REPORT ON GEOTECHNICAL INVESTIGATION

FOR

PROPOSED AITE OF STP PATNA IN BIHAR

Submitted to:

M/S TETRA TECH INDIA LIMITED

951, 9TH FLOOR, NETAJI SUBHASH PALACE, PITAMPURA

NEW DELHI

By

B K SOIL CONSULTANTS PVT. LTD.

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1.0 INTRODUCTION

1.1 Project Description

B K SOIL CONSULTANTS PVT LTD, M-7, Ajnara Enclave Chander Nagar, Sahibabad has been awarded the work of soil investigation for STP at four locations in Patna, Bihar by M/S Tetra Tech India Limited.

The report Presented hereunder, deals with the test results and their interpretation, estimation of safe allowable bearing capacity and recommendation, regarding the type, size and shape of foundation which may be provided for the proposed structure.

1.2 Purpose of Study

The purposes of this study were to evaluate the subsurface stratigraphy so as to develop recommendations for foundation design and construction. To accomplish these purposes, the study was conducted in the following phase:

- **i** Drilling of one boreholes to 15.00m depth below existing ground level at each STP site.
- **ii** Conducting standard penetration test in the bore holes.
- **iii** Collecting disturbed and undisturbed soil samples.
- **iv** Testing of soil samples collected from bore holes in the laboratory.
- **v** Preparing this technical report with foundation design and recommendations.

Test location was marked by us in the field and approved by client.

2.0 FIELD INVESTIGATION

2.1 Soil Boring

Bore holes in soil were advanced manually using auger. The diameter of bore holes were approximately 150 mm. The boring procedure was in accordance with IS 1892. Standard penetration tests (SPT) were conducted in the bore holes. A split spoon sampler of 50mm diameter was connected to 'A' rod and driven it by 45 cm a 65 kg hammer falling freely from a height of 75 cms. The test procedure was in general accordance with IS : 2131.

The number from each 15cm of sampler penetration was recorded. The blows required to penetrate the last 30 cm of the 45 cm sampling interval is termed the SPT value of the 'N' value. The 'N' values are presented on the soil profiles for each boring. Where very dense/hard material was encountered, the penetration of the sampler after the initial 15 cm seating is recorded for the total of 75 blows. An SPT value exceeding 75 blows for 30 cm or 25 blows for 2.5 cm penetration of this split spoon sampler is considered as refusal. Refusal is also said to have occurred if the bore holes can not be progressed further in hard soils by manual methods.

Disturbed samples were collected from the split spoon after conducting SPT. The samples are preserved in transparent polythene bags. UDS were collected by driving 75 mm diameter thin walled tubes using a 65 kg hammer in accordance with IS : 2132. The tubes are sealed with wax at both ends to minimize loss of moisture. All samples were transported to our laboratory for further examination and testing.

3.0 LABORATORY TESTS

The laboratory testing program was aimed at verify the field classification and developing perimeters for engineering analysis. All testing were performed in accordance with relevant IS specification. The following tests were performed on selected soil samples recovered from the bore holes.

i Grain size analysis
ii Natural moisture content
iii Bulk density
iv Shear test
v Atterberg limits

4.0 GENERAL SITE CONDITIONS

4.1 Site Stratigraphy

Based on our investigation in field and laboratory, it is revealed that the soils at site are sandy silt primarily. The soil strata, thickness of layer, consistency of soil SPT values has been presented on borelogs and soil profile locationwise.

4.2 Ground Water

Based on our measurement in the completed borehole, the ground water has been encountered at 3.00m to 11.00m depth at the time of our investigation in the completed boreholes up to 15.00m depth. Fluctuation may takes place due to surface evaporation rates and variation in seasonal rainfall.

5.0 FOUNDATION ANALYSIS AND RECOMMENDATIONS

5.1 General

A suitable foundation for any structure should satisfy two basic and independent criteria with regard to the performance of the underlying soils. Firstly, the soils should have adequate shear strength to support the superimposed loads so that there is an adequate safety factor against the bearing capacity.

Secondly, the settlement of the soils including immediate elastic settlement and long term's consolidation settlements should be within tolerable limits for the structure. The net allowable bearing pressure on the foundations should be taken as the lower of the two values obtained from these two criteria. We believe that foundation designed in accordance with these recommendations given in this report will satisfy criteria.

5.2 Foundation Type

In general light to medium loaded structures may bear on isolated square and strip footing & heavy loaded structure may bear on raft foundation or pile foundation.

Detailed recommendations each of those foundation schemes are given in the following sections. In our case the structure is a medium loaded and stratum is loose to medium dense so following type of foundation may be adopted.

1. Isolated square footing bearing at 2.00m depth below ground level.

5.3 Isolated Square Footing

Isolated square/strip footing is a feasible foundation scheme. Considering the presence of loose to medium dense soils, we recommend a minimum foundation embedment depth of 2.00m below the existing ground surface. In order to limit differential settlement, we suggest that a plinth beam interconnecting the foundation be provided. Bearing capacity analysis for the shallow square footing is in accordance with IS: 6403-1981.

Considering the potential rise in ground water level, which is presently, encountered at 3.00m to 11.00m depth at the time of our investigation, a water table correction factor of 0.5 has been considered. A safety factor of 2.5 has been considered in the analysis as per IS: 1904.

Settlement analysis has been performed in accordance with IS: 8009 part -I. For computation of foundation settlement an average lower bound corrected 'N' value has been used.

A tolerable total settlement of 50mm has been considered as per IS: 1904. We recommend that an RCC plinth been be provided to keep differential settlement within tolerable limits. The following are our recommended values for square footing at a depth of 2.00m from existing ground surface.

Locations of STP	Foundation depth in m	Recommended net SBC t/m^2
BEAUR	2.00	8.9
PAHARI	2.00	12.5
KARMALTCHAK	2.00	8.1
KURTHAL	2.00	13.9

6.0 SUMMARY OF PRINCIPAL FINDINGS

B K SOIL CONSULTANTS PVT LTD carried out four bore holes 15.00m depth and and laboratory tests for proposed STP sites in Patna. Based on our investigation in field and laboratory, it is revealed that the soils at site are sandy silt primarily. The soil strata, thickness of layer, consistency of soil SPT values has been presented on borelogs and soil profile locationwise. The ground water table has been encountered at 3.00m to 11.00m depth at the time of our investigation. Following are the foundation recommendations and net safe bearing capacity of soil.

Locations of STP	Foundation depth	Recommended net SBC
BEAUR	2.00m	8.9 t/m^2
PAHARI	2.00m	12.5 t/m^2
KARMALTCHAK	2.00m	8.1 t/m^2
KURTHAL	2.00m	13.9 t/m^2

7.0 CLOSURE

We appreciate the opportunity given to us to submit this report. Please contact us if you need any clarification.

For B K SOIL CONSULTANTS PVT LTD

(Er B K SINGHAL)

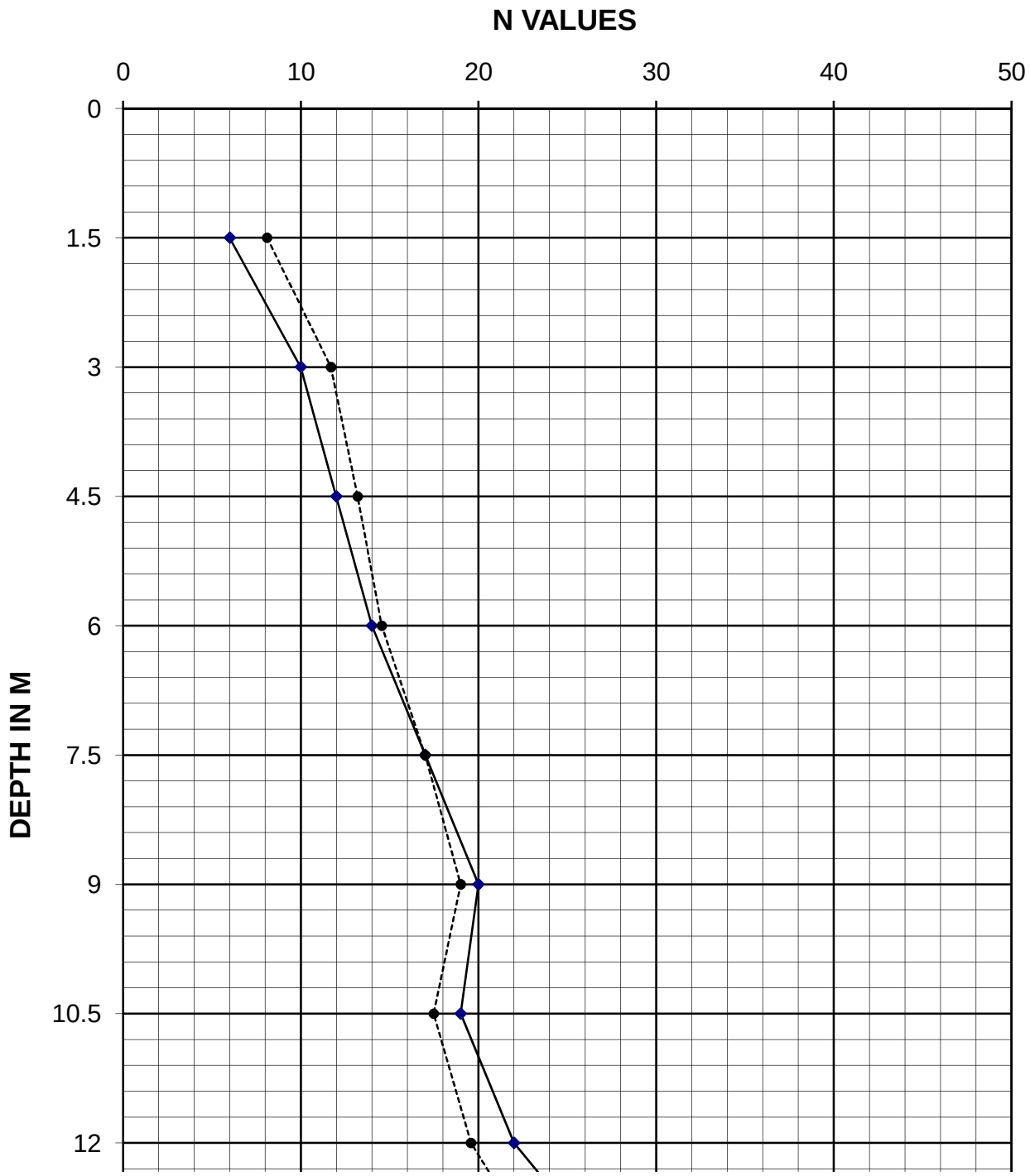
DIRECTOR

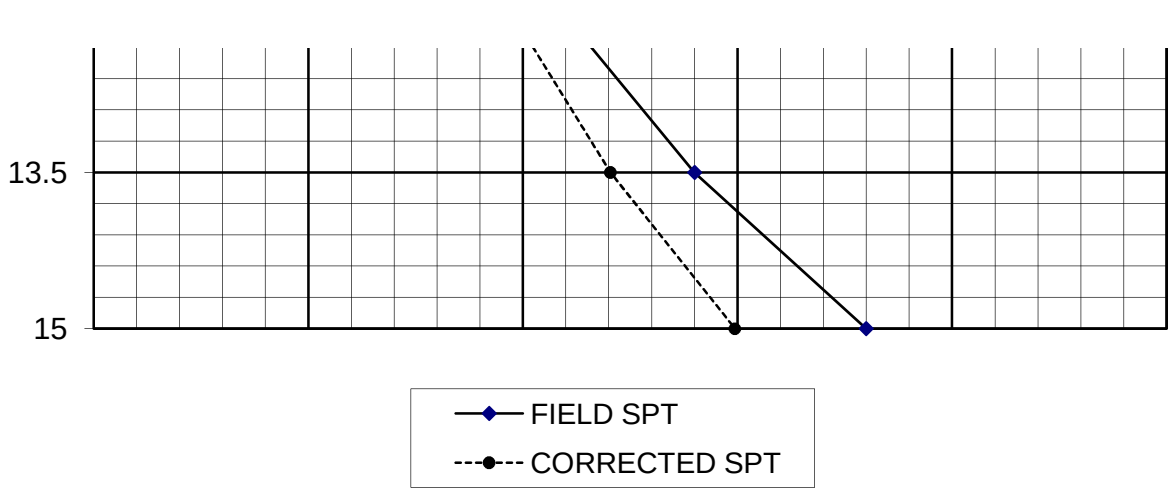
B K SOIL CONSULTANTS PVT. LTD.				SHEET NO.	
BORELOG					
PROJECT	PROPOSED SITE AT PATNA				
BOREHOLE NO.	1		LOCATION	BEAUR-STP	
BORING METHOD	AUGER & BAILER		GROUND LEVEL	EGL	
WATER TABLE	3.00 m		DATE OF START	28.04.2010	
BORING DEPTH	15.00 m		DATE OF COMPLETE	28.04.2010	

DEPTH (m)	DESCRIPTION OF STRATUM	IS CLASSI-FICATION	STRATA LEGEND	STRATA THICKNESS (m)	SPT VALUES	SAMPLES TYPE	NO.	DEPTH (m)
0.00	CLAYEY SILT	CL		2.00				
						DS	1	0.50
1.00								
					6	SPT	1	1.50
2.00	SANDY SILT	ML		13.00				
						UDS	1	2.25
3.00					10	SPT	2	3.00
4.00								
					12	SPT	3	4.50
5.00								
						UDS	2	5.25
6.00					14	SPT	4	6.00
7.00								
					17	SPT	5	7.50
8.00								
						UDS	3	8.25
9.00					20	SPT	6	9.00
10.00								
					19	SPT	7	10.50
11.00								
						UDS	4	11.25
12.00					22	SPT	8	12.00
13.00								
					28	SPT	9	13.50
14.00								
						UDS	5	14.25
15.00					36	SPT	10	15.00

B K SOIL CONSULTANTS PVT. LTD.			SOIL PROFILE	PROPOSED SITE AT PATNA										SHEET	
				B. H. NO.	BORING DATE			TERMINAL DEPTH (m)			WATER TABLE (m)				
				1	28.04.2010			15.00			3.00				
N VALUES	DEPTH (m)	SAMPLE	DESCRIPTION OF SOIL	IS CLASSI-FICATION	GRAIN SIZE ANALYSIS				LIQUID LIMITS %	PLASTIC LIMITS %	BULK DENSITY gm/cc	MOIST CONT %	SHEAR PARAMETER		
					GRAVEL %	SAND %	SILT %	CLAY %					TEST TYPE	C kg/cm^2	ϕ deg.
	0.50	DS	CLAYEY SILT	CL											
6	1.50	SPT-1													
	2.25	UDS-1	SANDY SILT	ML	2	32	64	2	22	18	1.86	14.3	UUT	0.10	23
10	3.00	SPT-2													
12	4.50	SPT-3													
	5.25	UDS-2			1	30	68	1	23	19	1.93	18.3	UUT	0.12	23
14	6.00	SPT-4													
17	7.50	SPT-5													
	8.25	UDS-3			0	34	64	2	25	21	1.95	18.8	UUT	0.12	24
20	9.00	SPT-6													
19	10.50	SPT-7													
	11.25	UDS-4			1	36	61	2	24	20	1.98	19.4	UUT	0.15	25
22	12.00	SPT-8													
28	13.50	SPT-9													
	14.25	UDS-5			0	45	55	0	24	20	2.02	19.7	UUT	0.15	26
36	15.00	SPT-10													

B K SOIL CONSULTANTS PVT. LTD.	SHEET NO.	





BH NO **1**

GRAPH OF N VALUES

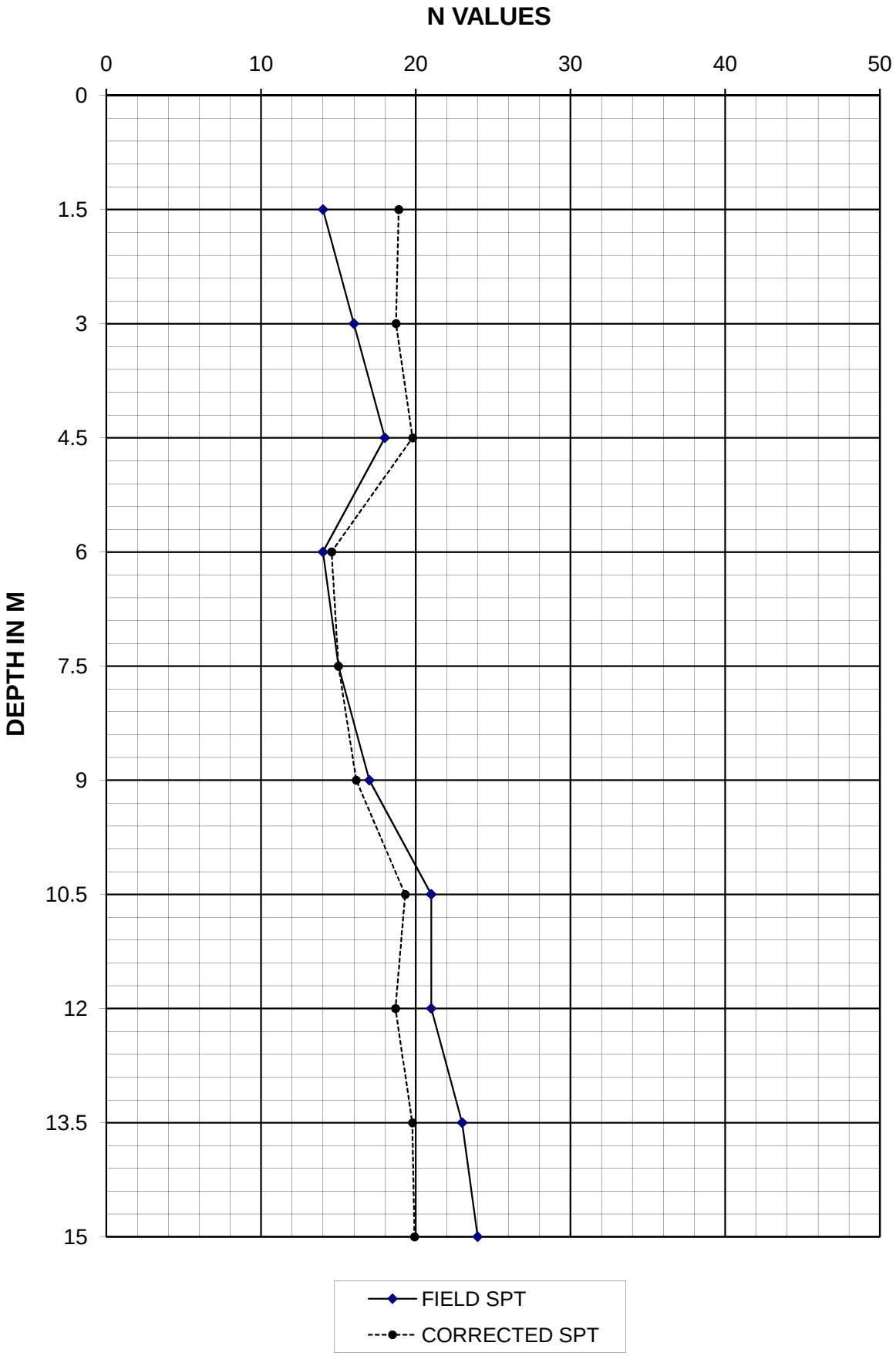
0	0	Overburden	correction factor	corrected N	Corrected N '
1.5	6	0.27	1.35	8.1	8.1
3	10	0.54	1.17	11.7	11.7
4.5	12	0.7	1.1	13.2	13.2
6	14	0.85	1.04	14.6	14.6
7.5	17	1	1	17.0	17.0
9	20	1.15	0.95	19.0	19.0
10.5	19	1.3	0.92	17.5	17.5
12	22	1.45	0.89	19.6	19.6
13.5	28	1.6	0.86	24.1	24.1
15	36	1.75	0.83	29.9	29.9

B K SOIL CONSULTANTS PVT. LTD.				SHEET NO.	
BORELOG					
PROJECT	PROPOSED SITE AT PATNA				
BOREHOLE NO.	2		LOCATION	PAHARI-STP	
BORING METHOD	AUGER & BAILER		GROUND LEVEL	EGL	
WATER TABLE	5.50 m		DATE OF START	29.04.2010	
BORING DEPTH	15.00 m		DATE OF COMPLETE	29.04.2010	

DEPTH (m)	DESCRIPTION OF STRATUM	IS CLASSI-FICATION	STRATA LEGEND	STRATA THICKNESS (m)	SPT VALUES	SAMPLES TYPE	NO.	DEPTH (m)
0.00	CLAYEY SILT	CL		4.50				
						DS	1	0.50
1.00								
					14	SPT	1	1.50
2.00								
						UDS	1	2.25
3.00					16	SPT	2	3.00
4.00								
					18	SPT	3	4.50
5.00	SANDY SILT	ML		10.50				
						UDS	2	5.25
6.00					14	SPT	4	6.00
7.00								
					15	SPT	5	7.50
8.00								
						UDS	3	8.25
9.00					17	SPT	6	9.00
10.00								
					21	SPT	7	10.50
11.00								
						UDS	4	11.25
12.00					21	SPT	8	12.00
13.00								
					23	SPT	9	13.50
14.00								
						UDS	5	14.25
15.00					24	SPT	10	15.00

B K SOIL CONSULTANTS PVT. LTD.			SOIL PROFILE	PROPOSED SITE AT PATNA										SHEET	
				B. H. NO.	BORING DATE			TERMINAL DEPTH (m)			WATER TABLE (m)				
				2	29.04.2010			15.00			5.50				
N VALUES	DEPTH (m)	SAMPLE	DESCRIPTION OF SOIL	IS CLASSI-FICATION	GRAIN SIZE ANALYSIS				LIQUID LIMITS %	PLASTIC LIMITS %	BULK DENSITY gm/cc	MOIST CONT %	SHEAR PARAMETER		
					GRAVEL %	SAND %	SILT %	CLAY %					TEST TYPE	C kg/cm^2	ϕ deg.
	0.50	DS	CLAYEY SILT	CL											
14	1.50	SPT-1													
	2.25	UDS-1			1	12	72	15	37	23	1.82	4.3	UUT	0.45	13
16	3.00	SPT-2													
18	4.50	SPT-3													
	5.25	UDS-2	SANDY SILT	ML	1	29	70	0	24	20	1.90	15.4	UUT	0.15	24
14	6.00	SPT-4													
15	7.50	SPT-5													
	8.25	UDS-3			2	33	63	2	23	19	2.01	21.3	UUT	0.15	24
17	9.00	SPT-6													
21	10.50	SPT-7													
	11.25	UDS-4			1	35	63	1	23	19	2.01	20.5	UUT	0.18	24
21	12.00	SPT-8													
23	13.50	SPT-9													
	14.25	UDS-5			1	41	58	0	22	18	2.06	20.3	UUT	0.20	25
24	15.00	SPT-10													

B K SOIL CONSULTANTS PVT. LTD.	SHEET NO.	



BH NO 2

GRAPH OF N VALUES

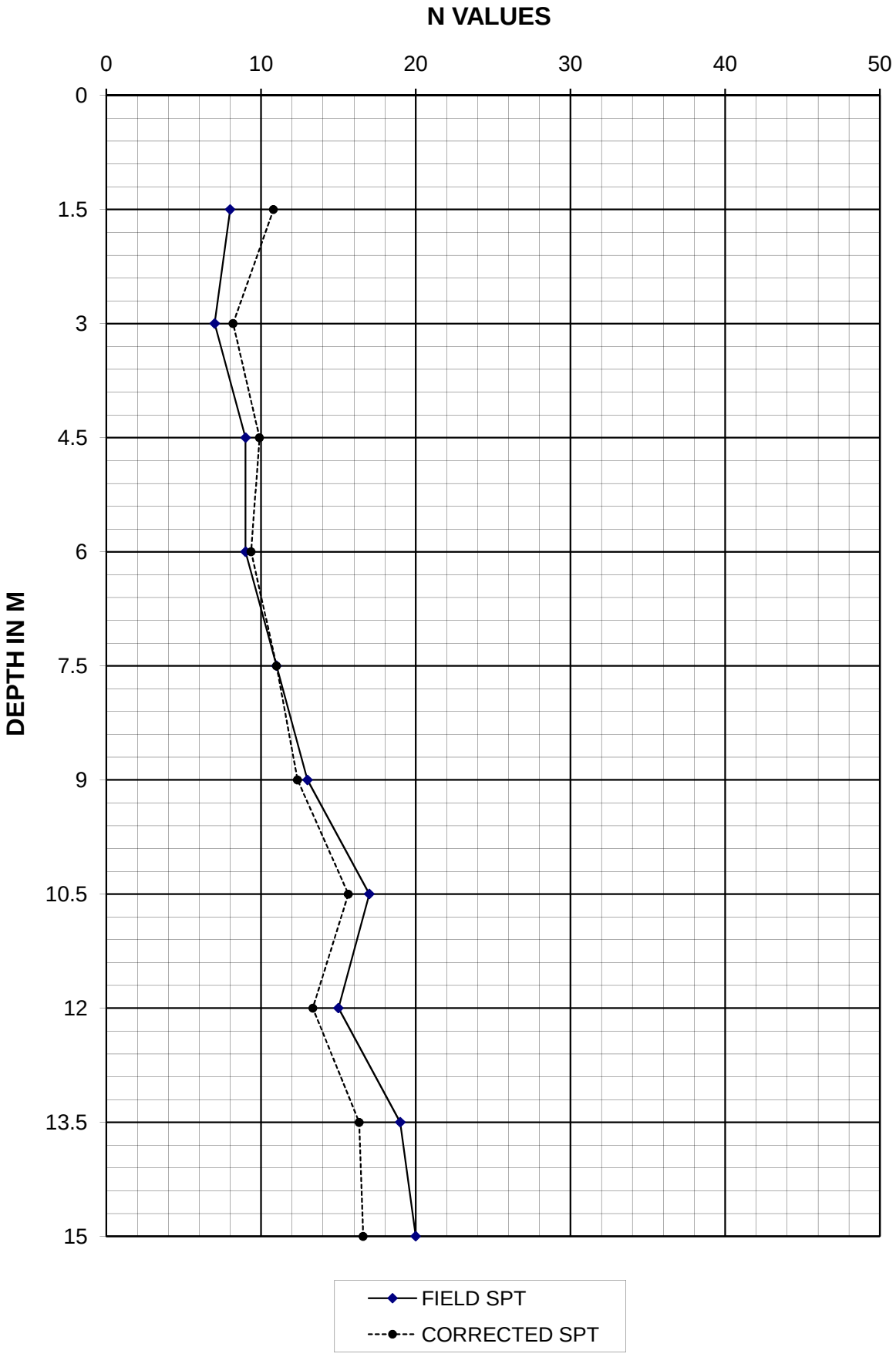
0	0	Overburden	correction factor	corrected N	Corrected N '
1.5	14	0.27	1.35	18.9	18.9
3	16	0.54	1.17	18.7	18.7
4.5	18	0.7	1.1	19.8	19.8
6	14	0.85	1.04	14.6	14.6
7.5	15	1	1	15.0	15.0
9	17	1.15	0.95	16.2	16.2
10.5	21	1.3	0.92	19.3	19.3
12	21	1.45	0.89	18.7	18.7
13.5	23	1.6	0.86	19.8	19.8
15	24	1.75	0.83	19.9	19.9

B K SOIL CONSULTANTS PVT. LTD.				SHEET NO.	
BORELOG					
PROJECT	PROPOSED SITE AT PATNA				
BOREHOLE NO.	3		LOCATION		KARMALTCHAK-ST
BORING METHOD	AUGER & BAILER		GROUND LEVEL		EGL
WATER TABLE	2.00	m	DATE OF START		30.04.2010
BORING DEPTH	15.00	m	DATE OF COMPLETE		30.04.2010

DEPTH (m)	DESCRIPTION OF STRATUM	IS CLASSI-FICATION	STRATA LEGEND	STRATA THICKNESS (m)	SPT VALUES	SAMPLES TYPE	SAMPLES NO.	SAMPLES DEPTH (m)
0.00	CLAYEY SILT	CL		5.00				
						DS	1	0.50
1.00								
					8	SPT	1	1.50
2.00								
						UDS	1	2.25
3.00					7	SPT	2	3.00
4.00								
					9	SPT	3	4.50
5.00	SANDY SILT	ML		10.00				
						UDS	2	5.25
6.00					9	SPT	4	6.00
7.00								
					11	SPT	5	7.50
8.00								
						UDS	3	8.25
9.00					13	SPT	6	9.00
10.00								
					17	SPT	7	10.50
11.00								
						UDS	4	11.25
12.00					15	SPT	8	12.00
13.00								
					19	SPT	9	13.50
14.00								
						UDS	5	14.25
15.00					20	SPT	10	15.00

B K SOIL CONSULTANTS PVT. LTD.			SOIL PROFILE	PROPOSED SITE AT PATNA										SHEET	
				B. H. NO.	BORING DATE			TERMINAL DEPTH (m)			WATER TABLE (m)				
				3	30.04.2010			15.00			2.00				
N VALUES	DEPTH (m)	SAMPLE	DESCRIPTION OF SOIL	IS CLASSI-FICATION	GRAIN SIZE ANALYSIS				LIQUID LIMITS %	PLASTIC LIMITS %	BULK DENSITY gm/cc	MOIST CONT %	SHEAR PARAMETER		
					GRAVEL %	SAND %	SILT %	CLAY %					TEST TYPE	C kg/cm^2	ϕ deg.
	0.50	DS	CLAYEY SILT	CL											
8	1.50	SPT-1													
	2.25	UDS-1			2	11	71	16	38	24	1.98	27.6	UUT	0.35	10
7	3.00	SPT-2													
9	4.50	SPT-3													
	5.25	UDS-2	SANDY SILT	ML	0	33	65	2	25	22	2.01	22.4	UUT	0.10	24
9	6.00	SPT-4													
11	7.50	SPT-5													
	8.25	UDS-3			1	29	69	1	24	20	2.02	21.1	UUT	0.15	23
13	9.00	SPT-6													
17	10.50	SPT-7													
	11.25	UDS-4			2	36	62	0	24	21	2.03	20.2	UUT	0.15	24
15	12.00	SPT-8													
19	13.50	SPT-9													
	14.25	UDS-5			0	39	59	2	23	21	2.04	20.1	UUT	0.20	24
20	15.00	SPT-10													

B K SOIL CONSULTANTS PVT. LTD.	SHEET NO.	



BH NO 3

GRAPH OF N VALUES

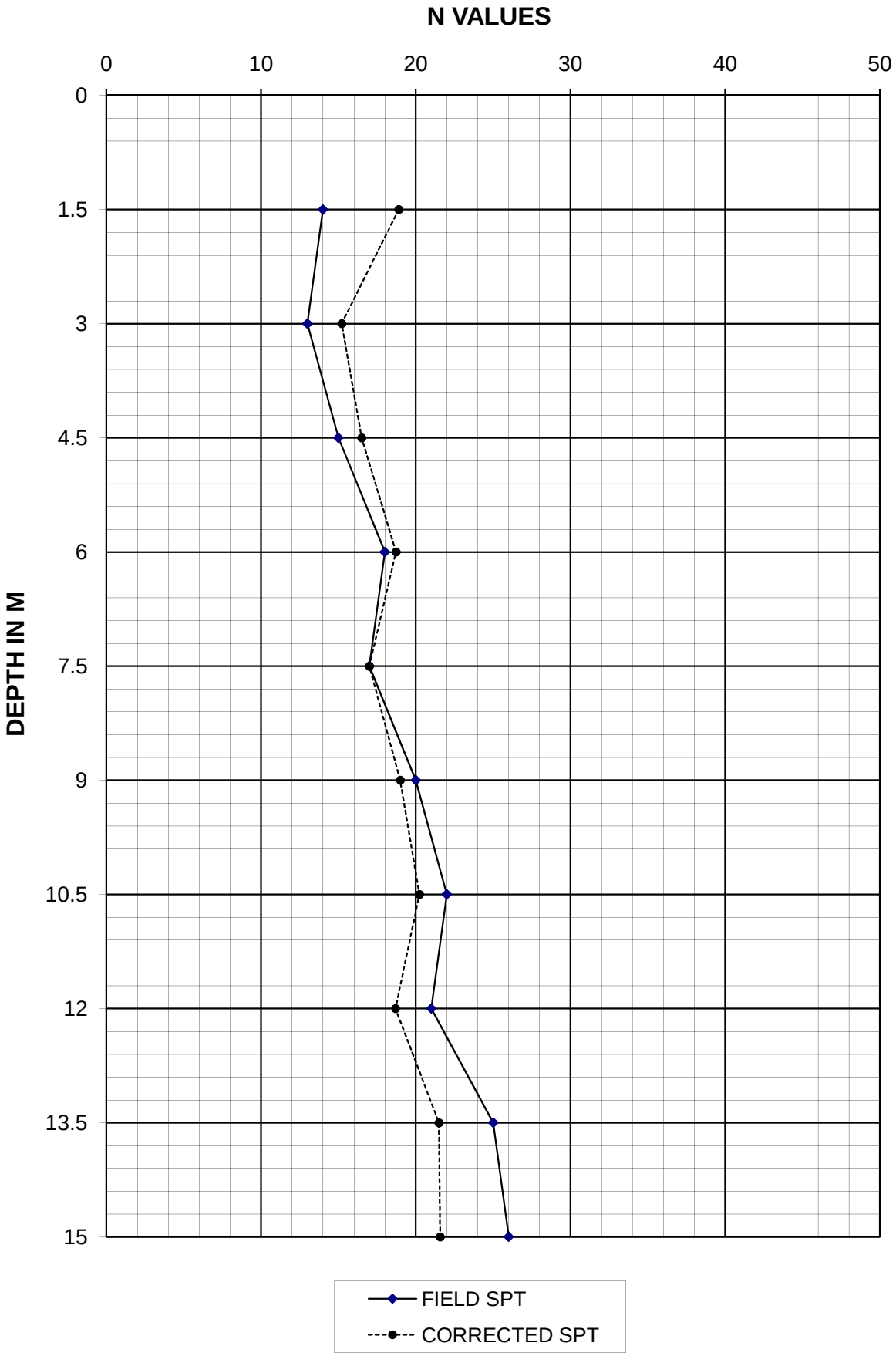
0	0	Overburden	correction factor	corrected N	Corrected N '
1.5	8	0.27	1.35	10.8	10.8
3	7	0.54	1.17	8.2	8.2
4.5	9	0.7	1.1	9.9	9.9
6	9	0.85	1.04	9.4	9.4
7.5	11	1	1	11.0	11.0
9	13	1.15	0.95	12.4	12.4
10.5	17	1.3	0.92	15.6	15.6
12	15	1.45	0.89	13.4	13.4
13.5	19	1.6	0.86	16.3	16.3
15	20	1.75	0.83	16.6	16.6

B K SOIL CONSULTANTS PVT. LTD.				SHEET NO.	
BORELOG					
PROJECT	PROPOSED SITE AT PATNA				
BOREHOLE NO.	4		LOCATION		KURTHAL(PROPOS
BORING METHOD	AUGER & BAILER		GROUND LEVEL		EGL
WATER TABLE	11.00	m	DATE OF START		31.04.2010
BORING DEPTH	15.00	m	DATE OF COMPLETE		31.04.2010

DEPTH (m)	DESCRIPTION OF STRATUM	IS CLASSI-FICATION	STRATA LEGEND	STRATA THICKNESS (m)	SPT VALUES	SAMPLES TYPE	SAMPLES NO.	SAMPLES DEPTH (m)
0.00	CLAYEY SILT	CL		7.00				
						DS	1	0.50
1.00								
					14	SPT	1	1.50
2.00								
						UDS	1	2.25
3.00					13	SPT	2	3.00
4.00								
					15	SPT	3	4.50
5.00								
						UDS	2	5.25
6.00					18	SPT	4	6.00
7.00	SANDY SILT	ML		8.00				
					17	SPT	5	7.50
8.00								
						UDS	3	8.25
9.00					20	SPT	6	9.00
10.00								
					22	SPT	7	10.50
11.00								
						UDS	4	11.25
12.00					21	SPT	8	12.00
13.00								
					25	SPT	9	13.50
14.00								
						UDS	5	14.25
15.00					26	SPT	10	15.00

B K SOIL CONSULTANTS PVT. LTD.			SOIL PROFILE	PROPOSED SITE AT PATNA										SHEET	
				B. H. NO.	BORING DATE			TERMINAL DEPTH (m)			WATER TABLE (m)				
				4	31.04.2010			15.00			11.00				
N VALUES	DEPTH (m)	SAMPLE	DESCRIPTION OF SOIL	IS CLASSI-FICATION	GRAIN SIZE ANALYSIS				LIQUID LIMITS %	PLASTIC LIMITS %	BULK DENSITY gm/cc	MOIST CONT %	SHEAR PARAMETER		
					GRAVEL %	SAND %	SILT %	CLAY %					TEST TYPE	C kg/cm^2	ϕ deg.
	0.50	DS	CLAYEY SILT	CL											
14	1.50	SPT-1													
	2.25	UDS-1			1	10	75	14	37	23	1.79	5.4	UUT	0.65	12
13	3.00	SPT-2													
15	4.50	SPT-3													
	5.25	UDS-2			2	12	70	16	36	24	1.83	7.6	UUT	0.80	13
18	6.00	SPT-4													
17	7.50	SPT-5	SANDY SILT	ML											
	8.25	UDS-3			2	30	66	2	24	20	1.85	10.4	UUT	0.18	23
20	9.00	SPT-6													
22	10.50	SPT-7													
	11.25	UDS-4			1	34	64	1	24	21	2.04	20.2	UUT	0.18	26
21	12.00	SPT-8													
25	13.50	SPT-9													
	14.25	UDS-5			2	38	60	0	23	21	2.07	19.8	UUT	0.25	27
26	15.00	SPT-10													

B K SOIL CONSULTANTS PVT. LTD.	SHEET NO.	



BH NO 4

GRAPH OF N VALUES

0	0	Overburden	correction factor	corrected N	Corrected N '
1.5	14	0.27	1.35	18.9	18.9
3	13	0.54	1.17	15.2	15.2
4.5	15	0.7	1.1	16.5	16.5
6	18	0.85	1.04	18.7	18.7
7.5	17	1	1	17.0	17.0
9	20	1.15	0.95	19.0	19.0
10.5	22	1.3	0.92	20.2	20.2
12	21	1.45	0.89	18.7	18.7
13.5	25	1.6	0.86	21.5	21.5
15	26	1.75	0.83	21.6	21.6

B K SOIL CONSULTANTS PVT. LTD.	SHEET NO

COMPUTATION OF NET SAFE BEARING CAPACITY AS PER IS: 6403-1981

LOCATION-BEAUR STP

SHEAR FAILURE CONSIDERATION CONSIDERATION

1	$Q_{(ult} = cN_cs_cd_ci_c + q(N_q - 1)s_qd_qi_q + 0.5BgN_gs_gd_gi_gW'$			
2	FOUNDATION WIDTH		2.00	M
3	DEPTH OF FOUNDATION BELOW EGL Df		2.00	M
4	ANGLE OF INTERNAL FRICTION AVERAGE		20	DEG
5	UNIT WT OF OVERBURDEN		1.75	T/CUM
6	COHESIVE STRENGTH C		0.80	T/CUM
7	BEARING CAPACITY FACTOR, Nc		14.8	
8	BEARING CAPACITY FACTOR, Nq		6.4	
9	BEARING CAPACITY FACTOR, Ny		5.4	
10	DEPTH FACTOR, dc = 1+(0.2XDf/B)Xsqrt(NΦ)		1.29	
11	DEPTH FACTOR, dq = 1+(0.1XDf/B)Xsqrt(NΦ)		1.14	
12	DEPTH FACTOR, dy = 1+(0.1XDf/B)Xsqrt(NΦ)		1.14	
13	SHAPE FACTOR, sc		1.3	
14	SHAPE FACTOR, sq		1.2	
15	SHAPE FACTOR, sy		0.8	
16	INCLINATION FACTOR, ic		1	
17	INCLINATION FACTOR, iq		1	
18	INCLINATION FACTOR, iy		1	
19	WATER TABLE CORRECTION FACTOR, W'		0.5	
20	ULTIMATE BEARING CAPACITY UBC1=	cNcscdcic	19.7884	t/sqm
21	ULTIMATE BEARING CAPACITY UBC2=	q(Nq-1)sqdqiq	25.92	t/sqm
22	ULTIMATE BEARING CAPACITY UBC3=	0.5ByNysydyiyW'	4.32	t/sqm
23	NET ULTIMATE BEARING CAPACITY, UBC	UBC1+UBC2+UBC3	50.03	t/sqm
24	NET SBC WITH FACTOR OF SAFETY OF 2.5=	UBC/2.5=	20.01	t/sqm
		SAY	20	t/sqm

SETTLEMENT CONSIDERATION AS PER IS: 8009

N VALUE	DEPTH m	WIDTH m	NET PRESSURE t/sqm	SETTLEMENT mm
11	2.00	2.00	8.9	50

calculation

settlement by applying 1kg/sqcm pressure as per IS:8009-I=		28	
corrected settlement by applying W'=	0.5	56	
net SBC allowed for 50mm settlement(50/corr settlement)=	0.89	8.9	t/sqm

B K SOIL CONSULTANTS PVT. LTD.	SHEET NO

COMPUTATION OF NET SAFE BEARING CAPACITY AS PER IS: 6403-1981

LOCATION-PAHARI STP

SHEAR FAILURE CONSIDERATION CONSIDERATION

1	$Q_{(ult} = cN_cs_cd_ci_c + q(N_q - 1)s_qd_qi_q + 0.5BgN_gs_gd_gi_gW'$			
2	FOUNDATION WIDTH		2.00	M
3	DEPTH OF FOUNDATION BELOW EGL Df		2.00	M
4	ANGLE OF INTERNAL FRICTION AVERAGE		13	DEG
5	UNIT WT OF OVERBURDEN		1.75	T/CUM
6	COHESIVE STRENGTH C		3.00	T/CUM
7	BEARING CAPACITY FACTOR, Nc		9.8	
8	BEARING CAPACITY FACTOR, Nq		3.2	
9	BEARING CAPACITY FACTOR, Ny		2	
10	DEPTH FACTOR, dc = 1+(0.2XDf/B)Xsqrt(NΦ)		1.25	
11	DEPTH FACTOR, dq = 1+(0.1XDf/B)Xsqrt(NΦ)		1.13	
12	DEPTH FACTOR, dy = 1+(0.1XDf/B)Xsqrt(NΦ)		1.13	
13	SHAPE FACTOR, sc		1.3	
14	SHAPE FACTOR, sq		1.2	
15	SHAPE FACTOR, sy		0.8	
16	INCLINATION FACTOR, ic		1	
17	INCLINATION FACTOR, iq		1	
18	INCLINATION FACTOR, iy		1	
19	WATER TABLE CORRECTION FACTOR, W'		0.5	
20	ULTIMATE BEARING CAPACITY UBC1=	cNcscdcic	47.8298	t/sqm
21	ULTIMATE BEARING CAPACITY UBC2=	q(Nq-1)sqdqiq	10.40	t/sqm
22	ULTIMATE BEARING CAPACITY UBC3=	0.5ByNysydyiyW'	1.58	t/sqm
23	NET ULTIMATE BEARING CAPACITY, UBC	UBC1+UBC2+UBC3	59.81	t/sqm
24	NET SBC WITH FACTOR OF SAFETY OF 2.5=	UBC/2.5=	23.92	t/sqm
		SAY	24	t/sqm

SETTLEMENT CONSIDERATION AS PER IS: 8009

N VALUE	DEPTH m	WIDTH m	NET PRESSURE t/sqm	SETTLEMENT mm
14	2.00	2.00	12.5	50

calculation

settlement by applying 1kg/sqcm pressure as per IS:8009-I=		20	
corrected settlement by applying W'=	0.5	40	
net SBC allowed for 50mm settlement(50/corr settlement)=	1.25	12.5	t/sqm

B K SOIL CONSULTANTS PVT. LTD.	SHEET NO

COMPUTATION OF NET SAFE BEARING CAPACITY AS PER IS: 6403-1981

LOCATION-KARMALTCHAK-STP

SHEAR FAILURE CONSIDERATION CONSIDERATION

1	$Q_{(ult} = cN_cs_cd_ci_c + q(N_q - 1)s_qd_qi_q + 0.5BgN_gs_gd_gi_gW'$			
2	FOUNDATION WIDTH		2.00	M
3	DEPTH OF FOUNDATION BELOW EGL Df		2.00	M
4	ANGLE OF INTERNAL FRICTION AVERAGE		10	DEG
5	UNIT WT OF OVERBURDEN		1.75	T/CUM
6	COHESIVE STRENGTH C		3.00	T/CUM
7	BEARING CAPACITY FACTOR, Nc		8.3	
8	BEARING CAPACITY FACTOR, Nq		2.4	
9	BEARING CAPACITY FACTOR, Ny		1.2	
10	DEPTH FACTOR, dc = 1+(0.2XDf/B)Xsqrt(NΦ)		1.24	
11	DEPTH FACTOR, dq = 1+(0.1XDf/B)Xsqrt(NΦ)		1.12	
12	DEPTH FACTOR, dy = 1+(0.1XDf/B)Xsqrt(NΦ)		1.12	
13	SHAPE FACTOR, sc		1.3	
14	SHAPE FACTOR, sq		1.2	
15	SHAPE FACTOR, sy		0.8	
16	INCLINATION FACTOR, ic		1	
17	INCLINATION FACTOR, iq		1	
18	INCLINATION FACTOR, iy		1	
19	WATER TABLE CORRECTION FACTOR, W'		0.5	
20	ULTIMATE BEARING CAPACITY UBC1=	cNcscdcic	40.0854	t/sqm
21	ULTIMATE BEARING CAPACITY UBC2=	q(Nq-1)sqdqiq	6.58	t/sqm
22	ULTIMATE BEARING CAPACITY UBC3=	0.5ByNysydyiyW'	0.94	t/sqm
23	NET ULTIMATE BEARING CAPACITY, UBC	UBC1+UBC2+UBC3	47.61	t/sqm
24	NET SBC WITH FACTOR OF SAFETY OF 2.5=	UBC/2.5=	19.04	t/sqm
		SAY	19	t/sqm

SETTLEMENT CONSIDERATION AS PER IS: 8009

N VALUE	DEPTH m	WIDTH m	NET PRESSURE t/sqm	SETTLEMENT mm
10	2.00	2.00	8.1	50

calculation

settlement by applying 1kg/sqcm pressure as per IS:8009-I=		31	
corrected settlement by applying W'=	0.5	62	
net SBC allowed for 50mm settlement(50/corr settlement)=	0.81	8.1	t/sqm

B K SOIL CONSULTANTS PVT. LTD.	SHEET NO

COMPUTATION OF NET SAFE BEARING CAPACITY AS PER IS: 6403-1981

LOCATION-KURTHAL(PROPOSED)-STP

SHEAR FAILURE CONSIDERATION CONSIDERATION

1	$Q_{(ult} = cN_cs_cd_ci_c + q(N_q - 1)s_qd_qi_q + 0.5BgN_gs_gd_gi_gW'$			
2	FOUNDATION WIDTH		2.00	M
3	DEPTH OF FOUNDATION BELOW EGL Df		2.00	M
4	ANGLE OF INTERNAL FRICTION AVERAGE		12	DEG
5	UNIT WT OF OVERBURDEN		1.75	T/CUM
6	COHESIVE STRENGTH C		5.00	T/CUM
7	BEARING CAPACITY FACTOR, Nc		9.1	
8	BEARING CAPACITY FACTOR, Nq		3	
9	BEARING CAPACITY FACTOR, Ny		1.7	
10	DEPTH FACTOR, dc = 1+(0.2XDf/B)Xsqrt(NΦ)		1.25	
11	DEPTH FACTOR, dq = 1+(0.1XDf/B)Xsqrt(NΦ)		1.12	
12	DEPTH FACTOR, dy = 1+(0.1XDf/B)Xsqrt(NΦ)		1.12	
13	SHAPE FACTOR, sc		1.3	
14	SHAPE FACTOR, sq		1.2	
15	SHAPE FACTOR, sy		0.8	
16	INCLINATION FACTOR, ic		1	
17	INCLINATION FACTOR, iq		1	
18	INCLINATION FACTOR, iy		1	
19	WATER TABLE CORRECTION FACTOR, W'		0.5	
20	ULTIMATE BEARING CAPACITY UBC1=	cNcscdcic	73.7588	t/sqm
21	ULTIMATE BEARING CAPACITY UBC2=	q(Nq-1)sqdqiq	9.44	t/sqm
22	ULTIMATE BEARING CAPACITY UBC3=	0.5ByNysydyiyW'	1.34	t/sqm
23	NET ULTIMATE BEARING CAPACITY, UBC	UBC1+UBC2+UBC3	84.53	t/sqm
24	NET SBC WITH FACTOR OF SAFETY OF 2.5=	UBC/2.5=	33.81	t/sqm
		SAY	34	t/sqm

SETTLEMENT CONSIDERATION AS PER IS: 8009

N VALUE	DEPTH m	WIDTH m	NET PRESSURE t/sqm	SETTLEMENT mm
15	2.00	2.00	13.9	50

calculation

settlement by applying 1kg/sqcm pressure as per IS:8009-I=		18	
corrected settlement by applying W'=	0.5	36	
net SBC allowed for 50mm settlement(50/corr settlement)=	1.39	13.9	t/sqm