GEOTECHNICAL INVESTIGATION REPORT

CLIENT:

McGrath Development Ltd.

116, Kazi Nazrul Islam Avenue, 11th Floor,
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Project Name: REZIA

Report On Sub-Soil Investigation For The Construction Of Proposed (G+9) =10 - (Ten) Storied Residential Building At The 113, Middle Basaboo, Plot No.-A/51, Khilgaon, Rehabilition Area, Dhaka.

SUBMISSION TIME:
JUNE– 2025.

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REPORT ON SUB-SOIL INVESTIGATION

INTRODUCTION

This report has been prepared and submitted to present the sub-soil and geotechnical features of the following project:

Client :	McGrath Development Ltd.
Name of Project :	Construction of Proposed (G+9) =10 - (Ten) Storied Residential Building
Site Location :	Khilgaon, Rehabilition Area, Dhaka.
Basic wind Speed :	

Technical soil data obtained from the field investigations are presented in this report along with the analyses of bearing capacity of foundations of a different range of size and depth.

SOIL ENGINEERING & PILING, House No.- 174/2, Road No.- 06, JanataHousing, Sha Ali Bagh, Mirpur- 1, Dhaka.-1216.is a renowned company & was engaged with the geotechnical investigation work for the above mentioned site by the concerned authority.

SCOPE OF WORKS

The purpose of the investigation was to obtained information relating to foundation condition and natural construction materials commensurate with the magnitude and type of structure may be involved within the project.

- The investigation program included drilling boreholes and collecting soil samples from field at desired intervals for subsequent observation and laboratory testing.
- The soil investigation both in the field and laboratory were carried out in detail to evaluate the mechanical, physical and geotechnical properties of safe and economic foundation for the with a view to recommend the safe and economic foundation for the proposed structures to be constructed within the investigation site.
- The report contained the works program, methodology of the field and laboratory investigation works, discussions on physical and engineering properties of sub-soil formation encountered during investigation, evaluation of laboratory test data, analysis of bearing capacities, foundation recommendations and charts and graphs representing the field and laboratory test results.

The laboratory test results, analysis, discussion and recommendations which are presented in this report are valid only for the locations where the actual investigations have carried out.

INVESTIGATION PROGRAM

The sub-soil and geotechnical investigation works program for this report is presented below-

A. Field Investigation

Number of Boring	:	4	Depth of Boring	:	70-80 ft
SPT Execution	:	-	Interval of SPT execution	:	1.5 m
Disturbed sample	:	62	Undisturbed Sample	:	-
Compaction Test	:	Nil	Water Table Level below	:	-
Permeability Tests	:	N/A	**other Tests**	:	N/A

B. Laboratory Investigation

The laboratory tests on soil samples were started immediately after the receipt of the same in the laboratory.

Grain Size Distribution	:	16	Atterberg Limits Test	:	-
Specific Gravity	:	8	Moisture Content	:	8
Unconfined Compression Test	:	2	Consolidation Test	:	1
Direct Shear Test	:	2	Standard Proctor Test	:	Nil
Free Swell Index	:	Nil	Chemical Test	:	Nil
Unit weight of soil	:	Nil	**Other Tests**	:	N/A

METHODOLOGY

The methodology of conducting field and laboratory investigation and evaluations for determining bearing capacities of shallow and deep foundations is discussed thoroughly with the following pages.

FIELD INVESTIGATION

Execution of Borings

The boring was conducted using 100 mm diameter casing. The method consists in first driving a casing through which a hollow drill rod with a sharp chisel or chopping bit at the lower end is inserted. Water is forced under pressure through the drill rod which is alternatively raised and dropped, and also rotated. The soil cuttings are forced upto the dropped and also rotated. The soil cuttings are forced upto the ground in the drilled rod and casing. Before taking SPT and collection of disturbed and undisturbed soil samples, the bore hole is cleaned with repeated circulation of mudslurry.

Standard Penetration Tests (SPT)

The standard Penetration Tests (SPT) was performed in all the bore holes locations. In SPT testing, the rope-and-pulley (R-P) method would be used. This consisted of a hollow cylindrical mass sliding over a steel rod. It is operated by lifting the mass with a rope over a cat head. The tests were executed by using 63.5 kg hammer falling freely from a constant height of 760 mm. The SPT value (N-value) was taken as the summation of blows required in 2nd and 3rd 15 cm of penetration of sampler. The SPT values (N-values) are shown on the borehole logs against the respective interval of tests.

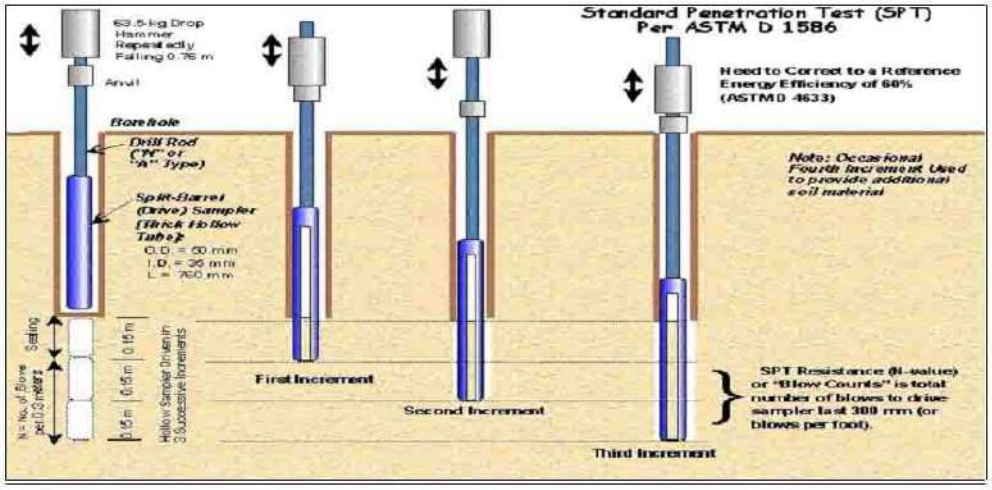


Fig for Standard Penetration Tests

- The Standard Penetration Tests provide a fair knowledge on the density and consistency of the soil layer encountered and in addition yields disturbed/ semi-disturbed soil samples from within the split spoon sampler used during thetests.

Disturbed Sample Collection

The disturbed samples were collected with the help of split spoon sampler used during Standard Penetration Tests. The collected samples were classified in-situ and were preserved in water tight polythene bags with proper identification marks for onward transmission to the laboratory for further analysis.

The disturbed samples were also used to reconstruct depth wise stratification of bore holes depending on its classifications.

Undisturbed Sample Collection

The undisturbed samples were collected whenever feasible from the cohesive layers with the help of thin walled Shelby tubes 76 mm diameter thin walled Shelby tubes are penetrated into the undisturbed soil formation at the bottom of the borehole by applying rapid but continuous force. The samples recovered within the Shelby tubes were wax sealed at both ends and transmitted to the laboratory with proper identification marks.

Recording of Ground Water Table

Groundwater is one element that affects in the stability and foundation analyses. The ground water table was recorded in each of the boreholes by rope/rod sounding after 24 hours of completion of the drilling and sampling operation.

However, the low permeability of the soil will mean that the water level in the borehole is controlled more by drilling fluid rather than by the ground water itself. Significant fluctuations in the location of ground water table should be anticipated throughout the year, depending upon the amount of precipitation, evaporation and surfacerunoff.

Other Field Tests

Any other field tests, which were conducted at site was done as per AASHTO/ASTM standard specifications.

LABORATORY INVESTIGATION

Different types of geotechnical laboratory tests were performed in the laboratory to evaluate the physical and engineering properties of the sub-soil formation to facilitate determination of soil bearing capacities and to recommend foundation type and magnitude.

- Grain Size Analysis, Atterberg Limit and Specific Gravity Tests were performed to ascertain the detail composition of the soil and to evaluate the physical parameters of the formation. These tests also help in classifying the soils properly for geological and geotechnical interpretation.
- Unconfined Compression, unit weights of soils, moisture contents and Direct Shear tests were done to evaluate the shear characteristics of the soils, angle of internal friction ϕ which directly help in bearing capacity calculation.
- Consolidation tests provide data on consolidation behavior of the sub-soil formation which help to calculate the settlement of the structure.

The laboratory tests were performed as per AASHTO/ASTM Standard specifications.

The soils will be also classified based on the Unified Soil Classification System (USCS).

CALCULATION OF SOIL MECHANICS PARAMETERS

Bearing capacity of soil is the value of the average contact pressure between the foundation and the soil which will produce shear failure in the soil. **Ultimate bearing capacity** is the theoretical maximum pressure which can be supported without failure. **Allowable bearing capacity** is what is used in geotechnical design, and is the ultimate bearing capacity divided by a factor of safety.

The bearing capacity of shallow and deep foundation parameters were evaluated using field and laboratory tests. For cohesionless soil and for instances where undisturbed samples could not be collected, the field SPT values after necessary correction were used to obtained soil constants like cohesion (c), angle of internal friction (φ) and unit weight (γ).

CORRELATIONS

A. The following definitions are used in this report to describe the soil compositions:

Trace:	1% to 10%	Sandy:	> 36% to 60% Sand
Little :	> 10% to 20%	Clayey :	> 36% to 60% Clay
Some:	> 20% to 36%	Silty :	> 36% to 60% Silt

B. Correlation among SPT values (N) with Different Engineering Propertiesof Cohesion less (Sandy) soil:

N Value	Compactness or Consistency	Angle of Internal Friction (φ)	Relative Density	Moist unit weight, pcf	Allowable Soil Pressure, ton/sft
0 to 4	Very Loose	25^o to 32^o	0% to 15%	70 to 100	0.00 to 0.40
4 to 10	Loose	27^o to 35^o	15% to 35%	95 to 125	0.40 to 0.70
10 to 30	Medium	30^o to 40^o	35% to 65%	110 to 130	0.70 to 2.60
30 to 50	Dense	35^o to 45^o	65% to 85%	110 to 140	2.60 to 4.60
Over 50	Very Dense	> 45^o	85% to 100%	> 130	> 4.60

C. Correlation among SPT values (N) with Different Engineering Propertiesof Cohesive (Clayey)soil:

NValue	Compactness or Consistency	Consistency Index (%)	Unconfined Compressive Strength(q_u), ton/sft	Allowable Bearing Capacity (q_a), ton/sft	
				Square Footing 1.2 x q_u	Continuous Footing 0.90 x q_u
0 - 2	Very Soft	0 – 25	0.00 - 0.26	0.00 - 0.30	0.00 - 0.23
2 - 4	Soft	25 – 50	0.26 - 0.60	0.30 - 0.72	0.23 - 0.46
4 - 8	Medium Stiff	50 – 75	0.60 – 1.00	0.72 – 1.20	0.54 – 0.90
8 - 16	Stiff	75 – 100	1.00 – 2.00	1.20 – 2.40	0.90 – 1.80
16 - 32	Very Stiff	> 100	2.00 – 4.00	2.40 – 4.80	1.80 – 3.60
> 32	Hard	> 100	> 4.00	> 4.80	> 3.60

DETERMINATION OF BEARING CAPACITY OF SOIL FOR FOOTING

The SPT is widely used to obtain the allowable bearing capacity values in the following general equation for sandy soil (for Max 25 mm settlement)

A. Cohesive soil:

*Q_{net} (u) = 5.14*Cu*(1+0.2* D_f /B)*(1+0.2*B/L)*B*L ; [Skempton (1951)]*
where,
Q_{net} (u) = net ultimate bearing capacity
(kip) Cu = undrained cohesion (ksf)
D_f = depth of foundation from EGL
(ft) B = width of foundation (ft)
L = length of foundation (ft)

Allowable net bearing capacity, Q_{net}(all) = Q_{net} (u)/(FS=2.5)

B. Cohesionless soil:

i) for B ≤4.0ft
Q_{net} (all) = (N_{corr}/2.5)(F_d*S)*B*L ; [Bowles (1977)]*

ii) for B>4.0ft
Q_{net} (all) = (N_{corr} /4.0)(F_d *S)*((B+1)/B)^2*B*L; [Bowles (1977)]*
where,
Q_{net} (all) = net allowable bearing capacity(kip)
N_{corr} = corrected SPT (within 2B to 3B) for overburden
pressure F_d =depthfactor = 1+0.33(D_f /B)≤1.33*
D_f = depth of foundation from EGL
(ft) S = tolerable settlement (inch)

❖ Terzaghi Ultimate Bearing CapacityTheory

$Q_u = c\ N_c + \gamma\ D\ N_q + 0.5\ \gamma\ BN_\gamma$
= Ultimate bearing capacity equation for shallow strip footings, (kN/m^2) (lb/ft^2)

$Q_u = 1.3\ c\ N_c + \gamma\ D\ N_q + 0.4\ \gamma\ B\ N_\gamma$
= Ultimate bearing capacity equation for shallow square footings, (kN/m^2) (lb/ft^2)

$Q_u = 1.3\ c\ N_c + \gamma\ D\ N_q + 0.3\ \gamma\ B\ N_\gamma$
= Ultimate bearing capacity equation for shallow circular footings, (kN/m^2) (lb/ft^2)

Where:
c = Cohesion of soil (kN/m^2) (lb/ft^2),
γ = effective unit weight of soil $N_\gamma = (1/2)\tan\phi\ (k_p/\cos^2\phi - 1)$,
D = depth of footing (m) (ft), **e** = Napier's constant = 2.718...,
B = width of footing (m) (ft), k_p= passive pressure coefficient,
$N_c = \cot\phi(N_q - 1)$, ϕ = angle of internal friction (degrees).
$N_q = e^{2(3\pi/4 - \phi/2)\tan\phi}/[2\cos^2(45+\phi/2)]$, k_p= passive pressure coefficient,

❖**Mayerhof's Equation for BearingCapacity**

$q_a = qu/Fs = (c\cdot Nc\cdot s_c\cdot d_i\cdot i_c + 0.5\cdot \gamma_1\cdot B\cdot Nr\cdot s_r\cdot d_r\cdot i_r + \gamma_2\cdot D_f\cdot Nq\cdot s_q\cdot d_q\cdot i_q)/Fs$

DETERMINATION OF PILE CAPACITY (A SINGLE PILE)

The load applied to a single pile is carried jointly by the soil beneath the tip of the pile (End Bearing) and by soil around the shaft (Skin Friction), with deducting the self weight of the pile and the maximum load that the pile can support. The pile capacity is given by-

Q_{ult} = Base Resistance, Q_p + Shaft Resistance, Q_s –Weight of pile
= Ap*Eb + *fs □*D* L - Wp**

Where,
E_b = end bearing capacity
f_s = shaft resistance (skin friction)
A_p = area of pile point
D = diameter of pile
L = length of pile

Design load capacity, $Q_d = Q_{ult}/FS$

where, FS , factor of safety = 2.5 for cohesive soil
= 3.0 for cohesion less soil

Ultimate Skin Friction

A. Cohesivesoil:

$$Q_s = \alpha^* C_u * A_s; \text{ [Das (1990)]}$$

where,
Q_s= ultimate skin friction of pile (kip)
α = empirical adhesion factor [0.40 used in this report]
C_u= undrained cohesion [=N/8 (ksf), where no data is available]
A_s= circumferential area of pile (sft)

B. Cohesionless soil:

$$Q_s = 0.02^* N_{corr} * A_s \text{ ; [Meyerhof (1976)]}$$

where,
Q_s = ultimate skin friction of pile(kip)
N_{corr} = corrected SPT for overburden pressure
A_s = circumferential area of pile(sft)

Ultimate End Bearing Capacity

A. Cohesivesoil:

$$Q_p = 9^* C_u * A_p \text{ ; [Das (1990)]}$$

where,
Q_p = ultimate end bearing capacity of pile (kip)
C_u = undrained cohesion [=N/8 (ksf), where no data is available]
A_p = tip area of pile (sft)

B. Cohesionless soil:

$$Q_p = 2.66^* N_{corr} * A_p \text{ ; [Meyerhof (1976)]}$$

where,
Q_p = ultimate end bearing capacity of pile (kip)
N_{corr}= corrected SPT for overburdenpressure
A_p= tip area of pile (sft)

CONCLUSION & RECOMMENDATIONS

This Recommendations submitted in this report are prepared on the basis of supplied SPT & available subsurface Samples from field for the exclusive use of the following project.

Name of Project:	Construction of Proposed (G+9) =10 -(Ten) Storied Residential Building
Location	Khilgaon, Rehabilition Area, Dhaka.

From the field and laboratory test results, it can be concluded as follows:

SHALLOW FOUNDATION as lsolated column footing:

The average bearing capacity of the Shallow Foundation as lsolated column footing may be considered in the following way.

- To be considered **1.75 Tsf** (F.S.= 2.50) at a depth of **12 ft** measured from EGL particularly at and around for all Borings.

Or,

R.C.C. CAST-IN-SITU PILE:

The average bearing capacities (F.S.= 2.5) of different diameter pile with the embedment length up to **65 ft** from EGL of each boring may be considered as follows:

- **60 Ton** for **18 inch** dia pile.
- **70 Ton** for **20 inch** dia pile.

Note:

a. 1 tsf= 2ksf= 107.25 kn//m^2, 1 Ton = 2,000 Lbs = 9.87 kN.
1 m = 3.28 ft, EGL = existing Ground level & F.S. Factor of Safety.

b. The designer may select any other alternative type, depth as well as the bearing capacity of the foundation in the light of information provided in this report.

c. Foundation base should be kept dry during construction period.

d. Pile load test should be performed. If Pile load test is not performed then the value of pile capacity should be considered half.

Recommended by

CLIENT : McGrath Development Ltd.		**Calculation Done:** Engr.
PROJECT :Construction of Proposed (G+9) =10 - (Ten) Storied Residential Building		B. Sc. In Civil Engineering
LOCATION :Khilgaon, Rehabilition Area, Dhaka.		

SHALLOW FOUNDATION LOAD BEARING CAPACITY AT DIFFERENT DEPTH

Table - 1.0

Factor of Safety 2.50 **Average Unit Weight of Soil = 117.5 pcf**

Allowable Settlement 1 inch **Unit Weight of Water = 62.4 pcf**

LOCATION	Depth (ft)	Depth (m)	Field SPT -N	Soil Type	N_{60}	$N_{60[corr]}$	Cu (ksf)	Allowable Capacity, qall (ksf)		Bearing Capacity (ksf)	Bearing Capacity (Tsf)
								By Bowles	By Terzaghi		
BH -1	5	1.5	2	Clay	2	2	0.25	0.80	0.92	0.80	0.40
	10	3.5	10	Clay	10	10	1.25	4.00	3.90	3.90	1.95
	15	4.5	14	Clay	11	11	1.75	4.20	5.51	4.20	2.10
	20	6.0	13	Clay	10	10	1.62	3.90	5.39	3.90	1.95
BH- 2	5	1.5	2	Clay	2	2	0.25	0.80	0.92	0.80	0.40
	10	3.5	9	Clay	9	9	1.13	3.60	3.56	3.56	1.78
	15	4.5	12	Clay	12	12	1.50	4.80	4.82	4.80	2.40
	20	6.0	13	Clay	10	10	1.62	3.90	5.39	3.90	1.95
BH- 3	5	1.5	6	Clay	6	6	0.75	2.40	2.29	2.29	1.15
	10	3.5	7	Clay	7	7	0.88	2.80	2.87	2.80	1.40
	15	4.5	12	Clay	12	12	1.50	4.80	4.82	4.80	2.40
	20	6.0	15	Clay	11	11	1.87	4.50	6.08	4.50	2.25
BH- 4	5	1.5	3	Clay	3	3	0.38	1.20	1.27	1.20	0.60
	10	3.5	10	Clay	10	10	1.25	4.00	3.90	3.90	1.95
	15	4.5	13	Clay	10	10	1.62	3.90	5.15	3.90	1.95
	20	6.0	12	Clay	12	12	1.50	4.80	5.06	4.80	2.40

Chart for Ultimate Skin Friction & End Bearing Capacity of RCC Cast-in-situ Pile

TABLE - 2.0 **Bore Hole - 1**

Depth (ft)	Depth (m)	Field SPT Value	Soil Type	Corrected SPT, N_{60}	Corrected SPT, $N_{60[corr]}$	Cu (Tsf)
5	1.5	2	Clay	2	2	0.13
10	3.0	10	Clay	10	10	0.63
15	4.5	14	Clay	11	11	0.66
20	6.0	13	Clay	10	10	0.61
25	7.5	11	Clay	11	11	0.69
30	9.0	17	Sand	13	13	
35	10.5	22	Sand	17	17	
40	12.0	30	Sand	23	23	
45	13.5	33	Sand	25	25	
50	15.0	35	Sand	26	26	
55	16.5	38	Sand	29	29	
60	18.0	50	Sand	38	38	
65	19.8	50	Sand	38	38	
70	21.3	50	Sand	38	38	

Calculation Done:

Engr. K.H. Iftekhar Ahmed
B. Sc. In Civil Engineering

Chart for Ultimate Skin Friction & End Bearing Capacity of RCC Cast-in-situ Pile

TABLE - 3.0 **Bore Hole - 1**

Depth	Depth	18 inch Dia Bored Pile					20 inch Dia Bored Pile					24 inch Dia Bored Pile				
		Skin Friction	Cum Skin Friction	End Bearing	Pile weight	Allowable Load	Skin Friction	Cum Skin Friction	End Bearing	Pile weight	Allowable Load	Skin Friction	Cum Skin Friction	End Bearing	Pile weight	Allowable Load
ft	m	Ton	Ton	Ton	Ton	**Ton**	Ton	Ton	Ton	Ton	**Ton**	Ton	Ton	Ton	Ton	**Ton**
5	**1.5**	1.18	1.18	1.98	0.66	**1.00**	1.30	1.30	2.44	0.81	**1.17**	1.57	1.57	3.53	1.18	**1.57**
10	**3.0**	5.89	7.07	9.90	1.33	**6.26**	6.52	7.82	12.21	1.62	**7.36**	7.86	9.43	17.67	2.36	**9.90**
15	**4.5**	6.18	13.25	10.40	1.99	**8.66**	6.84	14.66	12.82	2.43	**10.02**	8.25	17.67	18.56	3.53	**13.08**
20	**6.0**	5.74	19.00	9.65	2.65	**10.40**	6.35	21.02	11.90	3.25	**11.87**	7.66	25.33	17.23	4.71	**15.14**
25	**7.5**	6.48	25.47	10.89	3.31	**13.22**	7.17	28.19	13.43	4.06	**15.02**	8.64	33.97	19.44	5.89	**19.01**
30	**9.0**	3.00	28.48	29.85	3.98	**21.74**	3.32	31.51	36.80	4.87	**25.38**	4.01	37.98	53.27	7.07	**33.67**
35	**10.5**	3.89	32.37	38.62	4.64	**26.54**	4.30	35.81	47.62	5.68	**31.10**	5.18	43.16	68.94	8.25	**41.54**
40	**12.0**	5.30	37.67	52.67	5.30	**34.01**	5.87	41.68	64.94	6.49	**40.05**	7.07	50.23	94.01	9.42	**53.93**
45	**13.5**	5.83	43.50	57.93	5.96	**38.19**	6.45	48.13	71.43	7.30	**44.90**	7.78	58.01	103.41	10.60	**60.33**
50	**15.0**	6.18	49.68	61.45	6.63	**41.80**	6.84	54.98	75.76	8.12	**49.05**	8.25	66.26	109.68	11.78	**65.66**
55	**16.5**	6.71	56.40	66.71	7.29	**46.33**	7.43	62.41	82.25	8.93	**54.29**	8.95	75.21	119.08	12.96	**72.53**
60	**18.0**	8.84	65.23	87.78	7.95	**58.02**	9.78	72.18	108.23	9.74	**68.27**	11.78	86.99	156.69	14.14	**91.82**
65	**19.8**	8.84	74.07	87.78	8.61	**61.29**	9.78	81.96	108.23	10.55	**71.85**	11.78	98.78	156.69	15.32	**96.06**
70	**21.3**	8.84	82.90	87.78	9.28	**64.56**	9.78	91.73	108.23	11.36	**75.44**	11.78	110.56	156.69	16.49	**100.30**

Calculation Done:

Engr. K.H. Iftekhar Ahmed
B. Sc. In Civil Engineering

Chart for Ultimate Skin Friction & End Bearing Capacity of RCC Precast Pile

TABLE - 4.0 Bore Hole - 1

Depth	Depth	12"x12" Precast Pile					14"x14" Precast Pile					16"x16" Precast Pile				
		Skin Friction	Cum Skin Friction	End Bearing	Pile weight	Allowable Load	Skin Friction	Cum Skin Friction	End Bearing	Pile weight	Allowable Load	Skin Friction	Cum Skin Friction	End Bearing	Pile weight	Allowable Load
ft	m	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton
5	**1.5**	1.00	1.00	1.13	0.38	**0.70**	1.16	1.16	1.51	0.50	**0.87**	1.32	1.32	1.96	1.14	**0.86**
10	**3.0**	5.00	6.00	5.63	0.75	**4.35**	5.80	6.96	7.54	1.01	**5.40**	6.60	7.92	9.79	2.27	**6.17**
15	**4.5**	5.25	11.25	5.91	1.13	**6.41**	6.09	13.05	7.91	1.51	**7.78**	6.93	14.85	10.28	3.41	**8.69**
20	**6.0**	4.88	16.13	5.48	1.50	**8.04**	5.66	18.71	7.35	2.02	**9.61**	6.44	21.29	9.54	4.54	**10.51**
25	**7.5**	5.50	21.63	6.19	1.88	**10.38**	6.38	25.09	8.29	2.52	**12.34**	7.26	28.55	10.77	5.68	**13.45**
30	**9.0**	2.55	24.18	16.96	2.25	**15.55**	2.96	28.04	22.72	3.03	**19.10**	3.37	31.91	29.51	6.81	**21.84**
35	**10.5**	3.30	27.48	21.95	2.63	**18.72**	3.83	31.87	29.41	3.53	**23.10**	4.36	36.27	38.18	7.95	**26.60**
40	**12.0**	4.50	31.98	29.93	3.00	**23.56**	5.22	37.09	40.10	4.04	**29.26**	5.94	42.21	52.07	9.08	**34.08**
45	**13.5**	4.95	36.93	32.92	3.38	**26.59**	5.74	42.83	44.11	4.54	**32.96**	6.53	48.74	57.28	10.22	**38.32**
50	**15.0**	5.25	42.18	34.91	3.75	**29.34**	6.09	48.92	46.78	5.05	**36.26**	6.93	55.67	60.75	11.35	**42.03**
55	**16.5**	5.70	47.88	37.91	4.13	**32.66**	6.61	55.54	50.79	5.55	**40.31**	7.52	63.20	65.95	12.49	**46.66**
60	**18.0**	7.50	55.38	49.88	4.50	**40.30**	8.70	64.24	66.83	6.06	**50.00**	9.90	73.10	86.78	13.62	**58.50**
65	**19.8**	7.50	62.88	49.88	4.88	**43.15**	8.70	72.94	66.83	6.56	**53.28**	9.90	83.00	86.78	14.76	**62.01**
70	**21.3**	7.50	70.38	49.88	5.25	**46.00**	8.70	81.64	66.83	7.06	**56.56**	9.90	92.90	86.78	15.89	**65.51**

Calculation Done:

Engr. K.H. Iftekhar Ahmed
B. Sc. In Civil Engineering

Chart for Ultimate Skin Friction & End Bearing Capacity of RCC Cast-in-situ Pile

TABLE - 2.1 **Bore Hole - 2**

Depth (ft)	Depth (m)	Field SPT Value	Soil Type	Corrected SPT, N_{60}	Corrected SPT, $N_{60[corr]}$	Cu (Tsf)
5	1.5	2	Clay	2	2	0.13
10	3.0	9	Clay	9	9	0.56
15	4.5	12	Clay	12	12	0.75
20	6.0	13	Clay	10	10	0.61
25	7.5	10	Clay	10	10	0.63
30	9.0	18	Sand	14	14	
35	10.5	20	Sand	15	15	
40	12.0	25	Sand	19	19	
45	13.5	32	Sand	24	24	
50	15.0	36	Sand	27	27	
55	16.5	37	Sand	28	28	
60	18.0	50	Sand	38	38	
65	19.8	50	Sand	38	38	
70	21.3	50	Sand	38	38	
75	22.8	50	Sand	38	38	
80	24.3	50	Sand	38	38	

Calculation Done:

Engr. K.H. Iftekhar Ahmed
B. Sc. In Civil Engineering

Chart for Ultimate Skin Friction & End Bearing Capacity of RCC Cast-in-situ Pile

TABLE - 3.1 **Bore Hole - 2**

Depth	Depth	18 inch Dia Bored Pile					20 inch Dia Bored Pile					24 inch Dia Bored Pile				
		Skin Friction	Cum Skin Friction	End Bearing	Pile weight	Allowable Load	Skin Friction	Cum Skin Friction	End Bearing	Pile weight	Allowable Load	Skin Friction	Cum Skin Friction	End Bearing	Pile weight	Allowable Load
ft	m	Ton	Ton	Ton	Ton	**Ton**	Ton	Ton	Ton	Ton	**Ton**	Ton	Ton	Ton	Ton	**Ton**
5	**1.5**	1.18	1.18	1.98	0.66	**1.00**	1.30	1.30	2.44	0.81	**1.17**	1.57	1.57	3.53	1.18	**1.57**
10	**3.0**	5.30	6.48	8.91	1.33	**5.63**	5.87	7.17	10.99	1.62	**6.61**	7.07	8.64	15.90	2.36	**8.88**
15	**4.5**	7.07	13.55	11.88	1.99	**9.38**	7.82	14.99	14.65	2.43	**10.88**	9.43	18.07	21.21	3.53	**14.30**
20	**6.0**	5.74	19.29	9.65	2.65	**10.52**	6.35	21.34	11.90	3.25	**12.00**	7.66	25.73	17.23	4.71	**15.30**
25	**7.5**	5.89	25.18	9.90	3.31	**12.71**	6.52	27.86	12.21	4.06	**14.40**	7.86	33.58	17.67	5.89	**18.14**
30	**9.0**	3.18	28.36	31.60	3.98	**22.39**	3.52	31.38	38.96	4.87	**26.19**	4.24	37.82	56.41	7.07	**34.86**
35	**10.5**	3.53	31.89	35.11	4.64	**24.95**	3.91	35.29	43.29	5.68	**29.16**	4.71	42.53	62.67	8.25	**38.79**
40	**12.0**	4.42	36.31	43.89	5.30	**29.96**	4.89	40.18	54.11	6.49	**35.12**	5.89	48.43	78.34	9.42	**46.94**
45	**13.5**	5.65	41.97	56.18	5.96	**36.87**	6.26	46.44	69.27	7.30	**43.36**	7.54	55.97	100.28	10.60	**58.26**
50	**15.0**	6.36	48.33	63.20	6.63	**41.96**	7.04	53.48	77.92	8.12	**49.31**	8.48	64.45	112.81	11.78	**66.19**
55	**16.5**	6.54	54.87	64.96	7.29	**45.01**	7.23	60.71	80.09	8.93	**52.75**	8.72	73.17	115.95	12.96	**70.46**
60	**18.0**	8.84	63.70	87.78	7.95	**57.41**	9.78	70.49	108.23	9.74	**67.59**	11.78	84.95	156.69	14.14	**91.00**
65	**19.8**	8.84	72.54	87.78	8.61	**60.68**	9.78	80.26	108.23	10.55	**71.18**	11.78	96.73	156.69	15.32	**95.24**
70	**21.3**	8.84	81.37	87.78	9.28	**63.95**	9.78	90.04	108.23	11.36	**74.76**	11.78	108.52	156.69	16.49	**99.48**
75	**22.8**	8.84	90.21	87.78	9.94	**67.22**	9.78	99.82	108.23	12.17	**78.35**	11.78	120.30	156.69	17.67	**103.73**
80	**24.3**	8.84	99.04	87.78	10.60	**70.49**	9.78	109.59	108.23	12.99	**81.93**	11.78	132.08	156.69	18.85	**107.97**

Calculation Done:

Engr. K.H. Iftekhar Ahmed
B. Sc. In Civil Engineering

Chart for Ultimate Skin Friction & End Bearing Capacity of RCC Precast Pile

TABLE - 4.1 Bore Hole - 2

Depth	Depth	12"x12" Precast Pile					14"x14" Precast Pile					16"x16" Precast Pile				
		Skin Friction	Cum Skin Friction	End Bearing	Pile weight	Allowable Load	Skin Friction	Cum Skin Friction	End Bearing	Pile weight	Allowable Load	Skin Friction	Cum Skin Friction	End Bearing	Pile weight	Allowable Load
ft	m	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton
5	**1.5**	1.00	1.00	1.13	0.38	**0.70**	1.16	1.16	1.51	0.50	**0.87**	1.32	1.32	1.96	1.14	**0.86**
10	**3.0**	4.50	5.50	5.06	0.75	**3.93**	5.22	6.38	6.78	1.01	**4.86**	5.94	7.26	8.81	2.27	**5.52**
15	**4.5**	6.00	11.50	6.75	1.13	**6.85**	6.96	13.34	9.05	1.51	**8.35**	7.92	15.18	11.75	3.41	**9.41**
20	**6.0**	4.88	16.38	5.48	1.50	**8.14**	5.66	19.00	7.35	2.02	**9.73**	6.44	21.62	9.54	4.54	**10.65**
25	**7.5**	5.00	21.38	5.63	1.88	**10.05**	5.80	24.80	7.54	2.52	**11.92**	6.60	28.22	9.79	5.68	**12.93**
30	**9.0**	2.70	24.08	17.96	2.25	**15.91**	3.13	27.93	24.06	3.03	**19.58**	3.56	31.78	31.24	6.81	**22.48**
35	**10.5**	3.00	27.08	19.95	2.63	**17.76**	3.48	31.41	26.73	3.53	**21.84**	3.96	35.74	34.71	7.95	**25.00**
40	**12.0**	3.75	30.83	24.94	3.00	**21.11**	4.35	35.76	33.42	4.04	**26.05**	4.95	40.69	43.39	9.08	**30.00**
45	**13.5**	4.80	35.63	31.92	3.38	**25.67**	5.57	41.33	42.77	4.54	**31.82**	6.34	47.03	55.54	10.22	**36.94**
50	**15.0**	5.40	41.03	35.91	3.75	**29.27**	6.26	47.59	48.12	5.05	**36.26**	7.13	54.15	62.48	11.35	**42.11**
55	**16.5**	5.55	46.58	36.91	4.13	**31.74**	6.44	54.03	49.46	5.55	**39.17**	7.33	61.48	64.22	12.49	**45.28**
60	**18.0**	7.50	54.08	49.88	4.50	**39.78**	8.70	62.73	66.83	6.06	**49.40**	9.90	71.38	86.78	13.62	**57.81**
65	**19.8**	7.50	61.58	49.88	4.88	**42.63**	8.70	71.43	66.83	6.56	**52.68**	9.90	81.28	86.78	14.76	**61.32**
70	**21.3**	7.50	69.08	49.88	5.25	**45.48**	8.70	80.13	66.83	7.06	**55.96**	9.90	91.18	86.78	15.89	**64.83**
75	**22.8**	7.50	76.58	49.88	5.63	**48.33**	8.70	88.83	66.83	7.57	**59.24**	9.90	101.08	86.78	17.03	**68.33**
80	**24.3**	7.50	84.08	49.88	6.00	**51.18**	8.70	97.53	66.83	8.07	**62.51**	9.90	110.98	86.78	18.17	**71.84**

Calculation Done:

Engr. K.H. Iftekhar Ahmed
B. Sc. In Civil Engineering

Chart for Ultimate Skin Friction & End Bearing Capacity of RCC Cast-in-situ Pile

TABLE - 2.2 **Bore Hole - 3**

Depth (ft)	Depth (m)	Field SPT Value	Soil Type	Corrected SPT, N_{60}	Corrected SPT, $N_{60[corr]}$	Cu (Tsf)
5	1.5	6	Clay	6	6	0.38
10	3.0	7	Clay	7	7	0.44
15	4.5	12	Clay	12	12	0.75
20	6.0	15	Clay	11	11	0.70
25	7.5	11	Clay	11	11	0.69
30	9.0	18	Sand	14	14	
35	10.5	21	Sand	16	16	
40	12.0	28	Sand	21	21	
45	13.5	32	Sand	24	24	
50	15.0	34	Sand	26	26	
55	16.5	40	Sand	30	30	
60	18.0	50	Sand	38	38	
65	19.8	50	Sand	38	38	
70	21.3	50	Sand	38	38	
75	22.8	50	Sand	38	38	
80	24.3	50	Sand	38	38	

Calculation Done:

Engr. K.H. Iftekhar Ahmed
B. Sc. In Civil Engineering

Chart for Ultimate Skin Friction & End Bearing Capacity of RCC Cast-in-situ Pile

TABLE - 3.2 **Bore Hole - 3**

Depth	Depth	18 inch Dia Bored Pile					20 inch Dia Bored Pile					24 inch Dia Bored Pile				
		Skin Friction	Cum Skin Friction	End Bearing	Pile weight	Allowable Load	Skin Friction	Cum Skin Friction	End Bearing	Pile weight	Allowable Load	Skin Friction	Cum Skin Friction	End Bearing	Pile weight	Allowable Load
ft	m	Ton	Ton	Ton	Ton	**Ton**	Ton	Ton	Ton	Ton	**Ton**	Ton	Ton	Ton	Ton	**Ton**
5	**1.5**	3.53	3.53	5.94	0.66	**3.52**	3.91	3.91	7.32	0.81	**4.17**	4.71	4.71	10.60	1.18	**5.66**
10	**3.0**	4.12	7.66	6.93	1.33	**5.30**	4.56	8.47	8.54	1.62	**6.16**	5.50	10.21	12.37	2.36	**8.09**
15	**4.5**	7.07	14.73	11.88	1.99	**9.85**	7.82	16.29	14.65	2.43	**11.40**	9.43	19.64	21.21	3.53	**14.92**
20	**6.0**	6.63	21.35	11.14	2.65	**11.94**	7.33	23.63	13.73	3.25	**13.64**	8.84	28.47	19.88	4.71	**17.46**
25	**7.5**	6.48	27.83	10.89	3.31	**14.16**	7.17	30.80	13.43	4.06	**16.07**	8.64	37.11	19.44	5.89	**20.27**
30	**9.0**	3.18	31.01	31.60	3.98	**23.45**	3.52	34.31	38.96	4.87	**27.36**	4.24	41.36	56.41	7.07	**36.28**
35	**10.5**	3.71	34.72	36.87	4.64	**26.78**	4.11	38.42	45.46	5.68	**31.28**	4.95	46.31	65.81	8.25	**41.55**
40	**12.0**	4.95	39.67	49.16	5.30	**33.41**	5.47	43.90	60.61	6.49	**39.20**	6.60	52.90	87.74	9.42	**52.49**
45	**13.5**	5.65	45.32	56.18	5.96	**38.22**	6.26	50.15	69.27	7.30	**44.85**	7.54	60.44	100.28	10.60	**60.05**
50	**15.0**	6.01	51.33	59.69	6.63	**41.76**	6.65	56.80	73.60	8.12	**48.91**	8.01	68.46	106.55	11.78	**65.29**
55	**16.5**	7.07	58.40	70.22	7.29	**48.53**	7.82	64.62	86.58	8.93	**56.91**	9.43	77.88	125.35	12.96	**76.11**
60	**18.0**	8.84	67.23	87.78	7.95	**58.82**	9.78	74.40	108.23	9.74	**69.15**	11.78	89.66	156.69	14.14	**92.89**
65	**19.8**	8.84	76.07	87.78	8.61	**62.09**	9.78	84.17	108.23	10.55	**72.74**	11.78	101.45	156.69	15.32	**97.13**
70	**21.3**	8.84	84.90	87.78	9.28	**65.36**	9.78	93.95	108.23	11.36	**76.33**	11.78	113.23	156.69	16.49	**101.37**
75	**22.8**	8.84	93.74	87.78	9.94	**68.63**	9.78	103.73	108.23	12.17	**79.91**	11.78	125.01	156.69	17.67	**105.61**
80	**24.3**	8.84	102.57	87.78	10.60	**71.90**	9.78	113.50	108.23	12.99	**83.50**	11.78	136.79	156.69	18.85	**109.85**

Calculation Done:

Engr. K.H. Iftekhar Ahmed
B. Sc. In Civil Engineering

Chart for Ultimate Skin Friction & End Bearing Capacity of RCC Precast Pile

TABLE - 4.2 Bore Hole - 3

Depth	Depth	12"x12" Precast Pile					14"x14" Precast Pile					16"x16" Precast Pile				
		Skin Friction	Cum Skin Friction	End Bearing	Pile weight	Allowable Load	Skin Friction	Cum Skin Friction	End Bearing	Pile weight	Allowable Load	Skin Friction	Cum Skin Friction	End Bearing	Pile weight	Allowable Load
ft	m	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton
5	**1.5**	3.00	3.00	3.38	0.38	**2.40**	3.48	3.48	4.52	0.50	**3.00**	3.96	3.96	5.87	1.14	**3.48**
10	**3.0**	3.50	6.50	3.94	0.75	**3.88**	4.06	7.54	5.28	1.01	**4.72**	4.62	8.58	6.85	2.27	**5.26**
15	**4.5**	6.00	12.50	6.75	1.13	**7.25**	6.96	14.50	9.05	1.51	**8.81**	7.92	16.50	11.75	3.41	**9.94**
20	**6.0**	5.63	18.13	6.33	1.50	**9.18**	6.53	21.03	8.48	2.02	**10.99**	7.43	23.93	11.01	4.54	**12.16**
25	**7.5**	5.50	23.63	6.19	1.88	**11.18**	6.38	27.41	8.29	2.52	**13.27**	7.26	31.19	10.77	5.68	**14.51**
30	**9.0**	2.70	26.33	17.96	2.25	**16.81**	3.13	30.54	24.06	3.03	**20.63**	3.56	34.75	31.24	6.81	**23.67**
35	**10.5**	3.15	29.48	20.95	2.63	**19.12**	3.65	34.19	28.07	3.53	**23.49**	4.16	38.91	36.45	7.95	**26.96**
40	**12.0**	4.20	33.68	27.93	3.00	**23.44**	4.87	39.06	37.43	4.04	**28.98**	5.54	44.45	48.60	9.08	**33.59**
45	**13.5**	4.80	38.48	31.92	3.38	**26.81**	5.57	44.63	42.77	4.54	**33.14**	6.34	50.79	55.54	10.22	**38.44**
50	**15.0**	5.10	43.58	33.92	3.75	**29.50**	5.92	50.55	45.45	5.05	**36.38**	6.73	57.52	59.01	11.35	**42.07**
55	**16.5**	6.00	49.58	39.90	4.13	**34.14**	6.96	57.51	53.47	5.55	**42.17**	7.92	65.44	69.43	12.49	**48.95**
60	**18.0**	7.50	57.08	49.88	4.50	**40.98**	8.70	66.21	66.83	6.06	**50.79**	9.90	75.34	86.78	13.62	**59.40**
65	**19.8**	7.50	64.58	49.88	4.88	**43.83**	8.70	74.91	66.83	6.56	**54.07**	9.90	85.24	86.78	14.76	**62.90**
70	**21.3**	7.50	72.08	49.88	5.25	**46.68**	8.70	83.61	66.83	7.06	**57.35**	9.90	95.14	86.78	15.89	**66.41**
75	**22.8**	7.50	79.58	49.88	5.63	**49.53**	8.70	92.31	66.83	7.57	**60.63**	9.90	105.04	86.78	17.03	**69.92**
80	**24.3**	7.50	87.08	49.88	6.00	**52.38**	8.70	101.01	66.83	8.07	**63.91**	9.90	114.94	86.78	18.17	**73.42**

Calculation Done:

Engr. K.H. Iftekhar Ahmed
B. Sc. In Civil Engineering

Chart for Ultimate Skin Friction & End Bearing Capacity of RCC Cast-in-situ Pile

TABLE - 2.3 **Bore Hole - 4**

Depth (ft)	Depth (m)	Field SPT Value	Soil Type	Corrected SPT, N_{60}	Corrected SPT, $N_{60[corr]}$	Cu (Tsf)
5	1.5	3	Clay	3	3	0.19
10	3.0	10	Clay	10	10	0.63
15	4.5	13	Clay	10	10	0.61
20	6.0	12	Clay	12	12	0.75
25	7.5	10	Clay	10	10	0.63
30	9.0	16	Sand	12	12	
35	10.5	22	Sand	17	17	
40	12.0	30	Sand	23	23	
45	13.5	34	Sand	26	26	
50	15.0	37	Sand	28	28	
55	16.5	40	Sand	30	30	
60	18.0	50	Sand	38	38	
65	19.8	50	Sand	38	38	
70	21.3	50	Sand	38	38	
75	22.8	50	Sand	38	38	
80	24.3	50	Sand	38	38	

Calculation Done:

Engr. K.H. Iftekhar Ahmed
B. Sc. In Civil Engineering

Chart for Ultimate Skin Friction & End Bearing Capacity of RCC Cast-in-situ Pile

TABLE - 3.3 **Bore Hole - 4**

Depth	Depth	18 inch Dia Bored Pile					20 inch Dia Bored Pile					24 inch Dia Bored Pile				
		Skin Friction	Cum Skin Friction	End Bearing	Pile weight	Allowable Load	Skin Friction	Cum Skin Friction	End Bearing	Pile weight	Allowable Load	Skin Friction	Cum Skin Friction	End Bearing	Pile weight	Allowable Load
ft	m	Ton	Ton	Ton	Ton	**Ton**	Ton	Ton	Ton	Ton	**Ton**	Ton	Ton	Ton	Ton	**Ton**
5	**1.5**	1.77	1.77	2.97	0.66	**1.63**	1.96	1.96	3.66	0.81	**1.92**	2.36	2.36	5.30	1.18	**2.59**
10	**3.0**	5.89	7.66	9.90	1.33	**6.49**	6.52	8.47	12.21	1.62	**7.62**	7.86	10.21	17.67	2.36	**10.21**
15	**4.5**	5.74	13.40	9.65	1.99	**8.43**	6.35	14.83	11.90	2.43	**9.72**	7.66	17.87	17.23	3.53	**12.63**
20	**6.0**	7.07	20.47	11.88	2.65	**11.88**	7.82	22.65	14.65	3.25	**13.62**	9.43	27.30	21.21	4.71	**17.52**
25	**7.5**	5.89	26.36	9.90	3.31	**13.18**	6.52	29.17	12.21	4.06	**14.93**	7.86	35.15	17.67	5.89	**18.77**
30	**9.0**	2.83	29.18	28.09	3.98	**21.32**	3.13	32.29	34.63	4.87	**24.82**	3.77	38.92	50.14	7.07	**32.80**
35	**10.5**	3.89	33.07	38.62	4.64	**26.82**	4.30	36.60	47.62	5.68	**31.41**	5.18	44.11	68.94	8.25	**41.92**
40	**12.0**	5.30	38.37	52.67	5.30	**34.30**	5.87	42.46	64.94	6.49	**40.36**	7.07	51.18	94.01	9.42	**54.31**
45	**13.5**	6.01	44.38	59.69	5.96	**39.24**	6.65	49.11	73.60	7.30	**46.16**	8.01	59.19	106.55	10.60	**62.05**
50	**15.0**	6.54	50.92	64.96	6.63	**43.70**	7.23	56.34	80.09	8.12	**51.33**	8.72	67.91	115.95	11.78	**68.83**
55	**16.5**	7.07	57.99	70.22	7.29	**48.37**	7.82	64.16	86.58	8.93	**56.73**	9.43	77.33	125.35	12.96	**75.89**
60	**18.0**	8.84	66.82	87.78	7.95	**58.66**	9.78	73.94	108.23	9.74	**68.97**	11.78	89.11	156.69	14.14	**92.67**
65	**19.8**	8.84	75.66	87.78	8.61	**61.93**	9.78	83.72	108.23	10.55	**72.56**	11.78	100.90	156.69	15.32	**96.91**
70	**21.3**	8.84	84.49	87.78	9.28	**65.20**	9.78	93.49	108.23	11.36	**76.14**	11.78	112.68	156.69	16.49	**101.15**
75	**22.8**	8.84	93.33	87.78	9.94	**68.47**	9.78	103.27	108.23	12.17	**79.73**	11.78	124.46	156.69	17.67	**105.39**
80	**24.3**	8.84	102.16	87.78	10.60	**71.74**	9.78	113.05	108.23	12.99	**83.32**	11.78	136.24	156.69	18.85	**109.63**

Calculation Done:

Engr. K.H. Iftekhar Ahmed
B. Sc. In Civil Engineering

Chart for Ultimate Skin Friction & End Bearing Capacity of RCC Precast Pile

TABLE - 4.3 Bore Hole - 4

Depth	Depth	12"x12" Precast Pile					14"x14" Precast Pile					16"x16" Precast Pile				
		Skin Friction	Cum Skin Friction	End Bearing	Pile weight	Allowable Load	Skin Friction	Cum Skin Friction	End Bearing	Pile weight	Allowable Load	Skin Friction	Cum Skin Friction	End Bearing	Pile weight	Allowable Load
ft	m	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton	Ton
5	**1.5**	1.50	1.50	1.69	0.38	**1.13**	1.74	1.74	2.26	0.50	**1.40**	1.98	1.98	2.94	1.14	**1.51**
10	**3.0**	5.00	6.50	5.63	0.75	**4.55**	5.80	7.54	7.54	1.01	**5.63**	6.60	8.58	9.79	2.27	**6.44**
15	**4.5**	4.88	11.38	5.48	1.13	**6.29**	5.66	13.20	7.35	1.51	**7.61**	6.44	15.02	9.54	3.41	**8.46**
20	**6.0**	6.00	17.38	6.75	1.50	**9.05**	6.96	20.16	9.05	2.02	**10.87**	7.92	22.94	11.75	4.54	**12.06**
25	**7.5**	5.00	22.38	5.63	1.88	**10.45**	5.80	25.96	7.54	2.52	**12.39**	6.60	29.54	9.79	5.68	**13.46**
30	**9.0**	2.40	24.78	15.96	2.25	**15.39**	2.78	28.74	21.39	3.03	**18.84**	3.17	32.70	27.77	6.81	**21.46**
35	**10.5**	3.30	28.08	21.95	2.63	**18.96**	3.83	32.57	29.41	3.53	**23.38**	4.36	37.06	38.18	7.95	**26.92**
40	**12.0**	4.50	32.58	29.93	3.00	**23.80**	5.22	37.79	40.10	4.04	**29.54**	5.94	43.00	52.07	9.08	**34.39**
45	**13.5**	5.10	37.68	33.92	3.38	**27.29**	5.92	43.70	45.45	4.54	**33.84**	6.73	49.73	59.01	10.22	**39.41**
50	**15.0**	5.55	43.23	36.91	3.75	**30.55**	6.44	50.14	49.46	5.05	**37.82**	7.33	57.06	64.22	11.35	**43.97**
55	**16.5**	6.00	49.23	39.90	4.13	**34.00**	6.96	57.10	53.47	5.55	**42.01**	7.92	64.98	69.43	12.49	**48.77**
60	**18.0**	7.50	56.73	49.88	4.50	**40.84**	8.70	65.80	66.83	6.06	**50.63**	9.90	74.88	86.78	13.62	**59.21**
65	**19.8**	7.50	64.23	49.88	4.88	**43.69**	8.70	74.50	66.83	6.56	**53.91**	9.90	84.78	86.78	14.76	**62.72**
70	**21.3**	7.50	71.73	49.88	5.25	**46.54**	8.70	83.20	66.83	7.06	**57.19**	9.90	94.68	86.78	15.89	**66.23**
75	**22.8**	7.50	79.23	49.88	5.63	**49.39**	8.70	91.90	66.83	7.57	**60.47**	9.90	104.58	86.78	17.03	**69.73**
80	**24.3**	7.50	86.73	49.88	6.00	**52.24**	8.70	100.60	66.83	8.07	**63.74**	9.90	114.48	86.78	18.17	**73.24**

Calculation Done:

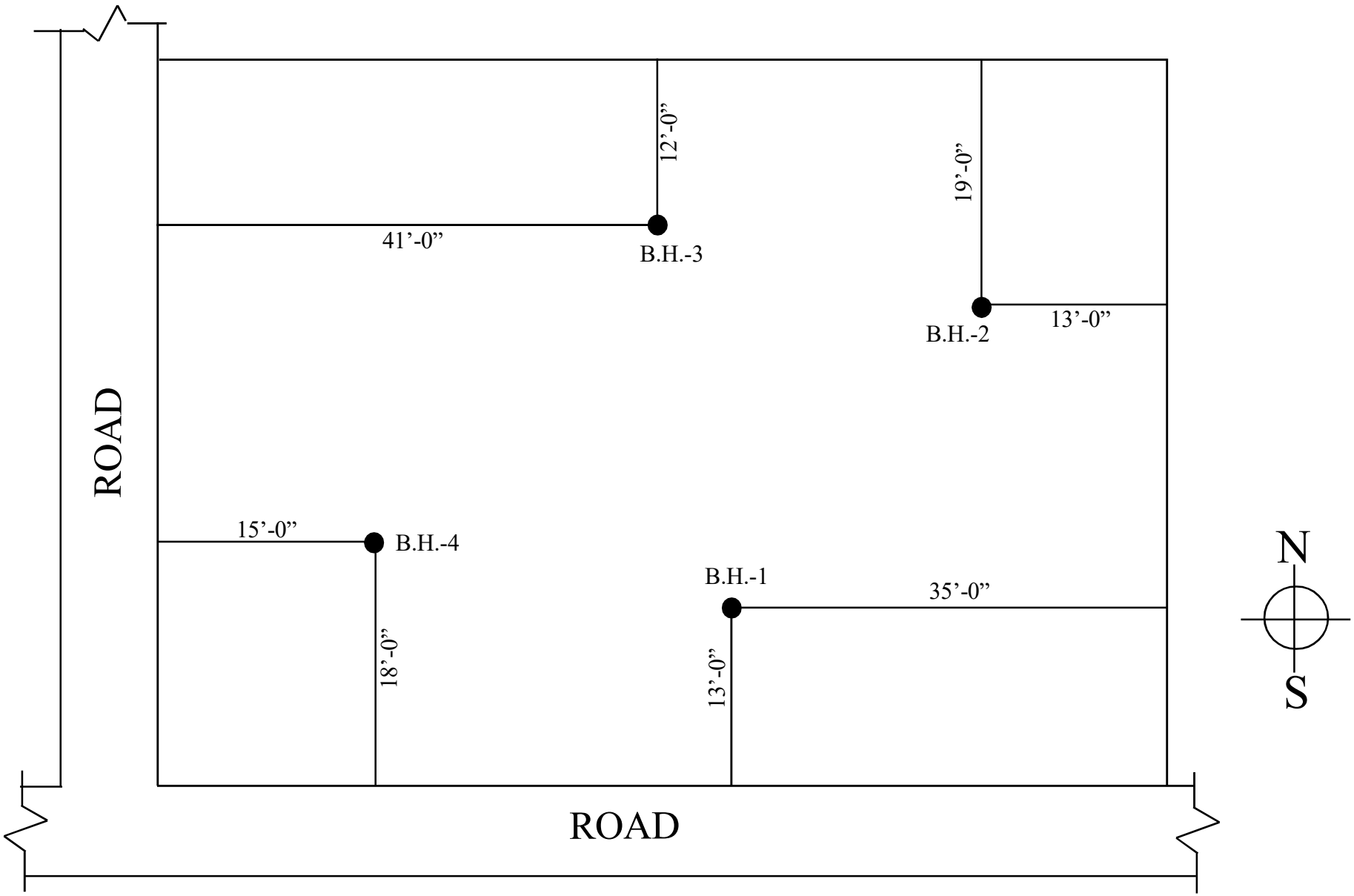
Engr. K.H. Iftekhar Ahmed
B. Sc. In Civil Engineering

SOIL ENGINEERING & PILING

LOCATION SKETCH

(Not to scale)

PROJECT : (G+9)=10 -STORIED RES. BUILDING
LOCATION : 113, MIDDLE BASABOO, PLOT NO.-A/51,
KHILGAON, REHABILITION AREA, DHAKA.

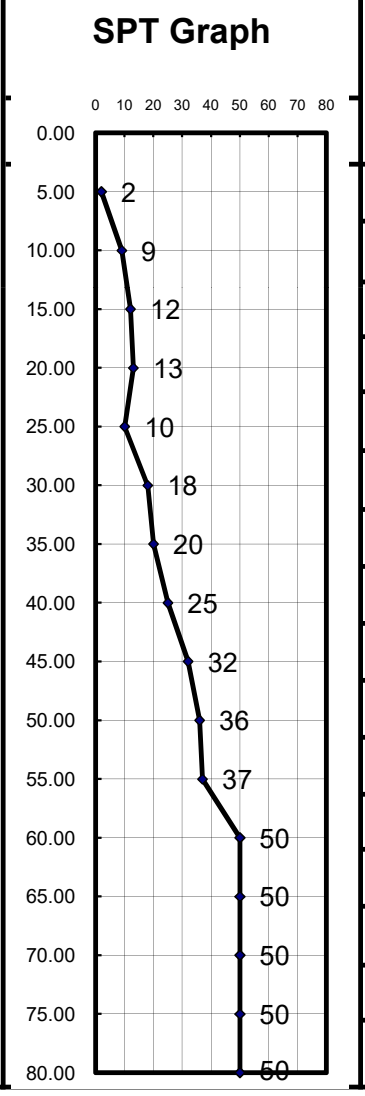


SOIL ENGINEERING & PILING

Bore Hole No.01	PROJECT : (G+9)=10- STORIED RESIDENTIAL BUILDING LOCATION : 113, MIDDLE BASABOO, PLOT NO.-A/51, KHILGAON, REHABILITION AREA, DHAKA.		
Date of Start	**0/0**	**Type of drilling:Manual drive (Hand Wash)**	
Date of Completion	**0/0**	**Dia of Boring**	**0.1016 m**
Weather	**SUNNY**	**GWL:(-)**	**6'-0" & R. L.(+) 0'-0"**

Total Depth = 80 ft

Cumulative depth below EGL (ft)	Depth of soil strata (ft)	Symbols	Description of Soil Strata	Nf	Sample ID
5.00			Gray soft to SILT, trace fine sand, some clay.	2	D-1
10.00				9	D-2
15.00			Brown medium stiff clayey SILT, trace fine sand.	12	D-3
20.00				13	D-4
25.00				10	D-5
30.00			Brown medium dense medium to fine SAND, some to little silt.	18	D-6
35.00				20	D-7
40.00				25	D-8
45.00			Brown medium dense to very dense medium to fine SAND, little to trace silt.	32	D-9
50.00				36	D-10
55.00				37	D-11
60.00				50	D-12
65.00				50	D-13
70.00				50	D-14
75.00				50	D-15
80.00				50	D-16



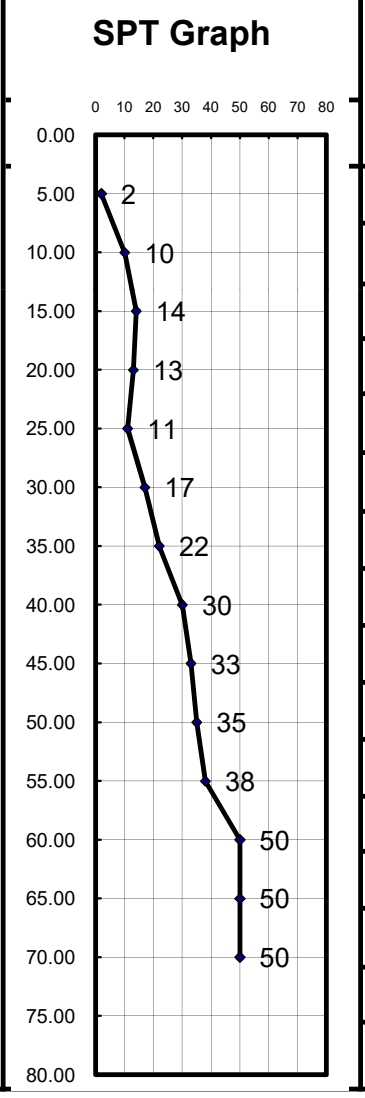
SAND SAMPLES ..... CLAY SAMPLES ..... UNDISTURBED SAMPLES .....

SOIL ENGINEERING & PILING

Bore Hole No.02	PROJECT : (G+9)=10- STORIED RESIDENTIAL BUILDING LOCATION : 113, MIDDLE BASABOO, PLOT NO.-A/51, KHILGAON, REHABILITION AREA, DHAKA.		
Date of Start	**0/0**	**Type of drilling:Manual drive (Hand Wash)**	
Date of Completion	**0/0**	**Dia of Boring**	**0.1016 m**
Weather	**SUNNY**	**GWL:(-)**	**6'-0" & R. L.(+) 0'-0"**

Total Depth = 70 ft

Cumulative depth below EGL (ft)	Depth of soil strata (ft)	Symbols	Description of Soil Strata	Nf	Sample ID
5.00			Gray soft to SILT, trace fine sand, some clay.	2	D-1
10.00				10	D-2
15.00			Brown medium stiff clayey SILT, trace fine sand.	14	D-3
20.00				13	D-4
25.00				11	D-5
30.00			Brown medium dense medium to fine SAND, some to little silt.	17	D-6
35.00				22	D-7
40.00			Brown medium dense to very dense medium to fine SAND, little to trace silt.	30	D-8
45.00				33	D-9
50.00				35	D-10
55.00				38	D-11
60.00				50	D-12
65.00				50	D-13
70.00				50	D-14



SAND SAMPLES ..... CLAY SAMPLES ..... UNDISTURBED SAMPLES ....

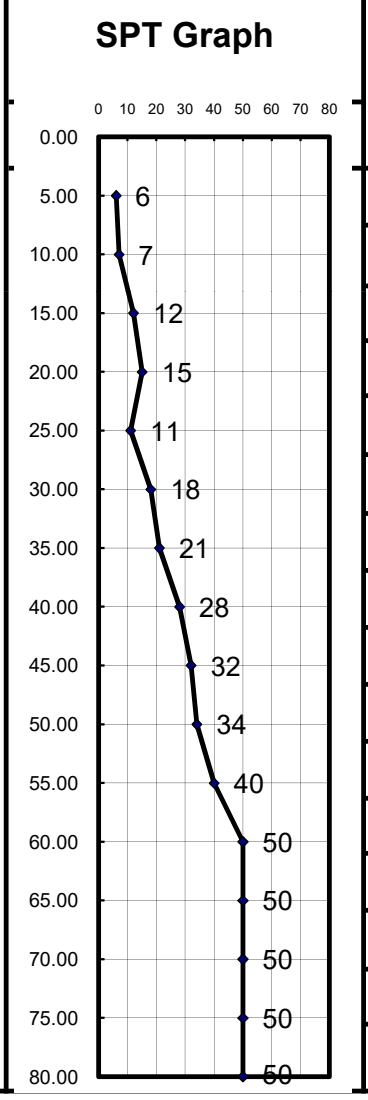
SOIL ENGINEERING & PILING

Bore Hole No.03	PROJECT : (G+9)=10- STORIED RESIDENTIAL BUILDING LOCATION : 113, MIDDLE BASABOO, PLOT NO.-A/51, KHILGAON, REHABILITION AREA, DHAKA.

Date of Start	**0/0**	**Type of drilling:Manual drive (Hand Wash)**	
Date of Completion	**0/0**	**Dia of Boring**	**0.1016 m**
Weather	**SUNNY**	**GWL:(-)**	**6'-0" & R. L.(+) 0'-0"**

Total Depth = 80 ft

Cumulative depth below EGL (ft)	Depth of soil strata (ft)	Symbols	Description of Soil Strata	Nf	Sample ID
5.00			Gray soft to medium SILT, trace fine sand, some clay.	6	D-1
10.00				7	D-2
15.00			Brown medium stiff clayey SILT, trace fine sand.	12	D-3
20.00				15	D-4
25.00				11	D-5
30.00			Brown medium dense medium to fine SAND, some to little silt.	18	D-6
35.00				21	D-7
40.00				28	D-8
45.00			Brown medium dense to very dense medium to fine SAND, little to trace silt.	32	D-9
50.00				34	D-10
55.00				40	D-11
60.00				50	D-12
65.00				50	D-13
70.00				50	D-14
75.00				50	D-15
80.00				50	D-16



SAND SAMPLES ..... CLAY SAMPLES ..... UNDISTURBED SAMPLES .....

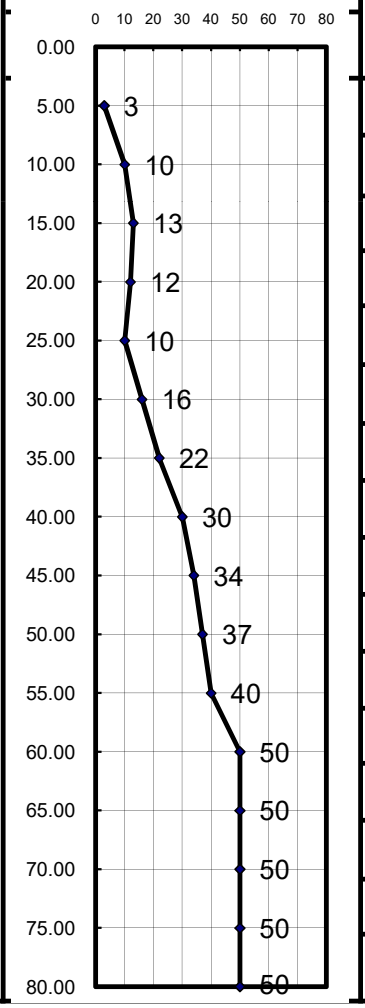
SOIL ENGINEERING & PILING

Bore Hole No.04	PROJECT : (G+9)=10- STORIED RESIDENTIAL BUILDING LOCATION : 113, MIDDLE BASABOO, PLOT NO.-A/51, KHILGAON, REHABILITION AREA, DHAKA.

Date of Start	**0/0**	**Type of drilling:Manual drive (Hand Wash)**	
Date of Completion	**0/0**	**Dia of Boring**	**0.1016 m**
Weather	**SUNNY**	**GWL:(-)**	**6'-0" & R. L.(+) 0'-0"**

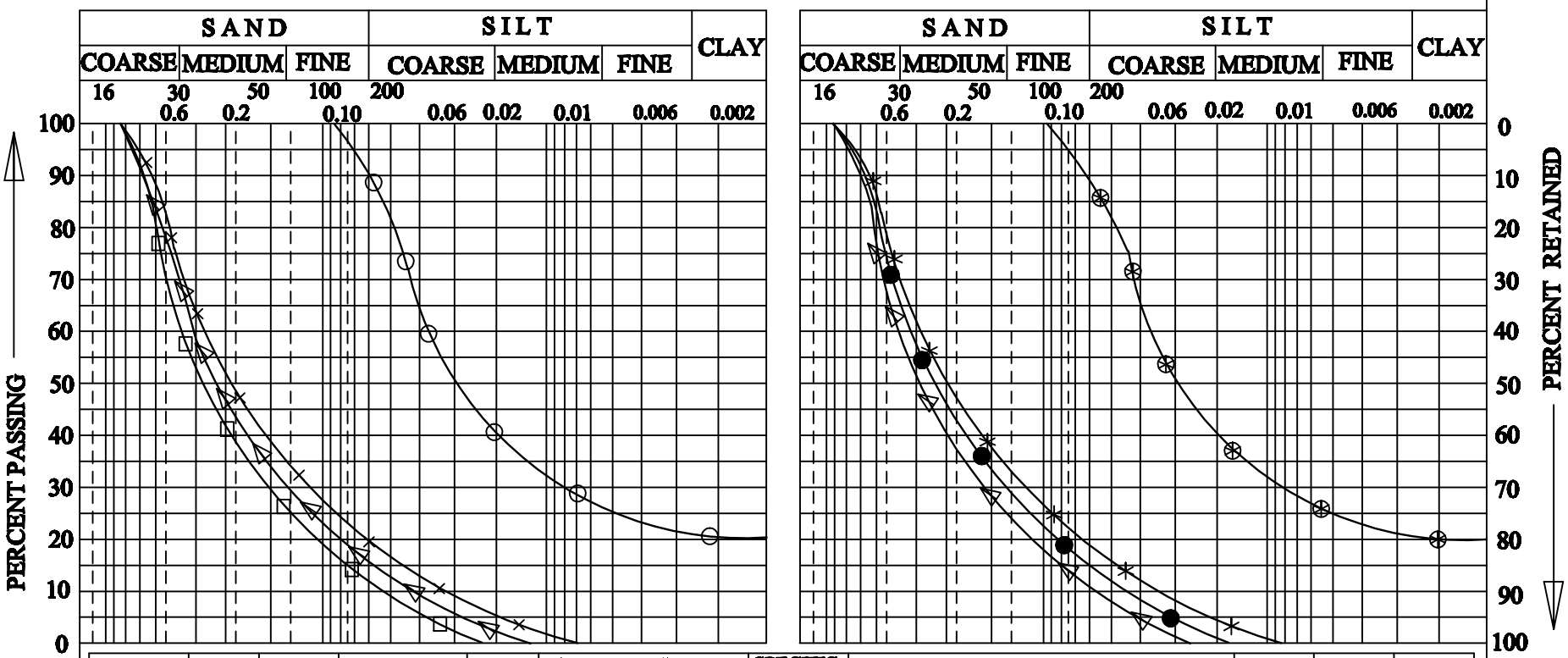
Total Depth = 80 ft

Cumulative depth below EGL (ft)	Depth of soil strata (ft)	Symbols	Description of Soil Strata	Nf	Sample ID
5.00			Gray soft to SILT, trace fine sand, some clay.	3	D-1
10.00				10	D-2
15.00			Brown medium stiff clayey SILT, trace fine sand.	13	D-3
20.00				12	D-4
25.00				10	D-5
30.00			Brown medium dense medium to fine SAND, some to little silt.	16	D-6
35.00				22	D-7
40.00			Brown medium dense to very dense medium to fine SAND, little to trace silt.	30	D-8
45.00				34	D-9
50.00				37	D-10
55.00				40	D-11
60.00				50	D-12
65.00				50	D-13
70.00				50	D-14
75.00				50	D-15
80.00				50	D-16



SAND SAMPLES ..... CLAY SAMPLES ..... UNDISTURBED SAMPLES ....

SOIL ENGINEERING & PILING	**GRAIN SIZE DISTRIBUTION**	**PROJECT : (G + 9) = 10- STORIED BUILDING.** **LOCATION : 113, MIDDLE BASABOO, PLOT NO.- A/51, KHILGAON REHABILITATION AREA, DHAKA.**

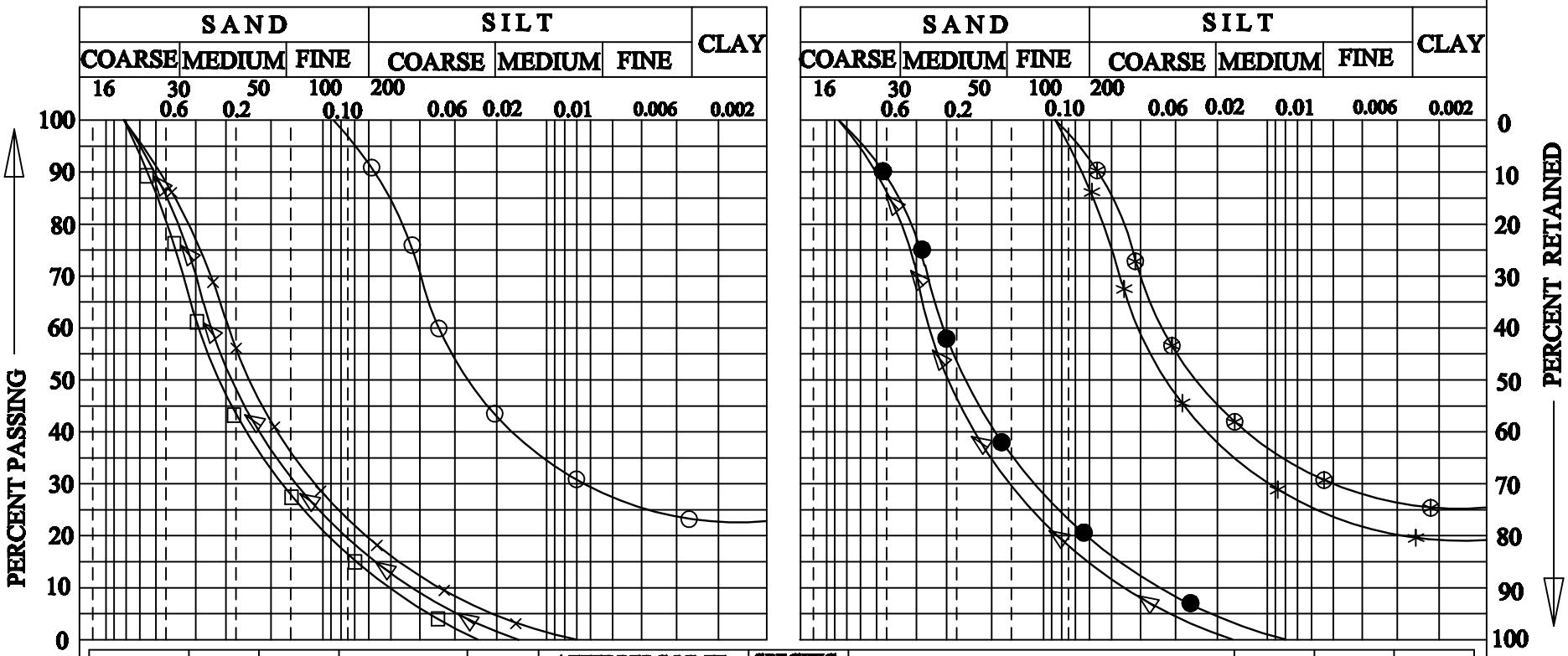


SYMBLE	BORE	SAMPLE	DEPTH IN Ft/m	N M C	ATTERBERG LIMIT			SPECIFIC GRAVITY	SOIL CLASSIFICATION	SAND(%)	SILT(%)	CLAY(%)
					L.L	P.L	P.I					
○○○	01	D-3	15	31.6	43	22	21	2.675	SILT, trace fine sand some clay.	11	69	20
×××		D-7	35	30.2	NP	NP	NP		Medium to fine SAND little silt.	83	17	-
◁◁◁		D-10	50						Medium to fine SAND little silt.	85	15	-
□□□		D-14	70						Medium to fine SAND little silt.	89	11	-
⊛⊛⊛	02	D-2	10	32.5	44	22	22	2.670	SILT, little fine sand little clay.	10	69	21
✳✳✳		D-6	30	32.0	NP	NP	NP		Medium to fine SAND little silt.	82	18	-
●●●		D-9	45						Medium to fine SAND little silt.	84	16	-
◁◁◁		D-13	65						Medium to fine SAND little silt.	87	13	-

TESTED BY :

CHECKED BY :

SOIL ENGINEERING & PILING	GRAIN SIZE DISTRIBUTION	PROJECT : (G + 9) = 10- STORIED BUILDING. LOCATION : 113, MIDDLE BASABOO, PLOT NO.- A/51, KHILGAON REHABILITATION AREA, DHAKA.



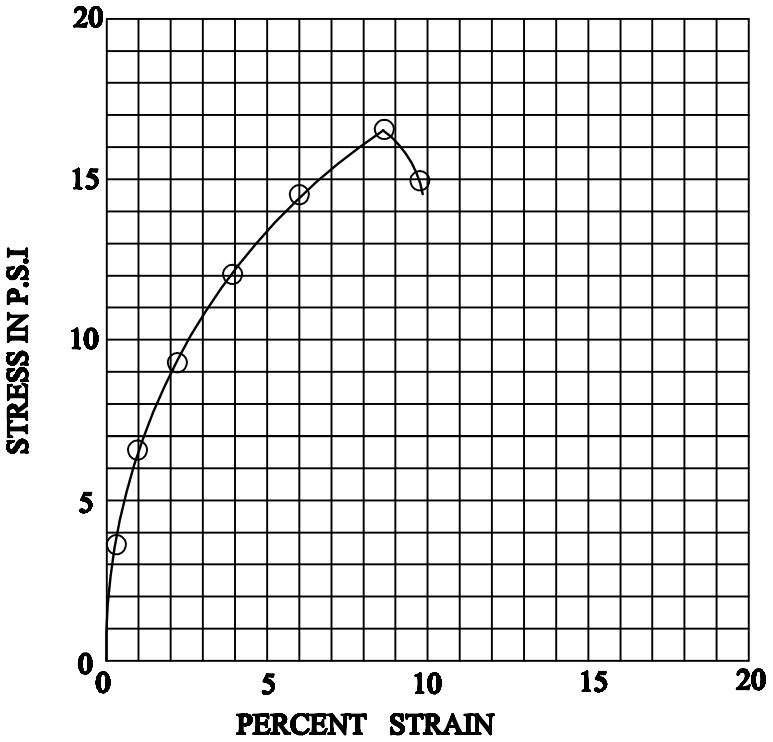
SYMBLE	BORE	SAMPLE	DEPTH IN Ft/m	N M C	ATTERBERG LIMIT			SPECIFIC GRAVITY	SOIL CLASSIFICATION	SAND(%)	SILT(%)	CLAY(%)
					L.L	P.L	P.I					
○ ○ ○	03	D-4	20	33.5	40	20	20	2.672	SILT, trace find sand some clay.	12	68	20
× × ×		D-8	40	31.5	NP	NP	NP		Medium to find SAND little silt.	84	16	-
◁ ◁ ◁		D-12	60						Medium to find SAND little silt.	86	14	-
□ □ □		D-16	80						Medium to find SAND little silt.	90	10	-
⊛ ⊛ ⊛	04	D-1	5	33.6	43	21	22	2.675	SILT, trace find sand some clay.	8	67	25
✳ ✳ ✳		D-4	20	31.6	42	22	20		SILT little fine sand little clay.	14	67	19
● ● ●		D-8	40						Medium to find SAND little silt.	85	15	-
◁ ◁ ◁		D-12	60						Medium to find SAND trace silt.	88	12	-

TESTED BY :

CHECKED BY :

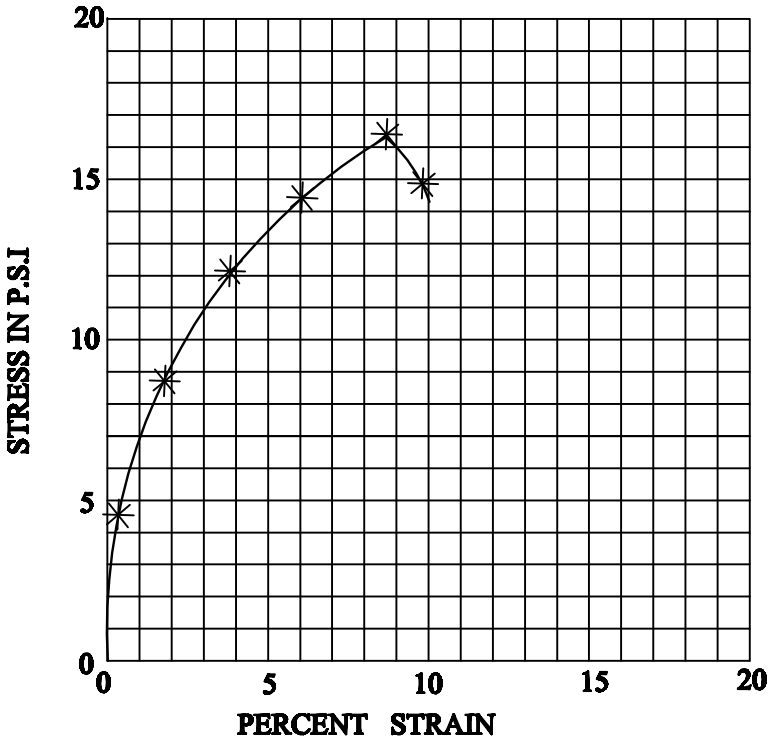
SOIL ENGINEERING & PILING	UNCONFINED COMPRESSION TEST	PROJECT : (G + 9) = 10- STORIED BUILDING. LOCATION : 113, MIDDLE BASABOO, PLOT NO.- A/51, KHILGAON REHABILITATION AREA, DHAKA.

BORE HOLE NO.-01 SAMPLE NO. UD-1 DEPTH 8 TO 9.5 FT



UNCONFINED COMPRESSIVE STRENGTH(PSI): 16.50
PERCENT STRAIN AT FAILURE : 8.52
MOISTURE CONTENT (%) : 33.3
WET DENSITY (P C F) : 117.5
DRY (P C F) : 88.34

BORE HOLE NO.-04 SAMPLE NO. UD-2 DEPTH 8 TO 9.5 FT

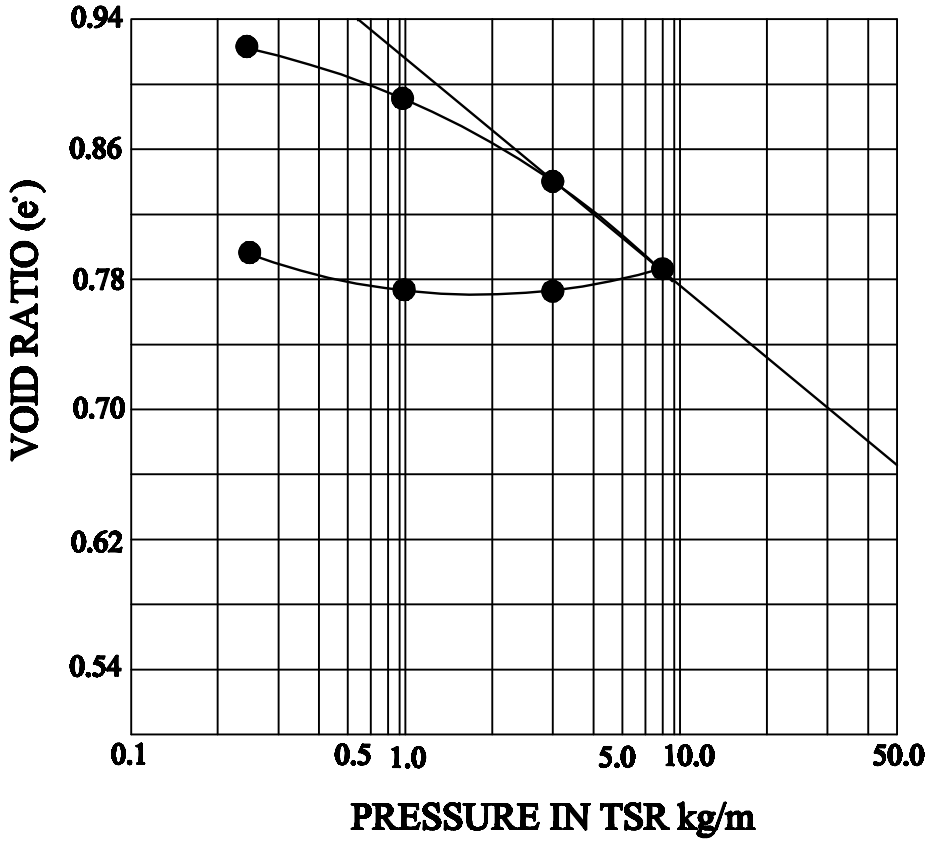


UNCONFINED COMPRESSIVE STRENGTH(PSI): 16.68
PERCENT STRAIN AT FAILURE : 8.78
MOISTURE CONTENT (%) : 30.1
WET DENSITY (P C F) :119.4
DRY (P C F) : 91.8

TESTED BY :

CHECKED BY :

SOIL ENGINEERING & PILING	**CONSOLIDATION TEST** VOID RATIO- LOG PRESSURE CURVE	**PROJECT : (G + 9) = 10- STORIED BUILDING.** **LOCATION : 113, MIDDLE BASABOO, PLOT NO.- A/51, KHILGAON REHABILITATION AREA, DHAKA.**



BORE HOLE NO : 04

SAMPLE DEPTH : 8 TO 9.5 FT

DIAMETER (CM) : 2.54

INITIAL HIGH (CM) : 6.35

SOLID HIGH (CM) : 1.666

INITIAL M.C : 30.1

SPECIFIC GRAVITY : 2.670

DRY DENSITY (PCF) : 91.8

INITIAL VOID RATIO (ė) : 0.936

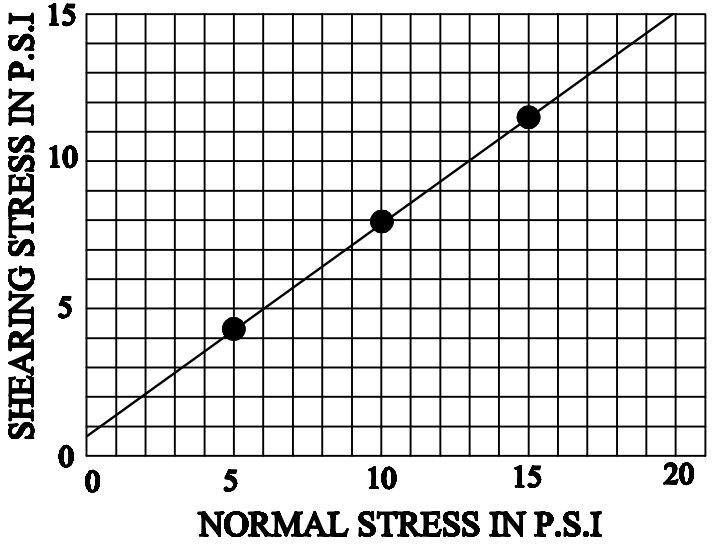
COMPRESSION INDEX : (ė) : 0.152

TESTED BY :

CHECKED BY :

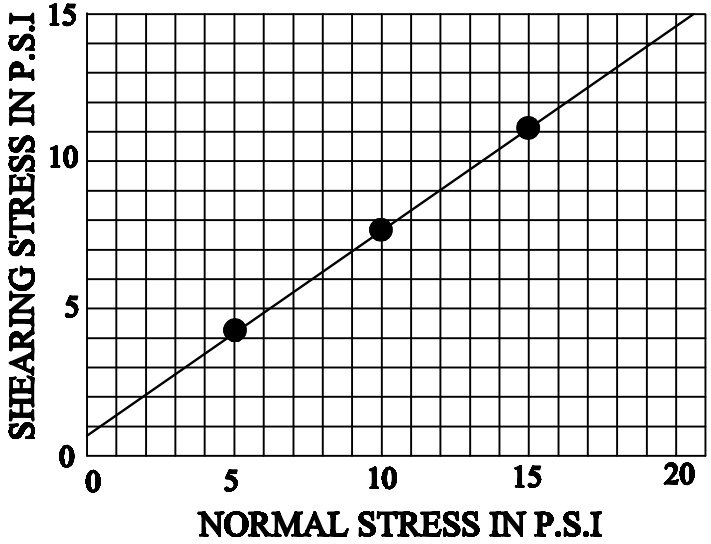
SOIL ENGINEERING & PILING	**DIRECT SHEAR TEST**	**PROJECT :** (G + 9) = 10- STORIED BUILDING. **LOCATION :** 113, MIDDLE BASABOO, PLOT NO.- A/51, KHILGAON REHABILITATION AREA, DHAKA.

Bore Hole . 01 Sample No. D-14 Depth 70 FT.



SHEARING ANGLE Φ°	36°
COHESION, CC(P.S.I)	0.62

Bore Hole . 02 Sample No. D-13 Depth 65 FT.



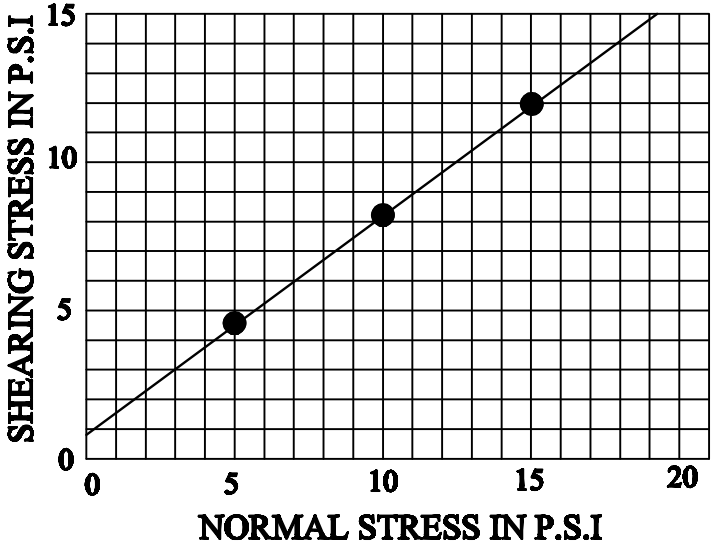
SHEARING ANGLE Φ°	35°
COHESION, CC(P.S.I)	0.65

TESTED BY :

CHECKED BY :

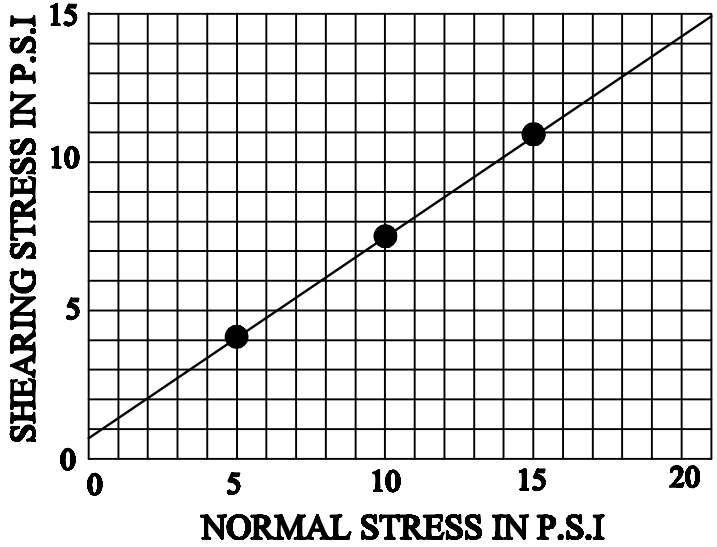
SOIL ENGINEERING & PILING	**DIRECT SHEAR TEST**	**PROJECT :** (G + 9) = 10- STORIED BUILDING. **LOCATION :** 113, MIDDLE BASABOO, PLOT NO.- A/51, KHILGAON REHABILITATION AREA, DHAKA.

Bore Hole . 03 Sample No. D-16 Depth 80 FT.



SHEARING ANGLE 0°	37°
COHESION, CC(P.S.I)	0.60

Bore Hole . 04 Sample No. D-12 Depth 60 FT.



SHEARING ANGLE 0°	34°
COHESION, CC(P.S.I)	0.67

TESTED BY :

CHECKED BY :

SOIL ENGINEERING & PILING

SUMMARY OF TEST RESULTS

PROJECT : **(G + 9) = 10- STORIED BUILDING.**

LOCATION : **113, MIDDLE BASABOO, PLOT NO.- A/51, KHILGAON REHABILITATION AREA, DHAKA.**

Bore Hole No.	Sample No.	Depth In Ft.	Wet Unit Weight (pcf)	Dry Unit Weight (pcf)	Natural Moisture Content (%)	Liquid Limit (%)	Plasticity index (%)	Unconfined Compression Test		Consolidation Test		Triaxial Shear Test		Direct Shear Test		Grain Size Test			S.P. Gravity
								Strength (psi)	Strain at failure (%)	Compression index (cc)	Void (eo)	ϕ^0	Cohesion (psi)	ϕ^0	Cohesion (psi)	SAND (%)	SILT (%)	CLAY (%)	
	UD-1	13	117.5	88.34	33.3			16.50	8.52										2.665
01	D-3	15			31.6	43	21									11	69	20	2.675
	D-7	35			30.2	NP	NP									83	17	-	
	D-10	50														85	15	-	
	D-14	70												36^O	0.62	89	11	-	
	D-2	10			32.5	44	22									10	69	21	2.670
02	D-6	30			32.0	NP	NP									82	18	-	
	D-9	45														84	16	-	
	D-13	65												35^O	0.65	87	13	-	
	D-4	20			33.5	40	20									12	68	20	2.672
03	D-8	40			31.5	NP	NP									84	16	-	
	D-12	60														86	14	-	
	D-16	80												37^O	0.60	90	10	-	
	UD-2	13	119.4	91.8	30.1			16.68	8.78	0.152	0.936								2.670
	D-1	5			33.6	43	22									8	67	25	2.675
04	D-4	20			31.6	42	20									14	67	19	
	D-8	40														85	15	-	
	D-12	60												34^O	0.67	88	12	-	

TESTED BY: **CHECKED BY:**