REPORT ON

SOIL INVESTIGATION

FOR

CONSTRUCTION OF PROPOSED LOWER GROUND + ELEVATED GROUND + 4 STORIED COMMERCIAL BUILDING AT MOUZA: BARUA, WARD NO.:02(NEW) OF RAIGANJ MUNICIPALITY, P.S: RAIGANJ, DIST: UTTAR DINAJPUR

OWNERS: SRI. KANAI LAL BAZAZ & OTHERS

FOUNDATION CONSULTANTS:

R. B. TESTING

A HOUSE GEO-TECHNICAL SOIL INVESTIGATION,
MATERIAL TESTING, SURVEYING, PLANNING, AND DESIGNING
72, LENIN SARANI, DURGA NAGAR, SILIGURI
DIST. JALPAIGURI, PIN-734 001
MOBILE NO: 98320-32995 / 9749389886 / 94761-54880
rtesting117@yahoo.in

APRIL-2019

C O N T E N T S

DESCRIPTION OF SAMPLE COLLECTION AND TESTS & CONCLUSION

Sinking of six (06) nos. of exploratory bore holes by shell and auger method up to the max. depth of 10.45 m were conducted. The location of the bore-holes were decided and fixed by the Engineer in charge. Disturbed and undisturbed soil samples at every meter interval were collected for necessary field and laboratory tests.

(A) Field Tests:

(i) Determination of In-Situ density.

In-situ density of the soil was determined by Split spoon sampler. The results are shown in Table- 07

(ii) Standard penetration test:

The standard penetration test was executed with the split-spoon sampler at the depths of 1.50 M, 2.00 M, & upto 10.00M. For determination of N value, number of blows required for a penetration of 30 cm after 15 cm seating drive, when driven by a weight of 63.50 Kg having a fall of 75 cm, was counted. The N value has been corrected as per IS: 2131-1981. Bore Hole Logs are shown in Tables- 01-06

(B) Laboratory Tests and Results

Following tests have been conducted on various soil samples in the laboratory:

Laboratory Test	IS : Code Referred
Natural moisture content	IS : 2720 (Part-2)
Specific gravity	IS : 2720 (Part-3)
Grain Size analysis	IS : 2720 (Part-4)
Direct Shear Test	IS : 2720 (Part-13)
Engineering classification of soil	IS :1498 - 1970

The results are being tabulated in Table-07

(C) Determination of Bearing capacity of soil.

(i) **Bearing capacity considering shear failure as per IS: 6403-1981. & considering Safe settlement as per IS: 8009**

Table – 01

R. B. TESTING 72, LENIN SARANI, DURGA NAGAR, SILIGURI DIST. JALPAIGURI, Pin-734 001			BORE LOG (As per I.S. 1892 : 1979)			BORE HOLE NO. - I	
Dia of Bore	Type of Boring	Type of Drilling		Ground/ Bed RL		99.95 M	
100 mm	Shell & Auger	B.M.D.		Project/Location			
Termination depth	10.45M			MOUZA : BARUA, WARD NO.:02(NEW) OF RAIGANJ MUNICIPALITY, J.L NO : 152,PLOT NO :319,302 (R.S) 2864 , 2857(L.R) KHATIAN NO :74 , 49 (R.S), 223, 914 , 4096 (L.R) P.S: RAIGANJ, DIST: UTTAR DINAJPUR.			
Standing Water Level	5.00 M						
Commenced on : 09.04.2019	Completed on: 09.04.2019						

Description of Strata	Description of samples & N' Value						
	Below EGL		Thickness	'N' Value	Samples		Depth (M)
	From	To					
	M	M	M		Type	Ref. No.	Ref. LV. EGL
Poorly graded sand with little fines (SP)	0.00	4.45	4.45	4	P	P-I/1	1.50-1.80
				7	P	P-I/2	2.15-2.45
				10	P	P-I/3	3.15-3.45
				12	P	P-I/4	4.15-4.45
Poorly graded to well graded sand (SP-SW)	4.45	10.45	6.00	14	P	P-I/5	6.15-6.45
				18	P	P-I/6	8.15-8.45
				23	P	P-I/7	10.15-10.45

CODE: EGL- Existing Ground Level, UDS – Undisturbed Sample, DS– Disturbed Sample,
W – Water Sample, SPT – Standard Penetration Test, V – Vane Test.

No. of Disturbed Sample: Nil No. of U.D.S.: Nil No. Vane Test : Nil
No. of Large Disturbed Sample: Nil No. of S.P.T.: Seven (07) No. Water Sample : Nil

Table – 02

R. B. TESTING 72, LENIN SARANI, DURGA NAGAR, SILIGURI DIST. JALPAIGURI, Pin-734 001			BORE LOG (As per I.S. 1892 : 1979)			BORE HOLE NO. - II	
Dia of Bore	Type of Boring	Type of Drilling		Ground/ Bed RL		99.93 M	
100 mm	Shell & Auger	B.M.D.		Project/Location			
Termination depth	10.45M			MOUZA : BARUA WARD NO.:02(NEW) OF RAIGANJ MUNICIPALITY, J.L NO : 152,PLOT NO :319,302 (R.S) 2864 , 2857(L.R) KHATIAN NO :74 , 49 (R.S), 223, 914 , 4096 (L.R) P.S: RAIGANJ, DIST : UTTAR DINAJPUR.			
Standing Water Level	5.00 M						
Commenced on : 09.04.2019	Completed on: 09.04.2019						

Description of Strata	Description of samples & N' Value						
	Below EGL		Thickness	'N' Value	Samples		Depth (M)
	From	To					
	M	M	M		Type	Ref. No.	Ref. LV. EGL
Poorly graded sand with little fines (SP)	0.00	4.45	4.45	4	P	P-II/1	1.50-1.80
				7	P	P-II/2	2.15-2.45
				11	P	P-II/3	3.15-3.45
				14	P	P-II/4	4.15-4.45
Poorly graded to well graded sand (SP-SW)	4.45	10.45	6.00	16	P	P-II/5	6.15-6.45
				21	P	P-II/6	8.15-8.45
				30	P	P-II/7	10.15-10.45

CODE: EGL- Existing Ground Level, UDS – Undisturbed Sample, DS– Disturbed Sample,
W – Water Sample, SPT – Standard Penetration Test, V – Vane Test.

No. of Disturbed Sample: Nil No. of U.D.S.: Nil No. Vane Test : Nil
No. of Large Disturbed Sample: Nil No. of S.P.T.: Seven (07) No. Water Sample : Nil

Table – 03

R. B. TESTING 72, LENIN SARANI, DURGA NAGAR, SILIGURI DIST. JALPAIGURI, Pin-734 001	BORE LOG (As per I.S. 1892 : 1979)	BORE HOLE NO. - III

Dia of Bore	Type of Boring	Type of Drilling	Ground/ Bed RL	100.00 M
100 mm	Shell & Auger	B.M.D.	Project/Location	
Termination depth	10.45M		MOUZA : BARUA WARD NO.:02(NEW) OF RAIGANJ MUNICIPALITY, J.L NO : 152,PLOT NO :319,302 (R.S) 2864 , 2857(L.R) KHATIAN NO :74 , 49 (R.S), 223, 914 , 4096 (L.R) P.S: RAIGANJ, DIST : UTTAR DINAJPUR.	
Standing Water Level	5.00 M			
Commenced on : 09.04.2019	Completed on: 09.04.2019			

Description of Strata	Description of samples & N' Value						
	Below EGL		Thickness	'N' Value	Samples		Depth (M)
	From	To					
	M	M	M		Type	Ref. No.	Ref. LV. EGL
Poorly graded sand with little fines (SP)	0.00	5.45	5.45	5	P	P-III/1	1.50-1.80
				8	P	P-III/2	2.15-2.45
				11	P	P-III/3	3.15-3.45
				16	P	P-III/4	5.15-5.45
Poorly graded to well graded sand (SP-SW)	5.45	10.45	5.00	18	P	P-III/5	7.15-7.45
				19	P	P-III/6	9.15-9.45
				26	P	P-III/7	10.15-10.45

CODE: EGL- Existing Ground Level, UDS – Undisturbed Sample, DS– Disturbed Sample,
W – Water Sample, SPT – Standard Penetration Test, V – Vane Test.

No. of Disturbed Sample: Nil No. of U.D.S.: Nil No. Vane Test : Nil
No. of Large Disturbed Sample: Nil No. of S.P.T.: Seven (07) No. Water Sample : Nil

Table – 04

R. B. TESTING 72, LENIN SARANI, DURGA NAGAR, SILIGURI DIST. JALPAIGURI, Pin-734 001	BORE LOG (As per I.S. 1892 : 1979)	BORE HOLE NO. - IV

Dia of Bore	Type of Boring	Type of Drilling	Ground/ Bed RL	100.06 M
100 mm	Shell & Auger	B.M.D.	Project/Location	
Termination depth	10.45M		MOUZA : BARUA WARD NO.:02(NEW) OF RAIGANJ MUNICIPALITY, J.L NO : 152,PLOT NO :319,302 (R.S) 2864 , 2857(L.R) KHATIAN NO :74 , 49 (R.S), 223, 914 , 4096 (L.R) P.S: RAIGANJ, DIST : UTTAR DINAJPUR.	
Standing Water Level	5.00 M			
Commenced on : 10.04.2019	Completed on: 10.04.2019			

Description of Strata	Description of samples & N' Value						
	Below EGL		Thickness	'N' Value	Samples		Depth (M)
	From	To					
	M	M	M		Type	Ref. No.	Ref. LV. EGL
Poorly graded sand with little fines (SP)	0.00	5.45	5.45	6	P	P-IV/1	1.50-1.80
				9	P	P-IV/2	2.15-2.45
				12	P	P-IV/3	3.15-3.45
				17	P	P-IV/4	5.15-5.45
Poorly graded to well graded sand (SP-SW)	5.45	10.45	5.00	17	P	P-IV/5	7.15-7.45
				20	P	P-IV/6	9.15-9.45
				27	P	P-IV/7	10.15-10.45

CODE: EGL- Existing Ground Level, UDS – Undisturbed Sample, DS– Disturbed Sample,
W – Water Sample, SPT – Standard Penetration Test, V – Vane Test.

No. of Disturbed Sample: Nil No. of U.D.S.: Nil No. Vane Test : Nil
No. of Large Disturbed Sample: Nil No. of S.P.T.: Seven (07) No. Water Sample : Nil

Table – 05

R. B. TESTING 72, LENIN SARANI, DURGA NAGAR, SILIGURI DIST. JALPAIGURI, Pin-734 001			BORE LOG (As per I.S. 1892 : 1979)		BORE HOLE NO. - V
Dia of Bore	Type of Boring	Type of Drilling	Ground/ Bed RL		100.16 M
100 mm	Shell & Auger	B.M.D.	Project/Location		
Termination depth	10.45M		MOUZA : BARUA WARD NO.:02(NEW) OF RAIGANJ MUNICIPALITY, J.L NO : 152,PLOT NO :319,302 (R.S) 2864 , 2857(L.R) KHATIAN NO :74 , 49 (R.S), 223, 914 , 4096 (L.R) P.S: RAIGANJ, DIST : UTTAR DINAJPUR.		
Standing Water Level	5.00 M				
Commenced on : 10.04.2019	Completed on: 10.04.2019				

Description of Strata	Description of samples & N' Value						
	Below EGL		Thickness	'N' Value	Samples		Depth (M)
	From	To			Type	Ref. No.	Ref. LV. EGL
	M	M	M				
Poorly graded sand with little fines (SP)	0.00	4.45	4.45	5	P	P-V/1	1.50-1.80
				7	P	P-V/2	2.15-2.45
				11	P	P-V/3	3.15-3.45
				13	P	P-V/4	4.15-4.45
Poorly graded to well graded sand (SP-SW)	4.45	10.45	6.00	15	P	P-V/5	6.15-6.45
				19	P	P-V/6	8.15-8.45
				25	P	P-V/7	10.15-10.45

CODE: EGL- Existing Ground Level, UDS – Undisturbed Sample, DS– Disturbed Sample,
W – Water Sample, SPT – Standard Penetration Test, V – Vane Test.

No. of Disturbed Sample: Nil No. of U.D.S.: Nil No. Vane Test : Nil
No. of Large Disturbed Sample: Nil No. of S.P.T.: Seven (07) No. Water Sample : Nil

Table – 06

R. B. TESTING 72, LENIN SARANI, DURGA NAGAR, SILIGURI DIST. JALPAIGURI, Pin-734 001			BORE LOG (As per I.S. 1892 : 1979)		BORE HOLE NO. - VI
Dia of Bore	Type of Boring	Type of Drilling	Ground/ Bed RL		99.10 M
100 mm	Shell & Auger	B.M.D.	Project/Location		
Termination depth	10.45M		MOUZA : BARUA WARD NO.:02(NEW) OF RAIGANJ MUNICIPALITY, J.L NO : 152,PLOT NO :319,302 (R.S) 2864 , 2857(L.R) KHATIAN NO :74 , 49 (R.S), 223, 914 , 4096 (L.R) P.S: RAIGANJ, DIST : UTTAR DINAJPUR.		
Standing Water Level	5.00 M				
Commenced on : 10.04.2019	Completed on: 10.04.2019				

Description of Strata	Description of samples & N' Value						
	Below EGL		Thickness	'N' Value	Samples		Depth (M)
	From	To			Type	Ref. No.	Ref. LV. EGL
	M	M	M				
Poorly graded sand with little fines (SP)	0.00	4.45	4.45	6	P	P-VI/1	1.50-1.80
				9	P	P-VI/2	2.15-2.45
				10	P	P-VI/3	3.15-3.45
				14	P	P-VI/4	4.15-4.45
Poorly graded to well graded sand (SP-SW)	4.45	10.45	6.00	16	P	P-VI/5	6.15-6.45
				20	P	P-VI/6	8.15-8.45
				29	P	P-VI/7	10.15-10.45

CODE: EGL- Existing Ground Level, UDS – Undisturbed Sample, DS– Disturbed Sample,
W – Water Sample, SPT – Standard Penetration Test, V – Vane Test.

No. of Disturbed Sample: Nil No. of U.D.S.: Nil No. Vane Test : Nil
No. of Large Disturbed Sample: Nil No. of S.P.T.: Seven (07) No. Water Sample : Nil

Table-07
Physical Properties of Soil

BH	BH-I	BH-II	BH-III	BH-IV	BH-V	Design Value Among BH: (I,II,III,IV & V)	BH-VI
Stratum / Soil Parameter	Depth (1.00M to 4.45M)	Depth (1.00M to 4.45M)	Depth (1.00M to 5.45M)	Depth (1.00M to 5.45M)	Depth (1.00M to 4.45M)	Depth (1.00M to 4.45M)	Depth (1.00M to 4.45M)
Bulk density, γ_b (g/cc)	1.87	1.88	1.90	1.92	1.89	**1.87**	1.91
Natural Moisture Content w (%)	18.30	18.05	17.80	16.90	17.95	**18.30**	17.50
Natural Dry density γ_d (g/cc)	1.58	1.59	1.61	1.64	1.60	**1.58**	1.63
Specific Gravity, G	2.62	2.63	2.63	2.64	2.63	**2.62**	2.64
Void ratio, e	0.66	0.65	0.63	0.61	0.64	**0.66**	0.62
Saturated density, γ_{sat} (g/cc)	1.98	1.99	2.00	2.02	1.99	**1.98**	2.01
Submerged density, γ_{sub} (g/cc)	0.98	0.99	1.00	1.02	0.99	**0.98**	1.01
Relative density (%)	36.77	38.41	41.19	45.09	39.76	**36.77**	42.87
Angle of Internal friction (Ø)(degree)	30.25	30.50	31.00	31.75	30.75	**30.25**	31.25

Table-08

Correction of SPT (N) values

BH. NO.	Depth (M)	Bulk density γ_b (g/cc)	P (kg/cm^2)	C_n	N	Corrected N (N')
(BH: I,II,III, IV & V)	3.00	1.87	0.561	1.188	10	11.88
	4.00		0.748	1.092	12	13.10
BH: VI	3.00	1.91	0.573	1.186	10	11.86
	4.00		0.764	1.088	14	15.23

Table-09

As per IS code: 8009(part I) 1976, allowable bearing pressure on permissible settlement against corrected and adopted N & Shear failure

BH. NO.	Depth (M)	Width (M)	Adopted N after correction	Settlement (mm) per Kg/Cm^2	Bearing pressure in T/M^2 on		
					50 mm settlement	75 mm settlement	Shear Failure
(BH: I,II,III, IV & V)	3.00	3.00	11.88	30.25	16.53	---	20.58
		4.00		30.50	16.39	---	21.55
		6.00		32.00	---	23.44	24.02
	4.00	4.00	13.10	27.00	18.52	---	27.44
		5.00		28.50	17.54	---	28.38
		6.00		30.00	---	25.00	29.50
BH: VI	3.00	3.00	11.86	30.28	16.51	---	27.17
		4.00		30.54	16.37	---	28.52
		6.00		32.20	---	23.29	31.93
	4.00	4.00	15.23	21.28	23.49	---	36.23
		5.00		21.89	22.84	---	37.52
		6.00		22.50	---	33.33	39.08

FOR (BH: I,II,III,IV & V)

****SAMPLE CALCULATION FOR BEARING CAPACITY****
Failure Mode - General Shear
Footing Type - ISOLATED SQUARE = 3.00M x 3.00M
Depth of Foundation : 3.00M

Existing Ground level : 0.00M
Ground Water Table level: 0.00M
Relative Density: 36.77%
Bulk Density (W)of Soil Above Footing Base : 1.87 T/Cu.M.
Submerged Density (W')of Soil Above Footing Base : 1.08 T/Cu.M.
Bulk Density (W)of Soil Below Footing Base : 1.87 T/Cu.M.
Factor of Safety : 3.00
Shape factor Depth Factor Inclination Factor
Sq = 1.200 Dq = 1.174 Iq = 1.000
Sg = 0.800 Dg = 1.174 Ig = 1.000
Water Table Correction Factor w' = 0.50
Effective surcharge at base level q = 3.24 T/Sq.M.
****For General Shear Failure****
Ultimate Net B.C. = Qult_n = q*(Nq-1)*Sq*Dq*Iq + 0.5*B*W*Ng*Sg*Dg*Ig*W'
Angle of Internal Friction(phai) : 30.25
Bearing Capacity Factors
Nq = 18.95 Ng = 23.26
Thus Qult_n = 112.56 T/Sq.M.
Allowable Bearing Capacity (Qall) = 37.52 T/Sq.M.
Sample Calculation for Bearing capacity
Failure Mode - Local Shear
Footing Type - ISOLATED SQUARE = 3.00M x 3.00M
Depth of Foundation : 3.00M
Existing Ground Level : 0.00M
Ground Water Table level: 0.00M
Relative Density: 36.77%
Bulk Density (W) of Soil Above Footing Base : 1.87 T/Cu.M.
Submerged Density (W')of Soil Above Footing Base: 1.08 T/Cu.M.
Bulk Density (W)of Soil Below Footing Base : 1.87 T/Cu.M.
Factor of Safety : 3.00
Shape factor Depth Factor Inclination Factor
Sq = 1.200 Dq = 1.146 Iq = 1.000
Sg = 0.800 Dg = 1.146 Ig = 1.000
Water Table Correction Factor w' = 0.50
Effective surcharge at base level q = 3.24 T/Sq.M.
****For Local Shear Failure****
Ultimate Net B.C. = Qult_n = q*(N'q-1)*Sq*Dq*Iq + 0.5*B*W*N'g*Sg*Dg*Ig*W'
Effective Angle of Internal Friction(phai') : 21.25
Bearing Capacity Factors
N'q = 7.25 N'g = 6.42
Thus Qult_n = 36.11 T/Sq.M.
Allowable Bearing Capacity (Qall) = 12.04 T/Sq.M.
Sample Calculation for Bearing capacity
Failure Mode - Intermediate Between Genear & Local Shear
Under Loacl Shear Failur Mode Net Ultimate Bearing Capacity= 36.11 T/Sq.M.
Under Genearl Shear Failur Mode Net Ultimate Bearing Capacity= 112.56 T/Sq.M.
Relative Density: 36.77%
Thus Ultimate net Bearing Capacity (Qult_n) = 61.75 T/Sq.M.
Allowable Bearing Capacity (Qall) = 20.58 T/Sq.M.

**** TABLE TO COMPUTE BEARING CAPACITY FOR SQUARE FOOTING ****
**** UNDER INTERMEDIATE SHEAR FAILURE MODE ****

Sl. No.	Breadth (M)	Sc	Sq	Sg	Dc	Dq	Dg	Ic	Iq	Ig	W'	Qult(net) (T/Sq.M)	Qall(net) (T/Sq.M.)
001	3.000	1.300	1.200	0.800	1.292	1.146	1.146	1.000	1.000	1.000	0.500	61.75	20.58
002	4.000	1.300	1.200	0.800	1.219	1.110	1.110	1.000	1.000	1.000	0.500	64.65	21.55
003	5.000	1.300	1.200	0.800	1.175	1.088	1.088	1.000	1.000	1.000	0.500	68.20	22.73
004	6.000	1.300	1.200	0.800	1.146	1.073	1.073	1.000	1.000	1.000	0.500	72.07	24.02

****SAMPLE CALCULATION FOR BEARING CAPACITY****

Failure Mode - General Shear

Footing Type - ISOLATED SQUARE = 4.00M x 4.00M

Depth of Foundation : 4.00M

Existing Ground level : 0.00M
Ground Water Table level: 0.00M
Relative Density: 36.77%
Bulk Density (W)of Soil Above Footing Base : 1.87 T/Cu.M.
Submerged Density (W')of Soil Above Footing Base : 1.08 T/Cu.M.
Bulk Density (W)of Soil Below Footing Base : 1.87 T/Cu.M.
Factor of Safety : 3.00

Shape factor	Depth Factor	Inclination Factor
Sq = 1.200	Dq = 1.174	Iq = 1.000
Sg = 0.800	Dg = 1.174	Ig = 1.000

Water Table Correction Factor w' = 0.50
Effective surcharge at base level q = 4.32 T/Sq.M.
****For General Shear Failure****
Ultimate Net B.C. = Qult_n = q*(Nq-1)*Sq*Dq*Iq + 0.5*B*W*Ng*Sg*Dg*Ig*W'
Angle of Internal Friction(phai) : 30.25
Bearing Capacity Factors
Nq = 18.95 Ng = 23.26
Thus Qult_n = 150.08 T/Sq.M.
Allowable Bearing Capacity (Qall) = 50.03 T/Sq.M.
Sample Calculation for Bearing capacity
Failure Mode - Local Shear
Footing Type - ISOLATED SQUARE = 4.00M x 4.00M
Depth of Foundation : 4.00M
Existing Ground Level : 0.00M
Ground Water Table level: 0.00M
Relative Density: 36.77%
Bulk Density (W) of Soil Above Footing Base : 1.87 T/Cu.M.
Submerged Density (W')of Soil Above Footing Base: 1.08 T/Cu.M.
Bulk Density (W)of Soil Below Footing Base : 1.87 T/Cu.M.
Factor of Safety : 3.00

Shape factor	Depth Factor	Inclination Factor
Sq = 1.200	Dq = 1.146	Iq = 1.000
Sg = 0.800	Dg = 1.146	Ig = 1.000

Water Table Correction Factor w' = 0.50
Effective surcharge at base level q = 4.32 T/Sq.M.
****For Local Shear Failure****
Ultimate Net B.C. = Qult_n = q*(N'q-1)*Sq*Dq*Iq + 0.5*B*W*N'g*Sg*Dg*Ig*W'
Effective Angle of Internal Friction(phai') : 21.25
Bearing Capacity Factors
N'q = 7.25 N'g = 6.42
Thus Qult_n = 48.14 T/Sq.M.
Allowable Bearing Capacity (Qall) = 16.05 T/Sq.M.
Sample Calculation for Bearing capacity
Failure Mode - Intermediate Between Genear & Local Shear
Under Loacl Shear Failur Mode Net Ultimate Bearing Capacity= 48.14 T/Sq.M.
Under Genearl Shear Failur Mode Net Ultimate Bearing Capacity= 150.08 T/Sq.M.
Relative Density: 36.77%
Thus Ultimate net Bearing Capacity (Qult_n) = 82.33 T/Sq.M.
Allowable Bearing Capacity (Qall) = 27.44 T/Sq.M.

**** TABLE TO COMPUTE BEARING CAPACITY FOR SQUARE FOOTING ****
**** UNDER INTERMEDIATE SHEAR FAILURE MODE ****

Sl. No.	Breadth (M)	Sc	Sq	Sg	Dc	Dq	Dg	Ic	Iq	Ig	W'	Qult(net) (T/Sq.M)	Qall(net) (T/Sq.M.)
001	4.000	1.300	1.200	0.800	1.292	1.146	1.146	1.000	1.000	1.000	0.500	82.33	27.44
002	5.000	1.300	1.200	0.800	1.234	1.117	1.117	1.000	1.000	1.000	0.500	85.13	28.38
003	6.000	1.300	1.200	0.800	1.195	1.097	1.097	1.000	1.000	1.000	0.500	88.50	29.50

FOR BH: VI

****SAMPLE CALCULATION FOR BEARING CAPACITY****
Failure Mode - General Shear
Footing Type - ISOLATED SQUARE = 3.00M x 3.00M
Depth of Foundation : 3.00M

Existing Ground level : 0.00M
Ground Water Table level: 0.00M
Relative Density: 42.87%
Bulk Density (W)of Soil Above Footing Base : 1.91 T/Cu.M.
Submerged Density (W')of Soil Above Footing Base : 1.09 T/Cu.M.
Bulk Density (W)of Soil Below Footing Base : 1.91 T/Cu.M.
Factor of Safety : 3.00

Shape factor	Depth Factor	Inclination Factor
Sq = 1.200	Dq = 1.178	Iq = 1.000
Sg = 0.800	Dg = 1.178	Ig = 1.000

Water Table Correction Factor w' = 0.50
Effective surcharge at base level q = 3.28 T/Sq.M.
****For General Shear Failure****
Ultimate Net B.C. = Qult_n = q*(Nq-1)*Sq*Dq*Iq + 0.5*B*W*Ng*Sg*Dg*Ig*W'
Angle of Internal Friction(phai) : 31.25
Bearing Capacity Factors
Nq = 21.25 Ng = 27.01
Thus Qult_n = 130.32 T/Sq.M.
Allowable Bearing Capacity (Qall) = 43.44 T/Sq.M.
Sample Calculation for Bearing capacity
Failure Mode - Local Shear
Footing Type - ISOLATED SQUARE = 3.00M x 3.00M
Depth of Foundation : 3.00M
Existing Ground Level : 0.00M
Ground Water Table level: 0.00M
Relative Density: 42.87%
Bulk Density (W) of Soil Above Footing Base : 1.91 T/Cu.M.
Submerged Density (W')of Soil Above Footing Base: 1.09 T/Cu.M.
Bulk Density (W)of Soil Below Footing Base : 1.91 T/Cu.M.
Factor of Safety : 3.00

Shape factor	Depth Factor	Inclination Factor
Sq = 1.200	Dq = 1.148	Iq = 1.000
Sg = 0.800	Dg = 1.148	Ig = 1.000

Water Table Correction Factor w' = 0.50
Effective surcharge at base level q = 3.28 T/Sq.M.
****For Local Shear Failure****
Ultimate Net B.C. = Qult_n = q*(N'q-1)*Sq*Dq*Iq + 0.5*B*W*N'g*Sg*Dg*Ig*W'
Effective Angle of Internal Friction(phai') : 22.03
Bearing Capacity Factors
N'q = 7.85 N'g = 7.16
Thus Qult_n = 40.36 T/Sq.M.
Allowable Bearing Capacity (Qall) = 13.45 T/Sq.M.
Sample Calculation for Bearing capacity
Failure Mode - Intermediate Between Genear & Local Shear
Under Loacl Shear Failur Mode Net Ultimate Bearing Capacity= 40.36 T/Sq.M.
Under Genearl Shear Failur Mode Net Ultimate Bearing Capacity= 130.32 T/Sq.M.
Relative Density: 42.87%
Thus Ultimate net Bearing Capacity (Qult_n) = 81.51 T/Sq.M.
Allowable Bearing Capacity (Qall) = 27.17 T/Sq.M.

**** TABLE TO COMPUTE BEARING CAPACITY FOR SQUARE FOOTING ****
**** UNDER INTERMEDIATE SHEAR FAILURE MODE ****

Sl. No.	Breadth (M)	Sc	Sq	Sg	Dc	Dq	Dg	Ic	Iq	Ig	W'	Qult(net) (T/Sq.M)	Qall(net) (T/Sq.M.)
001	3.000	1.300	1.200	0.800	1.297	1.148	1.148	1.000	1.000	1.000	0.500	81.51	27.17
002	4.000	1.300	1.200	0.800	1.222	1.111	1.111	1.000	1.000	1.000	0.500	85.55	28.52
003	5.000	1.300	1.200	0.800	1.178	1.089	1.089	1.000	1.000	1.000	0.500	90.45	30.15
004	6.000	1.300	1.200	0.800	1.148	1.074	1.074	1.000	1.000	1.000	0.500	95.79	31.93

****SAMPLE CALCULATION FOR BEARING CAPACITY****

Failure Mode - General Shear

Footing Type - ISOLATED SQUARE = 4.00M x 4.00M

Depth of Foundation : 4.00M

Existing Ground level : 0.00M
Ground Water Table level: 0.00M
Relative Density: 42.87%
Bulk Density (W)of Soil Above Footing Base : 1.91 T/Cu.M.
Submerged Density (W')of Soil Above Footing Base : 1.09 T/Cu.M.
Bulk Density (W)of Soil Below Footing Base : 1.91 T/Cu.M.
Factor of Safety : 3.00

Shape factor	Depth Factor	Inclination Factor
Sq = 1.200	Dq = 1.178	Iq = 1.000
Sg = 0.800	Dg = 1.178	Ig = 1.000

Water Table Correction Factor w' = 0.50
Effective surcharge at base level q = 4.37 T/Sq.M.
****For General Shear Failure****
Ultimate Net B.C. = Qult_n = q*(Nq-1)*Sq*Dq*Iq + 0.5*B*W*Ng*Sg*Dg*Ig*W'
Angle of Internal Friction(phai) : 31.25
Bearing Capacity Factors
Nq = 21.25 Ng = 27.01
Thus Qult_n = 173.76 T/Sq.M.
Allowable Bearing Capacity (Qall) = 57.92 T/Sq.M.
Sample Calculation for Bearing capacity
Failure Mode - Local Shear
Footing Type - ISOLATED SQUARE = 4.00M x 4.00M
Depth of Foundation : 4.00M
Existing Ground Level : 0.00M
Ground Water Table level: 0.00M
Relative Density: 42.87%
Bulk Density (W) of Soil Above Footing Base : 1.91 T/Cu.M.
Submerged Density (W')of Soil Above Footing Base: 1.09 T/Cu.M.
Bulk Density (W)of Soil Below Footing Base : 1.91 T/Cu.M.
Factor of Safety : 3.00

Shape factor	Depth Factor	Inclination Factor
Sq = 1.200	Dq = 1.148	Iq = 1.000
Sg = 0.800	Dg = 1.148	Ig = 1.000

Water Table Correction Factor w' = 0.50
Effective surcharge at base level q = 4.37 T/Sq.M.
****For Local Shear Failure****
Ultimate Net B.C. = Qult_n = q*(N'q-1)*Sq*Dq*Iq + 0.5*B*W*N'g*Sg*Dg*Ig*W'
Effective Angle of Internal Friction(phai') : 22.03
Bearing Capacity Factors
N'q = 7.85 N'g = 7.16
Thus Qult_n = 53.81 T/Sq.M.
Allowable Bearing Capacity (Qall) = 17.94 T/Sq.M.
Sample Calculation for Bearing capacity
Failure Mode - Intermediate Between Genear & Local Shear
Under Loacl Shear Failur Mode Net Ultimate Bearing Capacity= 53.81 T/Sq.M.
Under Genearl Shear Failur Mode Net Ultimate Bearing Capacity= 173.76 T/Sq.M.
Relative Density: 42.87%
Thus Ultimate net Bearing Capacity (Qult_n) = 108.68 T/Sq.M.
Allowable Bearing Capacity (Qall) = 36.23 T/Sq.M.

**** TABLE TO COMPUTE BEARING CAPACITY FOR SQUARE FOOTING ****
**** UNDER INTERMEDIATE SHEAR FAILURE MODE ****

Sl. No.	Breadth (M)	Sc	Sq	Sg	Dc	Dq	Dg	Ic	Iq	Ig	W'	Qult(net) (T/Sq.M)	Qall(net) (T/Sq.M.)
001	4.000	1.300	1.200	0.800	1.297	1.148	1.148	1.000	1.000	1.000	0.500	108.68	36.23
002	5.000	1.300	1.200	0.800	1.237	1.119	1.119	1.000	1.000	1.000	0.500	112.57	37.52
003	6.000	1.300	1.200	0.800	1.198	1.099	1.099	1.000	1.000	1.000	0.500	117.24	39.08

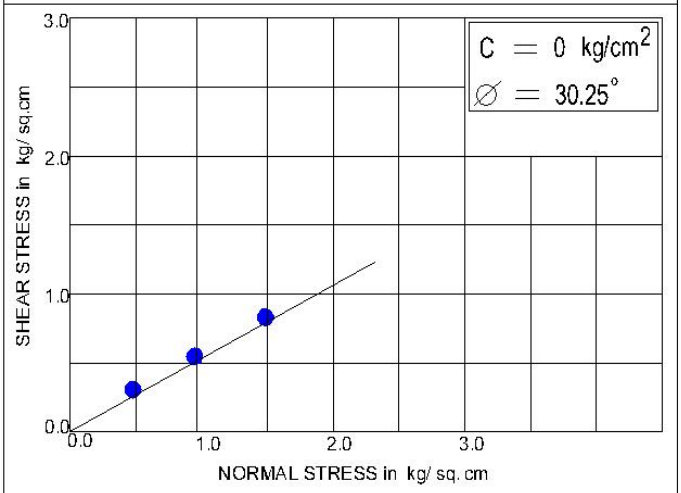
Table-10
RECOMMENDED NET SAFE BEARING CAPACITY FOR ISOLATED (SQUARE) TYPE FOUNDATION

BH. NO.	Depth (m)	Corresponding R.L.(m)	Size (mxm)	Bearing Capacity (t/m^2)
(BH: I,II,III,IV & V)	3.00	96.93	3.00x3.00	16.00
			4.00x4.00	16.00
			6.00x6.00	20.00
	4.00	95.93	4.00x4.00	17.00
			5.00x5.00	17.00
			6.00x6.00	22.00
BH: VI	3.00	96.10	3.00x3.00	16.00
			4.00x4.00	16.00
			6.00x6.00	22.00
	4.00	95.10	4.00x4.00	20.00
			5.00x5.00	20.00
			6.00x6.00	26.00

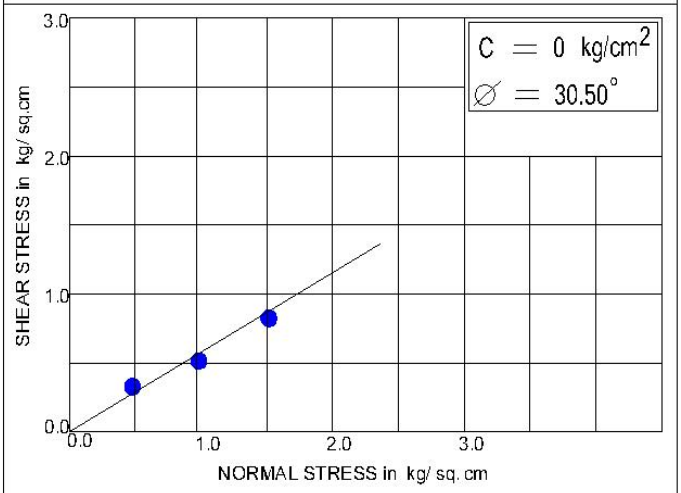
Note: (6.00Mx6.00M) = Minimum size of raft.

DIRECT SHEAR TEST CURVE

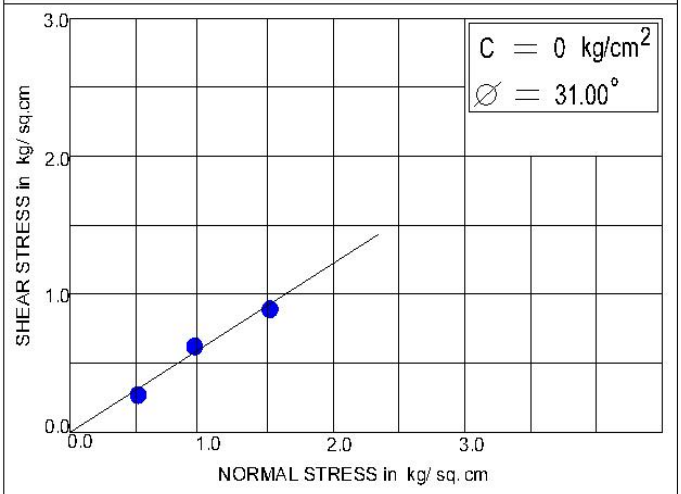
BH-I **DEPTH (M)-1.00-4.45**



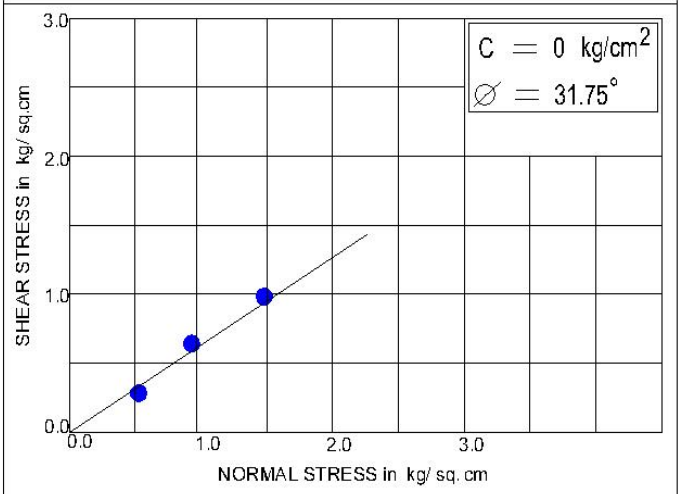
BH-II **DEPTH (M)-1.00-4.45**



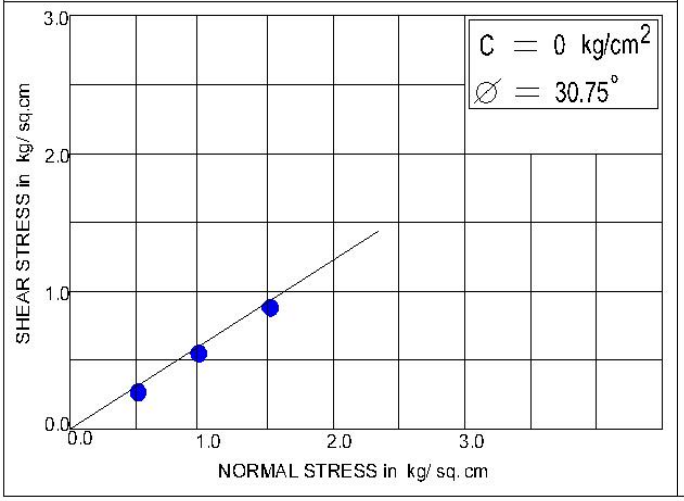
BH-III **DEPTH (M)-1.00-5.45**



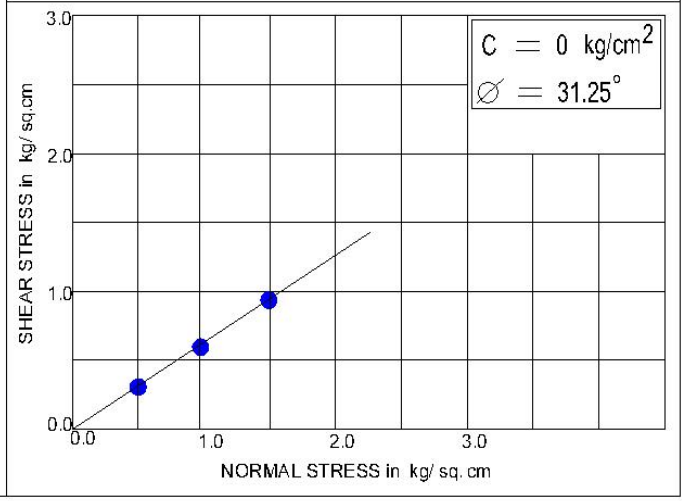
BH-IV **DEPTH (M)-1.00-5.45**

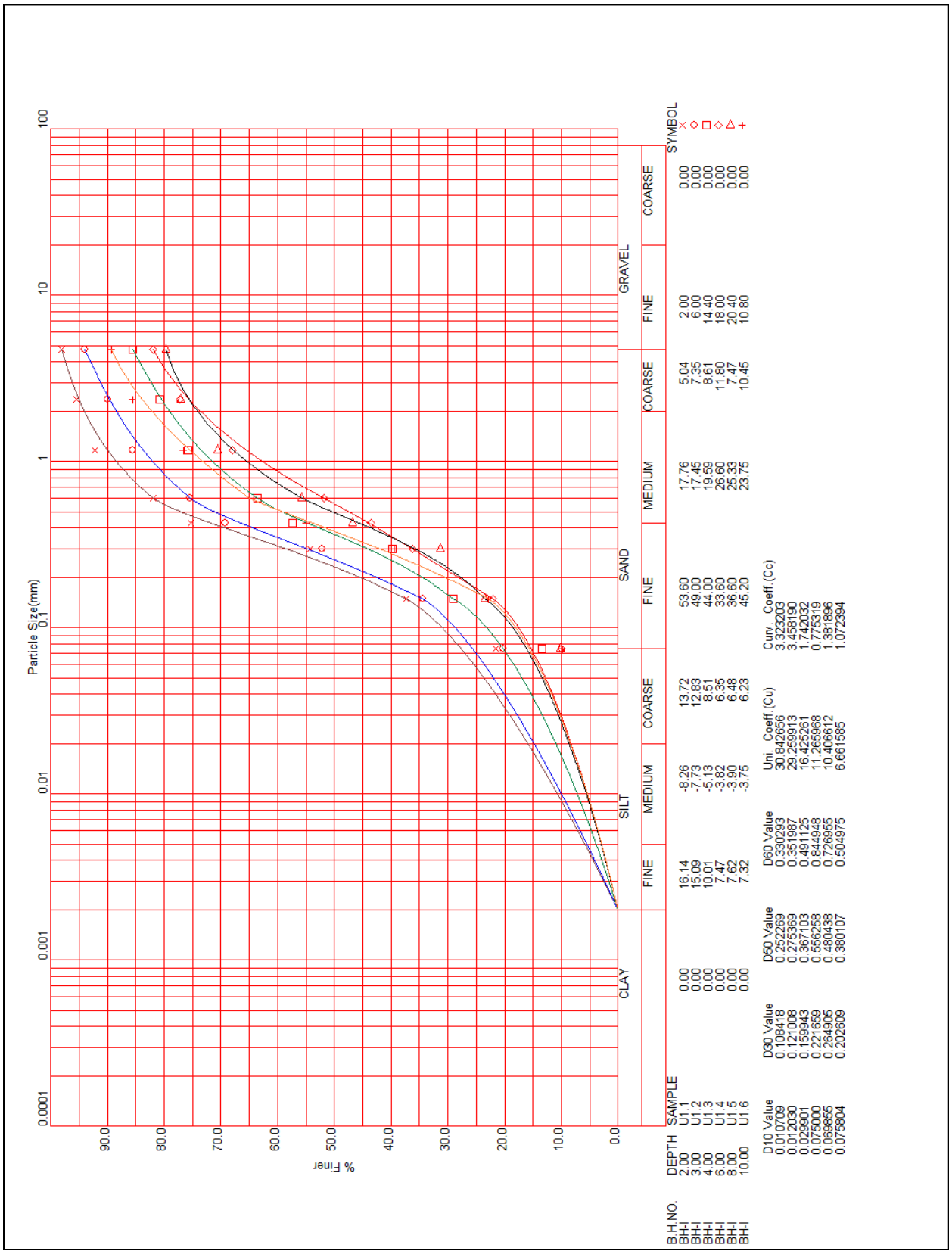


BH-V **DEPTH (M)-1.00-4.45**

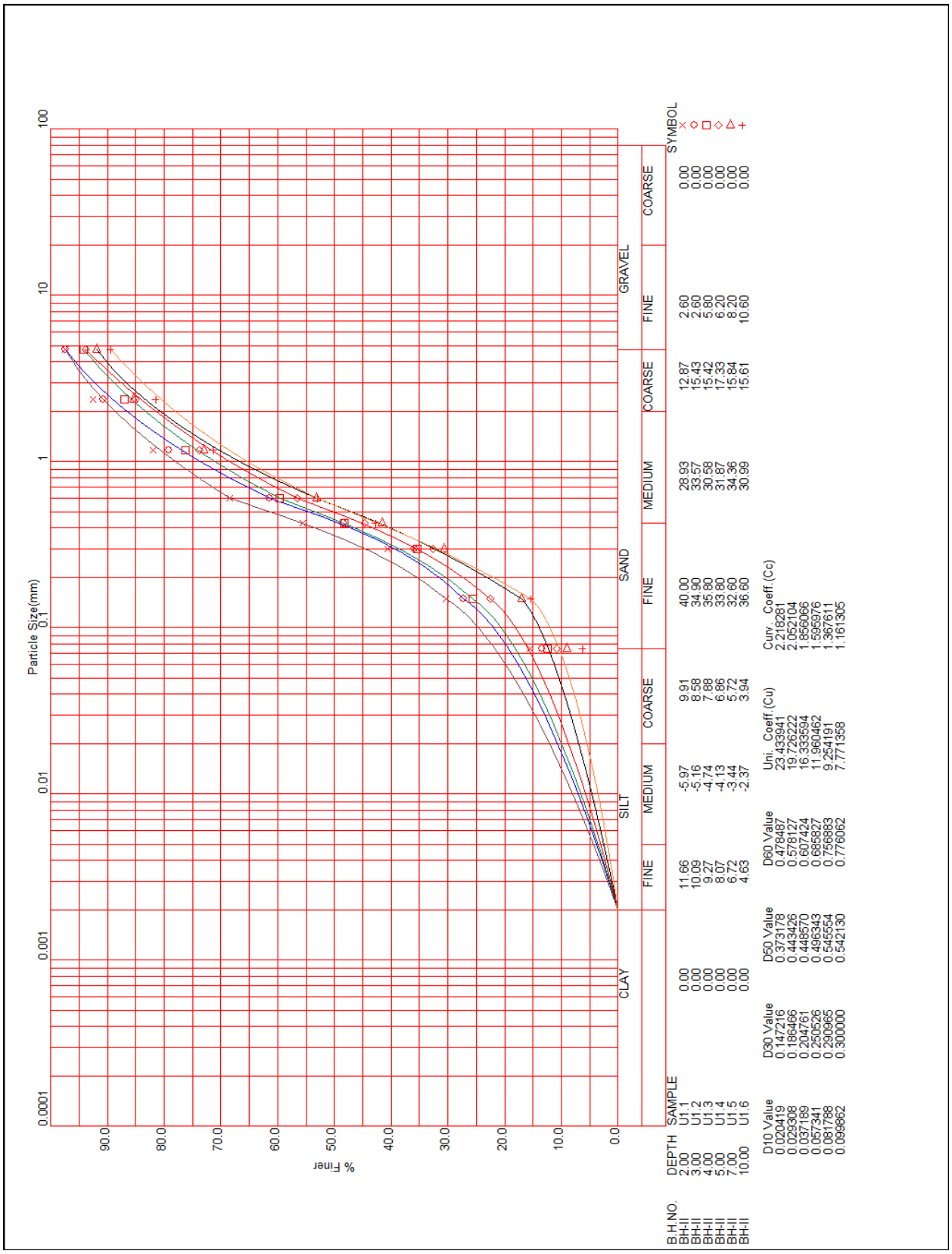


BH-VI **DEPTH (M)-1.00-4.45**

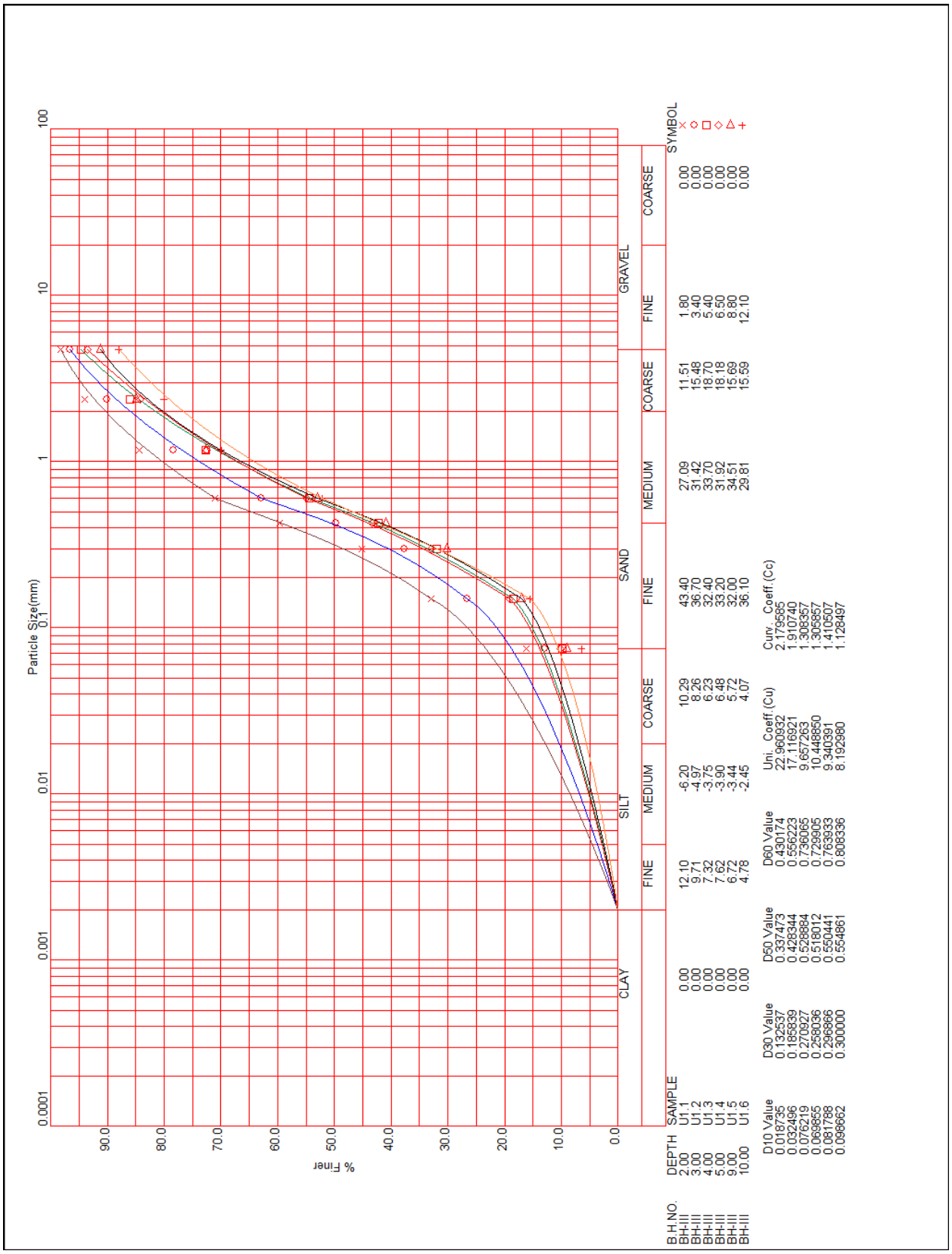


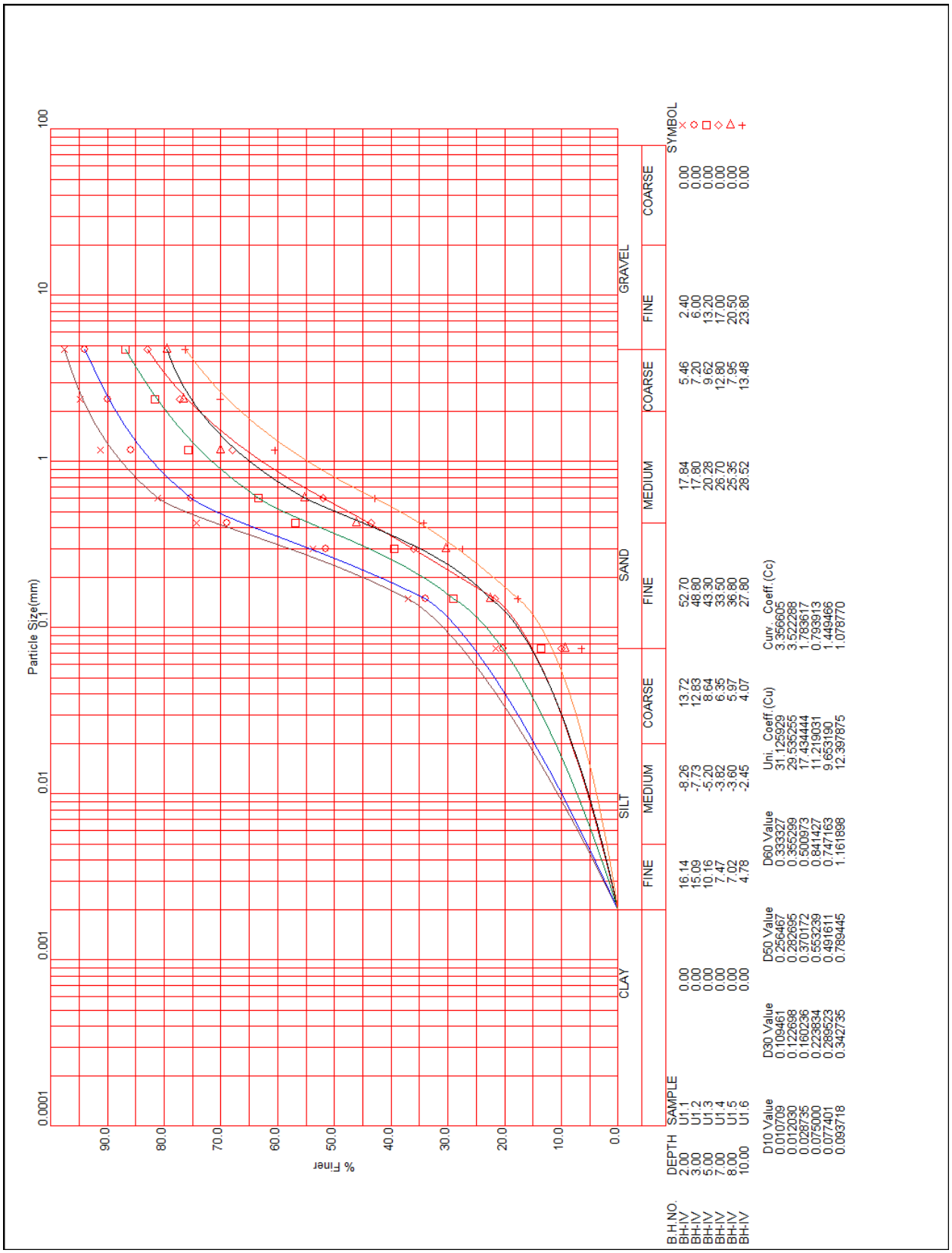


B.H.NO.	DEPTH	SAMPLE	D10 Value	D30 Value	D50 Value	D60 Value	Uni. Coeff (Cu)	Curv. Coeff (Cc)	CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	COARSE	SYMBOL
BH-I	2.00	U1.1	0.010709	0.108418	0.252269	0.330293	30.842656	3.323203	0.00	16.14	-8.26	13.72	53.60	17.76	5.04	2.00	0.00	×
BH-I	3.00	U1.2	0.012030	0.121008	0.275369	0.351987	29.259913	3.458190	0.00	15.09	-7.73	12.83	49.00	17.45	7.35	6.00	0.00	◇
BH-I	4.00	U1.3	0.029901	0.159943	0.367103	0.491125	16.425261	1.742032	0.00	10.01	-5.13	8.51	44.00	19.59	8.61	14.40	0.00	□
BH-I	6.00	U1.4	0.075000	0.221659	0.556258	0.844948	11.265968	0.775319	0.00	7.47	-3.82	6.35	33.60	26.60	11.80	18.00	0.00	◇
BH-I	8.00	U1.5	0.069855	0.264905	0.480438	0.726955	10.406612	1.381896	0.00	7.62	-3.90	6.48	36.60	25.33	7.47	20.40	0.00	△
BH-I	10.00	U1.6	0.075804	0.202609	0.380107	0.504975	6.661585	1.072394	0.00	7.32	-3.75	6.23	45.20	23.75	10.45	10.80	0.00	+

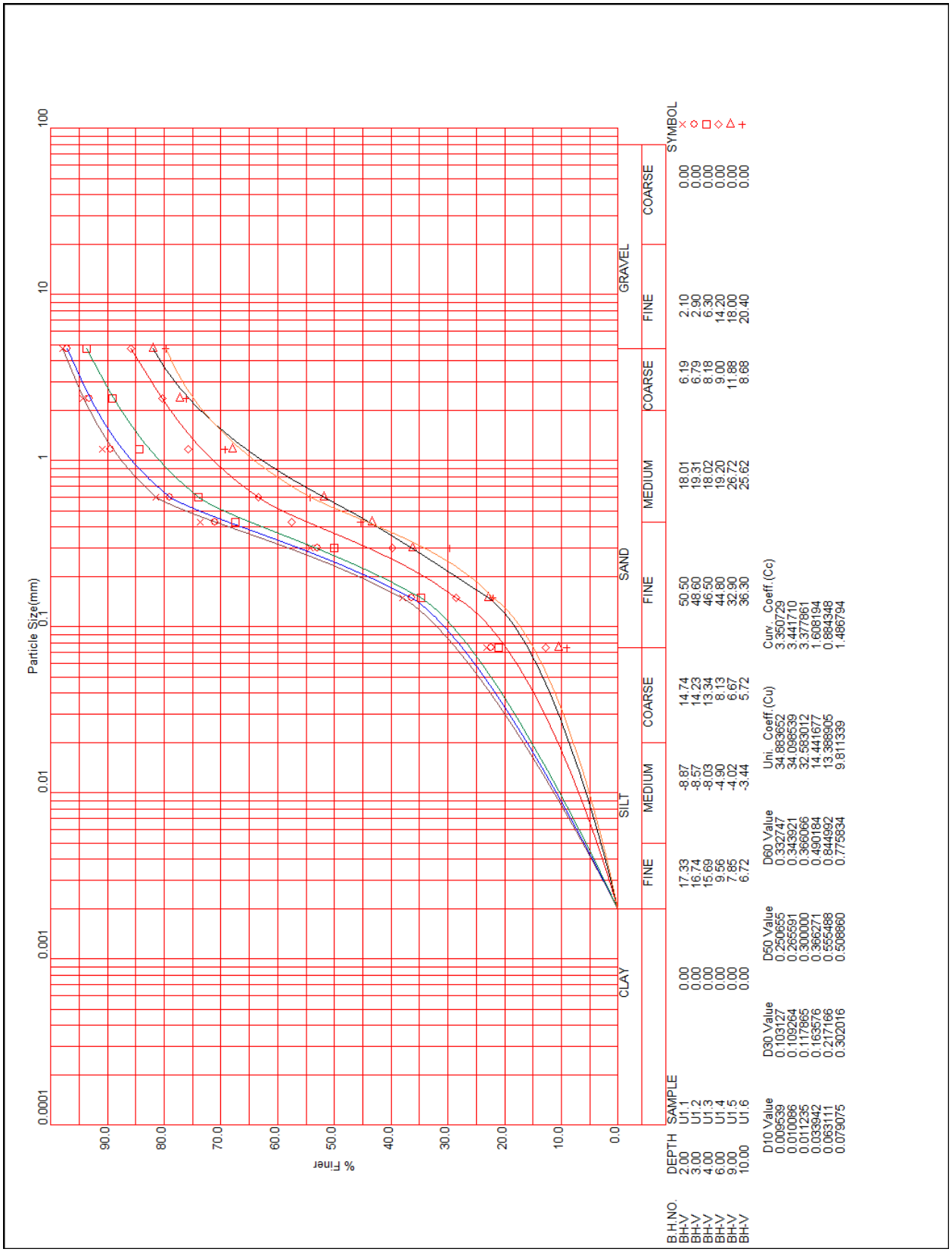


B.H.NO.	DEPTH	SAMPLE	D10 Value	D30 Value	D50 Value	D60 Value	Uni. Coeff (Cu)	Curv. Coeff (Cc)	CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	COARSE	SYMBOL
BH-II	2.00	U1.1	0.020419	0.147216	0.373178	0.478487	23.433941	2.218281	0.00	11.66	-5.97	9.91	40.00	28.93	12.87	2.60	0.00	×
BH-II	3.00	U1.2	0.029308	0.186466	0.443426	0.578127	19.726222	2.052104	0.00	10.09	-5.16	8.58	34.90	33.57	15.43	2.60	0.00	◇
BH-II	4.00	U1.3	0.037189	0.204761	0.448570	0.607424	16.333594	1.856066	0.00	9.27	-4.74	7.88	35.80	30.58	15.42	5.80	0.00	□
BH-II	5.00	U1.4	0.057341	0.250526	0.496343	0.685827	11.960462	1.595976	0.00	8.07	-4.13	6.86	33.80	31.87	17.33	6.20	0.00	◇
BH-II	7.00	U1.5	0.081788	0.290965	0.545554	0.756883	9.254191	1.367611	0.00	6.72	-3.44	5.72	32.60	34.36	15.84	8.20	0.00	△
BH-II	10.00	U1.6	0.099862	0.300000	0.542130	0.776062	7.771358	1.161305	0.00	4.63	-2.37	3.94	36.60	30.99	15.61	10.60	0.00	+

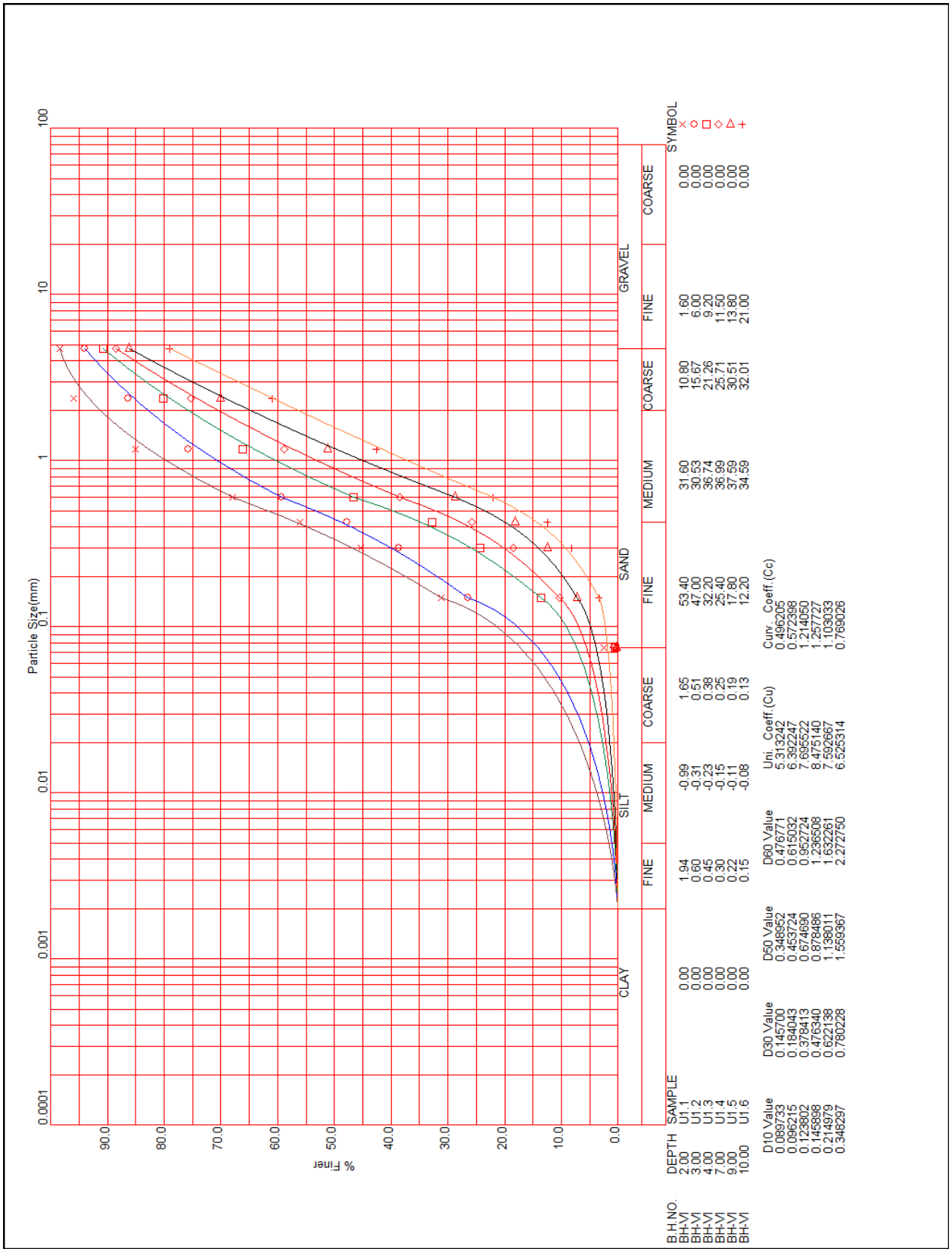

Particle Size(mm)
100
10
1
0.1
0.01
0.001
0.0001
% Finer
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
GRAVEL
SAND
SILT
CLAY
COARSE
FINE
MEDIUM
COARSE
FINE
COARSE
FINE
SYMBOL
B.H.NO. DEPTH SAMPLE D10 Value D30 Value D50 Value D60 Value Uni. Coeff.(Cu) Curv. Coeff.(Cc)
BH-III 2.00 U1.1 0.018735 0.132537 0.337473 0.430174 22.960932 2.179585
BH-III 3.00 U1.2 0.032496 0.185839 0.428344 0.556223 17.116921 1.910740
BH-III 4.00 U1.3 0.076219 0.270927 0.526884 0.736065 9.657263 1.308357
BH-III 5.00 U1.4 0.069855 0.258036 0.518012 0.729905 10.448850 1.305857
BH-III 9.00 U1.5 0.081788 0.296866 0.550441 0.763933 9.340391 1.410507
BH-III 10.00 U1.6 0.098662 0.300000 0.554861 0.808336 8.192980 1.128497
0.00 12.10 -6.20 10.29 43.40 27.09 11.51 1.80 0.00
0.00 9.71 -4.97 8.26 36.70 31.42 15.48 3.40 0.00
0.00 7.32 -3.75 6.23 32.40 33.70 18.70 5.40 0.00
0.00 7.62 -3.90 6.48 33.20 31.92 18.18 6.50 0.00
0.00 6.72 -3.44 5.72 32.00 34.51 15.69 8.80 0.00
0.00 4.78 -2.45 4.07 36.10 29.81 15.59 12.10 0.00



B.H.NO.	DEPTH	SAMPLE	D10 Value	D30 Value	D50 Value	D60 Value	Uni. Coeff.(Cu)	Curv. Coeff.(Cc)								
BH-IV	2.00	U1.1	0.010709	0.109461	0.256467	0.333327	31.125929	3.356605	0.00	16.14	-8.26	13.72	52.70	17.84	5.46	2.40
BH-IV	3.00	U1.2	0.012030	0.122698	0.282695	0.355299	29.535255	3.522288	0.00	15.09	-7.73	12.83	48.80	17.80	7.20	6.00
BH-IV	5.00	U1.3	0.028735	0.160236	0.370172	0.500973	17.434444	1.783617	0.00	10.16	-5.20	8.64	43.30	20.28	9.62	13.20
BH-IV	7.00	U1.4	0.075000	0.223834	0.553239	0.841427	11.219031	0.793913	0.00	7.47	-3.82	6.35	33.50	26.70	12.80	17.00
BH-IV	8.00	U1.5	0.077401	0.289523	0.491611	0.747163	9.653190	1.449466	0.00	7.02	-3.60	5.97	36.80	25.35	7.95	20.50
BH-IV	10.00	U1.6	0.093718	0.342735	0.789445	1.161898	12.397875	1.078770	0.00	4.78	-2.45	4.07	27.80	28.52	13.48	23.80



B.H.NO.	DEPTH	SAMPLE	D10 Value	D30 Value	D50 Value	D60 Value	Uni. Coeff.(Cu)	Curv. Coeff.(Cc)	CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	COARSE	SYMBOL
BH-V	2.00	U1.1	0.009539	0.103127	0.250655	0.332747	34.883652	3.350729	0.00	17.33	-8.87	14.74	50.50	18.01	6.19	2.10	0.00	×
BH-V	3.00	U1.2	0.010086	0.109264	0.265591	0.343921	34.098539	3.441710	0.00	16.74	-8.57	14.23	48.60	19.31	6.79	2.90	0.00	◇
BH-V	4.00	U1.3	0.011235	0.117865	0.300000	0.366066	32.583012	3.377861	0.00	15.69	-8.03	13.34	46.50	18.02	8.18	6.30	0.00	□
BH-V	6.00	U1.4	0.033942	0.163576	0.366271	0.490184	14.441677	1.608194	0.00	9.56	-4.90	8.13	44.80	19.20	9.00	14.20	0.00	◇
BH-V	9.00	U1.5	0.063111	0.217166	0.555488	0.844992	13.388905	0.884348	0.00	7.85	-4.02	6.67	32.90	26.72	11.88	18.00	0.00	△
BH-V	10.00	U1.6	0.079075	0.302016	0.508860	0.775834	9.811339	1.486794	0.00	6.72	-3.44	5.72	36.30	25.62	8.68	20.40	0.00	+



B.H.NO.	DEPTH	SAMPLE	D10 Value	D30 Value	D50 Value	D60 Value	Uni. Coeff.(Cu)	Curv. Coeff.(Cc)	CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	COARSE	SYMBOL
BH-VI	2.00	U1.1	0.089733	0.145700	0.348952	0.476771	5.313242	0.496205	0.00	1.94	-0.99	1.65	53.40	31.60	10.80	1.60	0.00	×
BH-VI	3.00	U1.2	0.096215	0.184043	0.453724	0.615032	6.392247	0.572398	0.00	0.60	-0.31	0.51	47.00	30.53	15.67	6.00	0.00	◇
BH-VI	4.00	U1.3	0.123802	0.378413	0.674690	0.952724	7.695522	1.214050	0.00	0.45	-0.23	0.38	32.20	36.74	21.26	9.20	0.00	□
BH-VI	7.00	U1.4	0.145898	0.476340	0.878486	1.236506	8.475140	1.257727	0.00	0.30	-0.15	0.25	25.40	36.99	25.71	11.50	0.00	◇
BH-VI	9.00	U1.5	0.214979	0.622138	1.138011	1.632261	7.592667	1.103033	0.00	0.22	-0.11	0.19	17.80	37.59	30.51	13.80	0.00	△
BH-VI	10.00	U1.6	0.348297	0.780228	1.559367	2.272750	6.525314	0.769026	0.00	0.15	-0.08	0.13	12.20	34.59	32.01	21.00	0.00	+

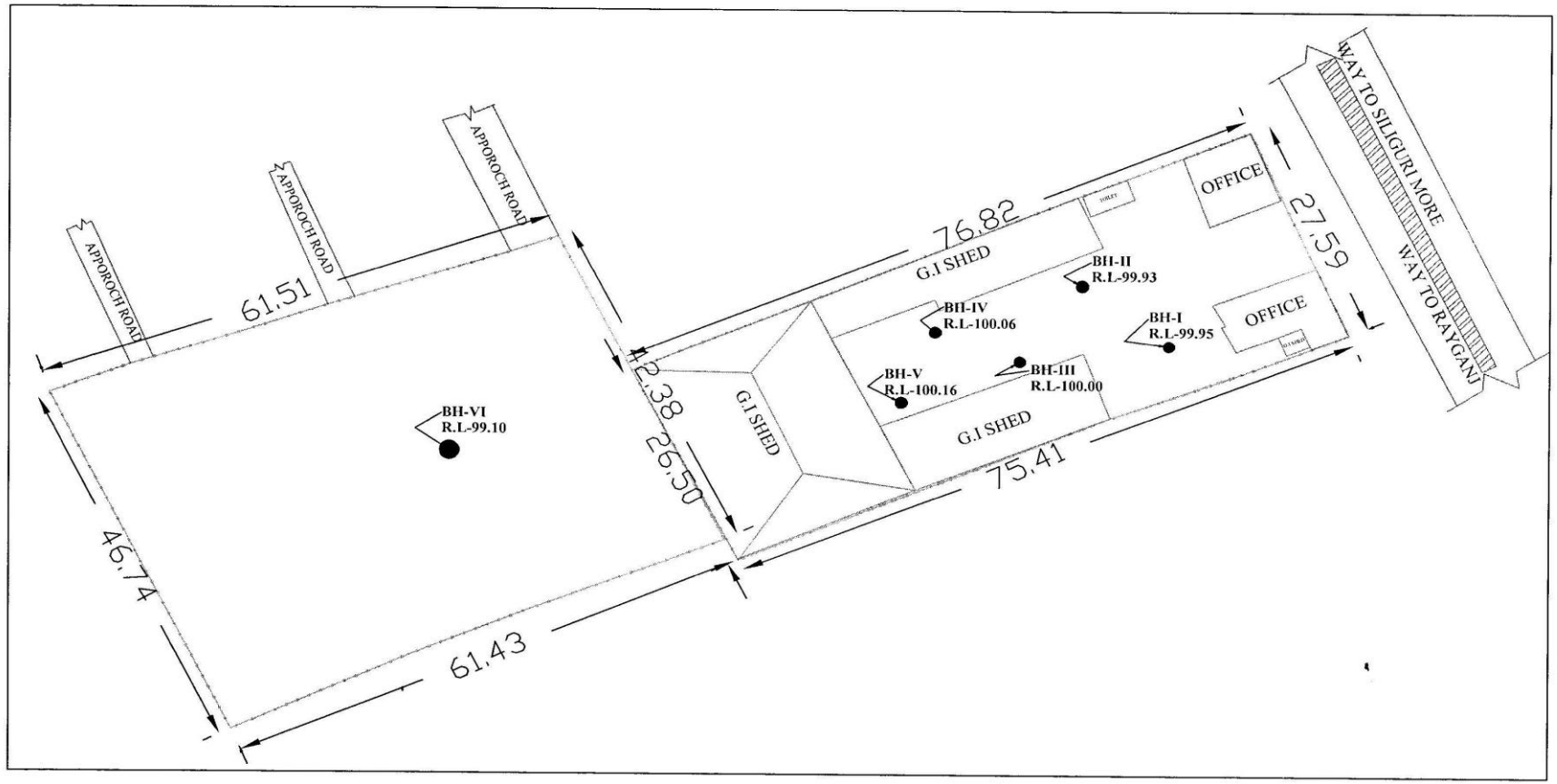
R.B./P.S: RAIGANJ/2019-20/21

OWNERS: 1. SRI. KANAI LAL BAZAZ, 2. SRI. CHANDAN KUMAR BAJAJ
3. SRI. NARAYAN KALYANI, 4. SRI. KRISHNA KALYANI
5. SRI. PREM KUMAR AGARWAL

LAND SCHEDULE:
MOUZA : BARUA
WARD NO.:02(NEW) OF RAIGANJ MUNICIPALITY,J.L NO : 152,
PLOT NO :319,302 (R.S) 2864 , 2857(L.R)
KHATIAN NO :74 , 49 (R.S), 223, 914 , 4096 (L.R)
P.S : RAIGANJ,DIST : UTTAR DINAJPUR.

SITE-PLAN SHOWING THE BORE-HOLE LOCATIONS FOR PROPOSED LOWER GROUND + ELEVATED GROUND + 4 STORIED COMMERCIAL BUILDING AT MOUZA: BARUA, WARD NO.:02(NEW) OF RAIGANJ MUNICIPALITY, P.S : RAIGANJ,DIST : UTTAR DINAJPUR

SITE-PLAN



PHOTOGRAPH OF SITE WORK IN PROGRESS