REPORT ON

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

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 Sariar

ANIL KUMAR SARIAR
Partner, Shamvwi Consultant

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

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 starta/ 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.

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 CALCLATION OF ALLOWABLE BEARING CAPACITY

6.1 COHESIVE SOIL

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

qd = net ultimate bearing capacity

Nc=5.14

Sc=1 for strip footing

Dc=1+0.2*D/B

Ic=1 for vertical loading

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

Settlement criteria

S=H/(1+eo)*Cc*log((po+p1)/po)

S= settlement

H=thickness of compressible layer

eo=initial void ratio

po=initial effective pressure

p1=pressure increment

Cc=compression index

6.2 Soil with the value of c &θ

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

Qd=cNcScDcIc+q(Nq–1)SqDqIq+0.5R*BNr*Sr*Dr*Ir*w'

For local shear failure

Tan θ'=0.67*Tanθ

C'=2*c/3

Sc=Sq=Sr=1 for strip footing

Dc=1+0.2*(D/B)*Tan(45+θ/2)

Ic=Iq=Ir=1 for vertical loading

Dq=Dr=1+0.1*(D/B)Tan(45+θ/2)

q=(R-Rw)*D

M= moisture content

R= bulk density of soil

Rw=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

Qna=3.5*(N-3)*{(B+0.3)/2*B}*{(B+0.3)/2*B}*w'*Fd

N= corrected N

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

7.0 METHOD FOR CALCLATION 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 :

$Q=Ap*Nc*Cp+a*C*As$

Ap=cross sectional area of pile toe in cm2

Nc=Bearing capacity factor usually taken as 9

Cp=average cohesion at pile tip in Kg/cm

a=reduction factor

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

As= surface area of pile shaft in cm2

8.0 METHOD FOR CALCLATION 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 :

$Q=Ap*Nc*Cp+Aa\,Nc*\,C'a+C'a*As'+\alpha*Ca*As$

Ap=cross sectional area of pile toe in cm2

Nc=Bearing capacity factor usually taken as 9

Cp= cohesion of soil around toe.

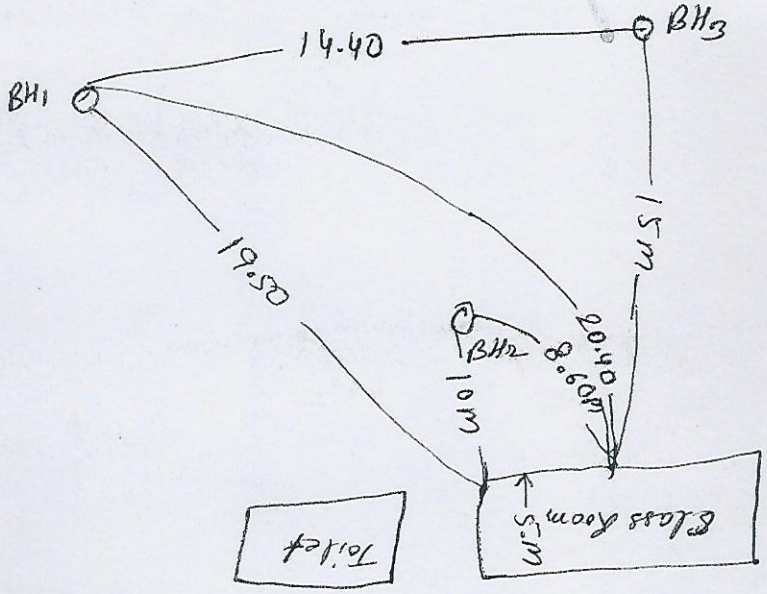
α=reduction factor

$Aa=\pi*(Du^2-D^2)/4$

C'a= average cohesion around under ream
Du=dia of under-ream,D=dia of pile
As= surface area of pile shaft in cm2
As=surface area of stem
A's=surface area of the cylinder circumscribing the under ream.

Shiksha Bhawan at Araria

Road



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Shamvavi Consultant

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Araria

SHAMVWI CONSULTANTS ,414J.T.C.,FRASER ROAD, PATNA	NAME OF PROJECT : SOIL INVESTIGATION FOR CONSTRUCTION OF SHIKSHA BHAWAN (G+4) AT ARARIA	BORING DATES	TERMINATION DEPTH :10.5	TABLE NO :2
		START :29.05.2023	WATER TABLE DEPTH : 3.0M	BORE HOLE NO :BH1
		FINISH :29.05.2023		

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 kg/cm2	COEFFICIENT OF VOLUME COMPRESSIBILITY Mv cm3/kg
		OBSERVED VALUE	CORRECTED VALUE	5 10 20		GRAVEL (%)	SAND (%)	SILT (%)	CLAY (%)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDE	BULK DENSITY (gm/cm3)	DRY DENSITY(gm/cm3)			TYPE OF TEST	COHESION c (kg/cm2)	ANGLE OF FRICTION IN DEGREE	VOID RATIO eo	COMPRESSION INDEX Cc		
DS	G.L.																						
DS1					SAND SP																		
SPT1	1.5	13				0.0	86.90	13.1		NON-PLASTIC			1.95	1.72	13.1	2.68	DST	0	29.0				
DS2					SAND SP																		
SPT2	3	21				0.0	95.20	4.8		NON-PLASTIC			1.95	1.72	13.5	2.66							
DS3					SAND SP																		
SPT3	4.5	21				0.0	95.60	4.4		NON-PLASTIC			1.95	1.71	13.8	2.66	DST	0	30.00				
DS4					SAND SP																		
SPT4	6	25				0.0	92.80	7.2		NON-PLASTIC			1.95	1.70	14.6	2.71							

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/m2

SHAMVWI CONSULTANTS ,414J.T.C.,FRASER ROAD, PATNA	NAME OF PROJECT : SOIL INVESTIGATION FOR CONSTRUCTION OF SHIKSHA BHAWAN (G+4) AT ARARIA	BORING DATES	TERMINATION DEPTH :10.5	TABLE NO :3
		START :29.05.2023	WATER TABLE DEPTH : 3.0M	BORE HOLE NO :BH1
		FINISH :29.05.2023		

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 kg/cm2	COEFFICIENT OF VOLUME COMPRESSIBILITY Mv cm3/kg
		OBSERVED VALUE	CORRECTED VALUE	5 10 20		GRAVEL (%)	SAND (%)	SILT (%)	CLAY (%)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDE	BULK DENSITY (gm/cm3)	DRY DENSITY(gm/cm3)			TYPE OF TEST	COHESION c (kg/cm2)	ANGLE OF FRICTION IN DEGREE	VOID RATIO eo	COMPRESSION INDEX Cc		
DS5					SAND SP																		
SPT5	7.5	28				0.0	92.30	7.7		NON-PLASTIC			1.96	1.72	13.8	2.70	DST	0	30.00				
DS6					SAND SP																		
SPT6	9.0	20				0.0	97.20	2.8		NON-PLASTIC			1.96	1.72	14.2	2.70							
DS7					SAND SP																		
SPT7	10.5	22				1.6	97.40	1.0		NON-PLASTIC			1.96	1.72	13.9	2.70	DST	0	30.00				

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		START :29.05.2023	WATER TABLE DEPTH : 3.0M	BORE HOLE NO :BH2
		FINISH :29.05.2023		

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 kg/cm2	COEFFICIENT OF VOLUME COMPRESSIBILITY Mv cm3/kg
		OBSERVED VALUE	CORRECTED VALUE	5 10 20		GRAVEL (%)	SAND (%)	SILT (%)	CLAY (%)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDE	BULK DENSITY (gm/cm3)	DRY DENSITY(gm/cm3)			TYPE OF TEST	COHESION c (kg/cm2)	ANGLE OF FRICTION IN DEGREE	VOID RATIO eo	COMPRESSION INDEX Cc		
DS	G.L.																						
DS1					SAND SP																		
SPT1	1.5	13				0.0	87.10	12.9		NON-PLASTIC			1.95	1.72	13.4	2.68	DST	0	29.0				
DS2					SAND SP																		
SPT2	3	20				0.0	94.60	5.4		NON-PLASTIC			1.95	1.73	12.4	2.66							
DS3					SAND SP																		
SPT3	4.5	22				0.0	94.20	5.8		NON-PLASTIC			1.95	1.72	13.5	2.66	DST	0	30.00				
DS4					SAND SP																		
SPT4	6	26				0.0	93.10	6.9		NON-PLASTIC			1.95	1.72	13.5	2.71							

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		START :29.05.2023	WATER TABLE DEPTH : 3.0M	BORE HOLE NO :BH2
		FINISH :29.05.2023		

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 kg/cm2	COEFFICIENT OF VOLUME COMPRESSIBILITY Mv cm3/kg
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DS5					SAND SP																		
SPT5	7.5	28				0.0	92.70	7.3		NON-PLASTIC			1.96	1.72	13.8	2.70	DST	0	30.00				
DS6					SAND SP																		
SPT6	9.0	21				0.0	96.80	3.2		NON-PLASTIC			1.96	1.72	14.2	2.70							
DS7					SAND SP																		
SPT7	10.5	24				1.6	97.20	1.2		NON-PLASTIC			1.96	1.72	13.8	2.70	DST	0	30.00				

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		START :29.05.2023	WATER TABLE DEPTH : 3.0M	BORE HOLE NO :BH3
		FINISH :29.05.2023		

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 kg/cm2	COEFFICIENT OF VOLUME COMPRESSIBILITY Mv cm3/kg
		OBSERVED VALUE	CORRECTED VALUE	5 10 20		GRAVEL (%)	SAND (%)	SILT (%)	CLAY (%)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDE	BULK DENSITY (gm/cm3)	DRY DENSITY(gm/cm3)			TYPE OF TEST	COHESION c (kg/cm2)	ANGLE OF FRICTION IN DEGREE	VOID RATIO eo	COMPRESSION INDEX Cc		
DS	G.L.																						
DS1					SAND SP																		
SPT1	1.5	12				0.0	88.30	11.7		NON-PLASTIC			1.95	1.72	13.6	2.68	DST	0	29.0				
DS2					SAND SP																		
SPT2	3	22				0.0	95.10	4.9		NON-PLASTIC			1.95	1.72	13.5	2.66							
DS3					SAND SP																		
SPT3	4.5	21				0.0	95.40	4.6		NON-PLASTIC			1.95	1.72	13.4	2.66	DST	0	30.00				
DS4					SAND SP																		
SPT4	6	26				0.0	91.80	8.2		NON-PLASTIC			1.95	1.70	14.5	2.71							

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		START :29.05.2023	WATER TABLE DEPTH : 3.0M	BORE HOLE NO :BH3
		FINISH :29.05.2023		

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 kg/cm2	COEFFICIENT OF VOLUME COMPRESSIBILITY Mv cm3/kg
		OBSERVED VALUE	CORRECTED VALUE	5 10 20		GRAVEL (%)	SAND (%)	SILT (%)	CLAY (%)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDE	BULK DENSITY (gm/cm3)	DRY DENSITY(gm/cm3)			TYPE OF TEST	COHESION c (kg/cm2)	ANGLE OF FRICTION IN DEGREE	VOID RATIO eo	COMPRESSION INDEX Cc		
DS5					SAND SP																		
SPT5	7.5	26				0.0	92.40	7.6		NON-PLASTIC			1.96	1.73	13.2	2.70	DST	0	30.00				
DS6					SAND SP																		
SPT6	9.0	22				0.0	97.20	2.8		NON-PLASTIC			1.96	1.72	13.8	2.70							
DS7					SAND SP																		
SPT7	10.5	21				1.6	97.00	1.4		NON-PLASTIC			1.96	1.72	13.9	2.70	DST	0	30.00				

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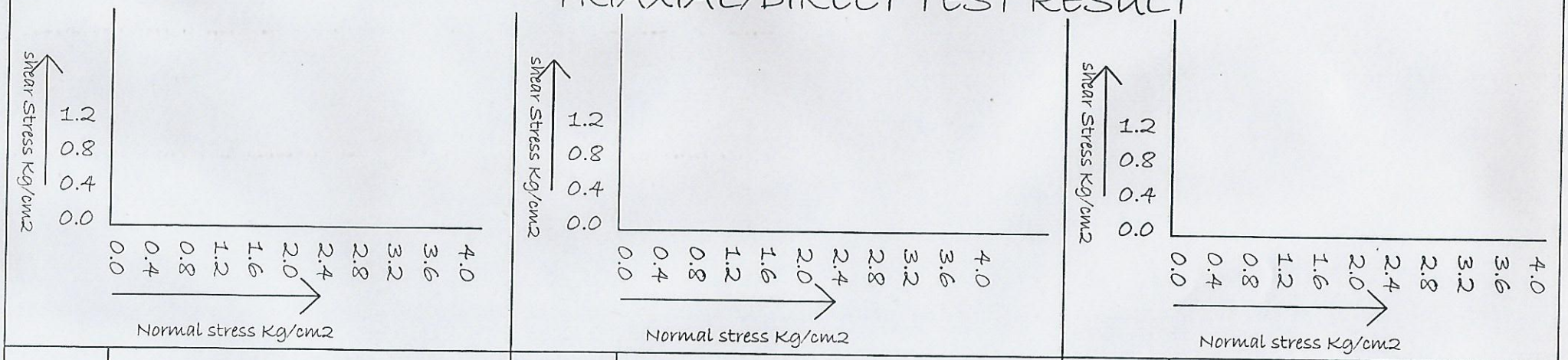
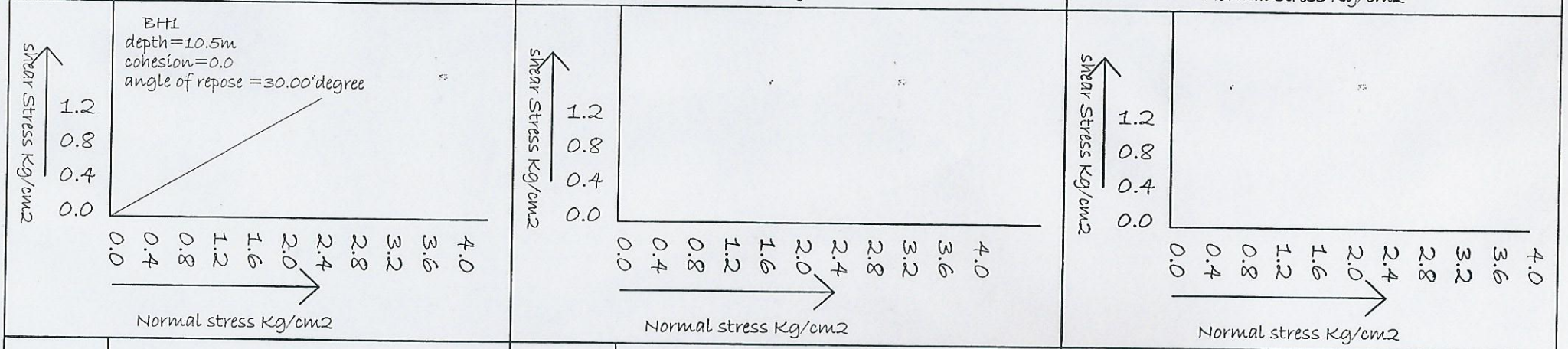
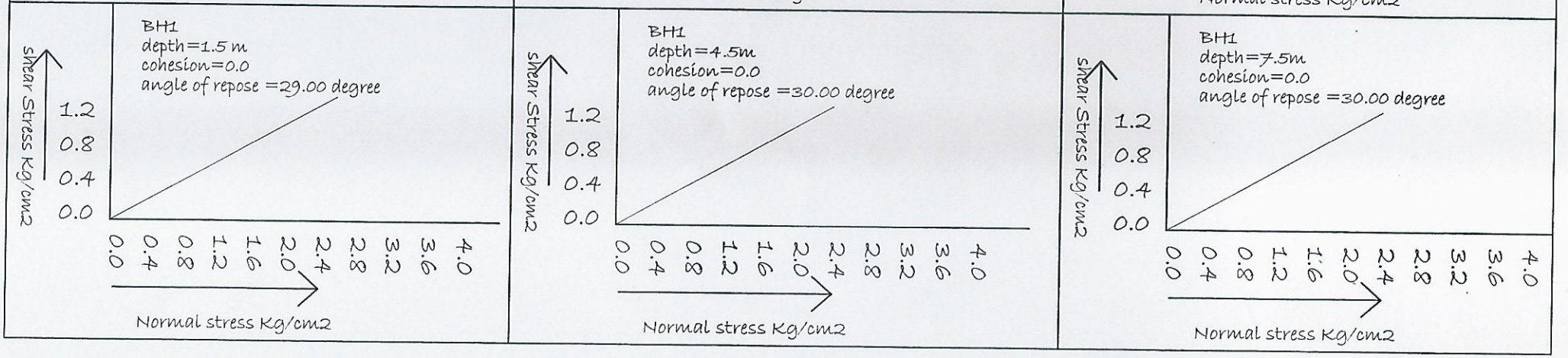
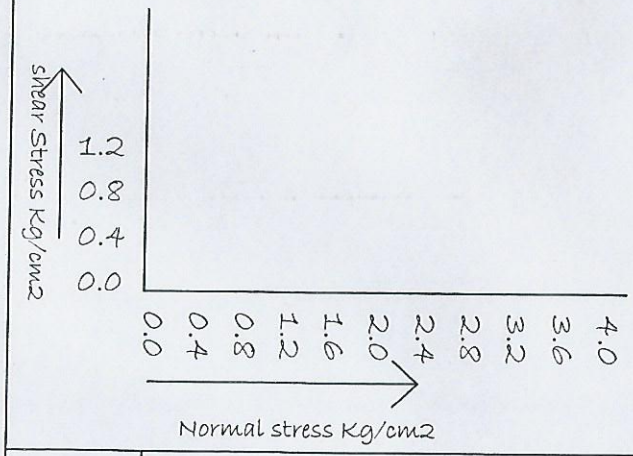
TRIAXIAL/DIRECT TEST RESULT

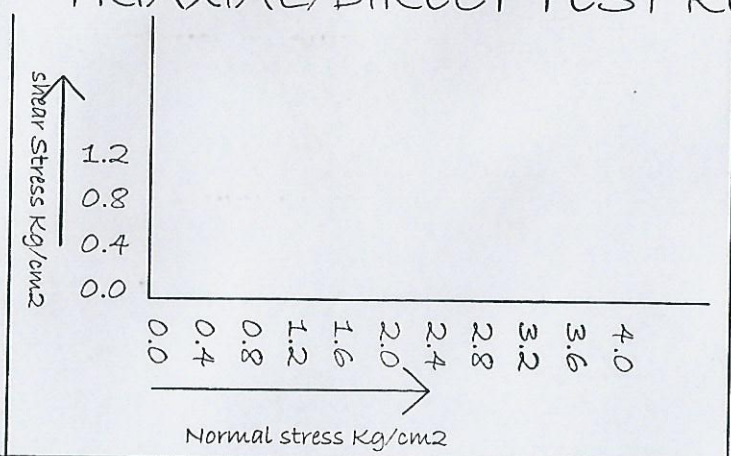


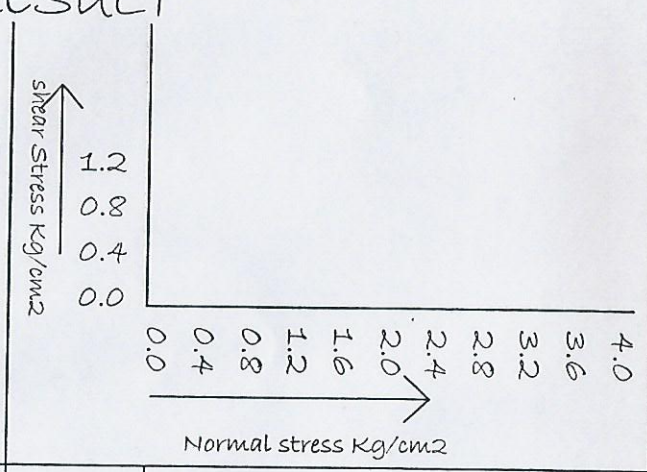


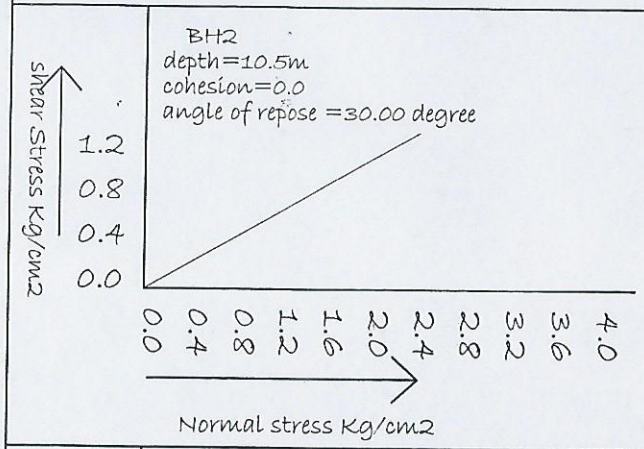


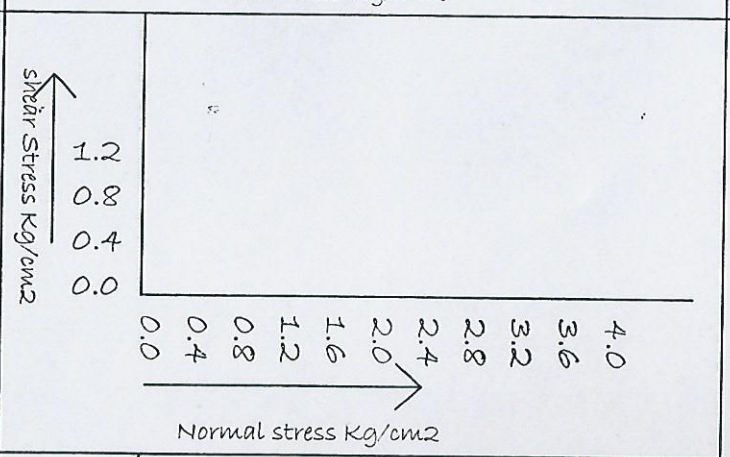
TRIAXIAL/DIRECT TEST RESULT

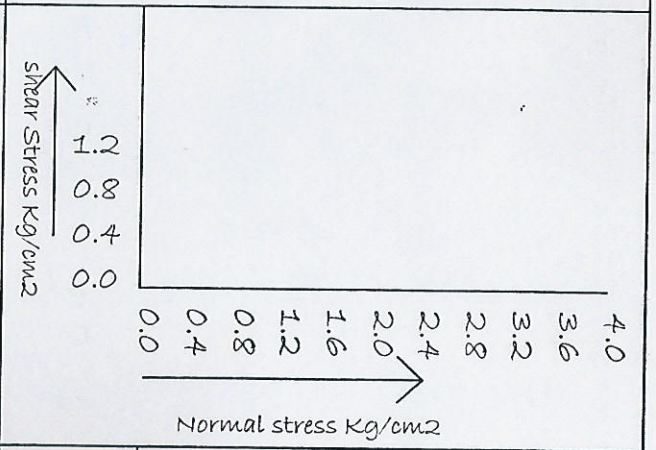


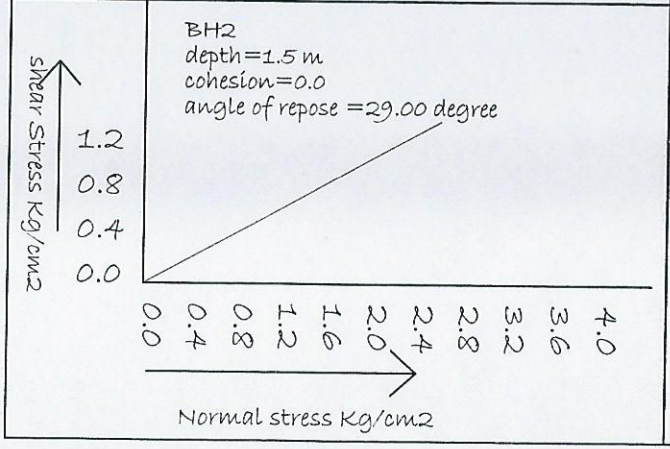


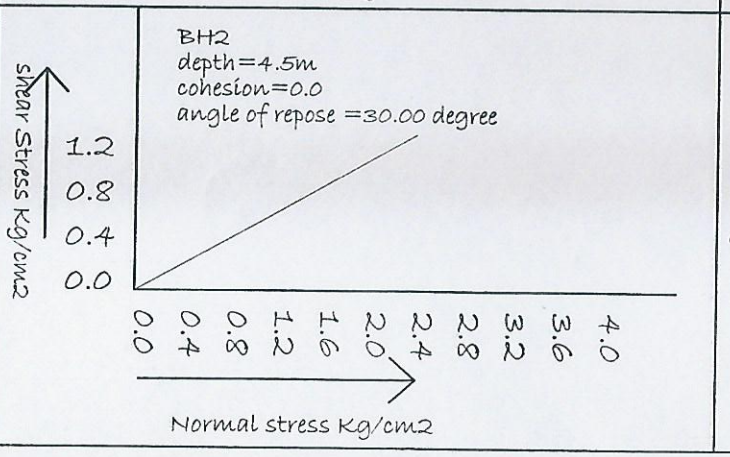


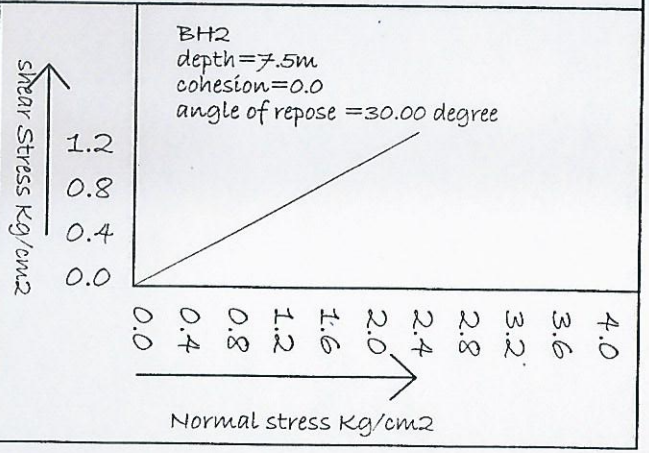




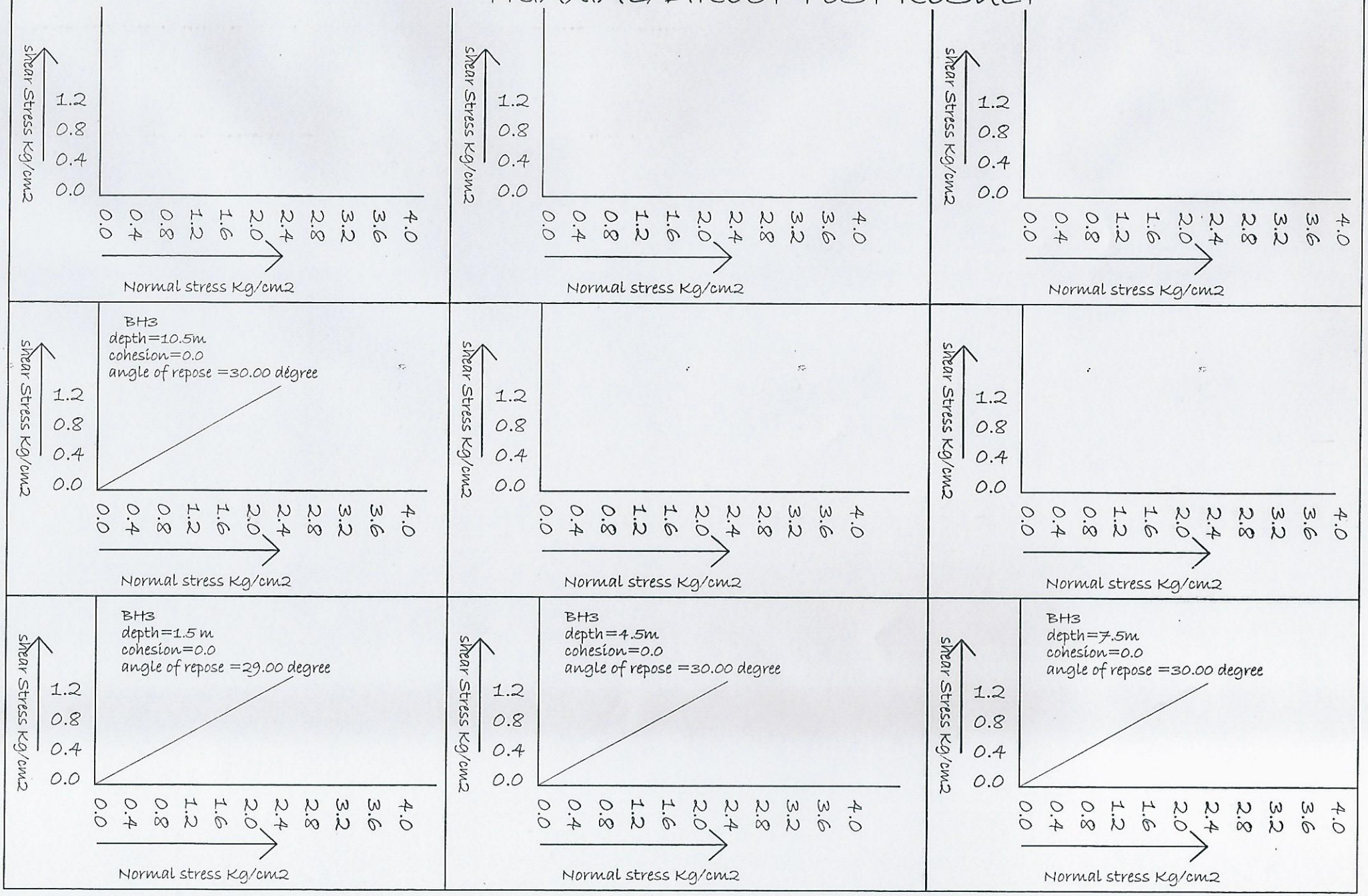




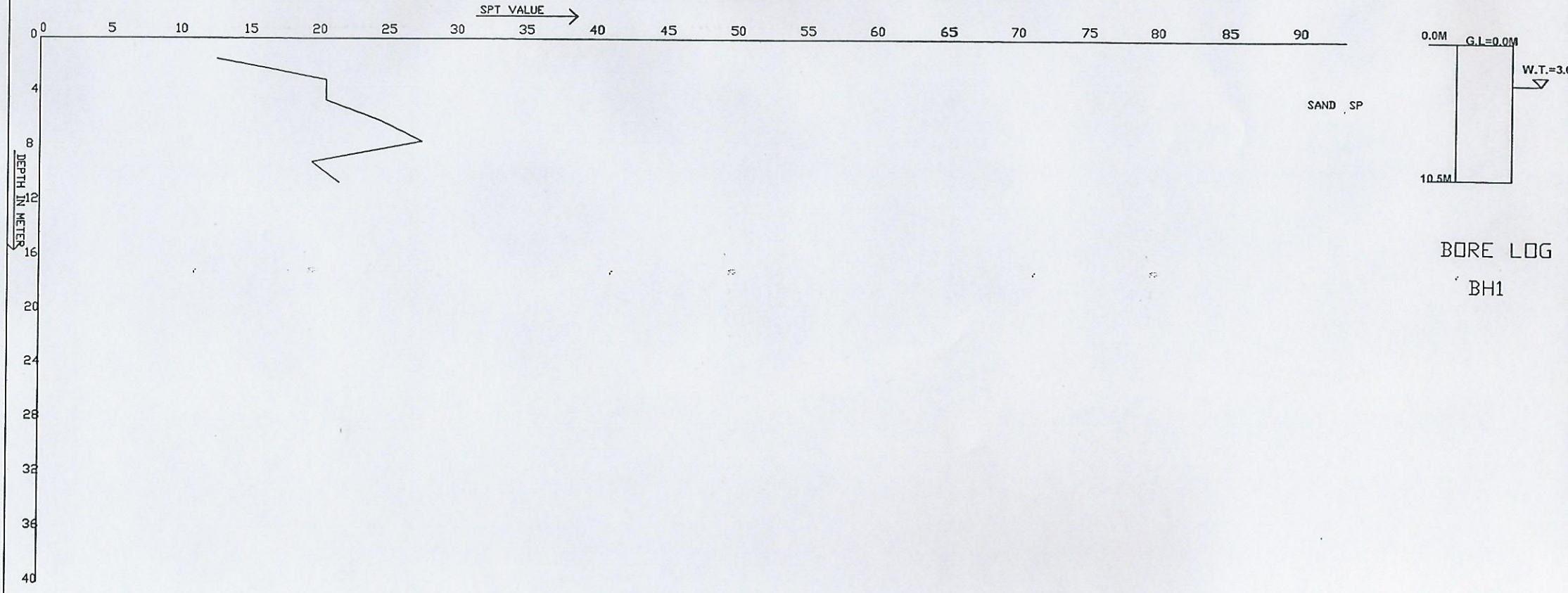




TRIAXIAL/DIRECT TEST RESULT



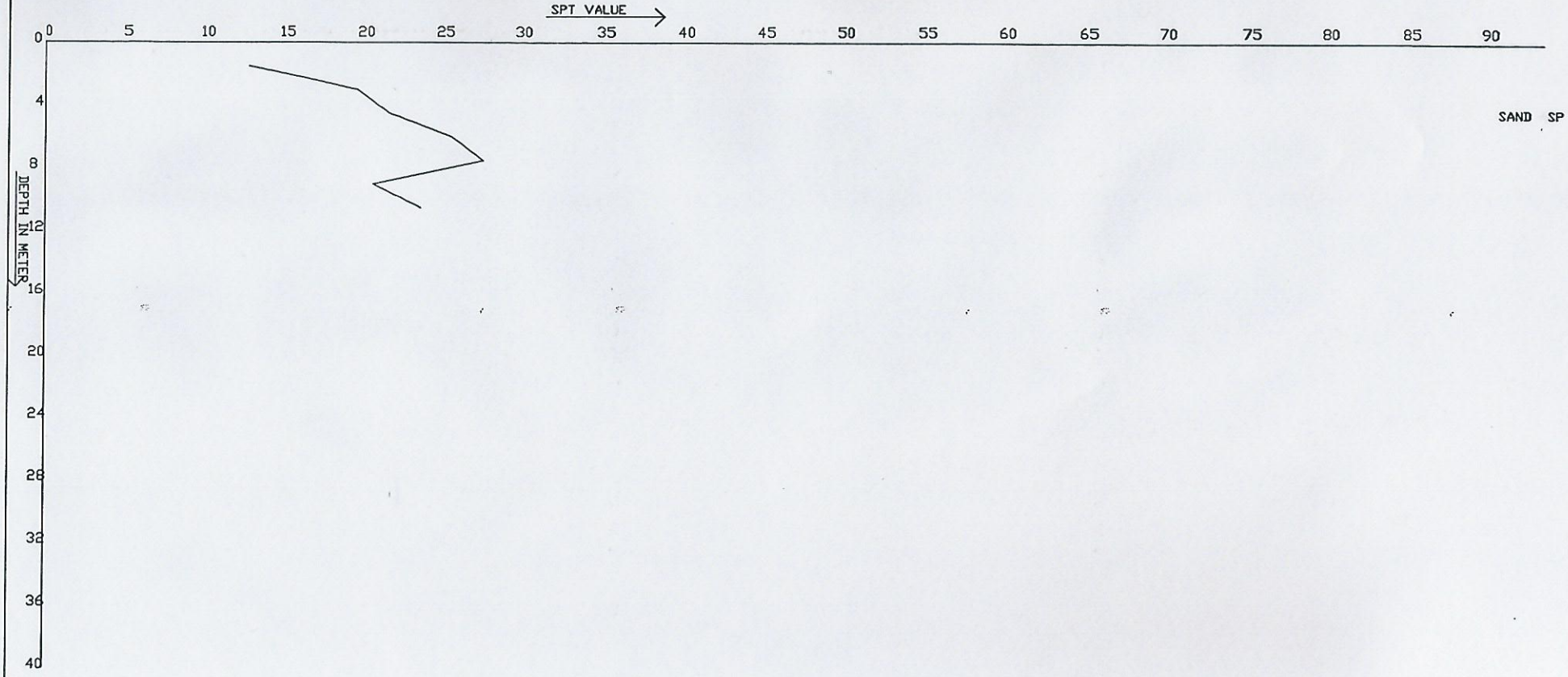
BORE LOG AND DEPTH ~ SPT GRAPH (CONSTRUCTION OF SHIKSHA BHAWAN (G+4) AT ARARIA.)

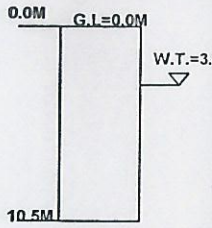


BORE LOG

BH1

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





BORE LOG

BH1

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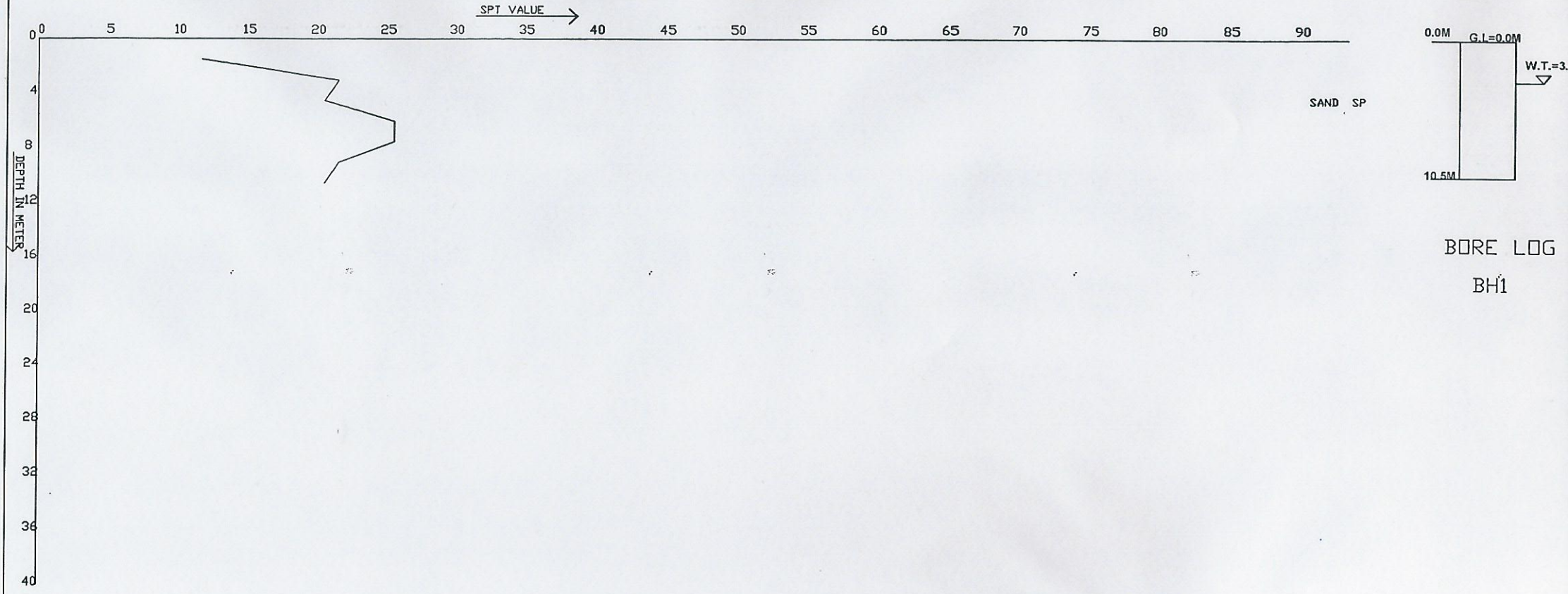
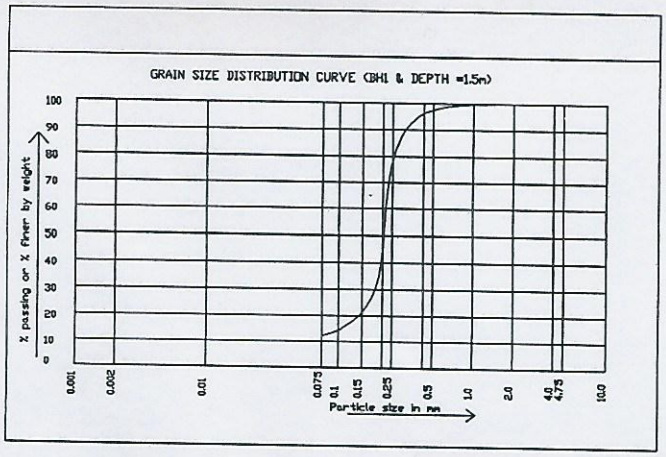


BORE LOG

BH1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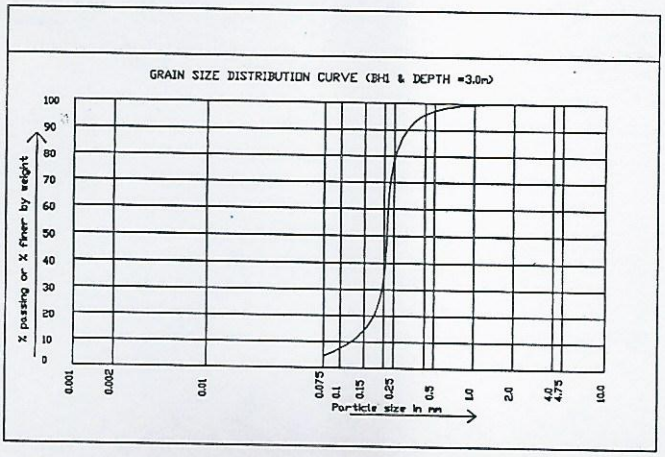
% passing or % finer by weight
Particle size in mm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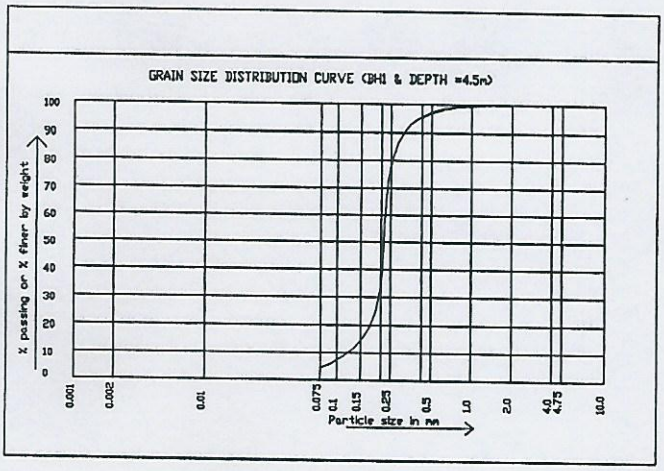
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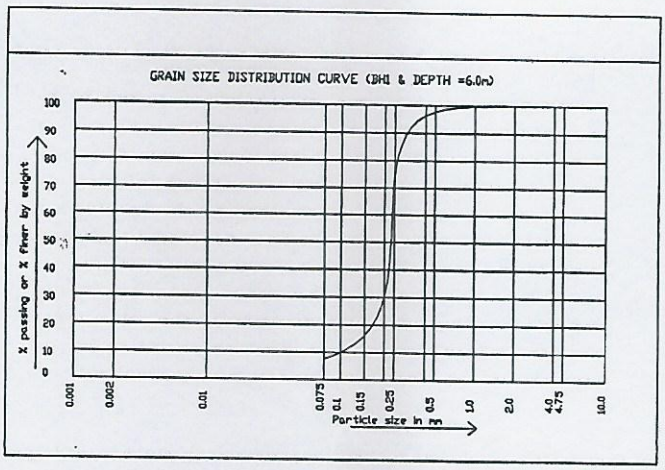
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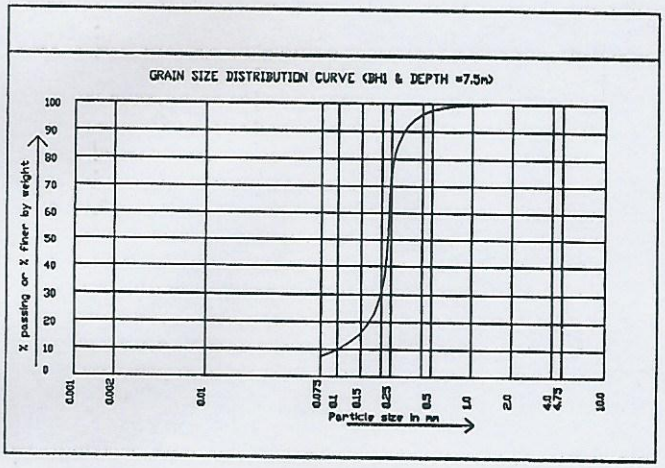
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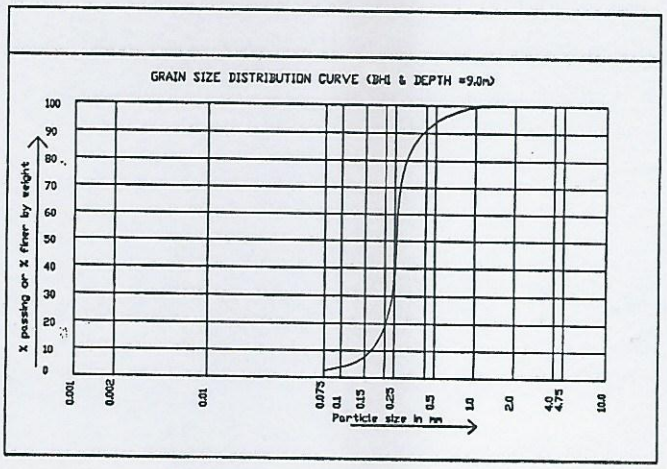
GRAIN SIZE DISTRIBUTION CURVE (BH1 & DEPTH =9.0m)
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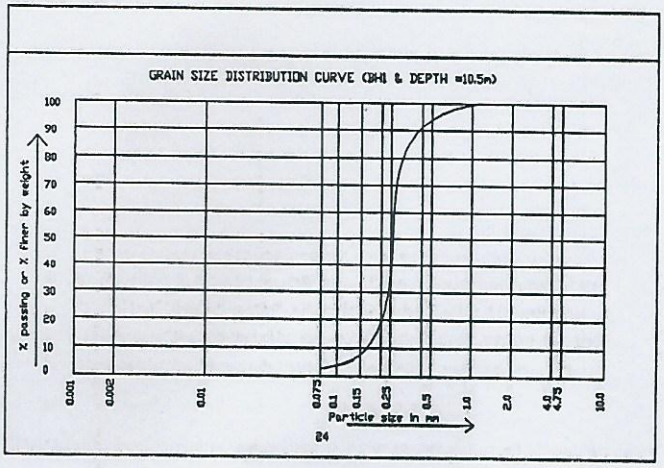
Particle size in mm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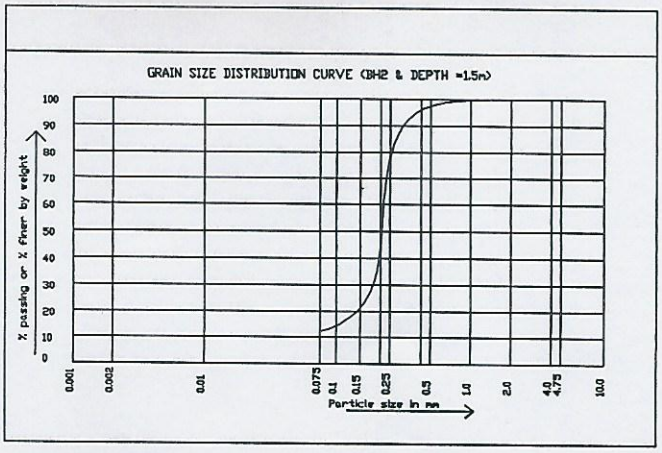
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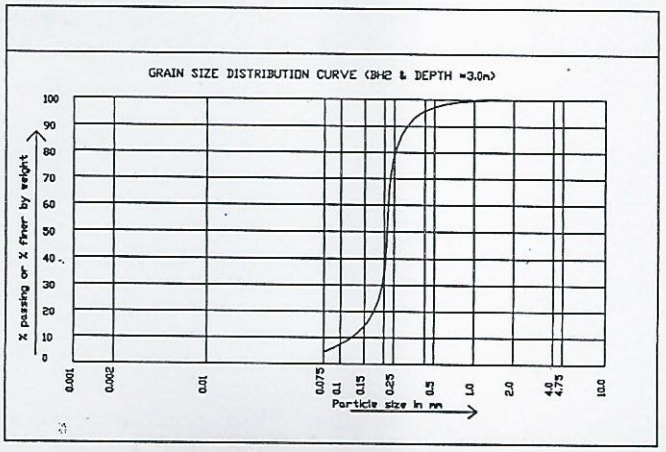
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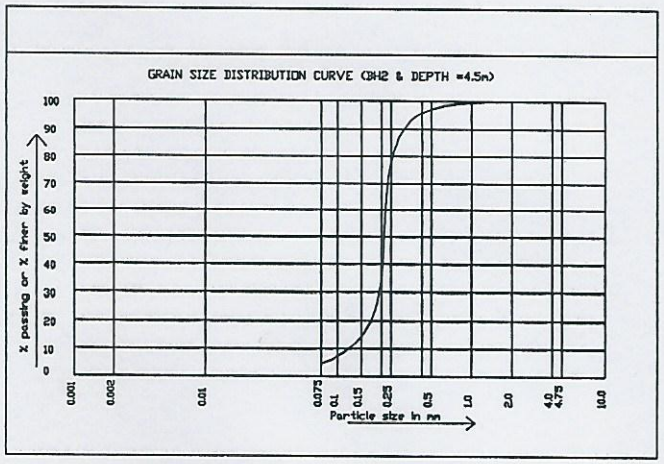
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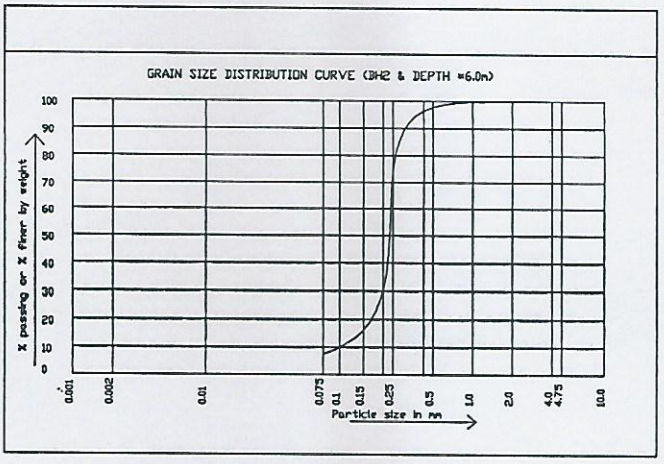
% passing or % finer by weight
Particle size in mm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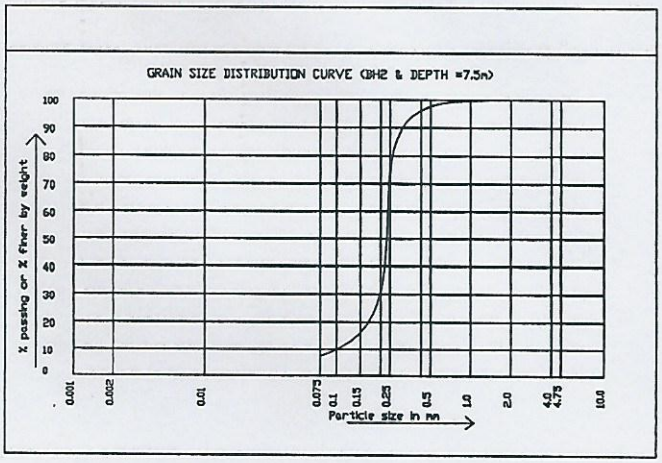
Particle size in mm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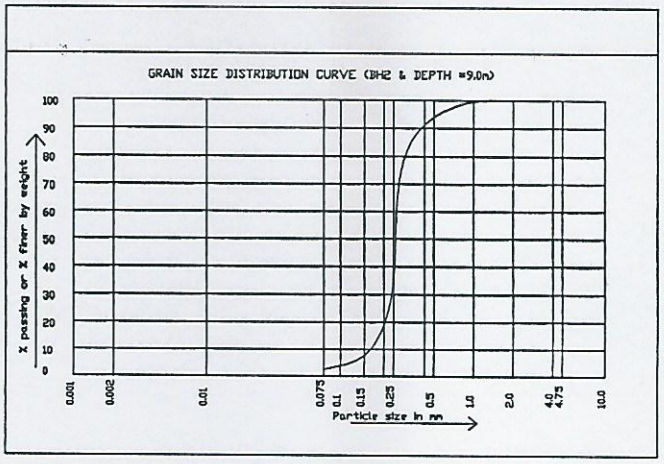
% passing or % finer by weight
Particle size in mm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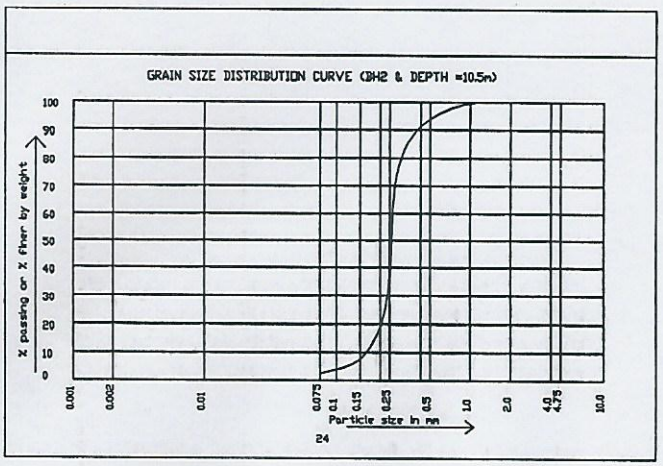
Particle size in mm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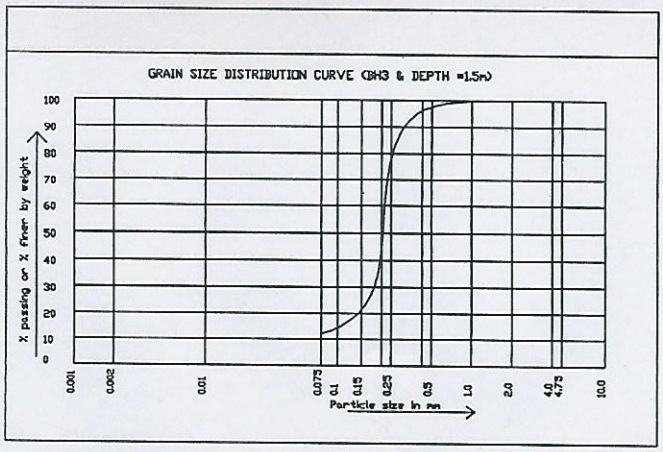
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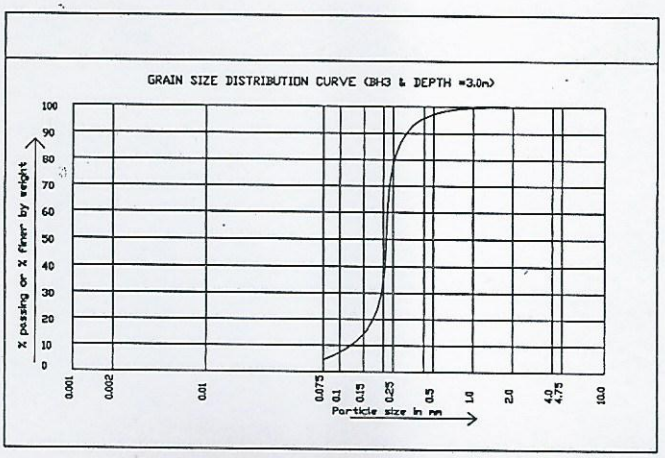
Particle size in mm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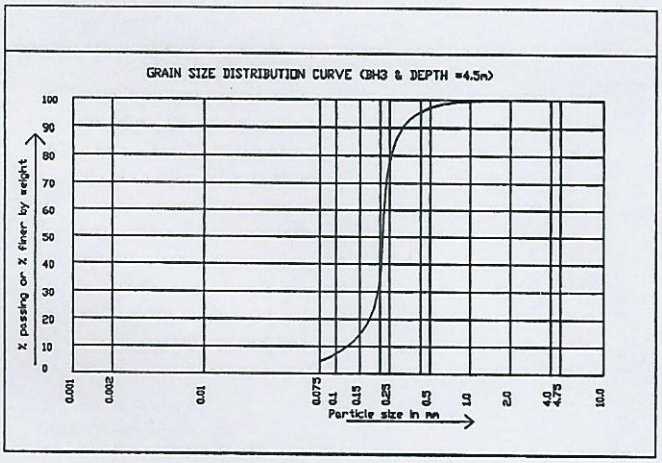
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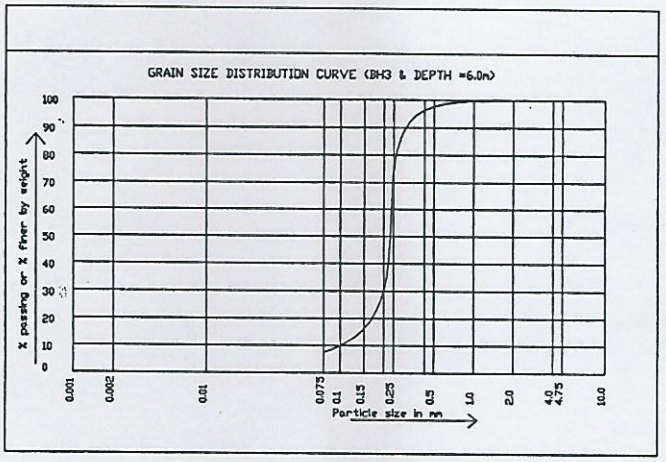
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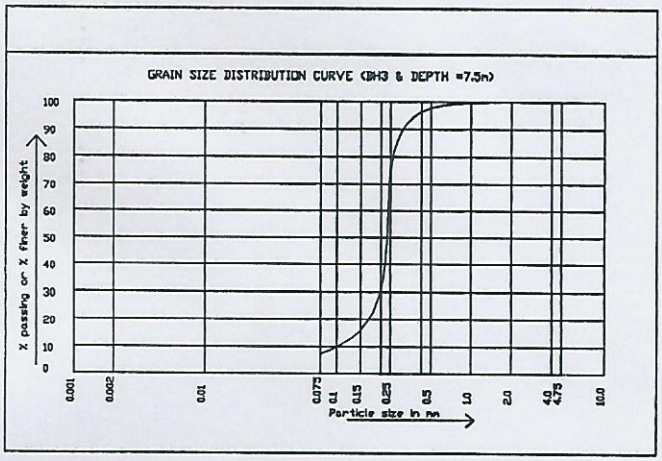
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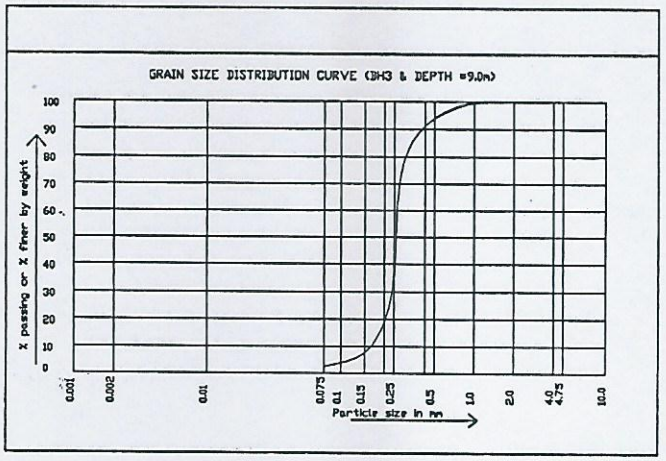
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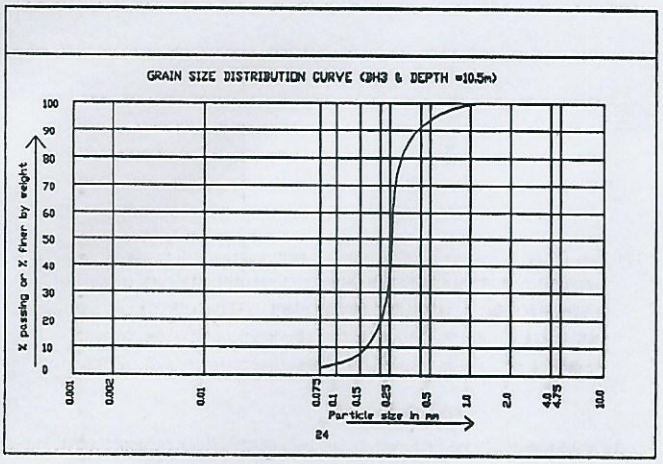
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% passing or % finer by weight
Particle size in mm
24

NAME OF PROJECT : SOIL INVESTIGATION FOR CONSTRUCTION OF SHIKSHA BHAWAN (G+4) AT ARARIA

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=	1.5										
Width of footing in meter,B=	2			Water Table considered=			1.5	m below GL			
Effective depth of soil formation contributing in	2.83										
Average cohesion of soil mobilised in Ton/m2=	0.00										
unit weight of soil in ton/m2,y=	1.95										
Angle of shearing resistance of soil, phi,in degree =	29.00		Corresponding Nc/N'c=	15.27	Corresponding Nq/N'q=	6.72	Corresponding Ny/N'y=	5.80			
Effective Angle of shearing resistance of soil, phi,in degree =	20.37		Corresponding Nc/N'c=	15.27	Corresponding Nq/N'q=	6.72	Corresponding Ny/N'y=	5.80			
Depth factor,dc=	1.22	dc=1+0.2*(Df/B)*tan(45+phi/2)									
Depth factor,dq=	1.11	dq=1+0.1*(Df/B)*tan(45+phi/2) if phi >10 otherwise dq=1									
Depth factor,dy=	1.11	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	2.9	q=yD									
Q1 ton/m2 =	0.00	Q1=(2/3)*c*N'c*dc									
Q2 ton/m2 =	18.413	Q2=q*(N'q-1)*dq									
Q3 ton/m2 =	6.12	Q3=(1/2)*B*y*N'y*dy*W'									
ultimate bearing capacity Q ton/m2 =	24.53	Q=Q1+Q2+Q3									
Factor of safety,F.S. =	3										
Net Safe Bearing Capacity in ton/m2 q=	8.18	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	
	2	2	
Shape factors	Sc	Sq	Sy
	1.3	1.2	0.8
Q1 ton/m2 =	0.00	Q1=(2/3)*c*N'c*dc*Sc	
Q2 ton/m2 =	22.10	Q2=q*(N'q-1)*dq*Sq	
Q3 ton/m2 =	4.90	Q3=(1/2)*B*y*N'y*dy*Sy*W'	
ultimate bearing capacity Q ton/m2 =	27	Q=Q1+Q2+Q3	
Factor of safety,F.S. =	3		
Net Safe Bearing Capacity in ton/m2 q=	9.00	q=Q1/F.S.	

Table 8

Soil stratification

DEPTH	SOIL TYPE	CONSISTANCY	CLASSIFICATION
0.0-10.5	SAND	MEDIUM	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 2-7. Study of these tables reveals that the sub-soil strata :

(a) Soil strata consist of coarse grained soil.

Therefore, foundation should be placed at 1.50m 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/m2)	Maximum expected settlement(mm)	Bearing capacity(t/m2) against maximum settelement	Allowable Bearing capacity(t/m2)
1.5	2.0	8.2	50	11.5	8
	3.0	8.9	50	12.5	8.5

SQUARE FOOTING

Depth below GL (m)	Foundation size (m)	Safe Bearing capacity (t/m2)	Maximum expected settlement(mm)	Bearing capacity(t/m2) against maximum settelement	Allowable Bearing capacity(t/m2)
1.5	2 X2	9	50	12	9

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, before starting the work, as per relevant Indian codes.

Anil Kumar Sariar

ANIL KUMAR SARIAR
Partner. Shamvwi consultant