



Report No.: GM/23/279G

Date: 07/12/2023

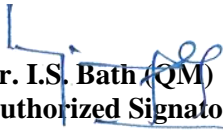
To

Kalgidhar Trust,
Baru Sahib.

Subject: Geotechnical investigation report for proposed Akal nursing college Building at Baru Sahib.

Please find enclosed herewith the bearing capacity report of soil for the above said project.

Rev. & App. by


Er. I.S. Bath (QM)
Authorized Signatory



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Project:	Geotechnical investigation report for proposed Akal nursing college Building at Baru Sahib.
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Project: Geotechnical investigation report for proposed Akal nursing college Building at Baru Sahib.

I. Discipline: Mechanical Testing

Group: Soil & Rock (Field Testing)

1.0 INTRODUCTION

Geo-Media Engineering and Consultancy Services (Geo-Media) Pvt. Ltd. presents herein our Geotechnical investigation report for proposed Akal nursing college Building at Baru Sahib. The purpose of this report is to assess subsurface conditions in order to provide geotechnical comments and recommendations for soil characteristics, bearing capacity and earth pressure. Attachments to this report include soil bore-logs.

2.0 FIELD INVESTIGATIONS

2.1 BORE HOLE LOCATION:

The locations of bore holes were given by Mr. Vikramjeet Singh. Three bore hole designated as BH-1 to BH-03 were done to carry out the desired investigations

2.2 STANDARD PENETRATION TEST

According to IS code 2131-1981 Standard penetration test was conducted at each bore hole and samples were collected at an interval of 1.5m or at a depth where there is change in strata. N values were recorded at required depths as per the code up to significant depth. N values observed in the field are corrected for both the corrections

- Overburden Pressure Correction $N_n = C_n \times N$

Where C_n is correction for overburden pressure, N = Observed no of blows.

- Dilatancy Correction : This correction is required for fine sands below water table

$$N_c = 15 + (N_n - 15) / 2 \quad \text{When } N_n > 15 \quad N_c = \text{corrected value.}$$

3.0 LABORATORY INVESTIGATIONS

3.1 INDEX PROPERTIES

Following Index Properties of the soil samples collected from various depths are determined for the classification of soil.

- Particle size distribution
- Relative density
- Atterbergs limits

3.2 ENGINEERING PROPERTIES

Following Engineering Properties are determined in the laboratory from the tests mentioned against them.

- Shear Strength (c' and Φ' from direct shear test and triaxial shear test)
- Permeability (k from constant and variable head permeability test)
- Compressibility (Compaction and Consolidation test)



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4.0 CALCULATION OF BEARING CAPACITY

The soil can fail either in shear or settlement. Net allowable bearing capacity will be determined with both the cases. The criteria, with minimum value will govern the bearing capacity of soil.

4.1 BEARING CAPACITY BASED ON SHEAR

Net ultimate bearing capacity q_{nu} as per IS code 6403--1981.

$$q_{nu} = 2/3 c' N'_c S_c d_c i_c + \gamma D_f (N_q - 1) S_q d_q i_q + 0.5 \gamma B N'_\gamma S_\gamma d_\gamma i_\gamma W' \quad (\text{local shear failure})$$

$$q_{nu} = c N_c S_c d_c i_c + \gamma D_f (N_q - 1) S_q d_q i_q + 0.5 \gamma B N_\gamma S_\gamma d_\gamma i_\gamma W' \quad (\text{General shear failure})$$

$$\text{Net safe bearing capacity } q_{ns} = q_{nu} / 2.5 \quad \Phi' = \tan^{-1} (2/3 \tan \Phi)$$

N'_c, N'_q, N'_γ are bearing capacity factors for local shear failure.

N_c, N_q, N_γ are bearing capacity factors for general shear failure

d_c, d_q, d_γ are the depth factors

i_c, i_q, i_γ are the Inclination factors

S_c, S_q, S_γ are the Shape factors

Assumed data of Foundation	Size (m)	1.50 x 1.50		
	Type	Square		
	Depth (m) w.r.t. Top of Bore Hole	1.00		
Properties ↓	BH-1	BH-2	BH-3	
w'	0.50	0.50	0.50	
c' (t/m ²)	0.00	0.00	0.00	
γ (g/cc)	1.62	1.70	1.70	
Φ°	26.50	29.00	29.00	
Φ'°	18.38	20.28	20.28	
N _c	13.59	15.20	15.20	
N _q	5.61	6.64	6.64	
N _γ	4.51	5.70	5.70	
S _c	1.30	1.30	1.30	
S _q	1.20	1.20	1.20	
S _r	0.80	0.80	0.80	
d _c	1.184	1.192	1.1835	
d _q =d _γ	1.092	1.096	1.092	
q _u (t/m ²)	12.18	15.80	15.74	
q _{ns} (t/m ²)	4.87	6.32	6.29	



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4.2 BEARING CAPACITY BASED ON SETTLEMENT CRITERIA

Both overburden and dilatancy corrections are required to be applied to the observed as per IS2131-1981. Net allowable safe bearing pressure is calculated as the allowable limits given in IS code 8009 part 1 and water table correction factor is taken into consideration.

BH-1

Depth from Top of Bore Hole (m)	N	Over Burden Pressure Kg /cm ²	C _n	N _n	N _c
1.00	3	0.162	1.610	4.83	4.83
1.50	4	0.244	1.474	5.90	5.90
2.00	6	0.327	1.376	8.26	8.26
3.00	9	0.499	1.235	11.11	11.11
4.50	10	0.761	1.093	10.93	10.93
6.00	89	1.073	0.978	87.06	87.06
7.50	113	1.388	0.892	100.81	100.81
9.00	Refusal	1.706	0.823	—	—
10.00	Refusal	1.918	0.784	—	—

BH-2

Depth from Top of Bore Hole (m)	N	Over Burden Pressure Kg /cm ²	C _n	N _n	N _c
1.00	8	0.170	1.594	12.75	12.75
1.50	75	0.274	1.435	107.65	107.65
2.00	6	0.357	1.347	8.08	8.08
3.00	8	0.527	1.216	9.73	9.73
4.50	25	0.819	1.069	26.71	26.71
6.00	86	1.131	0.961	82.61	82.61
7.50	121	1.448	0.878	106.25	106.25
9.00	Refusal	1.766	0.812	—	—
10.00	Refusal	1.978	0.774	—	—

BH-3

Depth from Top of Bore Hole (m)	N	Over Burden Pressure Kg /cm ²	C _n	N _n	N _c
1.00	8	0.170	1.594	12.75	12.75
1.50	15	0.263	1.449	21.74	21.74
2.00	15	0.355	1.348	20.22	20.22



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Depth from Top of Bore Hole (m)	N	Over Burden Pressure Kg /cm ²	C _n	N _n	N _c
3.00	20	0.545	1.205	24.10	24.10
4.50	85	0.823	1.067	90.71	90.71
6.00	95	1.115	0.965	91.71	91.71
7.50	116	1.430	0.882	102.33	102.33
9.00	Refusal	1.748	0.815	—	—
10.00	Refusal	1.960	0.777	—	—

Bore Holes	N _c (Avg)	Net allowable pressure q _{np} (t/m ²)
BH-1	8.21	12.98
BH-2	32.99	74.76
BH-3	33.90	77.04

5.0 NET ALLOWABLE BEARING CAPACITY

The net safe bearing capacity is the least of the bearing capacity based on above two criteria and its value is given in the following table.

Bore Hole	Depth of Foundation w.r.t top of Bore Hole (m)	Size of foundation (m)	Type of Foundation	Net safe bearing capacity q _{ns} (t/m ²) From shear criteria	Net safe pressure q _{np} (t/m ²) From Settlement criteria	Net Allowable Bearing Capacity (t/m ²)
BH-1	1.00	1.50 x 1.50	Square	4.87	12.98	4.87
BH-2	1.00	1.50 x 1.50	Square	6.32	74.76	6.32
BH-3	1.00	1.50 x 1.50	Square	6.29	77.04	6.29

6.0 RECOMMENDATIONS

i) Net allowable bearing capacity is given in following table.

Sr. No.	Depth of Foundation w.r.t Top of Bore Hole (m)	Size of foundation (m)	Type of Foundation	Net Allowable Bearing Capacity (t/m ²)	Gross Safe Bearing Capacity (t/m ²)
1	1.00	1.50	Strip	4.46	6.08
2	1.00	2.00	Strip	4.75	6.37
3	1.00	1.50 x 1.50	Square	4.87	6.49
4	1.00	2.00 x 2.00	Square	5.08	6.70

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Sr. No.	Depth of Foundation w.r.t Top of Bore Hole (m)	Size of foundation (m)	Type of Foundation	Net Allowable Bearing Capacity (t/m ²)	Gross Safe Bearing Capacity (t/m ²)
5	1.00	3.00 x 3.00	Square	5.58	7.20
6	1.50	1.50	Strip	6.77	9.21
7	1.50	2.00	Strip	7.00	9.44
8	1.50	1.50 x 1.50	Square	7.59	10.03
9	1.50	2.00 x 2.00	Square	7.70	10.14
10	1.50	3.00 x 3.00	Square	8.13	10.57
11	2.00	1.50	Strip	9.91	13.18
12	2.00	2.00	Strip	10.02	13.29
13	2.00	1.50 x 1.50	Square	11.26	14.53
14	2.00	2.00 x 2.00	Square	11.21	14.48
15	2.00	3.00 x 3.00	Square	11.53	14.80
16	2.70	3.00	Strip	14.67	19.14
17	3.00	1.50	Strip	17.17	22.44
18	3.00	2.00	Strip	16.81	22.08
19	3.00	1.50 x 1.50	Square	19.86	25.13
20	3.00	2.00 x 2.00	Square	19.22	24.49
21	3.00	3.00 x 3.00	Square	18.97	24.24

- ii) Top of bore hole is equal to NSL.
- iii) The Ground Water table has not been encountered upto the depth of soil exploration.
- iv) Allowable settlement is taken as 50mm for isolated foundation.

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1. This certificate refers only to the particular site location of testing.
2. This certificate shall not be reproduced, except in full, unless written permission is obtained.
3. The test results reported in this certificate are valid for the stated conditions of measurements.
4. Sample will be destroyed after three months from the date of the issue of the test report unless otherwise specified.
5. The test result is for the information of client and cannot be used for any legal purpose or produced in any court of law.


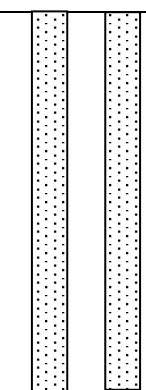


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7.0 Bore Log Chart


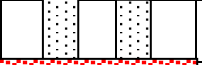

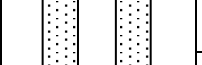
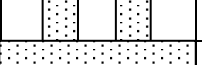
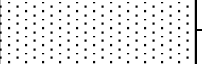


Ref. No. SRF/23/1122C		Ref. Dated: 29.11.23		Date of Field Testing: 26.11.2023			ULR No. TC117942300000604F			Ground water table: - not encountered		Bore Hole No.:- 01 of 03		 TC-11794	
Depth from Top of Bore Hole(m)	Nature of Sample	Symbolic Representation	Grain Size Analysis			Consistency Characteristics (%)			Bulk unit weight	Direct Shear Test		S.P.T Value (Observed) (N Value)	IS: Classification		
			Gravel (%)	Sand (%)	Silt & Clay (%)	L.L	P.L	P.I	γ (t/m ³)	C' (t/m ²)	ϕ ' ^o				
1.00	SPT/DS		0.00	63.21	36.79	NP	NP	NP	1.62	0.00	26.50	3	SM	SILTY SAND	
1.50	SPT/DS		0.00	52.76	47.24	NP	NP	NP	1.63	0.00	27.00	4	SM		
2.00	SPT/DS		0.00	51.28	48.72	NP	NP	NP	1.66	0.00	28.50	6	SM		
3.00	SPT/DS		0.00	56.75	43.25	NP	NP	NP	1.72	0.00	29.25	9	SM		
4.50	SPT		0.00	55.94	44.06	NP	NP	NP	1.75	—	—	10	SM		
6.00	SPT		15.43	62.75	21.82	NP	NP	NP	2.08	—	—	89	SM		
7.50	SPT		33.65	50.27	16.08	NP	NP	NP	2.10	—	—	113	SM		
9.00	—	Weathered Rock						2.12	—	—	Refusal	Weathered Rock			
10.00	—	Weathered Rock						2.12	—	—	Refusal				



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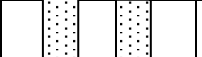
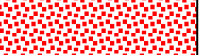
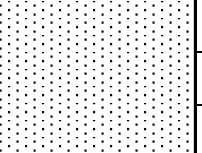
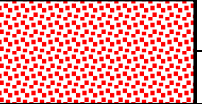
Ref. No. SRF/23/1122C		Ref. Dated: 29.11.23		Date of Field Testing: 27.11.2023			ULR No. TC117942300000604F			 TC-11794				
		Ground water table: - not encountered			Bore Hole No.:- 02 of 03									
Depth from Top of Bore Hole(m)	Nature of Sample	Symbolic Representation	Grain Size Analysis			Consistency Characteristics (%)			Bulk unit weight γ (t/m ³)	Direct Shear Test		S.P.T Value (Observed) (N Value)	IS: Classification	
			Gravel (%)	Sand (%)	Silt & Clay (%)	L.L	P.L	P.I		C' (t/m ²)	ϕ '°			
1.00	SPT/DS		0.00	72.10	27.90	NP	NP	NP	1.70	0.00	29.00	8	SM	SILTY SAND
1.50	SPT/DS		55.12	41.02	3.86	NP	NP	NP	2.07	0.00	29.00	75	GP	POORLY GRADED GRAVEL
2.00	SPT/DS		0.00	79.98	20.02	NP	NP	NP	1.66	0.00	28.50	6	SM	SILTY SAND
3.00	SPT/DS		0.00	53.14	46.86	NP	NP	NP	1.70	0.00	29.00	8	SM	
4.50	SPT		32.61	65.19	2.20	NP	NP	NP	1.95	—	—	25	SP	POORLY GRADED SAND
6.00	SPT		0.00	98.07	1.93	NP	NP	NP	2.08	—	—	86	SP	
7.50	SPT		56.12	40.15	3.73	NP	NP	NP	2.11	—	—	121	GP	POORLY GRADED GRAVEL
9.00	—		Weathered Rock						2.12	—	—	Refusal	Weathered Rock	
10.00	—		Weathered Rock						2.12	—	—	Refusal		



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Ref. No. SRF/23/1122C		Ref. Dated: 29.11.23		Date of Field Testing: 29.11.2023			ULR No. TC117942300000604F			Ground water table: - not encountered		Bore Hole No.:- 03 of 03		 TC-11794	
Depth from Top of Bore Hole(m)	Nature of Sample	Symbolic Representation	Grain Size Analysis			Consistency Characteristics (%)			Bulk unit weight γ (t/m ³)	Direct Shear Test		S.P.T Value (Observed) (N Value)	IS: Classification		
			Gravel (%)	Sand (%)	Silt & Clay (%)	L.L	P.L	P.I		C' (t/m ²)	ϕ '°				
1.00	SPT/DS		5.12	77.15	17.73	NP	NP	NP	1.70	0.00	29.00	8	SM	SILTY SAND	
1.50	SPT/DS		70.19	25.21	4.60	NP	NP	NP	1.85	0.00	29.75	15	GP	POORLY GRADED GRAVEL	
2.00	SPT/DS		0.00	98.78	1.22	NP	NP	NP	1.85	0.00	29.75	15	SP	POORLY GRADED SAND	
3.00	SPT/DS		12.15	86.51	1.34	NP	NP	NP	1.90	0.00	30.50	20	SP		
4.50	SPT		31.54	64.44	4.02	NP	NP	NP	1.85	—	—	85	SP		
6.00	SPT		62.57	35.48	1.95	NP	NP	NP	1.95	—	—	95	GP	POORLY GRADED GRAVEL	
7.50	SPT		51.21	45.75	3.04	NP	NP	NP	2.10	—	—	116	GP		
9.00	—		Weathered Rock						2.12	—	—	Refusal	Weathered Rock		
10.00	—		Weathered Rock						2.12	—	—	Refusal			

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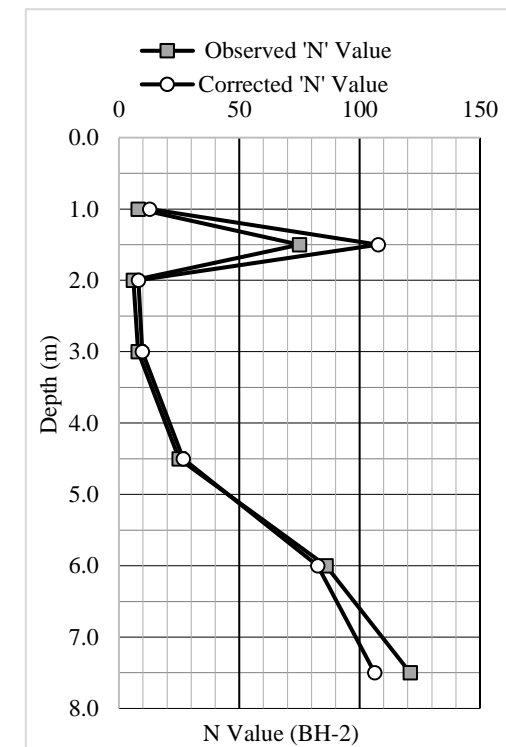
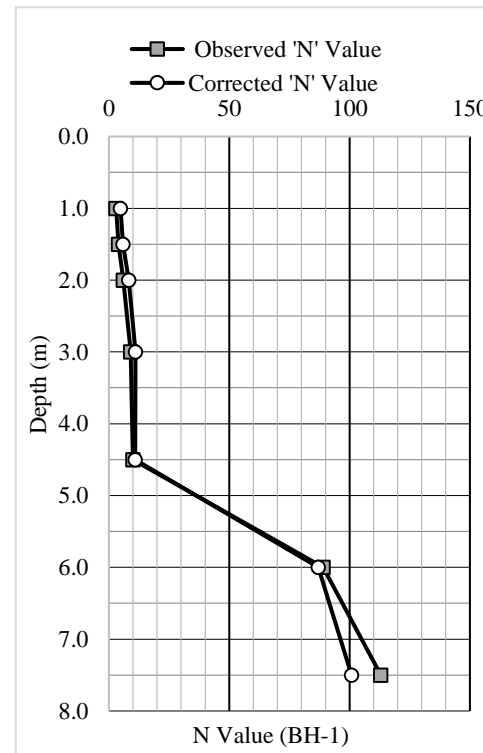
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8.0 Observed SPT 'N'-Value and Corrected 'N'-value Graph

Depth from Top of Bore Hole (m)	Observed 'N' Value		Corrected 'N' Value	
	BH-1	BH-2	BH-1	BH-2
1.00	3	8	4.83	12.75
1.50	4	75	5.90	107.65
2.00	6	6	8.26	8.08
3.00	9	8	11.11	9.73
4.50	10	25	10.93	26.71
6.00	89	86	87.06	82.61
7.50	113	121	100.81	106.25
9.00	Refusal	Refusal	—	—
10.00	Refusal	Refusal	—	—



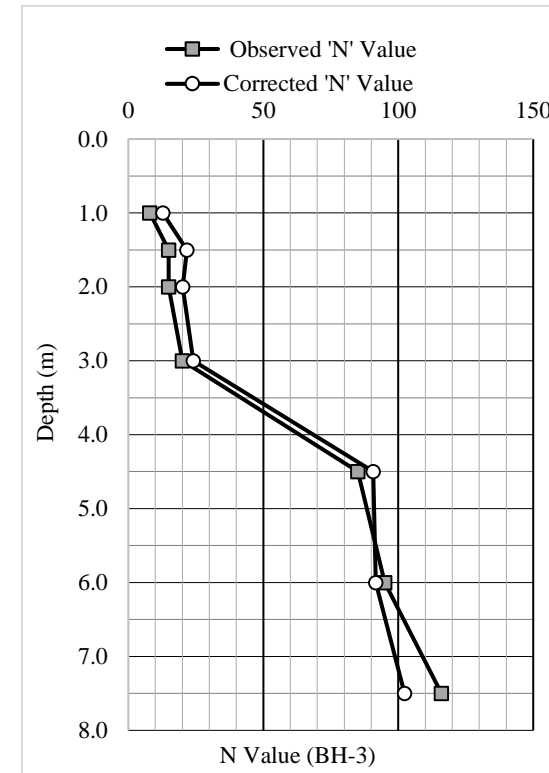


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Depth from Top of Bore Hole (m)	Observed 'N' Value	Corrected 'N' Value
	BH-3	BH-3
1.00	8	12.75
1.50	15	21.74
2.00	15	20.22
3.00	20	24.10
4.50	85	90.71
6.00	95	91.71
7.50	116	102.33
9.00	Refusal	—
10.00	Refusal	—



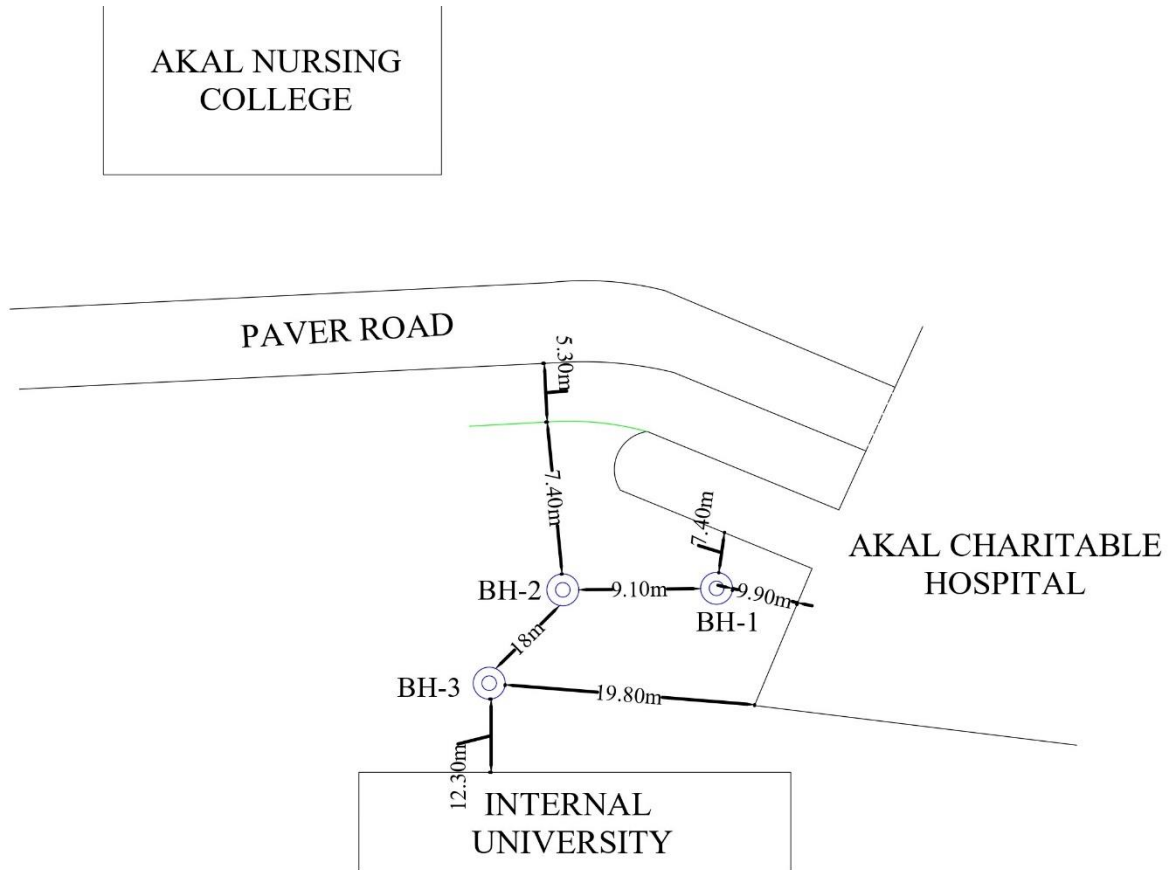


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9.0 Site Plan





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Appendix I

N'_c, N'_q, N'_γ	=	Bearing capacity factors for local shear failure.
N_c, N_q, N_γ	=	Bearing capacity factors for general shear failure.
S_c, S_q, S_γ	=	Shape factors.
d_c, d_q, d_γ	=	Depth factors.
W'	=	Water table correction factor.
N	=	Observed SPT value.
N_N	=	Normalised SPT value.
C_N	=	Correction factor.
N_c	=	Corrected N value
γ	=	Bulk unit weight.
γ'	=	Submerged unit weight
γ_d	=	Dry unit weight.
γ_{sat}	=	Saturated unit weight.
G	=	Specific gravity of soil.
LL	=	Liquid Limit.
PL	=	Plastic Limit.
PI	=	Plasticity Index.
GSF	=	General shear failure.
LSF	=	Local shear failure.
q_u	=	Unconfined compressive strength.
c_u	=	Un-drained shear strength
c_c	=	Compression index
B	=	Width of foundation
L	=	Length of foundation
D_f	=	Depth of foundation
H	=	Thickness of clayey layer
B_t	=	Top width of sandy layer
H	=	Thickness of sandy layer
q	=	Effective surcharge
Φ'	=	Angle of shearing resistance
Φ'_m	=	Mobilised angle of shearing resistance
c'	=	Cohesion intercept
$SSWL$	=	Sub soil water level
q_u	=	Ultimate bearing capacity
q_{nu}	=	Net ultimate bearing capacity
q_{ns}	=	Net safe bearing capacity against shear failure
q_{np}	=	Net safe bearing pressure against settlement failure
q_a	=	Allowable bearing capacity
WT	=	Water Table
GW	=	Well graded gravels
GP	=	poorly graded gravels
GM	=	Silty gravels



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GC	=	Clayey gravels
SW	=	Well graded Sand
SP	=	poorly graded Sand
SM	=	Silty Sand
SC	=	Clayey Sand
CL	=	Clay of low compressibility
ML	=	Silt of low compressibility
CI	=	Clay of medium compressibility
MI	=	Silt of medium compressibility
CH	=	Clay of high compressibility
MH	=	Silt of high compressibility
S_t	=	Total settlement
S_a	=	Allowable settlement
S_o	=	Settlement due to net unit foundation loading intensity
BH	=	Bore hole
OBP	=	overburden pressure
NSL	=	Natural surface level
C_1	=	Correction factor for depth of foundation embedment
C_2	=	Correction factor for creep in soils
I_z	=	Influence factor
E_s	=	Modulus of elasticity
ESL	=	Existing Surface Level

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Appendix-II

I. S. Codes

Following IS Codes are used for the testing and calculations in this report.

1. IS:1904-1986, "Design & Construction of Foundation in Soils, General Requirements."
2. IS:2131-1981, "Method for Standard Penetration Test for Soil."
3. IS:2720-Part-2 1973, "Determination of Water Content."
4. IS:2720-Part-3 1980, "Determination of Specific gravity-Fine-grained soils."
5. IS:2720-Part-4 1975, "Grain size analysis."
6. IS:2720-Part-5 1970, "Determination of Liquid and Plastic Limits."
7. IS:2720-Part-13 1982, "Direct Shear Test"
8. IS:2720-Part-15 1986, "Determination of Consolidation Properties."
9. IS:6403-1981, "Code of Practice for Determination of Bearing Capacity of Shallow Foundation"
10. IS:8009-Part 2-1980, "Code of Practice for calculations of settlement of Foundation-Deep Foundation subjected To Symmetrical Static Vertical Loading."
11. IS:8763-1978, "Guide for Undisturbed Sampling of Sand."
12. IS:9259-1979, "Specifications for Liquid Limit Apparatus for Soils."
13. IS:9640-1981, "Specifications for Split-spoon Sampler."

END OF REPORT