (T/M ³)	1.80	1.80	1.80
q (T/M ²)	1.20	1.20	1.20
α (Degree)	0.00	0.00	0.00

Bearing Capacity Factor

N _c	29.71	29.71	29.71
N _q	18.03	18.03	18.03
N _γ	21.81	21.81	21.81

Shape Factor

S _c	1.13	1.13	1.13
S _q	1.13	1.13	1.13
S _γ	0.73	0.73	0.73

Depth Factor

d _c	1.26	1.21	1.17
d _q	1.13	1.10	1.09
d _γ	1.13	1.10	1.09

Inclination

i _c	1.00	1.00	1.00
i _q	1.00	1.00	1.00
i _γ	1.00	1.00	1.00
W'	0.50	0.50	0.50

0.67cN _c S _c d _c i _c	0.00	0.00	0.00
q(N _q -1)S _q d _q i _q	26.16	25.56	25.16
0.5B _γ N _γ s _γ d _γ i _γ W'	16.26	19.86	23.46
N.U.B.C	42.42	45.41	48.61
F.O.S	2.50	2.50	2.50
N.S.B.C	16.97	18.17	19.45

Strip Footing

Size (m x m)	1.50	2.00	2.50
B (m)	1.50	2.00	2.50
D _f (m)	1.50	1.50	1.50
C (T/M ²)	0.00	0.00	0.00
φ (degree)	33	33	33
φ' (degree)	29.82	29.82	29.82
γ (T/M ³)	1.80	1.80	1.80
q (T/M ²)	1.20	1.20	1.20
α (Degree)	0.00	0.00	0.00

Bearing Capacity Factor

N _c	29.71	29.71	29.71
N _q	18.03	18.03	18.03
N _γ	21.81	21.81	21.81

Shape Factor

S _c	1.00	1.00	1.00
S _q	1.00	1.00	1.00
S _γ	1.00	1.00	1.00

Depth Factor

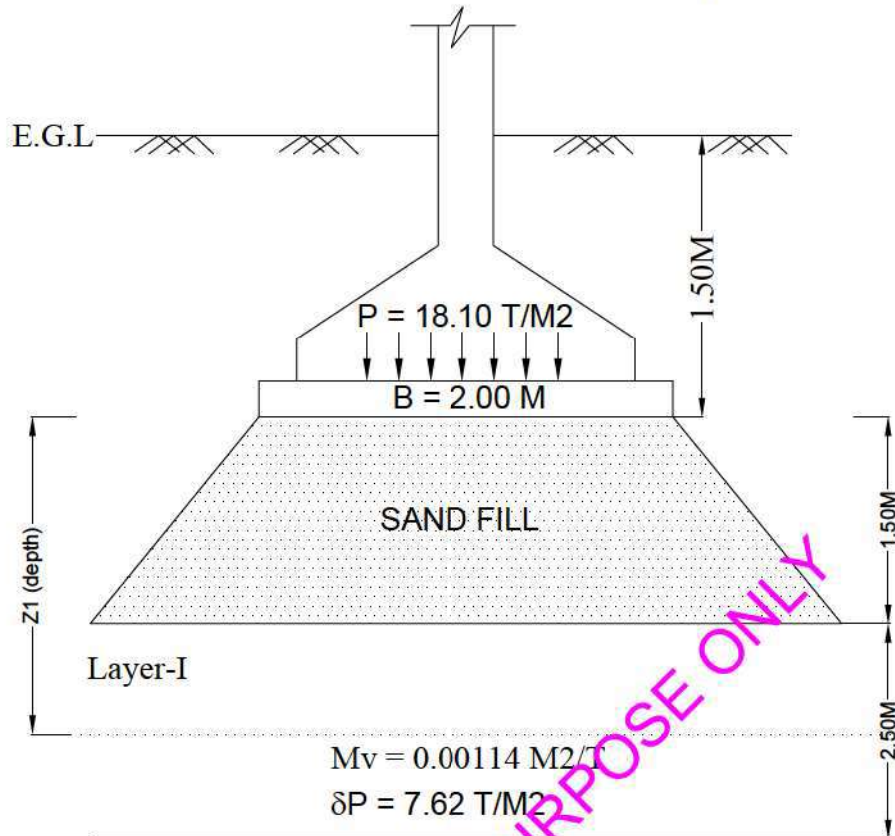
d _c	1.35	1.26	1.21
d _q	1.17	1.13	1.10
d _γ	1.17	1.13	1.10

Inclination

i _c	1.00	1.00	1.00
i _q	1.00	1.00	1.00
i _γ	1.00	1.00	1.00
W'	0.50	0.50	0.50

0.67cN _c S _c d _c i _c	0.00	0.00	0.00
q(N _q -1)S _q d _q i _q	23.96	23.08	22.55
0.5B _γ N _γ s _γ d _γ i _γ W'	17.26	22.17	27.08
N.U.B.C	41.22	45.25	49.63
F.O.S	2.50	2.50	2.50
N.S.B.C	16.49	18.10	19.85

Settlement Calculation for Strip Fo



Layer-I

$$\begin{aligned} \delta P \text{ at the centre of the compressible layer} &= P \times B / (B + Z_1) \\ &= 18.10 \times 2 / (2 + 2.75) \text{ T/M}^2 \\ &= 7.62 \text{ T/M}^2 \end{aligned}$$

Layer-I

$$\begin{aligned} \text{So, } S &= M_v \times \delta P \times H \\ &= 0.00114 \times 7.62 \times 2.50 \times 1000 \\ &= 21.72 \text{ mm} \end{aligned}$$

$$\text{Corrected Settlement} = 21.72 \times 0.80 = 17.38 \text{ mm} < 75 \text{ mm}$$

$$\text{Bearing Capacity of 2.00M wide strip} = 18.10 \text{ T/M}^2$$

$$\text{Similarity Settlement of 2.50M wide strip} = 27.54 \text{ mm} < 75 \text{ mm}$$

$$\text{Hence, Bearing Capacity of 2.50M wide strip for 75mm settlement} = 19.85 \text{ T/M}^2$$

Bearing Capacity of Soil after Ground Improvement with Co

TYPE OF FOOTINGS	SIZE OF FOUNDATION (m)			THICKNESS OF COMPACTED SAND FILL BELOW FOUNDATION (m)	SAFE BEARING CAPACITY OF COMPACTED SAND FILL AT FOUNDATION DEPTH (m)	ESTIMATED SETTLEMENT (mm)	PRESSURE ON VERGINE SOIL AT A LEVEL BELOW COMPACTED SAND FILL (t/m ²)	ALLOWABLE BEARING CAPACITY OF VERGINE SOIL (t/m ²)	ADOPTED PRESSURE AT TOP (VERGINE SOIL (t/m ²)) (LOWER OF THE VALUES OF vii & ix)	DESIGN SBC OF FOUNDATION ON OF SAND FILL (t/m ²)
	B	L	Df							
(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)	(xi)
ISOLATED SQUARE FOOTINGS	2.00	2.00	1.50	1.50	18.17	9.18	5.93	20.00	5.93	18.17
	2.50	2.50	1.50	1.50	19.49	14.68	7.61	20.00	7.61	19.49
	3.00	3.00	1.50	1.50	20.89	21.19	9.28	20.00	9.28	20.89
ISOLATED RECTANGULAR FOOTINGS	2.00	3.00	1.50	1.50	16.97	8.57	6.46	20.00	6.46	16.97
	2.50	3.75	1.50	1.50	18.17	13.71	8.11	20.00	8.11	18.17
	3.00	4.50	1.50	1.50	19.45	19.71	9.72	20.00	9.72	19.45
CONTINUOUS STRIP FOOTINGS	1.50		1.50	1.50	16.49	9.02	8.24	8.00	8.00	16.00
	2.00		1.50	1.50	18.10	17.38	10.34	8.00	8.00	14.00
	2.50		1.50	1.50	19.85	27.54	12.41	8.00	8.00	12.80