

REPORT ON

SOIL INVESTIGATION FOR CONSTRUCTION OF SHIKSHA
BHAWAN (G+4) AT SUPAUL.

Submitted to

CHIEF ENGINEER
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PREFACE

The present report on sub-soil investigation was carried out as per Chief Engineer, BSEIDC, Patna letter no BSEIDC/TECH/1960(P)/2018-3609 dated 21.04.2023.

The entire investigation process was broadly divided into two category –one field work and second was laboratory work.

Field work includes conducting SPT ,Dynamic cone test, collection of disturbed as well as undisturbed soil samples from different location and different depth of sub-soil strata.

It was tried to get information from local people to get an idea about variation of water table during different season of year and also to get first hand information about type of foundation usually provided in the locality.

We thanks Prof. M.P.Jakhanwal(Retired) ,M.Tech ,Ph.D. ,Muzaffarpur Institute of Technology, Muzaffarpur for his valuable advice during laboratory test and during preparation of report.

Client's help is gratefully acknowledged in providing Bore hole locations, cooperation and guidance during finalization of report.

We belief that the present report will serve the purpose, for which sub-soil investigation has been carried out.

Anil Kumar Sariaar

ANIL KUMAR SARIAR
Partner, Shamvwi Consultant

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REPORT ON SUB-SOIL INVESTIGATION FOR THE CONSTRUCTION OF SHIKSHA BHAWAN (G+4) AT SUPAUL.

1. INTRODUCTION

The objective of subsoil investigation reported here in, were taken up, to find out the nature of subsoil at the site of the proposed construction and to recommend the type or types of foundation suitable for it and the corresponding allowable bearing capacity.

The necessary field tests were carried out at the site. Soil samples from various depths in the different bore holes were collected, transported, carefully to the laboratory and tested to determine the engineering properties of the soil.

Based on the test results, certain recommendation were made and given in this report, regarding the type of foundation suitable for the proposed project and the allowable bearing capacity for certain sizes thereof.

2. TOPOGRAPHY

The land in question was even.

3. FIELD WORK

The field work consists of boring, soil sampling and conduct of Standard penetration tests and Dynamic cone penetration tests.

3.1 BORING

An appropriate number of boreholes of adequate depth were sunk at suitable spots as per direction of Engineer-in-charge. The details of the boreholes are given in table-1.

Table 1: Details of bore holes

DIAMETER OF BORE MM	DEPTH M	BORE HOLE
150	10.5	3 Bore Holes (BH-1 to BH-3)

The borings were kept dry while advancing through partially saturated soil. The position of water table in a borehole was recorded at least 48 hours after the stopping of the boring operation.

For boring below ground water level, the borehole was kept filled with water upto that level during boring.

3.2 SAMPLING

Undisturbed & disturbed samples were collected at different depth/where change of strata occurred. Identification slips were provided both inside and outside the tube.

On arrival in laboratory, the identification slips were checked against the boring and sampling records. Samples were extracted from the tubes just before testing.

3.3 STANDARD PENETRATION TEST

This test was performed in the boreholes at interval of depth of 1.5m, or at the change of strata/ as per IS: 2131 of 1963.

3.4 DYNAMIC CONE PENETRATION TEST

This test was performed when a bore hole could not be advanced to desired depth due to caving- in of the soil, or when it was felt necessary to supplement the information gained from SPT. This test was performed, as per relevant IS code till high value of penetration resistance was encountered or till desired depth of investigation was reached, at which stage the test was stopped.

CONSTRUCTION OF SHIKSHA BHAWAN (G+4) AT SUPAUL.

4. LABORATORY TEST

Lab. Test was performed to determine the following properties of soil samples as per relevant I.S. code.

- (a) Natural moisture content.
- (b) Bulk density.
- (c) Atterberg's limits (on fine grained soil only)
- (d) Grain size analysis.
- (e) Specific gravity.
- (f) Shear test.
- (i) Unconfined/triaxial compression tests for fine-grained soils.
- (ii) Direct shear test for coarse-grained soils.
- (g) Consolidation tests for fine grained soils.
- (h) Organic content, chemical test etc.
- (i) pH of soil and water.
- (j) Free swell Index
- (k) Crushing strength test (uniaxial)

4.1 SAMPLE EXTRACTION & PREPARATION OF TEST SPECIMENS

Samples for different tests were prepared as per method described in relevant IS code/as per method described in standard book.

4.2 ROUTINE CLASSIFICATION TESTS.

Tests for the determination of natural moisture content, bulk density, Atterberg's limit, grain size distribution and specific gravity were performed as per IS code on representative, disturbed soil samples, wherever felt necessary. The results were used in classifying the soils of different strata as per IS code 1498-1970.

5.0 PRESENTATION OF TEST RESULT

Results were presented in table form on the following pages.

6.0 METHOD FOR CALCULATION OF ALLOWABLE BEARING CAPACITY

6.1 COHESIVE SOIL

Net ultimate bearing capacity was calculated as per IS-6403-1981.

$$q_d = cN_c S_c D_c I_c$$

q_d = net ultimate bearing capacity

$$N_c = 5.14$$

$S_c = 1$ for strip footing

$$D_c = 1 + 0.2 \cdot D/B$$

$I_c = 1$ for vertical loading

c = cohesion obtained through unconfined compression test for depth of $2B/3$ below the foundation.

Settlement criteria

$$S = H / (1 + e_0) \cdot C_c \cdot \log((p_0 + p_1) / p_0)$$

S = settlement

H = thickness of compressible layer

CONSTRUCTION OF SHIKSHA BHAWAN (G+4) AT SUPAUL

e_o =initial void ratio

p_o =initial effective pressure

p_1 =pressure increment

C_c =compression index

6.2 Soil with the value of c & θ

Net ultimate bearing capacity was calculated as per IS 6403-1981

$$Q_d = c N_c S_c D_c I_c + q (N_q - 1) S_q D_q I_q + 0.5 R^* B N_r^* S_r^* D_r^* I_r^* w'$$

For local shear failure

$$\tan \theta' = 0.67 \tan \theta$$

$$C' = 2 * c / 3$$

$S_c = S_q = S_r = 1$ for strip footing

$$D_c = 1 + 0.2 * (D/B) * \tan(45 + \theta/2)$$

$I_c = I_q = I_r = 1$ for vertical loading

$$D_q = D_r = 1 + 0.1 * (D/B) \tan(45 + \theta/2)$$

$$q = (R - R_w) * D$$

M = moisture content

R = bulk density of soil

R_w = unit weight of water

L.L. = liquid limit

P.L. = plastic limit

S.L. = shrinkage limit

D = depth below ground level

Settlement criteria

The net allowable bearing capacity for a permissible settlement of 25mm, was obtained by teng's formula

$$Q_{na} = 3.5 * (N-3) * \{(B+0.3)/2 * B\} * \{(B+0.3)/2 * B\} * w' * F_d$$

N = corrected N

$F_d = 1 + D/B$ less than or equal to 2

CONSTRUCTION OF SHIKSHA BHAWAN (G+4) AT SUPAUL

7.0 METHOD FOR CALCULATION OF CAPACITY OF CAST-IN-SITU PLANE PILE AS PER BIS 2911 Part I/Sec 2-1979

7.1 COHESIVE SOIL

Net ultimate bearing capacity of pile is given by :

$$Q = A_p * N_c * C_p + a * C * A_s$$

A_p = cross sectional area of pile toe in cm²

N_c = Bearing capacity factor usually taken as 9

C_p = average cohesion at pile tip in Kg/cm

a = reduction factor

C = average cohesion throughout the length of pile in kg/cm²

A_s = surface area of pile shaft in cm²

8.0 METHOD FOR CALCULATION OF CAPACITY OF CAST-IN-SITU PLANE PILE AS PER BIS 2911 Part III-1980

8.1 COHESIVE SOIL

Net ultimate bearing capacity of pile is given by :

$$Q = A_p * N_c * C_p + A_a * N_c * C'_a + C'_a * A_s' + \alpha * C_a * A_s$$

A_p = cross sectional area of pile toe in cm²

N_c = Bearing capacity factor usually taken as 9

C_p = cohesion of soil around toe.

α = reduction factor

$$A_a = \pi * (D_u^2 - D^2) / 4$$

C'_a = average cohesion around under ream

D_u = dia of under-ream, D = dia of pile

A_s = surface area of pile shaft in cm²

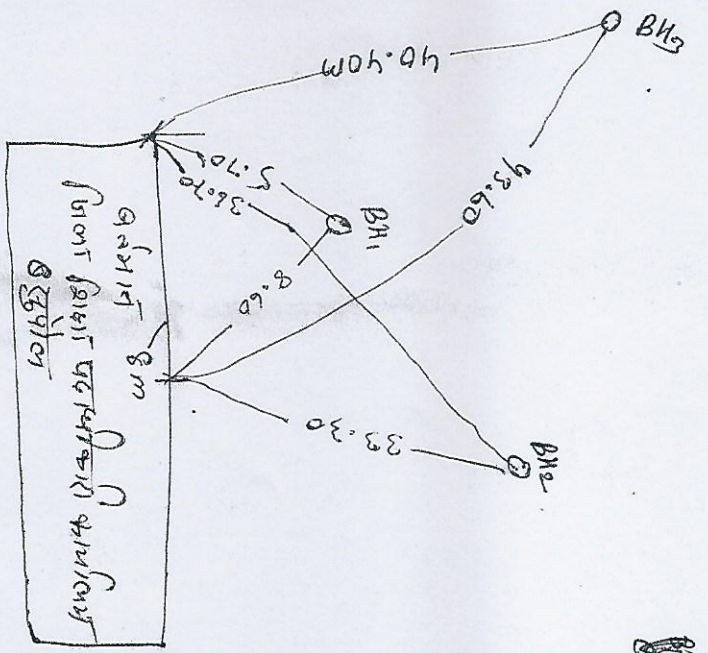
A_s' = surface area of stem

A_s' = surface area of the cylinder circumscribing the under ream.

1990

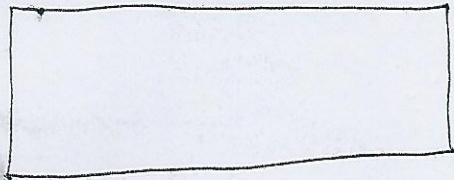
1991

Siksha Bhawan of Supaul



1991

1990



25/05/2023
 J.E
 BSE/DL KSM

(5)

25/5



SAMPLE NO	DEPTH OF SAMPLE	SPT BLOWS PER 30 CM		STANDARD PENETRATION RESISTANCE CURVE	VISUAL DESCRIPTION OF SOIL WITH B.S. CLASSIFICATION	GRAIN SIZE ANALYSIS				ATTERBERG'S LIMITS			DENSITY		NATURAL MOISTURE CONTENT (%)	SPECIFIC GRAVITY	TYPE OF TEST	SHEAR TEST				UNCONFINED COMPRESSION TEST, q _u (kg/cm ²)	COEFFICIENT OF VOLUME COMPRESSION CM ³ /KG	
		OBSERVED VALUE	CORRECTED VALUE			GRAVEL (%)	SAND (%)	SILT (%)	CLAY (%)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	BULK DENSITY (gm/cm ³)	DRY DENSITY (gm/cm ³)				VOID RATIO e ₀	COMPRESSION INDEX C _c	ANGLE OF FRICTION IN DEGREE	COHESION c (kg/cm ²)			
DS	G.L.			5 10 20																				
DS1					SILTY SAND SP/SM																			
SPT1	1.5	9			SAND 0.5 55.60 43.9	NON-PLASTIC	NON-PLASTIC	NON-PLASTIC	NON-PLASTIC	1.97	1.71	15.4	2.60	DST	0	28.0								
DS2					SILTY SAND SP/SM																			
SPT2	3	9			SAND 0.0 58.30 41.7	NON-PLASTIC	NON-PLASTIC	NON-PLASTIC	NON-PLASTIC	1.97	1.68	17.5	2.60											
DS3					SAND SP																			
SPT3	4.5	10			SAND 0.0 96.70 3.3	NON-PLASTIC	NON-PLASTIC	NON-PLASTIC	NON-PLASTIC	1.94	1.72	12.5	2.70	DST	0	29.00								
DS4					SAND SP																			
SPT4	6	11			SAND 0.0 96.40 3.6	NON-PLASTIC	NON-PLASTIC	NON-PLASTIC	NON-PLASTIC	1.94	1.71	13.6	2.70											
UUT : UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST		UCT : UNCONFINED COMPRESSION SHEAR TEST																					DST : DIRECT SHEAR TEST	
! SAMPLE SLIPPED ~ TEST ON REMOULDED SAMPLE		UDS : UNDISTURBED SAMPLE																					SPT : STANDARD PENETRATION TEST VALUE	

NOTES : CONSOLIDATION TEST RESULTS ARE FOR THE LOADING RANGE OF 5.0-10.0 t/m²

SHAMWI CONSULTANTS 414 J.T.C., FRASE R ROAD, PATNA			NAME OF PROJECT : SOIL INVESTIGATION FOR CONSTRUCTION OF SHIKSHA BHAWAN (G+4) AT SUPAUL										BORING DATES START : 25.05.2023 FINISH : 25.05.2023		TERMINATION DEPTH : 15.0m WATER TABLE DEPTH : 3.0M		TABLE NO : 3 BORE HOLE NO : BH1												
SAMPLE NO	DEPTH OF SAMPLE	SPT BLOWS PER 30 CM		STANDARD PENETRATION RESISTANCE CURVE			VISUAL DESCRIPTION OF SOIL WITH B.I.S CLASSIFICATION	GRAIN SIZE ANALYSIS				ATTERBERG'S LIMITS			DENSITY		NATURAL MOISTURE CONTENT (%)		SPECIFIC GRAVITY	TYPE OF TEST	SHEAR TEST			UNCONFINED COMPRESSION TEST, q _u kg/cm ²	COEFFICIENT OF VOLUME COMPRESSIONITY M _v cm ³ /kg				
		OBSERVED VALUE	CORRECTED VALUE	5	10	20		GRAVEL (%)	SAND (%)	SILT (%)	CLAY (%)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	BULK DENSITY (gm/cm ³)	DRY DENSITY (gm/cm ³)	NATURAL MOISTURE CONTENT (%)	GRAVEL (%)			ANGLE OF FRICTION IN DEGREE	COHESION c (kg/cm ²)	VOID RATIO e _o			COMPRESSION INDEX I _p			
DS5							SAND SP	0.0	97.20	2.8					1.96	1.73	13.4	2.68		DST	0	30.00							
SPT5 7.5	34						SAND SP	0.0	96.90	3.1					1.96	1.73	13.1	2.68											
DS6							SAND SP	0.0	92.30	6.8					1.96	1.72	13.8	2.68		DST	0	30.00							
SPT6 9.0	20						SAND SP	0.0	91.90	8.1					1.96	1.72	13.8	2.68											
DS7							SAND SP	0.0	91.90	8.1					1.96	1.72	13.8	2.68											
SPT7 10.5	29						SAND SP	0.0	91.90	8.1					1.96	1.72	13.8	2.68											
DS8							SAND SP	0.0	91.90	8.1					1.96	1.72	13.8	2.68											
SPT8 12.0	25						SAND SP	0.0	91.90	8.1					1.96	1.72	13.8	2.68											
UUT : UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST		UCT : UNCONFINED COMPRESSION SHEAR TEST														DST : DIRECT SHEAR TEST													
I SAMPLE SLIPPED ~ TEST ON REMOULDED SAMPLE		UDS : UNDISTURBED SAMPLE														SPT : STANDARD PENETRATION TEST VALUE													
NOTES : CONSOLIDATION TEST RESULTS ARE FOR THE LOADING RANGE OF 5.0-10.0 t/m ²																													

SHAMVI CONSULTANTS 414J.T.C.,FRASE R ROAD, PATNA		NAME OF PROJECT : SOIL INVESTIGATION FOR CONSTRUCTION OF SHIKSHA BHAWAN (G+4) AT SUPPAUL															TABLE NO :4														
		BORING DATES START :20.05.2004 FINISH :21.05.2004		TERMINATION DEPTH :15		BORE HOLE NO :BH1		SHEAR TEST								UNCONFINED COMPRESSION TEST		COEFFICIENT OF VOLUME COMPRESSIONITY M_v													
SAMPLE NO	DEPTH OF SAMPLE	SPT BLOWS PER 30 CM		GRAIN SIZE ANALYSIS					CONSISTENCY LIMITS			DENSITY		NATURAL MOISTURE CONTENT (%)		SPECIFIC GRAVITY		TYPE OF TEST	COHESION c (kg/cm ²)	ANGLE OF FRICTION IN DEGREE	VOID RATIO e_0	COMPRESSION INDEX C_c	UNCONFINED COMPRESSION TEST q_u (kg/cm ²)	COEFFICIENT OF VOLUME COMPRESSIONITY M_v (cm ³ /kg)							
		OBSERVED VALUE	CORRECTED VALUE	GRAVEL (%)	SAND (%)	SILT (%)	CLAY (%)	LIQUID LIMIT	PLASTIC LIMIT	SHRINKAGE LIMIT	BULK DENSITY (gm/cm ³)	DRY DENSITY (gm/cm ³)	GRAVEL (%)	SAND (%)	SILT (%)	CLAY (%)	LIQUID LIMIT								PLASTIC LIMIT	SHRINKAGE LIMIT					
DS9																															
SPT9	13.5	32		0.0	92.60	7.4					NON-PLASTIC	1.96	1.74	12.6	2.68																
DS10																															
SPT10	15.0	41		0.0	92.80	7.2					NON-PLASTIC	1.96	1.74	12.5	2.68																
UUT : UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST		UCT : UNCONFINED COMPRESSION SHEAR TEST															DST : DIRECT SHEAR TEST														
I SAMPLE SLIPED ~ TEST ON REMOULDED SAMPLE		UDS : UNDISTURBED SAMPLE															SPT : STANDARD PENETRATION TEST VALUE														
NOTES : CONSOLIDATION TEST RESULTS ARE FOR THE LOADING RANGE OF 5.0-10.0 t/m ²																															

SHAMVI CONSULTANTS 414J.T.C.,FRASE R ROAD, PATNA		NAME OF PROJECT : SOIL INVESTIGATION FOR CONSTRUCTION OF SHIKSHA BHAWAN (G+4) AT SUPAUL												TABLE NO :5													
SAMPLE NO	DEPTH OF SAMPLE	SPT BLOWS PER 30 CM		STANDARD PENETRATION RESISTANCE CURVE				VISUAL DESCRIPTION OF SOIL WITH B.I.S CLASSIFICATION	GRAIN SIZE ANALYSIS				ATTERBERG'S LIMITS			DENSITY		NATURAL MOISTURE CONTENT (%)		SPECIFIC GRAVITY		SHEAR TEST		CONSISTENCY LIMITS		UNCONFINED COMPRESSION TEST ,q _c kg/cm ²	COEFFICIENT OF VOLUME COMPRESSIONITY M _v cm ³ /kg
		OBSERVED VALUE	CORRECTED VALUE	5	10	20	GRAVEL (%)		SAND (%)	SILT (%)	CLAY (%)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	BULK DENSITY (gm/cm ³)	DRY DENSITY (gm/cm ³)	NATURAL MOISTURE (%)	GRAVITY	TYPE OF TEST	COHESION c (kg/cm ²)	ANGLE OF FRICTION IN DEGREE	VOID RATIO e _o	COMPRESSION INDEX C _c				
DS	G.L.																										
DS1																											
SPT1	1.5	7					0.5	55.10	44.4				NON-PLASTIC	1.97	1.72	14.8	2.60		DST	0	28.0						
DS2																											
SPT2	3	8					0.0	57.80	42.2				NON-PLASTIC	1.97	1.67	18.1	2.60										
DS3																											
SPT3	4.5	11					0.0	96.40	3.6				NON-PLASTIC	1.94	1.73	12.3	2.70		DST	0	29.00						
DS4																											
SPT4	6	31					0.0	96.50	3.5				NON-PLASTIC	1.94	1.72	12.7	2.70										
UUT : UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST								UCT : UNCONFINED COMPRESSION SHEAR TEST				DST : DIRECT SHEAR TEST															
1 SAMPLE SLIPPED		~ TEST ON REMOULDED SAMPLE						UDS : UNDISTURBED SAMPLE																		SPT : STANDARD PENETRATION TEST VALUE	

NOTES : CONSOLIDATION TEST RESULTS ARE FOR THE LOADING RANGE OF 5.0-10.0 t/m²

SHAMVVI CONSULTANTS 414J.T.C.,FRASE R ROAD, PATNA		NAME OF PROJECT : SOIL INVESTIGATION FOR CONSTRUCTION OF SHIKSHA BHAWAN (G+4) AT SUPAUL										BORING TERMINATION DEPTH : 15.0m			TABLE NO : 6																
SAMPLE NO	DEPTH OF SAMPLE	SPT BLOWS PER 30 CM		STANDARD PENETRATION RESISTANCE CURVE			VISUAL DESCRIPTION OF SOIL WITH B.S. CLASSIFICATION	GRAIN SIZE ANALYSIS				ATTERBERG'S LIMITS			DENSITY		NATURAL MOISTURE CONTENT (%)			SPECIFIC GRAVITY	TYPE OF TEST	COHESION c (kg/cm ²)	ANGLE OF FRICTION IN DEGREE	CONSISTENCY LIMITS		UNCONFINED COMPRESSION TEST q _u (kg/cm ²)	COEFFICIENT OF VOLUME COMPRESSION M _v (cm ³ /kg)				
		OBSERVED VALUE	CORRECTED VALUE	5	10	20		GRAVEL (%)	SAND (%)	SILT (%)	CLAY (%)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	BULK DENSITY (gm/cm ³)	DRY DENSITY (gm/cm ³)	WATER TABLE DEPTH : 3.0M	VOID RATIO e	COMPRESSION INDEX I _p					BORE HOLE NO : BH2							
DS5							SAND SP																								
SPT5	7.5	31					SAND SP	0.0	96.80	3.2			NON-PLASTIC	1.96	1.73	13.1	2.68					DST	0	30.00							
DS6							SAND SP																								
SPT6	9.0	29					SAND SP	0.0	96.90	3.1			NON-PLASTIC	1.96	1.73	13.1	2.68														
DS7							SAND SP																								
SPT7	10.5	24					SAND SP	0.9	92.50	6.6			NON-PLASTIC	1.96	1.72	14.1	2.68					DST	0	30.00							
DS8							SAND SP																								
SPT8	12.0	26					SAND SP	0.0	92.20	7.8			NON-PLASTIC	1.96	1.73	13.5	2.68														
UUT : UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST		UCT : UNCONFINED COMPRESSION SHEAR TEST		DST : DIRECT SHEAR TEST				DST : STANDARD PENETRATION TEST VALUE																							
I SAMPLE SLIPED ~ TEST ON REMOULDED SAMPLE		UDS : UNDISTURBED SAMPLE										SPT : STANDARD PENETRATION TEST VALUE																			
NOTES : CONSOLIDATION TEST RESULTS ARE FOR THE LOADING RANGE OF 5.0-10.0 t/m ²																															

SHAMWVI CONSULTANTS 4141.T.C., FRASE R ROAD, PATNA		NAME OF PROJECT : SOIL INVESTIGATION FOR CONSTRUCTION OF SHIKSHA BHAWAN (G+4) AT SUPAUL										BORING DATES START :20.05.2004 FINISH :21.05.2004		TERMINATION DEPTH :15 WATER TABLE DEPTH :1.9		TABLE NO :7 BORE HOLE NO :BH1												
SAMPLE NO	DEPTH OF SAMPLE	SPT BLOWS PER 30 CM	STANDARD PENETRATION RESISTANCE CURVE			VISUAL DESCRIPTION OF SOIL WITH B.I.S. CLASSIFICATION	GRAIN SIZE ANALYSIS				CONSISTENCY LIMITS			DENSITY		NATURAL MOISTURE CONTENT (%)		SPECIFIC GRAVITY		SHEAR TEST		CONSISTENCY LIMITS		UNCONFINED COMPRESSION TEST 'q' kg/cm ²	COEFFICIENT OF VOLUME COMPRESSIONITY M _v cm ³ /kg			
			OBSERVED VALUE	CORRECTED VALUE	5		10	20	GRAVEL (%)	SAND (%)	SILT (%)	CLAY (%)	LIQUID LIMIT	PLASTIC LIMIT	SHRINKAGE LIMIT	BULK DENSITY (gm/cm ³)	DRY DENSITY (gm/cm ³)			ANGLE OF FRICTION IN DEGREE	VOID RATIO e ₀	COMPRESSION INDEX C _c	TYPE OF TEST			COHESION c (kg/cm ²)	ANGLE OF FRICTION IN DEGREE	
DS9																												
SPT9	13.5	32				SAND SP	0.0	92.40	7.6			NON-PLASTIC				1.96	1.73	13.1	2.68		DST	0	30.00					
DS10																												
SPT10	15.0	29				SAND SP	0.0	92.60	7.4			NON-PLASTIC				1.96	1.73	13.2	2.68		DST	0	30.00					
UUT : UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST			UCT : UNCONFINED COMPRESSION SHEAR TEST										DST : DIRECT SHEAR TEST															
I SAMPLE SLIPPED ~ TEST ON REMOULDED SAMPLE			UDS : UNDISTURBED SAMPLE										SPT : STANDARD PENETRATION TEST VALUE															
NOTES : CONSOLIDATION TEST RESULTS ARE FOR THE LOADING RANGE OF 5.0-10.0 t/m ²																												

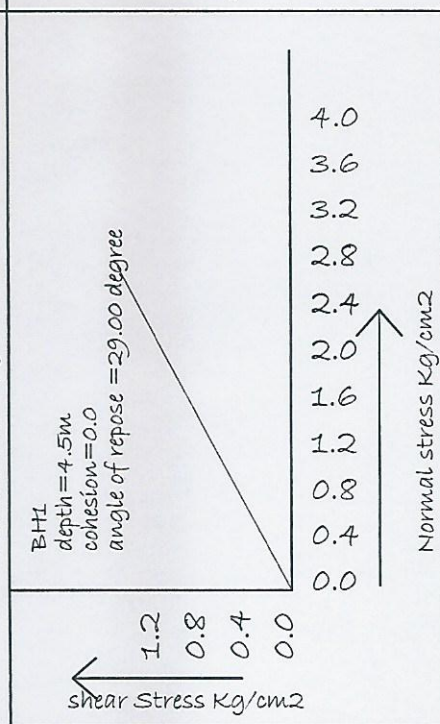
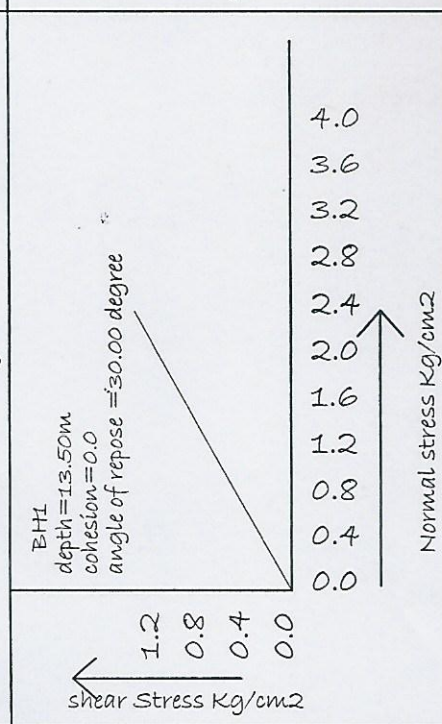
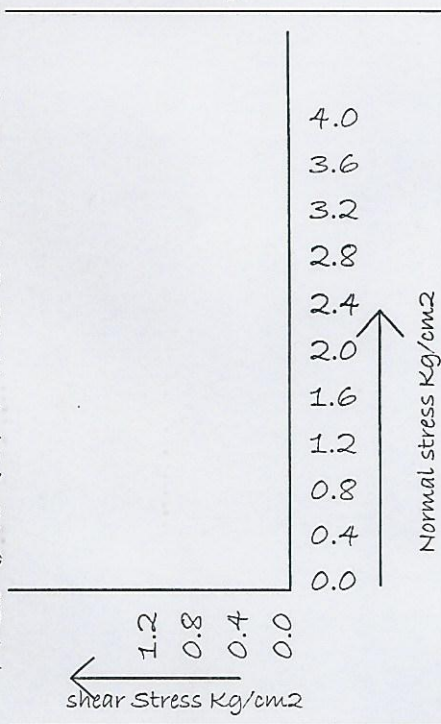
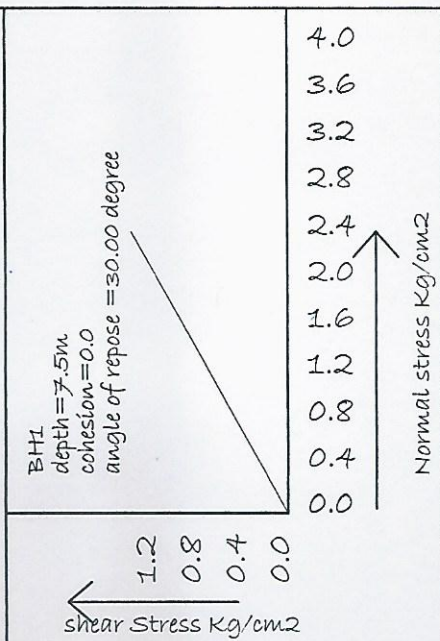
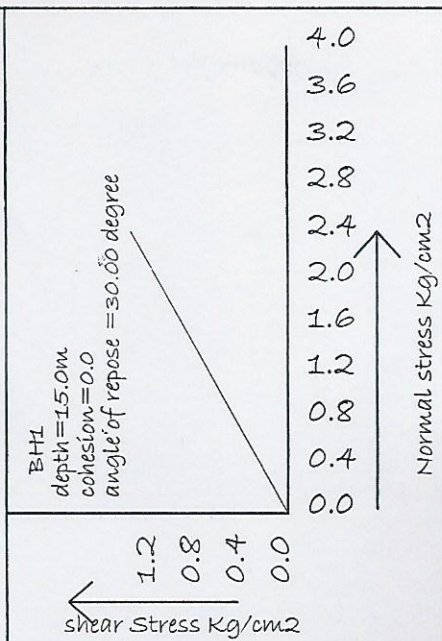
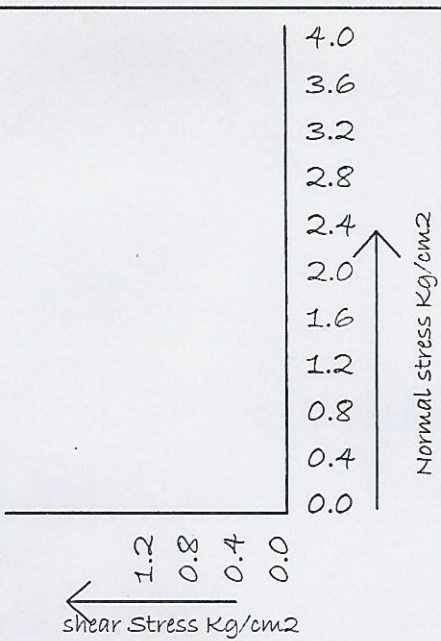
SHAMWMI CONSULTANTS 414J.T.C.FRASE R ROAD, PATNA		NAME OF PROJECT : SOIL INVESTIGATION FOR CONSTRUCTION OF SHIKSHA BHAWAN (G+4) AT SUPAUL										BORING DATES START :25.05.2023 FINISH :26.05.2023		TERMINATION DEPTH :15.0m WATER TABLE DEPTH : 3.0M		TABLE NO :8 BORE HOLE NO :BH3												
SAMPLE NO	DEPTH OF SAMPLE	SPT BLOWS PER 30 CM		STANDARD PENETRATION RESISTANCE CURVE			VISUAL DESCRIPTION OF SOIL WITH B.S. CLASSIFICATION	GRAIN SIZE ANALYSIS				ATTERBERG'S LIMITS			DENSITY		NATURAL MOISTURE CONTENT (%)		SPECIFIC GRAVITY		SHEAR TEST				UNCONFINED COMPRESSION TEST q _c (kg/cm ²)	COEFFICIENT OF VOLUME COMPRESSIONITY M _v (cm ³ /kg)		
		OBSERVED VALUE	CORRECTED VALUE	5	10	20		GRAVEL (%)	SAND (%)	SILT (%)	CLAY (%)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	BULK DENSITY (gm/cm ³)	DRY DENSITY (gm/cm ³)	NATURAL MOISTURE CONTENT (%)	GRAVITY	TYPE OF TEST	COHESION c (kg/cm ²)	ANGLE OF FRICTION IN DEGREE	VOID RATIO e ₀	COMPRESSION INDEX C _c					
DS	G.L.																											
DS1																												
SPT1	1.5	8					0.0	54.60	45.4		NON-PLASTIC	1.97	1.72	14.5	2.60													
DS2																												
SPT2	3	9					0.0	59.80	40.2		NON-PLASTIC	1.97	1.68	17.6	2.60													
DS3																												
SPT3	4.5	12					0.0	96.70	3.3		NON-PLASTIC	1.94	1.72	12.5	2.70													
DS4																												
SPT4	6	33					0.0	96.40	3.6		NON-PLASTIC	1.94	1.72	12.5	2.70													
UUT : UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST							UCT : UNCONFINED COMPRESSION SHEAR TEST				DST : DIRECT SHEAR TEST																	
! SAMPLE SLIPED ~ TEST ON REMOULDED SAMPLE							UDS : UNDISTURBED SAMPLE				SPT : STANDARD PENETRATION TEST VALUE																	
NOTES : CONSOLIDATION TEST RESULTS ARE FOR THE LOADING RANGE OF 5.0-10.0 t/m ²																												

SHAMVMI CONSULTANTS 414J T.C., FRASE R ROAD, PATNA		NAME OF PROJECT : SOIL INVESTIGATION FOR CONSTRUCTION OF SHIKSHA BHAWAN (G+4) AT SUPAUL										BORING DATES START : 25.05.2023 FINISH : 26.05.2023		TERMINATION DEPTH : 15.0m		TABLE NO : 9																
SAMPLE NO	DEPTH OF SAMPLE	SPT BLOWS PER 30 CM		STANDARD PENETRATION RESISTANCE CURVE			VISUAL DESCRIPTION OF SOIL WITH B.I.S. CLASSIFICATION	GRAIN SIZE ANALYSIS				ATTERBERG'S LIMITS			DENSITY		NATURAL MOISTURE CONTENT (%)	SPECIFIC GRAVITY	TYPE OF TEST	COHESION c (kg/cm2)	ANGLE OF FRICTION IN DEGREE	CONSISTENCY LIMITS		UNCONFINED COMPRESSION TEST q _u (kg/cm2)	COEFFICIENT OF VOLUME COMPRESSIBILITY M _v (cm ³ /kg)							
		OBSERVED VALUE	CORRECTED VALUE	5	10	20		GRAVEL (%)	SAND (%)	SILT (%)	CLAY (%)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	BULK DENSITY (gm/cm3)	DRY DENSITY (gm/cm3)						VOID RATIO e _o	COMPRESSION INDEX C _c									
DS5							SAND SP	0.0	96.80	3.2					1.96	1.73	13.5	2.68	DST	0	30.00											
SPT5	7.5	32					SAND SP	0.0	96.90	3.1					1.96	1.73	13.5	2.68														
DS6							SAND SP																									
SPT6	9.0	21					SAND SP																									
DS7							SAND SP																									
SPT7	10.5	25					SAND SP	0.9	92.50	6.6					1.96	1.72	13.7	2.68	DST	0	30.00											
DS8							SAND SP																									
SPT8	12.0	25					SAND SP	0.0	92.20	7.8					1.96	1.73	13.5	2.68														
UUT : UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST		~		TEST ON REMOULDED SAMPLE		UCT : UNCONFINED COMPRESSION SHEAR TEST		UDS : UNDISTURBED SAMPLE		DST : DIRECT SHEAR TEST		SPT : STANDARD PENETRATION TEST VALUE																				

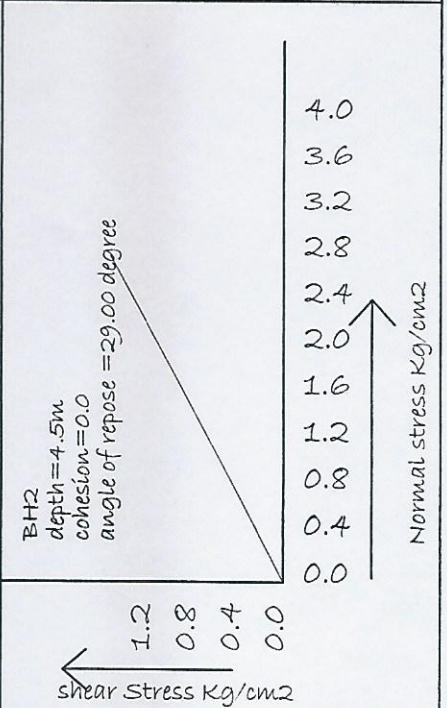
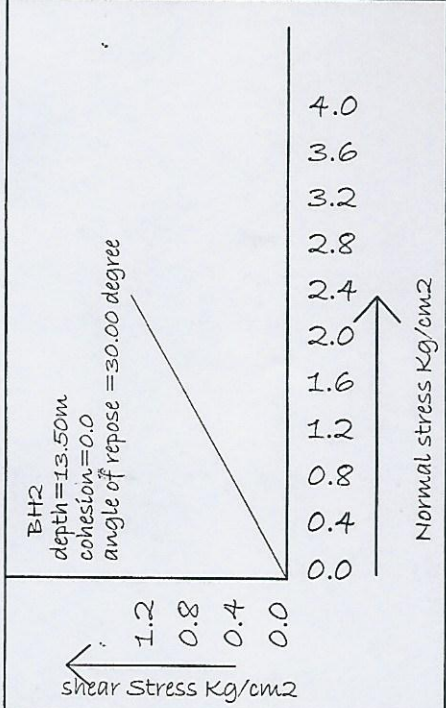
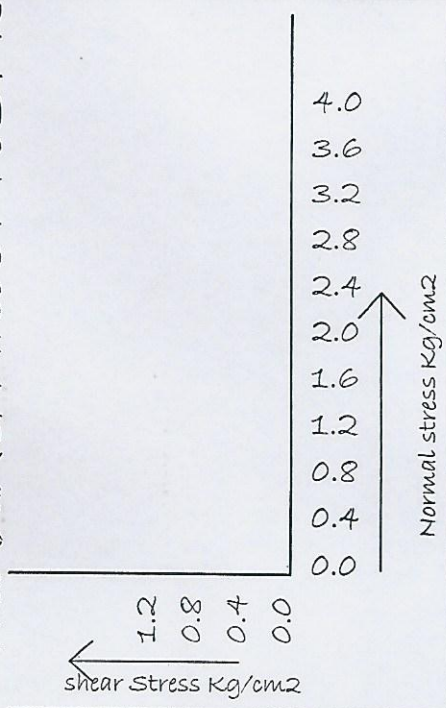
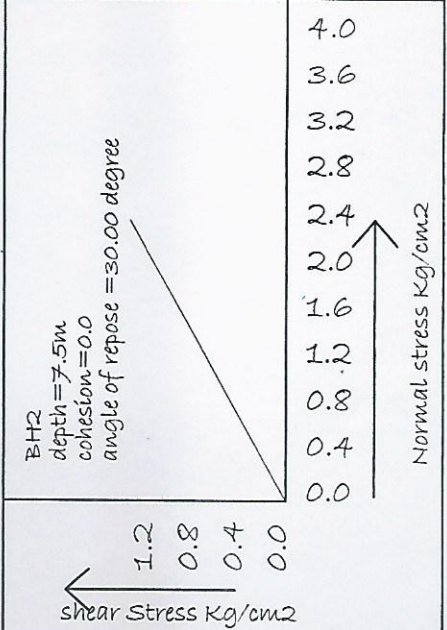
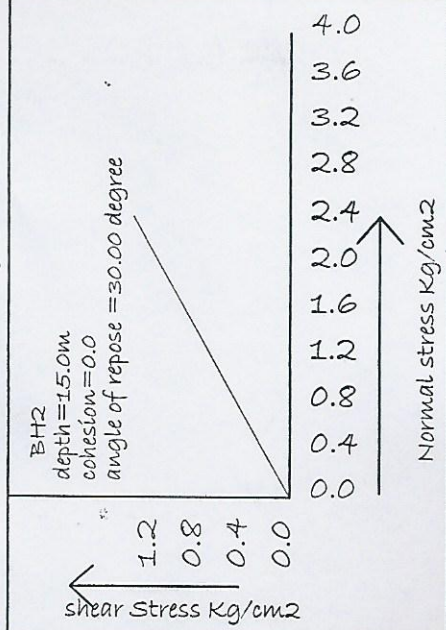
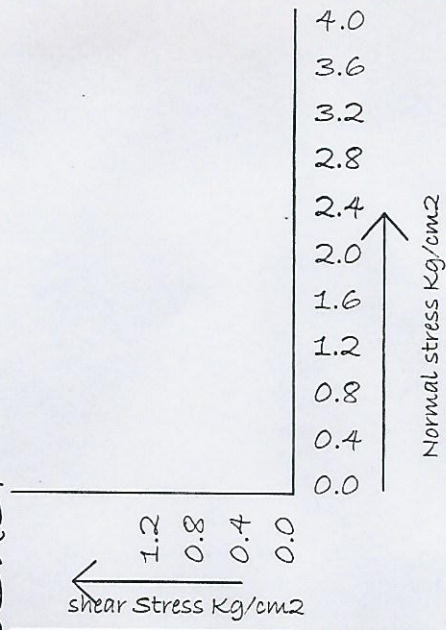
NOTES : CONSOLIDATION TEST RESULTS ARE FOR THE LOADING RANGE OF 5.0-10.0 t/m2

SHAMWI CONSULTANTS 414J.T.C., FRASE R ROAD, PATNA				NAME OF PROJECT : SOIL INVESTIGATION FOR CONSTRUCTION OF SHIKSHA BHAWAN (G+4) AT SUPAUL											BORING DATES		TERMINATION DEPTH : 15		TABLE NO : 10												
															START : 20.05.2004		WATER TABLE DEPTH : 1.9		BORE HOLE NO : BH1												
															FINISH : 21.05.2004																
SAMPLE NO	DEPTH OF SAMPLE	SPT BLOWS PER 30 CM		STANDARD PENETRATION RESISTANCE CURVE			VISUAL DESCRIPTION OF SOIL WITH B.I.S. CLASSIFICATION	GRAIN SIZE ANALYSIS				CONSISTENCY LIMITS			DENSITY		NATURAL MOISTURE CONTENT (%)		SPECIFIC GRAVITY		SHEAR TEST				CONSISTENCY LIMITS		UNCONFINED COMPRESSION TEST		COEFFICIENT OF VOLUME COMPRESSIBILITY m_v		
		OBSERVED VALUE	CORRECTED VALUE	5	10	20		GRAVEL (%)	SAND (%)	SILT (%)	CLAY (%)	LIQUID LIMIT	PLASTIC LIMIT	SHRINKAGE LIMIT	BULK DENSITY (gm/cm ³)	DRY DENSITY (gm/cm ³)	NATURAL MOISTURE CONTENT (%)	SPECIFIC GRAVITY	TYPE OF TEST	COHESION c (kg/cm ²)	ANGLE OF FRICTION IN DEGREE	VOID RATIO e _o	COMPRESSION INDEX C _c	UNCONFINED COMPRESSION TEST q _u	COEFFICIENT OF VOLUME COMPRESSIBILITY m_v						
DS9																															
SPT9	13.5	28					SAND SP	0.0	92.40	7.6				NON-PLASTIC	1.96	1.74	12.9	2.68	2.68				DST	0	30.00						
DS10																															
SPT10	15.0	31					SAND SP	0.0	92.60	7.4				NON-PLASTIC	1.96	1.74	12.5	2.68	2.68				DST	0	30.00						
				UUT : UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST			UCT : UNCONFINED COMPRESSION SHEAR TEST				DST : DIRECT SHEAR TEST																				
! SAMPLE SLIPPED		~ TEST ON REMOULDED SAMPLE		UDS : UNDISTURBED SAMPLE				UUC : UNCONFINED COMPRESSION SHEAR TEST				SPT : STANDARD PENETRATION TEST VALUE																			
NOTES : CONSOLIDATION TEST RESULTS ARE FOR THE LOADING RANGE OF 5.0-10.0 t/m2																															

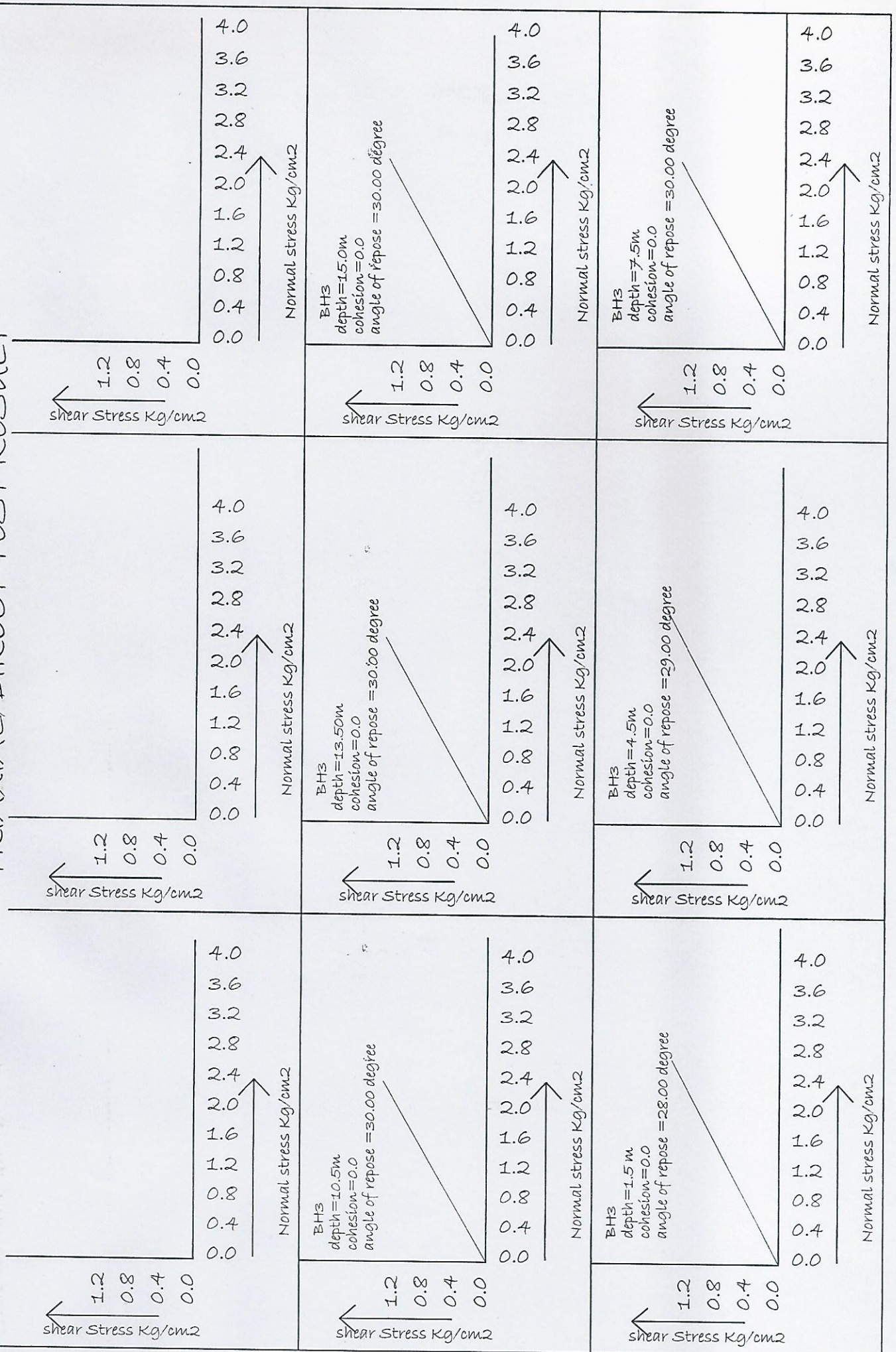
TRIAxIAL/DIRECT TEST RESULT



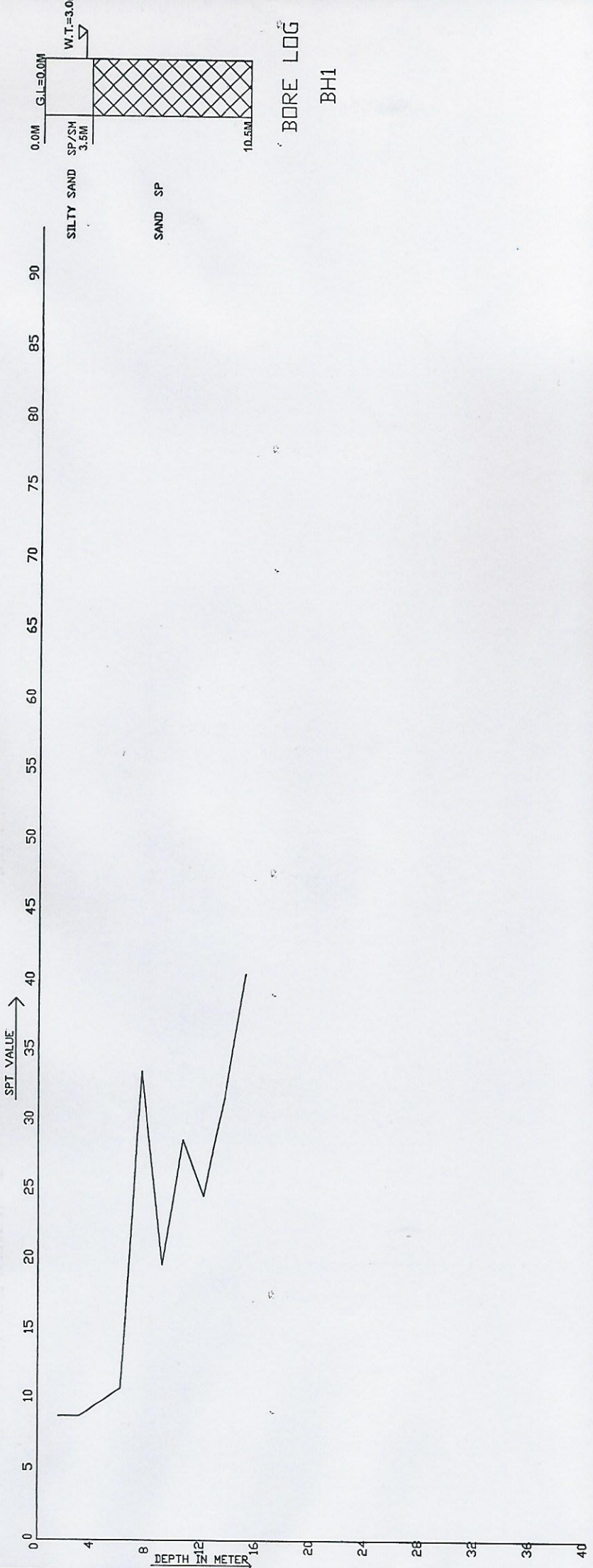
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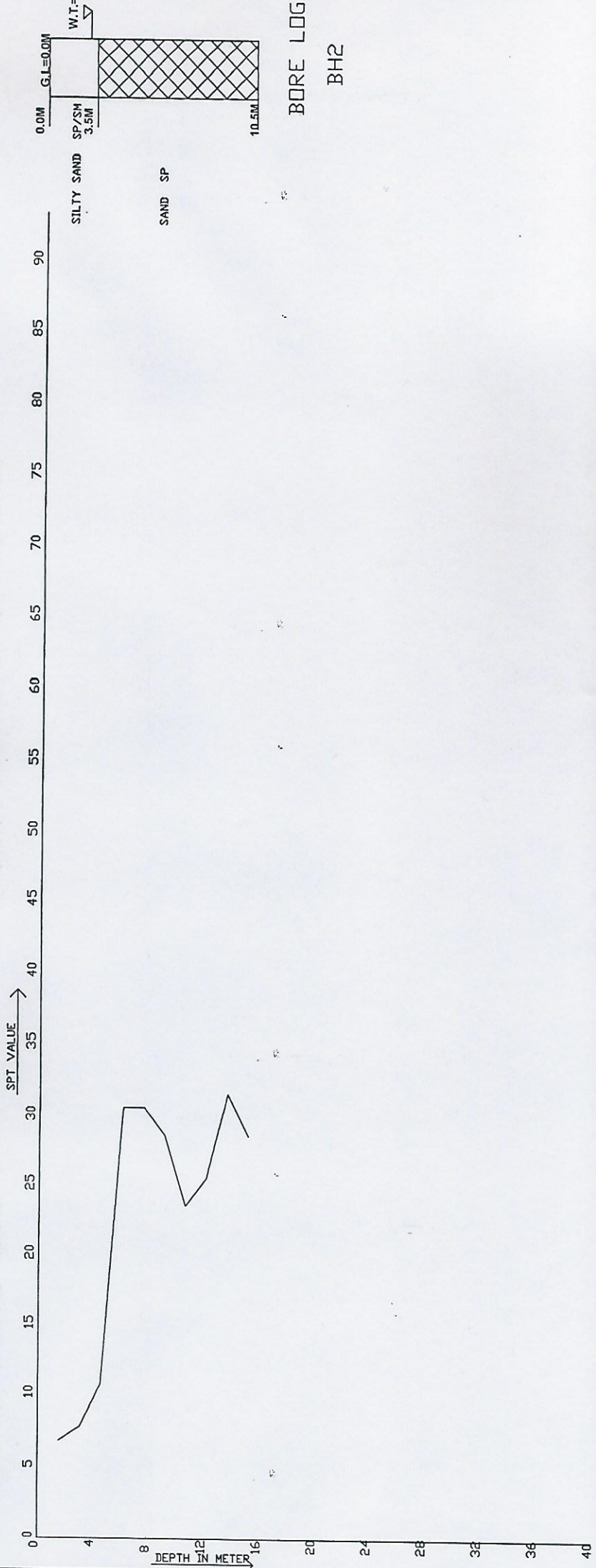
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BORE LOG AND DEPTH ~ SPT GRAPH (CONSTRUCTION OF SHIKSHA BHAWAN (G+4) AT SUPAUL)

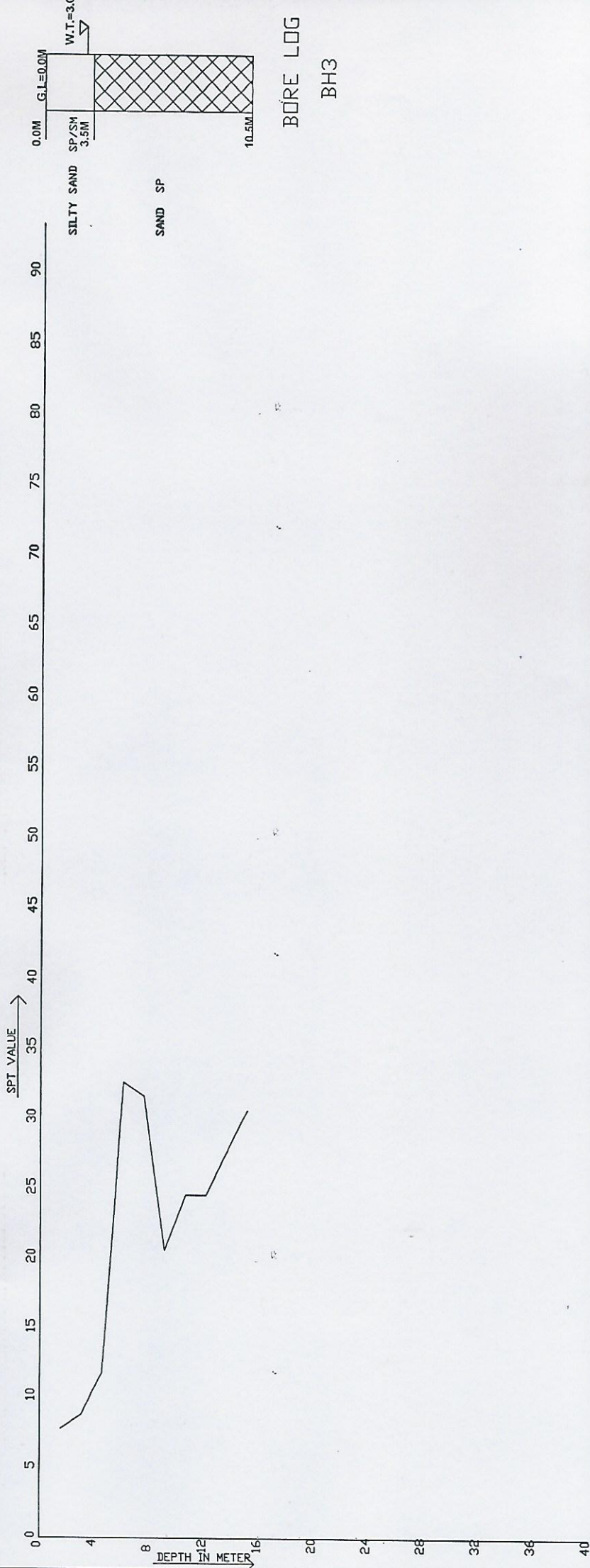


BORE LOG AND DEPTH ~ SPT GRAPH (CONSTRUCTION OF SHIKSHA BHAWAN (G+4) AT SUPAUL)

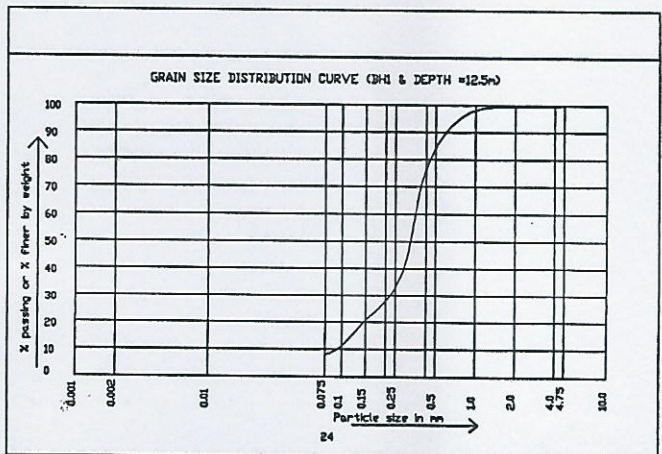
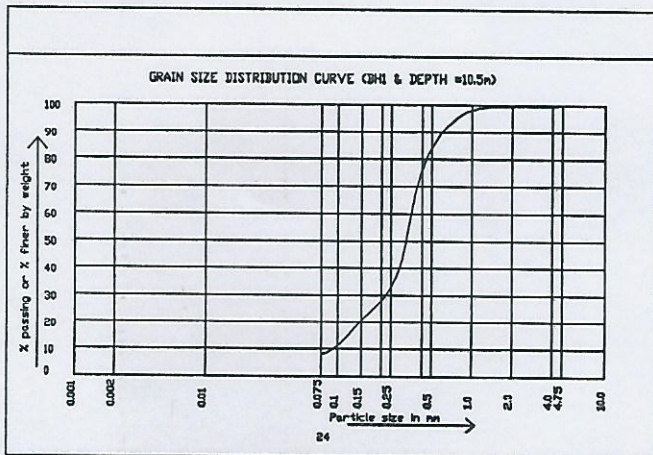
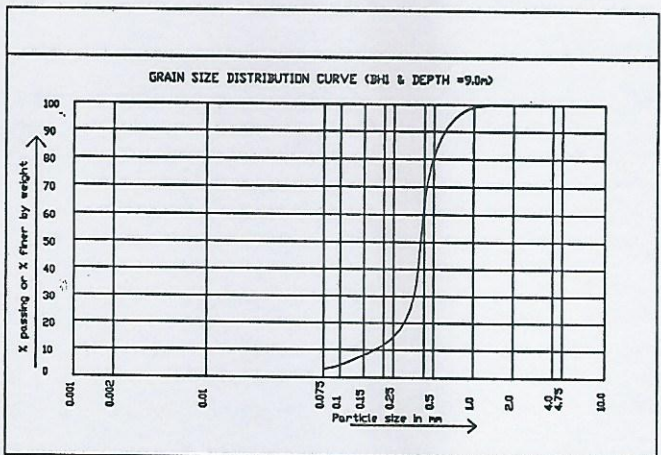
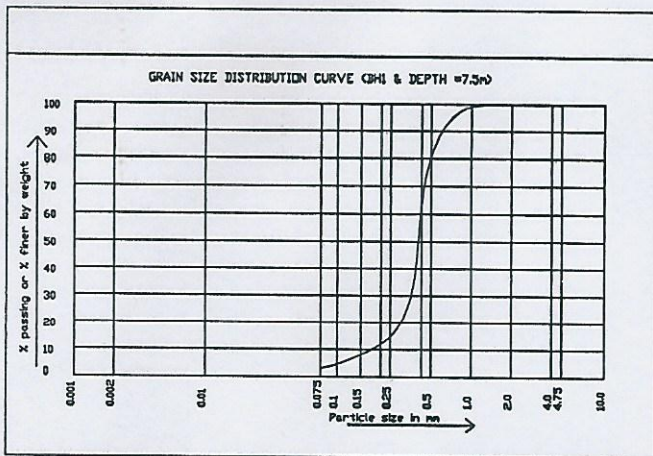
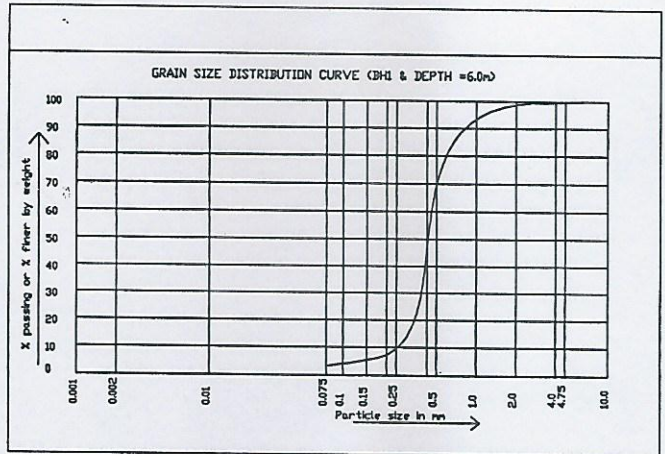
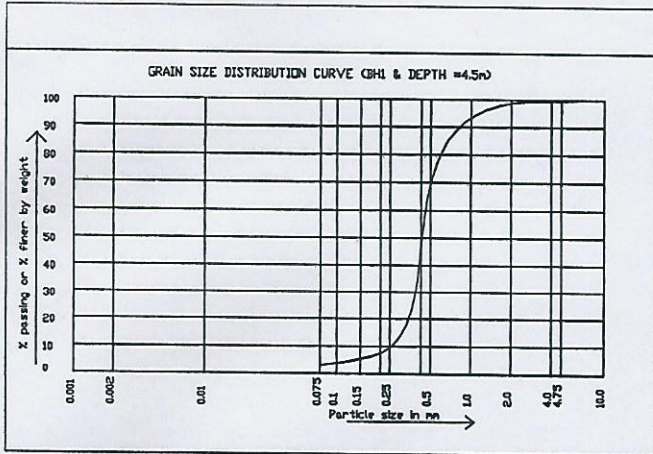
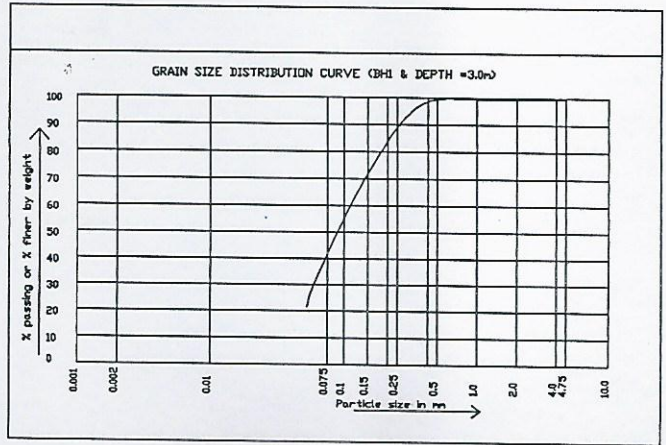
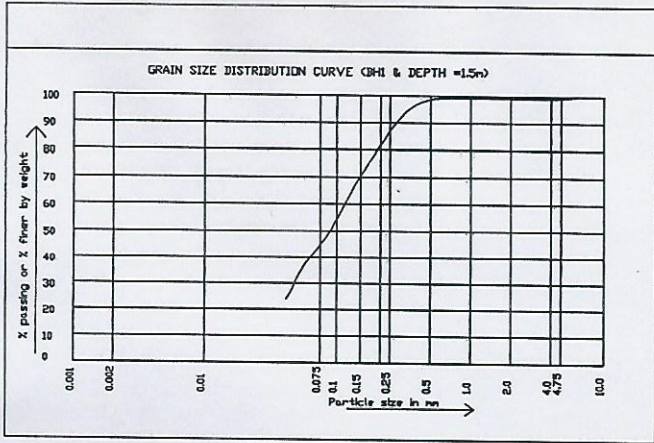


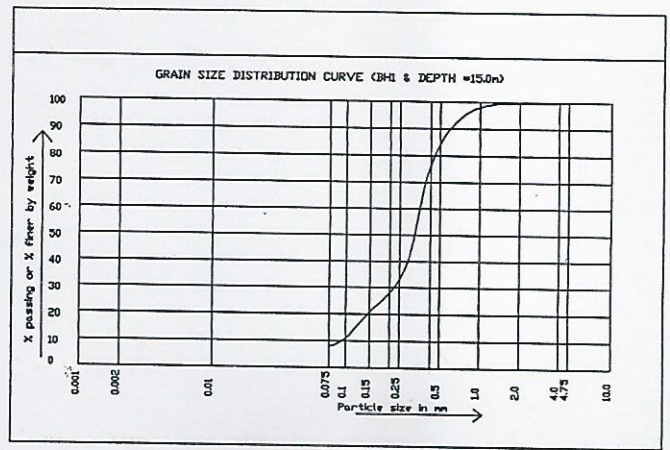
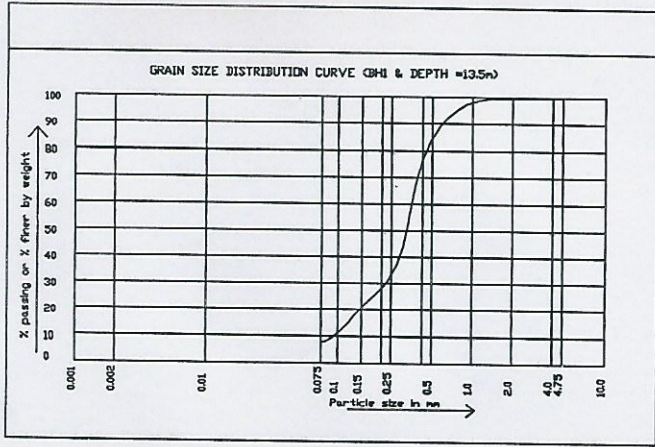
BORE LOG
BH2

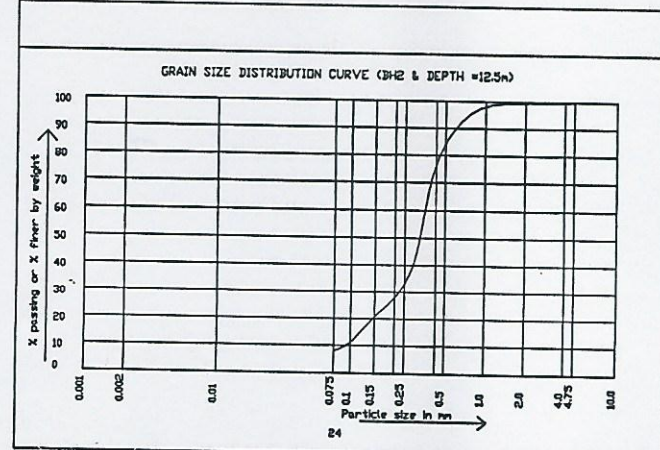
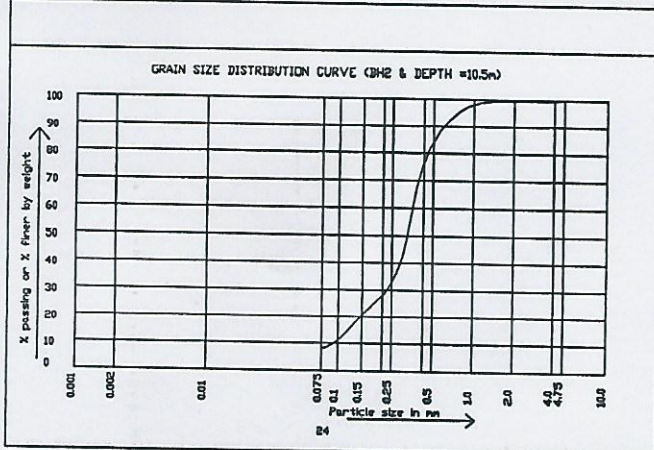
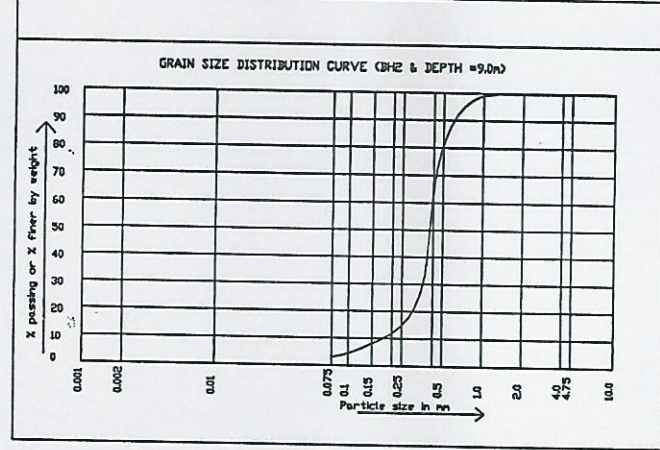
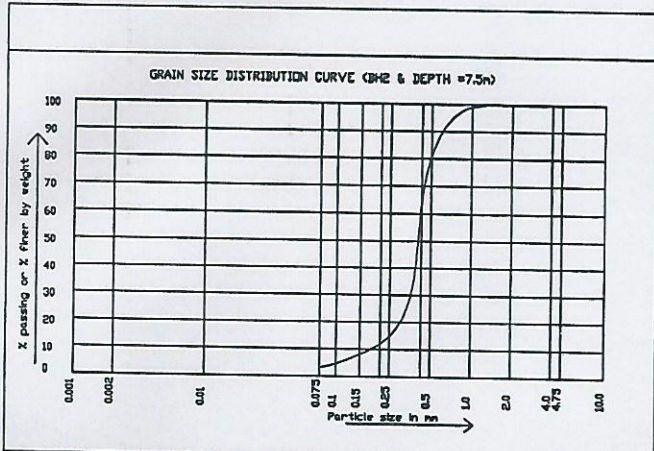
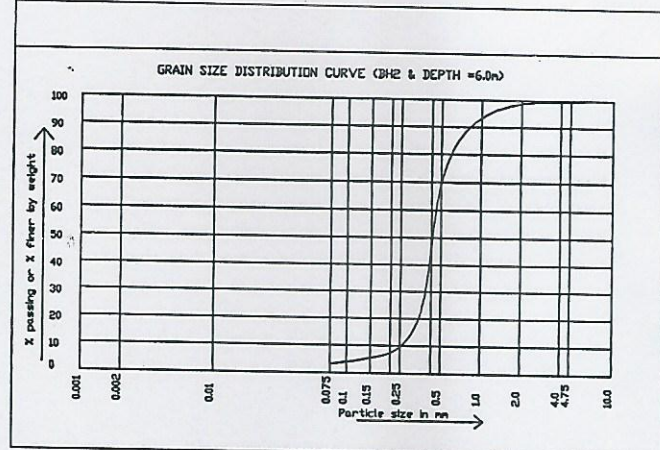
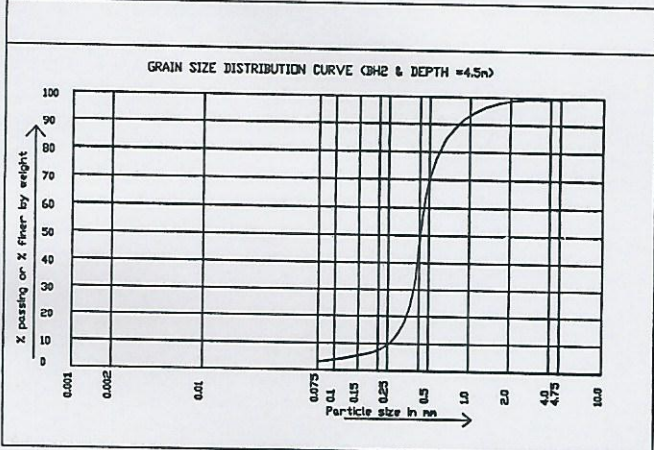
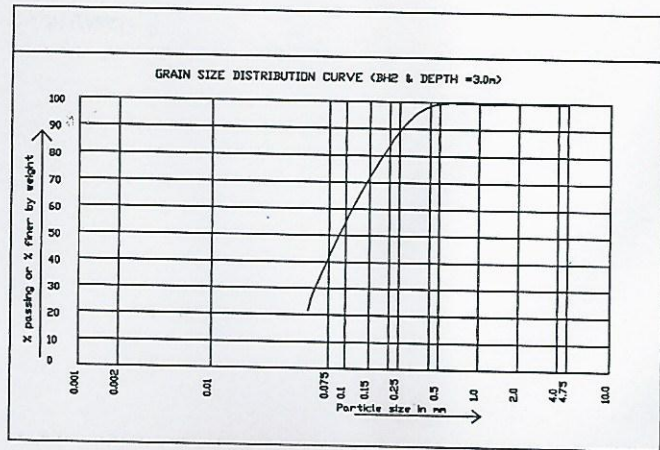
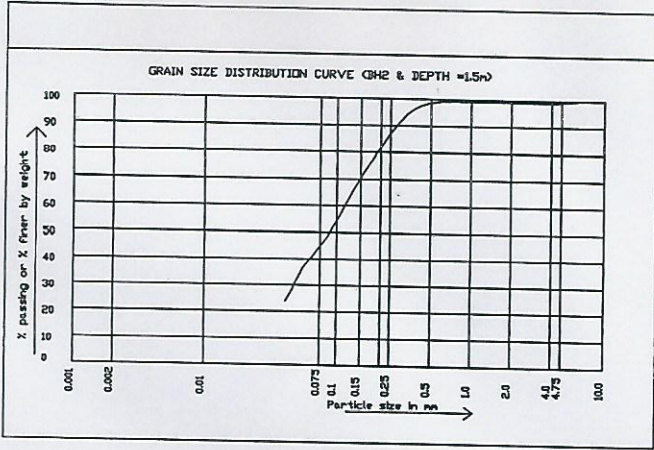
BORE LOG AND DEPTH ~ SPT GRAPH (CONSTRUCTION OF SHIKSHA BHAWAN (G+4) AT SUPAUL .)

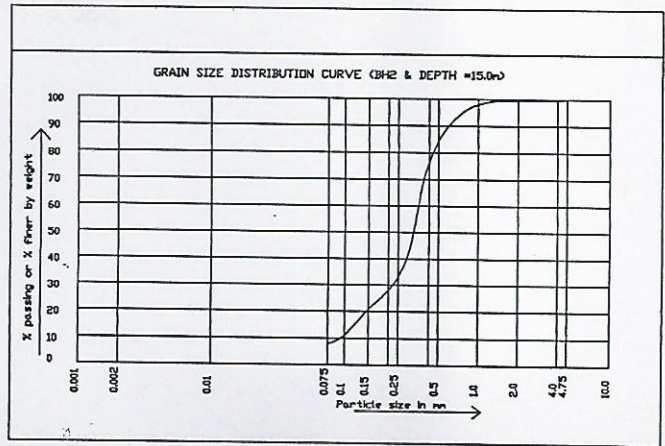
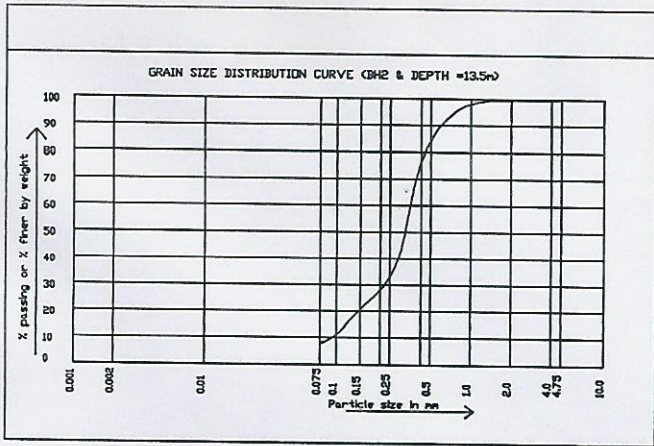


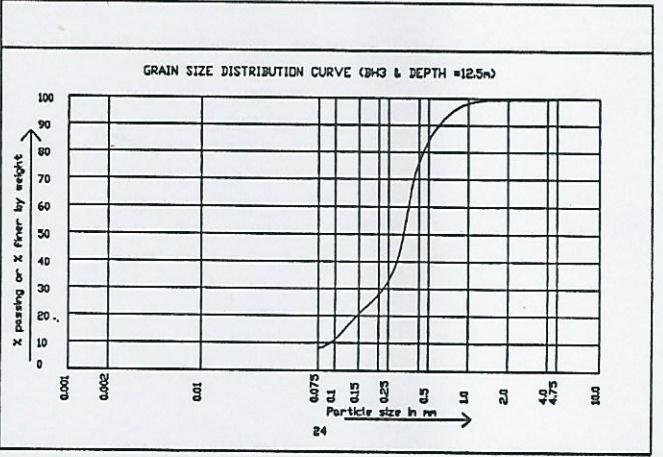
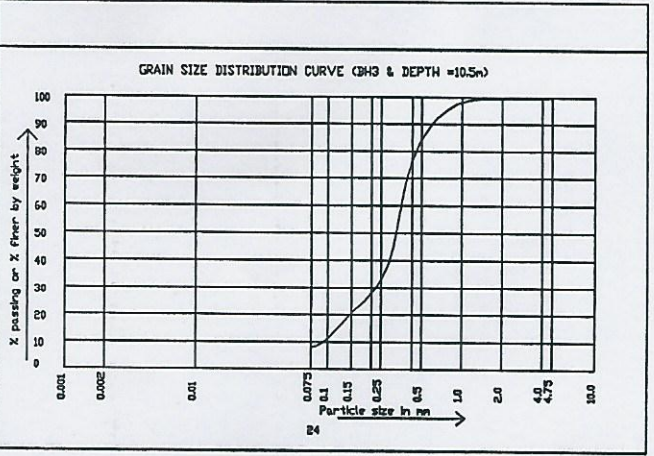
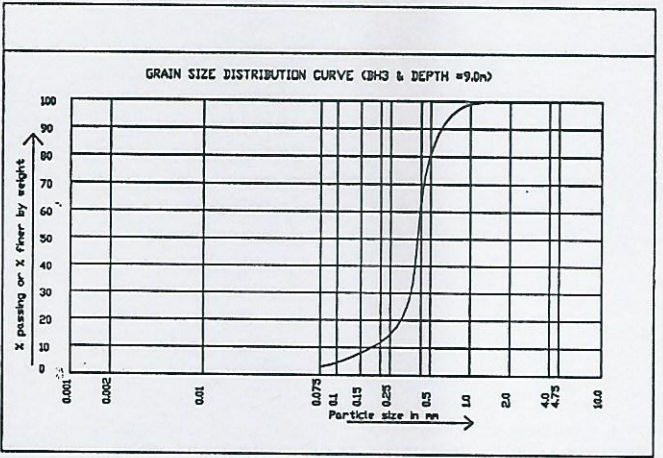
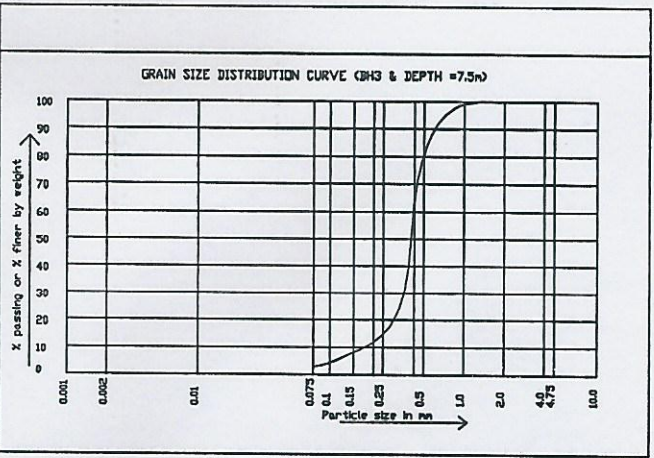
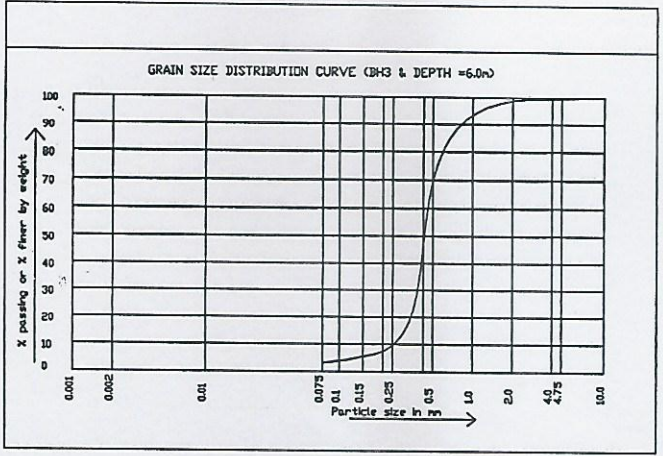
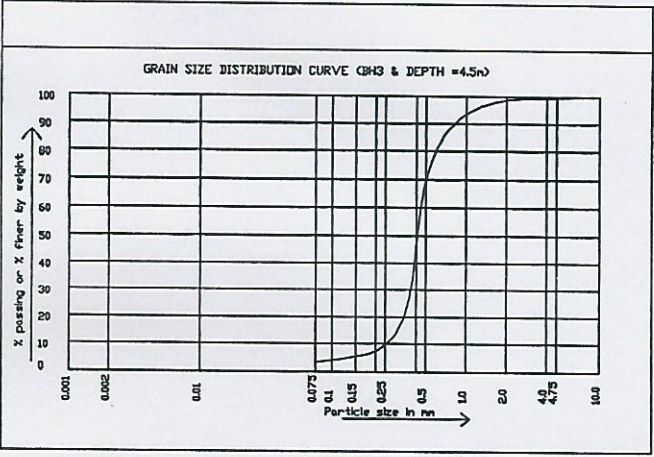
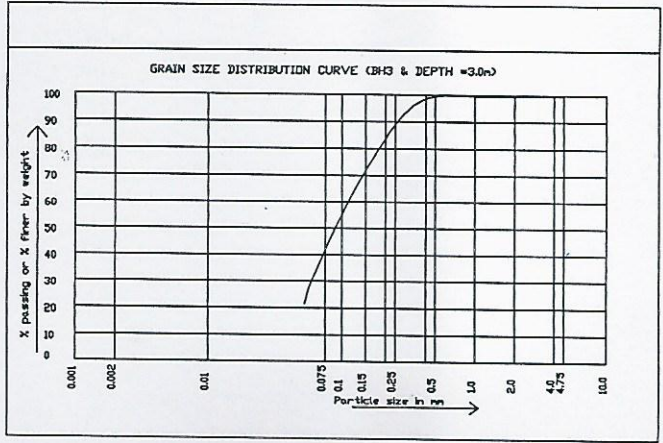
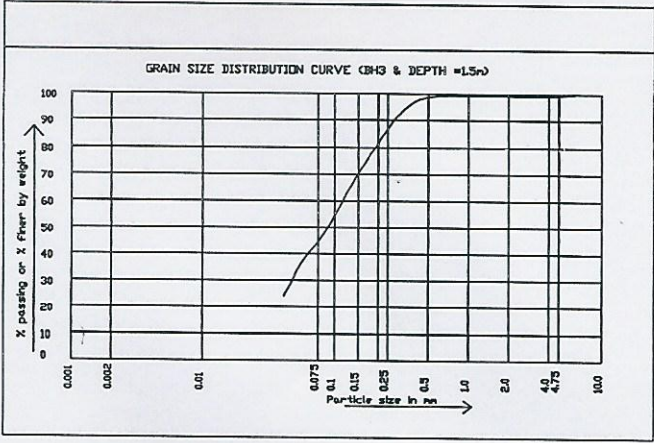
BORE LOG
BH3

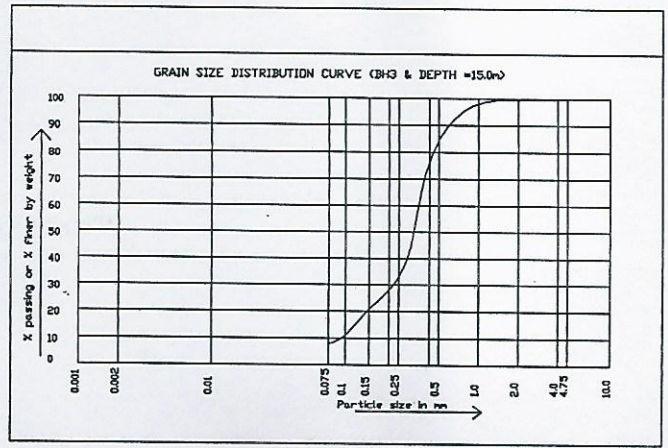
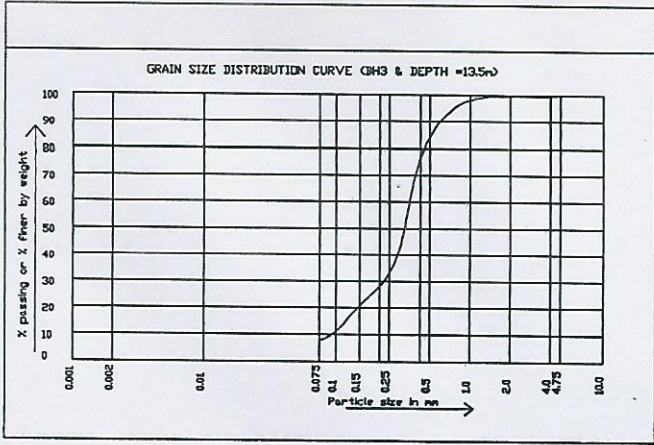












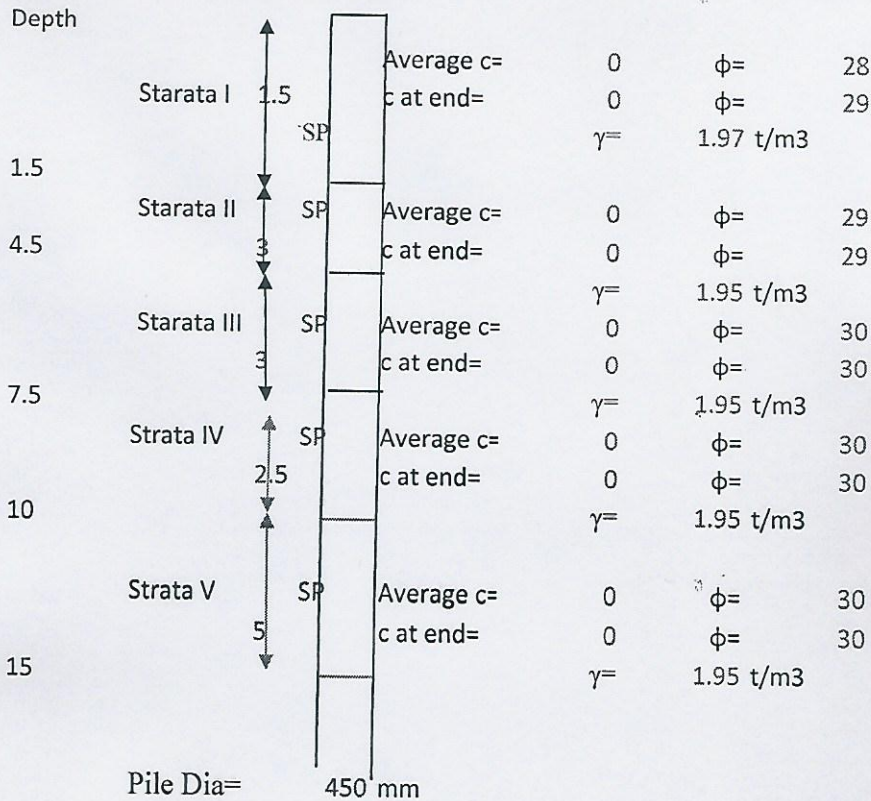
Calculation of Net safe Bearing Capacity for Strip Footing

Table 1 BEARING CAPACITY FACTORS AS PER IS 6403 : 1981

Angle of shearing resistance of soil, phi	Nc	Nq	Ny						
0	5.14	1	0						
5	6.49	1.57	0.45						
10	8.35	2.47	1.22						
15	10.98	3.94	2.65						
20	14.83	6.4	5.39						
25	20.72	10.66	10.88						
30	30.14	18.4	22.4						
35	46.12	33.3	48.03						
40	75.31	64.2	109.41						
45	138.88	134.88	271.76						
50	266.89	319.07	762.89						
Depth of footing below GL in meter D=	3								
Width of footing in meter, B=	2								
				Water Table considered=		1.5 m below GL			
Effective depth of soil formation contributing in	4.33								
Average cohesion of soil mobilised in Ton/m2=	0.00								
unit weight of soil in ton/m2, γ=	1.94								
Angle of shearing resistance of soil, phi, in degree =	28.00			Corresponding Nc/N'c=	14.53	Corresponding Nq/N'q=	6.21	Corresponding Ny/N'y=	5.18
Effective Angle of shearing resistance of soil, phi, in degree =	19.61			Corresponding Nc/N'c=	14.53	Corresponding Nq/N'q=	6.21	Corresponding Ny/N'y=	5.18
Depth factor, dc=	1.43	dc=1+0.2*(Df/B)*tan(45+phi/2)							
Depth factor, dq=	1.21	dq=1+0.1*(Df/B)*tan(45+phi/2) if phi >10 otherwise dq=1							
Depth factor, dy=	1.21	dy=1+0.1*(Df/B)*tan(45+phi/2) if phi >10 otherwise dy=1							
effective surcharge at base level of foundation, q=yD	4.3	q=yD							
Q1 ton/m2 =	0.00	Q1=(2/3)*c*N'c*dc							
Q2 ton/m2 =	27.108	Q2=q*(N'q-1)*dq							
Q3 ton/m2 =	5.89	Q3=(1/2)*B*γ*N'y*dy*W'							
ultimate bearing capacity Q ton/m2 =	33.00	Q=Q1+Q2+Q3							
Factor of safety, F.S. =	3								
Net Safe Bearing Capacity in ton/m2 q=	11.00	q=Q1/F.S.							

Calculation of Net safe Bearing Capacity for Isolated Square/Rectangular Footing										
Footing size	Length L in meter	Width B in meter								
	1.5	1.5								
Shape factors	Sc	Sq	Sy							
	1.3	1.2	0.8							
Q1 ton/m2 =	0.00	Q1=(2/3)*c*N*c*dc*S								
Q2 ton/m2 =	32.53	Q2=q*(Nq-1)*dq*Sq								
Q3 ton/m2 =	4.71	Q3=(1/2)*B*y*N*y*dy *Sy*W								
ultimate bearing capacity Q ton/m2 =	37.24	Q=Q1+Q2+Q3								
Factor of safety, F.S. =	3									
Net Safe Bearing Capacity in ton/m2 q=	12.41	q=Q1/F.S.								

Pile Design



A_p = base area = 0.159 m²

Overburden Pressure corresponding to L(6.75m) = 6.5475 t/m²

Strata I

ϕ	Nc	Nq	Ny	Average c=	c at end	α	γ
28	26.37	15.300	17.79	0	0	1.00	1.97

Top of Strata Depth= 0.000 Average γ = 1.97 t/m³

Pressure= 0.000 due to submerged soil

Effective length for overburden estimation=(15x0.45m)= 6.75 m

Pressure(Limiting at top of Strata)= 6.550 t/m²

End of Strata

Overburden Pressure corresponding to L(15x0.45m)=6.75m 6.55 t/m²

Depth= 1.500 Average γ = 1.97 t/m³

Pressure= 1.455 t/m² due to submerged soil

Pressure at end of strata= 1.455 not greater than limiting

Average Pressure in Strata for end bearing= 4.0025 t/m²

Average Pressure in Strata for skin bearing= 4.0025 t/m²

Surface area of Strata I= 2.121 m²

Capacity due to fine grained soil

$Q_{skin} = \alpha c A_s = 0.0 \text{ t}$

$Q_{end} = A_p N_c C_p = 0.0 \text{ t}$

Capacity due to coarse grained soil

$k = 1 \quad \delta = 28 \quad N_q = 16$

Skin friction in ton $Q_s = k \cdot P_d \cdot \tan(\delta) \cdot A_s = 1 \times 4.0025 \times \tan(\pi \times 28 / 180) \times 2.121 = 4.5 \text{ t}$

End bearing in ton $= Q_b = A_p \cdot [0.5 \cdot D \cdot \gamma \cdot N_y + P_d \cdot N_q] = 0.159 \times (0.5 \times 0.45) \times (1.97 - 1) \times 17.79 + 1.455 \times 16 = 4.3 \text{ t}$

\emptyset	30	40	For $\emptyset=28$ Degree
K	1	1.5	1
Critical Depth factor	15	20	15.0

Strata II

ϕ	Nc	Nq	Ny	Average c= c at end	α	γ
29	28.26	16.850	20.10	0	1.00	1.95

Top of Strata

Depth= 1.500 Average γ = 1.97 t/m3
 Pressure= 1.455 due to submerged soil
 Effective length for overburden estimation=(15x0.45m)= 6.75 m
 Pressure(Limiting at top of Strata)= 1.455 t/m2
 End of Strata
 Overburden Pressure corresponding to L(15x0.45m)=6.75m 6.41 t/m2
 Depth= 4.500 Average γ = 1.96 t/m3
 Pressure= 4.320 t/m2 due to submerged soil
 Pressure at end of strata= 4.320 not grater than limiting
 Avarage Pressure in Strata for end bearing= 2.888 t/m2
 Avarage Pressure in Strata for skin bearing= 2.8875 t/m2
 Surface area of Starata II= 4.241 m2

Capacity due to fine grained soil

$Q_{skin} = \sum \alpha c A_s = 0.0 \text{ t}$

$Q_{end} = A_p N_c C_p = 0.0 \text{ t}$

	30	40	For $\phi=29$ Degree
K	1	1.5	1
Critical Depth factor	15	20	15.0

Capacity due to coarse grained soil

$k = 1$ $\delta = 29$ $N_q = 18$
 Skin friction in ton $Q_s = k \cdot P_d \cdot \tan(\delta) \cdot A_s =$
 $= 1 \times 2.8875 \times \text{TAN}(\pi \times 29 / 180) \times 4.241 = 6.79 \text{ t}$
 End bearing in ton $= Q_b = A_p \cdot [0.5 \cdot D \cdot \gamma \cdot N_y + P_d \cdot N_q] =$
 $= 0.159 \times (0.5 \times (0.45) \times (1.95 - 1) \times 20.1 + 4.32 \times 18) = 13.0 \text{ t}$

Strata III

ϕ	Nc	Nq	Ny	Average c= c at end	α	γ
30	30.14	18.400	22.40	0	1.00	1.95

Top of Strata

Depth= 4.500 Average γ = 1.96 t/m3
 Pressure= 4.320 due to submerged soil
 Effective length for overburden estimation=(15x0.45m)= 6.75 m
 Pressure(Limiting at top of Strata)= 4.320 t/m2
 End of Strata
 Overburden Pressure corresponding to L(15x0.45m)=6.75m 6.41 t/m2

Depth= 7.500 Average γ = 1.96 t/m³
 Pressure= 7.200 t/m² due to submerged soil
 Pressure at end of strata= 6.410 not greater than limiting
 Average Pressure in Strata for end bearing= 5.365 t/m²
 Average Pressure in Strata for skin bearing= 5.76
 Surface area of Strata III= 4.241 m²

Capacity due to fine grained soil

$Q_{\text{skin}} = \alpha c A_s = 0.000 \text{ t}$

$Q_{\text{end}} = A_p N_c C_p = 0.000 \text{ t}$

Capacity due to coarse grained soil

$k = 1$ $\delta = 30$ $N_q = 20$
 Skin friction in ton $Q_s = k \cdot P_d \cdot \tan(\delta) \cdot A_s =$
 $= 1 \times 5.76 \times \text{TAN}(\pi \times 30 / 180) \times 4.241 = 14.104 \text{ t}$
 End bearing in ton $= Q_b = A_p \cdot [0.5 \cdot D \cdot \gamma \cdot N_y + P_d \cdot N_q] =$
 $= 0.159 \times (0.5 \times (0.45) \times (1.95 - 1) \times 22.4 + 6.41 \times 20) = 21.145 \text{ t}$

	30	40	For $\phi=30$ Degree
ϕ	1	1.5	1
Critical Depth factor	15	20	15.0

Strata IV

ϕ	Nc	Nq	Ny	Average c= c at end	α	γ
30	30.14	18.400	22.40	0	0	1.00 1.95

Top of Strata

Depth= 7.500 Average γ = 1.956667 t/m3

Pressure= 7.175 due to submerged soil

Effective length for overburden estimation=(15x0.45m)= 6.75 m

Pressure(Limiting at top of Strata)= 6.410 t/m2

End of Strata

Overburden Pressure corresponding to L(15x0.45m)=6.75m 6.41 t/m2

Depth= 10.000 Average γ = 1.955 t/m3

Pressure= 9.550 t/m2 due to submerged soil

Pressure at end of strata= 6.410 not grater than limiting

Average Pressure in Strata for end bearing= 6.41 t/m2

Average Pressure in Strata for skin bearing= 6.41

Surface area of Starata IV= 3.534 m2

Capacity due to fine grained soil

Q skin= $\sum \alpha c A_s$ = 0.000 t

Q end= $A_p N_c C_p$ = 0.000 t

	30	40	For $\phi=30$ Degree
K	1	1.5	1
Critical Depth factor	15	20	15.0

Capacity due to coarse grained soil

k= 1 delta= 30 Nq = 20

Skin friction in ton $Q_s = k \cdot P_d \cdot \tan(\delta) \cdot A_s$
 $= 1 \times 6.41 \times \tan(\pi \times 30 / 180) \times 3.534 = 13.079$ t

End bearing in ton $Q_b = A_p \cdot [0.5 \cdot D \cdot \gamma \cdot N_y + P_d \cdot N_q]$
 $= 0.159 \times (0.5 \times (0.45) \times (1.95 - 1)) \times 2 = 21.145$ t

Strata V

ϕ	Nc	Nq	Ny	c= c at end	α	γ
30	30.14	18.400	22.40	0	0	1.00 1.95

Top of Strata

Depth= 10.000 Average γ = 1.955 t/m3

Pressure= 9.550 due to submerged soil

Effective length for overburden estimation=(15x0.45m)= 6.75 m

Pressure(Limiting at top of Strata)= 6.410 t/m2

End of Strata

Overburden Pressure corresponding to L(15x0.45m)=6.75m 6.41 t/m2

Depth= 15.000 Average γ = 1.954 t/m3

Pressure= 14.310 t/m2 due to submerged soil

Pressure at end of strata= 6.410 not grater than limiting

Average Pressure in Strata for end bearing= 6.41 t/m2

Average Pressure in Strata for skin bearing= 6.41

Surface area of Starata IV= 7.069 m2

Capacity due to fine grained soil

$Q_{skin} = \alpha c A_s = 0.000 \text{ t}$

$Q_{end} = A_p N_c C_p = 0.000 \text{ t}$

Capacity due to coarse grained soil

$k = 1 \quad \delta = 30 \quad N_q = 20$

Skin friction in ton $Q_s = k \cdot P_d \cdot \tan(\delta) \cdot A_s =$
 $= 1 \times 6.41 \times \tan(\pi \times 30 / 180) \times 7.069 = 26.161 \text{ t}$

End bearing in ton $Q_b = A_p \cdot [0.5 \cdot D \cdot \gamma \cdot N_y + P_d \cdot N_q] =$
 $= 0.159 \times (0.5 \times 0.45) \times (1.95 - 1) \times 22.4 + 6.41 \times 20 = 21.145 \text{ t}$

ϕ	30	40	For $\phi=30$ Degree
K	1	1.5	1
Critical Depth factor	15	20	15.0

Capacity of Pile

Dia= 450 mm

Depth= 10.000 M

Capacity= $(4.5)+(6.79) + (14.104)+(34.224)=$ 59.62 t

F.S.= 2.500

Safe Capacity= 23.8 t

Capacity on basis of SPT value, N
In cohesionless soil

$$Q_u = 13N(L/B) A_p + (N' A_s / 0.5) \text{ kN}$$

$$\text{Max End Bearing} = 130N A_p$$

L=Length of Penetration of Pile,m

B=Pile Dia

A_p = Base Area, m²

N = Average SPT value at surface

N' = Average Base SPT value

A_s = Surface Area,m²

On Basis of SPT Value

Capacity on basis of SPT value, N
In Non-Plastic Silty soil

$$Q_u = 10N(L/B) A_p + (N' A_s / 0.6) \text{ kN}$$

First Term= Skin Friction

Second Term=End Bearing

Pile Dia,m	Pile Length,m	A_p = Base Area, m ²	A_s = Surface Area,m ²	N end	N' Average	End Bearing, kN	Skin Friction, kN	Total Ultimate Capacity, kN
0.45	30	0.159	42.4	20	17	2756	351	3107
0.45	16	0.159	22.6	20	25	1470	517	1987
0.45	16	0.159	22.6	30	40	2205	827	3032
0.45	16	0.159	22.6	20	25	1470	517	1987
0.45	16	0.159	22.6	30	29	2205	599	2804
0.45	16	0.159	22.6	30	29	2205	599	2804
0.45	16	0.159	22.6	30	40	2205	827	3032

F.S.	Safe Capacity, ton
2.5	124
2.5	79
2.5	121
2.5	79
2.5	112
2.5	112
2.5	121

CONSTRUCTION OF SHIKSHA BHAWAN (G+4) AT SUPAUL

Table 11

Soil stratification

DEPTH	SOIL TYPE	CONSISTANCY	CLASSIFICATION
0.0-3.5	SILTY SAND	LOOSE	SP/SM
3.5-10.5	SAND	MEDIUM TO DENSE	SP

WATER TABLE was found at the depth of about 3.0m below GL as reported May'2023.

RECOMMENDATION

The present report is prepared on the basis of lab. Test result & field test conducted in the field.

The lab. test result is obtained by conducting different test on representative sample obtained through 3 no. of bore holes whose location and depth were decided by BSEIDC and shown in the bore hole location plan.

The laboratory test of soil samples obtained in all bore holes are given in Tables 2-10. Study of these tables reveals that the sub-soil strata :

(a) Soil strata consist of coarse grained soil.

Therefore, foundation should be placed at 2.0m or beyond the ground level. Both, shallow as well as deep, foundations are feasible. Plane piles are feasible BUT, it is difficult to place the pile in sand.

By way of example the calculated value of safe capacity of certain type and size of Shallow foundation are being tabulated below: -

STRIP FOOTING

Depth below GL (m)	Width of foundation (m)	Safe Bearing capacity (t/m ²)	Maximum expected settlement(mm)	Bearing capacity(t/m ²) against maximum settlement	Allowable Bearing capacity(t/m ²)
2.0	2.0	8.5	50	5.5	5.5
	3.0	9.0	50	6.0	6.7
3.0	2.0	11.0	50	8.0	8.0
	3.0	11.0	50	10.0	10.0

SQUARE FOOTING

Depth below GL (m)	Foundation size (m)	Safe Bearing capacity (t/m ²)	Maximum expected settlement(mm)	Bearing capacity(t/m ²) against maximum settlement	Allowable Bearing capacity(t/m ²)
2.0	1.5X1.5	9.5	50	5.5	5.5
3.0	1.5X1.5	12	50	8.0	8.0

CONSTRUCTION OF SHIKSHA BHAWAN (G+4) AT SUPAUL

By way of example the calculated value of safe capacity of certain diameter of piles using IS : 2911 (Part 1/Sec 2) 2010:

Plane Pile Capacity

Depth of Pile below GL(m)	Dia of Pile (m)	Allowable Capacity (Ton)
10	0.45	22
10	0.5	25

Limitation

If the sub-soil condition is found much different from those reported here during trenching, suitable steps should be taken. Back filling over footing shall be done with proper compaction.

Pile capacity shall be confirmed by Initial and Routine pile load test as per relevant Indian codes. Group efficiency shall be considered for group of pile.

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