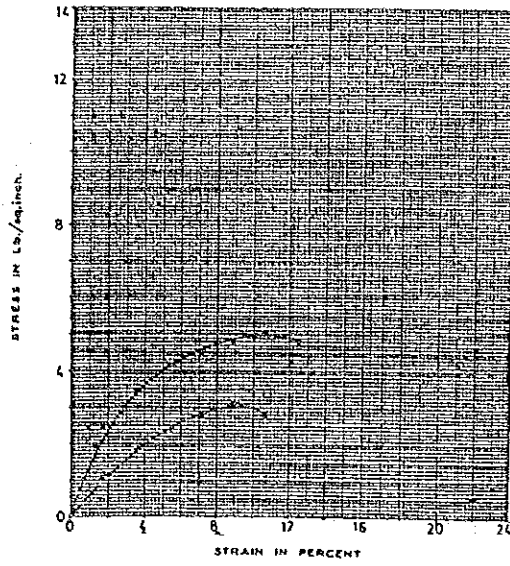# APPENDIX 2.5   UNCONFINED COMPRESSION TEST

Graph 1

Y-axis: STRESS IN lb./sq.inch. (marks at 0, 4, 8, 12, 14)
X-axis: STRAIN IN PERCENT (marks at 0, 4, 8, 12, 16, 20, 24)

BORING No.	A-1/1 (9880980)
Depth :	3.10 m to 3.55 m
Unconfined compressive strength	0.325 t/sft
Percent Strain at failure	10.71 %
Sencitivity 5.05/3.06 =	1.650
Moisture content (%)	62.52
Dry Density (lb.cft)	63.20

Un-disturbed Sample _____
Remoulded Sample _ _ _ _

Graph 2

Y-axis: STRESS IN lb./sq.inch. (marks at 0, 4, 8, 12, 14)
X-axis: STRAIN IN PERCENT (marks at 0, 4, 8, 12, 16, 20, 24)
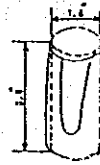
BORING No.	A-1/1 (9880980)
Depth :	7.10 m to 7.55 m
Unconfined compressive strength	0.502 t/sft
Percent Strain at failure	7.14 %
Sencitivity 7.80/4.93 =	1.566
Moisture content (%)	33.66
Dry Density (lb/cft)	89.28

Un-disturbed Sample _____
Remoulded Sample _ _ _ _

Graph 3

Y-axis: STRESS IN lb./sq.inch. (marks at 0, 4, 8, 12, 14)
X-axis: STRAIN IN PERCENT (marks at 0, 4, 8, 12, 16, 20, 24)

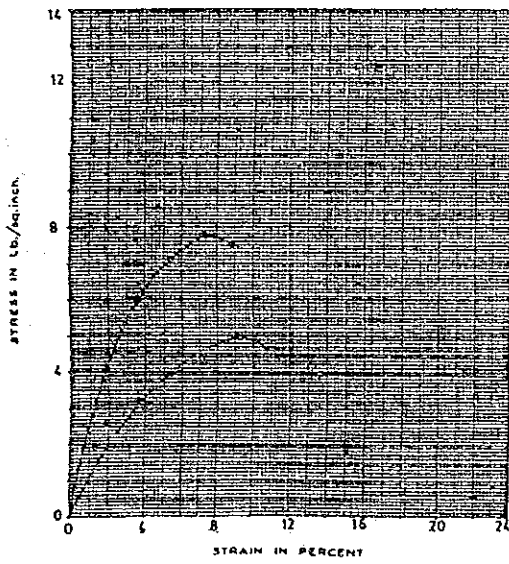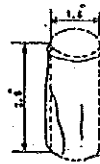| BORING No.	A-1/1 (9880980)
Depth :	23.10 m to 23.55 m
Unconfined compressive strength	0.320 t/sft
Percent Strain at failure	8.92 %
Sencitivity 4.93/2.87 =	1.735
Moisture content (%)	32.19
Dry Density (lb/cft)	90.61

Un-disturbed Sample _____
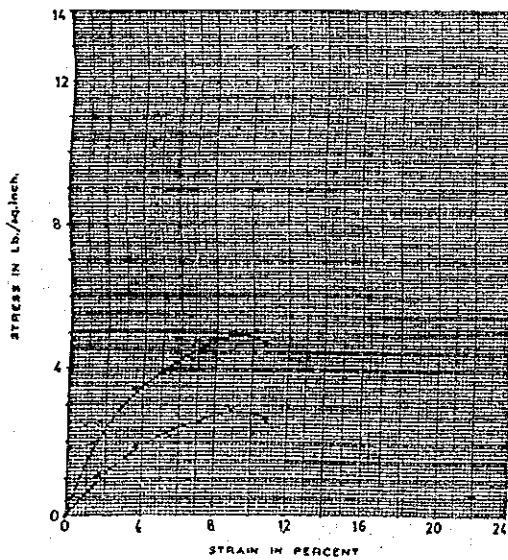Remoulded Sample _ _ _ _

UNCONFINED CONPRESSION TEST

BORING No. A-1 2 (98809850)
Depth : 2.10 m to 2.55 m
Unconfined compressive strength 0.269 t sft
Percent Strain at failure 16.71 %
Sensitivity 1.49 2.67 = 1.56?
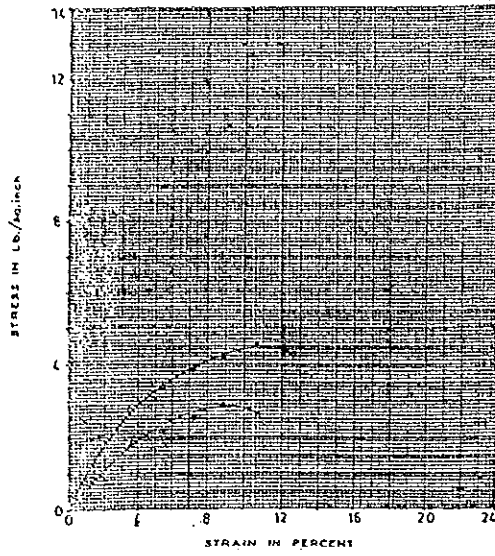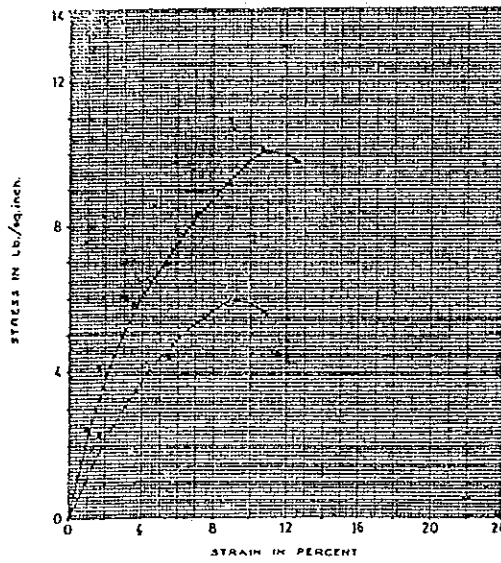Moisture content (%) 46.56
Dry Density (lb cft) 81.50

Un-disturbed Sample _____
Remoulded Sample __ __ __

BORING No. A-1 2 (98809850)
Depth : 5.10 m to 5.55 m
Unconfined compressive strength 0.651 t sft
Percent Strain at failure 16.71 %
Sensitivity 10.11 2.94 = 1.702
Moisture content (%) 29.83
Dry Density (lb cft) 94.13
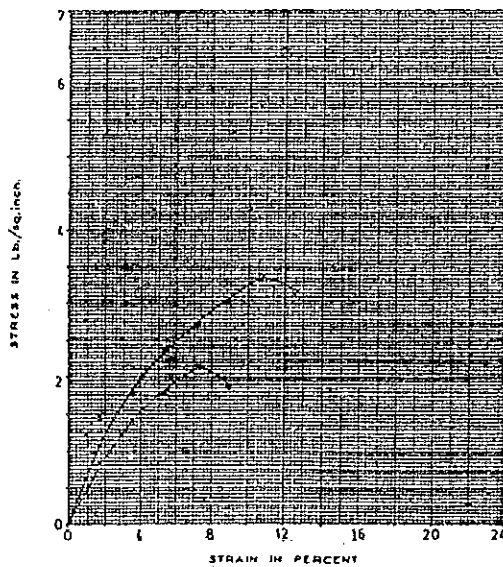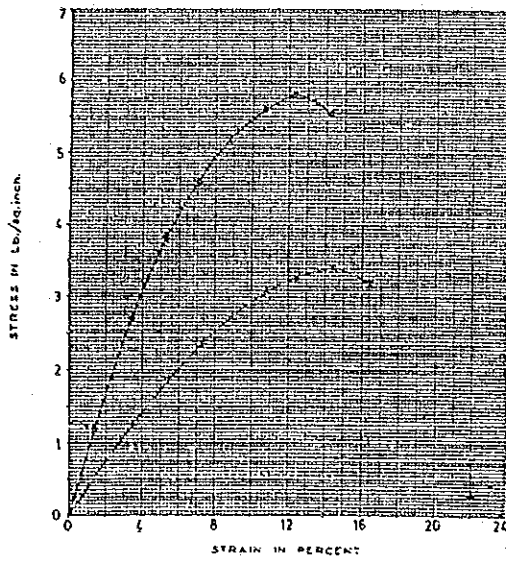
Un-disturbed Sample _____
Remoulded Sample __ __ __

BORING No. A-1 2 (98809850)
Depth : 15.10 m to 15.55 m
Unconfined compressive strength 0.217 t sft
Percent Strain at failure 16.71 %
Sensitivity 3.37 2.14 = 1.574
Moisture content (%) 31.18
Dry Density (lb cft) 92.99

Un-disturbed Sample _____
Remoulded Sample __ __ __

A-70

UNCONFINED COMPRESSION TEST

BORING No.	E-1 (9880982)	
Depth :	3.10 a to 3.55 a	
Unconfined compressive strength		0.370 t sft
Percent Strain at failure		12.49 %
Sensitivity	5.76 3.45 =	1.669
Moisture content (%)		45.35
Dry Density (lb cft)		71.09

Un-disturbed Sample _____
Removed Sample _ _ _ _
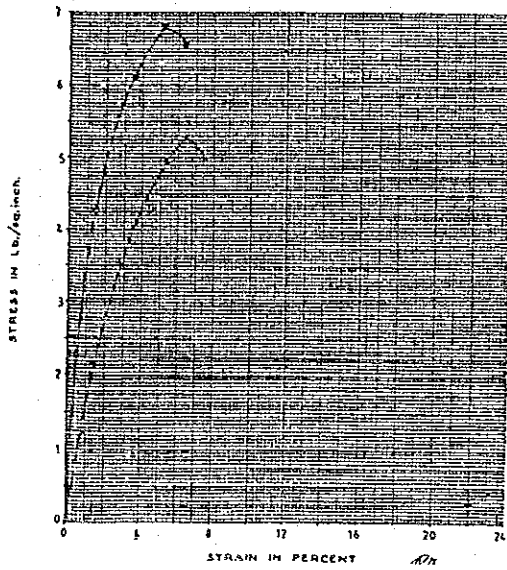
BORING No.	B-1 (9880982)	
Depth :	20.10 a to 20.55 a	
Unconfined compressive strength		0.448 t sft
Percent Strain at failure		5.35 %
Sensitivity	6.55 5.22 =	1.350
Moisture content (%)		35.65
Dry Density (lb cft)		79.09

Un-disturbed Sample _____
Removed Sample _ _ _ _

UNCONFINED COMPRESSION TEST
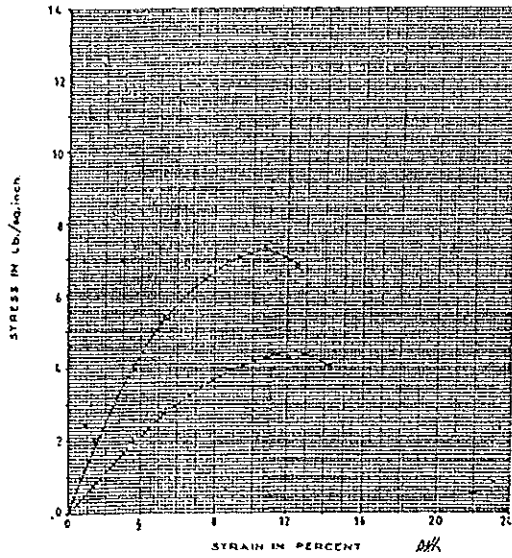
BORING No.	B-1 2 (988;982;
Depth :	4.10 a to 4.55 a
Unconfined compressive strength	0.462 t sft
Percent Strain at failure	10.71 %
Sencitivity : 7.16 4.35	1.650
Moisture content (%)	48.66
Dry Density (lb cft)	69.34

Un-disturbed sample _____
Remoulded Sample ___ ___ __
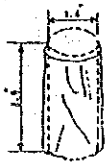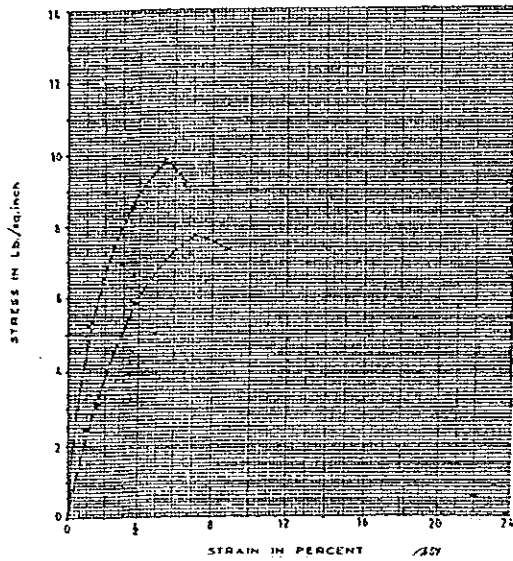
BORING No.	B-1 2 (9880982;
Depth :	14.10 a to 14.55 a
Unconfined compressive strength	0.840 t sft
Percent Strain at failure	5.35 %
Sencitivity : 9.94 7.83	1.269
Moisture content (%)	39.86
Dry Density (lb cft)	80.80

Un-disturbed sample _____
Remoulded Sample ___ ___ __

UNCONFINED CONPRESSION TEST
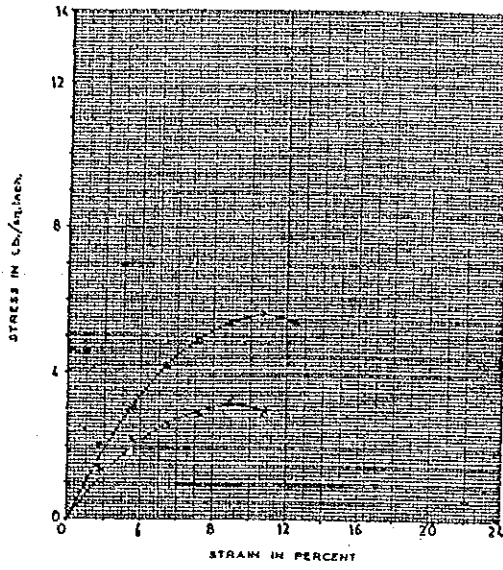
BORING No.	A-2-1 (9900182)	
Depth :	3.19 m to 3.55 m	
Unconfined compressive strength	0.382 t/sft	
Percent Strain at failure	16.71 %	
Sencitivity	5.62 3.25 = 1.729	
Moisture content (%)	39.17	
Dry Density (lb/cft)	83.71	

Un-disturbed Sample _____
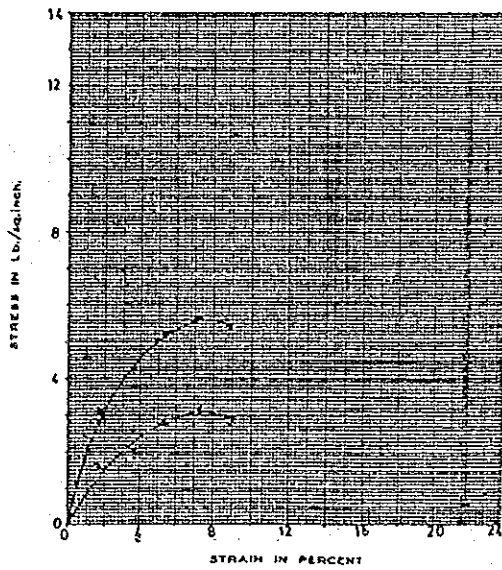
Remoulded Sample _ _ _ _

BORING No.	A-2-1 (9900182)	
Depth :	6.10 m to 6.55 m	
Unconfined compressive strength	0.364 t/sft	
Percent Strain at failure	7.14 %	
Sencitivity	5.68 3.12 = 1.814	
Moisture content (%)	36.60	
Dry Density (lb/cft)	102.54	

Un-disturbed Sample _____

Remoulded Sample _ _ _ _

A-73   UNCONFINED CONPRESSION TEST

STRESS IN Lb./sq.inch.

STRAIN IN PERCENT
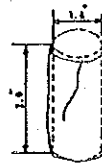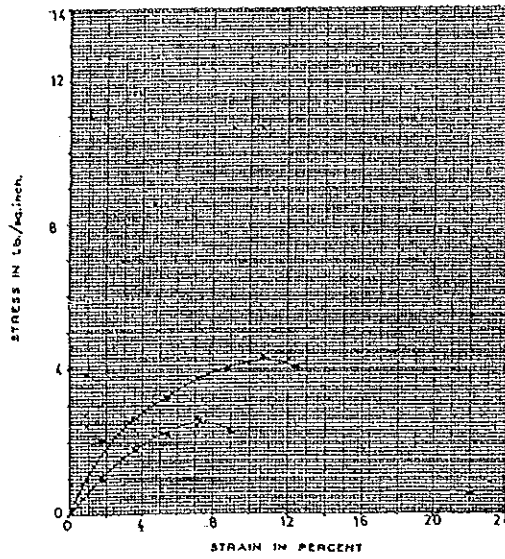
BORING No.	A-2 2 (9900182)
Depth :	2.10 m to 2.55 m
Unconfined compressive strength	0.277 t sft
Percent Strain at failure	10.71 %
Sensitivity 4.30 2.59 =	1.659
Moisture content (%)	71.85
Dry Density (lb cft)	59.67

Un-disturbed Sample ————
Remoulded Sample — — —

STRESS IN Lb./sq.inch.

STRAIN IN PERCENT
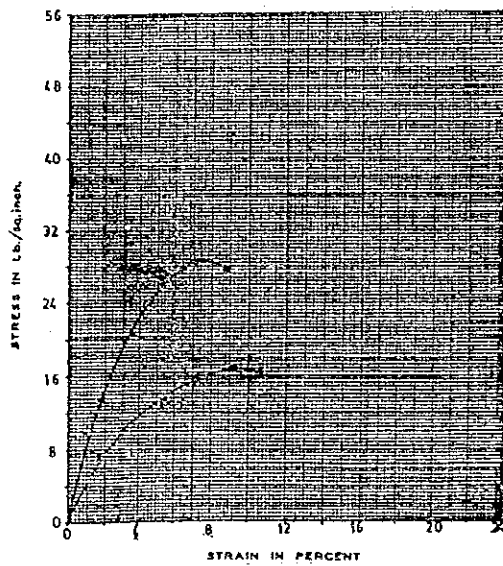
BORING No.	A-2 2 (9900182)
Depth :	21.10 m to 21.55 m
Unconfined compressive strength	1.835 t sft
Percent Strain at failure	7.14 %
Sensitivity 29.49 16.87=	1.688
Moisture content (%)	25.20
Dry Density (lb cft)	95.00

Un-disturbed Sample ————
Remoulded Sample — — —

UNCONFINED COMPRESSION TEST

BORING No.	A-5 1 (99AA485)
Depth :	5.10 x to 5.55 x
Unconfined compressive strength	0.617 t sft
Percent Strain at failure	3.57 %
Sensitivity	13.16/7.55 = 1.793
Moisture content (%)	26.53
Dry Density (lb/cft)	93.59

Un-disturbed Sample _____
Remoulded Sample _ _ _ _

BORING No.	A-5 1 (99AA485)
Depth :	7.10 x to 7.55 x
Unconfined compressive strength	1.238 t sft
Percent Strain at failure	3.57 %
Sensitivity	19.23/10.53 = 1.826
Moisture content (%)	23.99
Dry Density (lb/cft)	101.66

Un-disturbed Sample _____
Remoulded Sample _ _ _ _

UNCONFINED CONPRESSION TEST

STRESS IN Lb./sq.inch.

STRAIN IN PERCENT
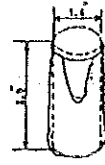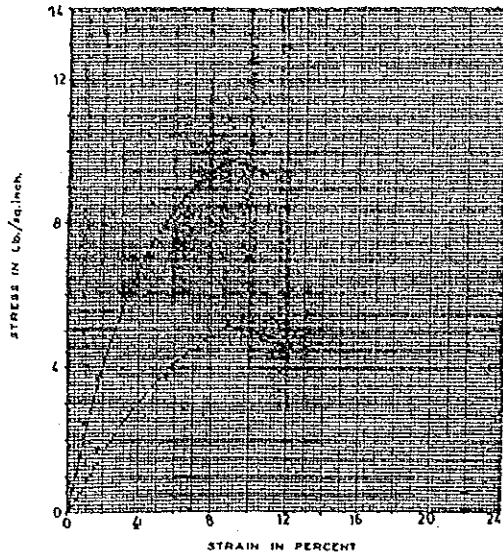
BORING No.	A-5-2 (99)X0485-
Depth :	5.10 e to 5.55 e
Unconfined compressive strength	0.629 t sf;
Percent Strain at failure	8.92 %
Sensitivity 9.77 5.17 =	1.699
Moisture content (%)	48.17
Dry Density (lb.cf1)	72.49

Undisturbed sample _____

Remoulded sample ___ ___ ___ ___

UNCONFINED CONPRESSION TEST
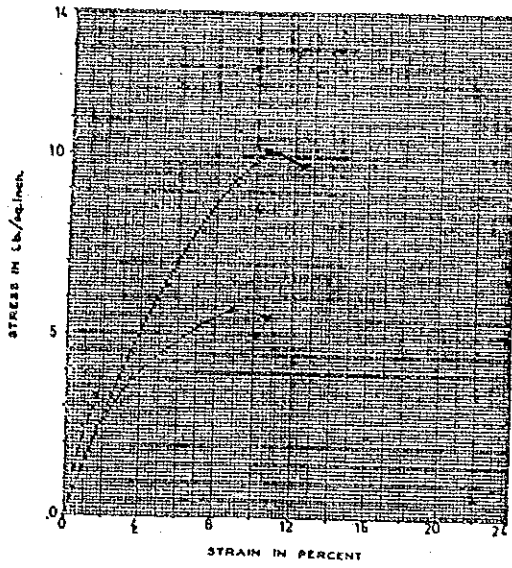
BORING No.	8-9-1 (9840480)
Depth :	2.10 m to 2.55 m
Unconfined compressive strength	0.651 t/sft
Percent Strain at failure	10.71 %
Sencitivity	10.11/5.75 = 1.758
Moisture content (%)	35.50
Dry Density (lb/cft)	88.40

Un-disturbed Sample _____
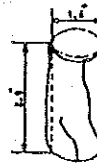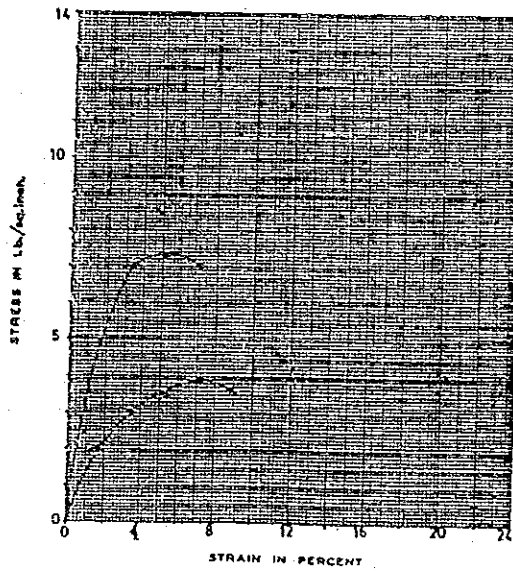
Remoulded Sample — — — —

BORING No.	8-9-1 (9840480)
Depth :	7.10 m to 7.55 m
Unconfined compressive strength	0.473 t/sft
Percent Strain at failure	5.35 %
Sencitivity	7.35/3.90 = 1.854
Moisture content (%)	23.36
Dry Density (lb/cft)	94.59

Un-disturbed Sample _____

Remoulded Sample — — — —

BORING No.	8-9-1 (9840480)
Depth :	12.10 m to 12.55 m
Unconfined compressive strength	0.266 t/sft
Percent Strain at failure	3.57 %
Sencitivity	4.45/2.38 = 1.869
Moisture content (%)	25.96
Dry Density (lb/cft)	91.95

Un-disturbed Sample _____

Remoulded Sample — — — —

A-77

UNCONFINED CONPRESSION TEST

Graph 1

STRESS IN Lb./sq.inch. (y-axis: 0, 4, 8, 12, 14)
STRAIN IN PERCENT (x-axis: 0, 4, 8, 12, 16, 20, 24)

BORING No.	B-9 2 (98+0+50)
Depth :	2.10 m to 2.55 m
Unconfined compressive strength	0.395 t sft
Percent Strain at failure	6.92
Sencitivity	6.13/3.51 = 1.746
Moisture content (%)	31.78
Dry Density (lb/cft)	91.49

Un-disturbed Sampe _____
Remoulded Sample _ _ _ _ _

Graph 2

STRESS IN Lb./sq.inch. (y-axis: 0, 4, 6, 8, 12, 14)
STRAIN IN PERCENT (x-axis: 0, 4, 8, 12, 16, 20, 24)

BORING No.	B-9 2 (98+0+80)
Depth :	7.10 m to 7.55 m
Unconfined compressive strength	0.565 t sft
Percent Strain at failure	3.57
Sencitivity	5.67/3.37 = 1.682
Moisture content (%)	27.68
Dry Density (lb/cft)	99.60

Un-disturbed Sampe _____
Remoulded Sample _ _ _ _ _

Graph 3

STRESS IN Lb./sq.inch. (y-axis: 0, 4, 8, 12, 14)
STRAIN IN PERCENT (x-axis: 0, 4, 8, 12, 16, 20, 24)

BORING No.	B-9 2 (98+0+60)
Depth :	10.10 m to 10.55 m
Unconfined compressive strength	0.547 t sft
Percent Strain at failure	3.57
Sencitivity	8.50/5.16 = 1.647
Moisture content (%)	32.52
Dry Density (lb/cft)	97.86

Un-disturbed Sampe _____
Remoulded Sample _ _ _ _ _

UNCONFINED CONPRESSION TEST

BORING No.	A-7 1 (98104811
Depth :	2.10 x to 2.55 x
Unconfined compressive strength	0.588 t sft
Percent Strain at failure	5.35 %
Sencitivity	9.14 5.17 = 1.76i
Moisture content (%)	33.36
Dry Density (lb cft)	95.61

Un-disturbed Sample _____
Remoulded Sample _ _ _ _ _

BORING No.	A-7-i (98104811
Depth :	7.10 x to 7.55 x
Unconfined compressive strength	0.995 t sft
Percent Strain at failure	5.35 %
Sencitivity	6.16 3.51 = 1.75i
Moisture content (%)	30.54
Dry Density (lb cft)	103.86

Un-disturbed Sample _____
Remoulded Sample _ _ _ _ _
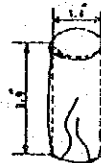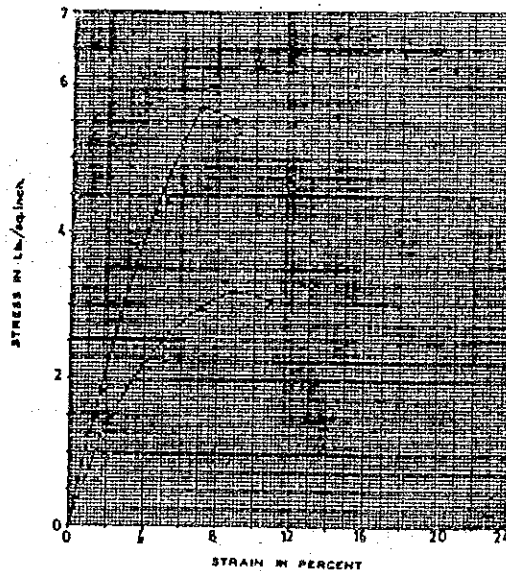
BORING No.	A-7 1 (98104811
Depth :	11.10 x to 11.55 x
Unconfined compressive strength	0.570 t sft
Percent Strain at failure	7.14 %
Sencitivity	5.75 3.25 = 1.769
Moisture content (%)	38.47
Dry Density (lb cft)	82.03

Un-disturbed Sample _____
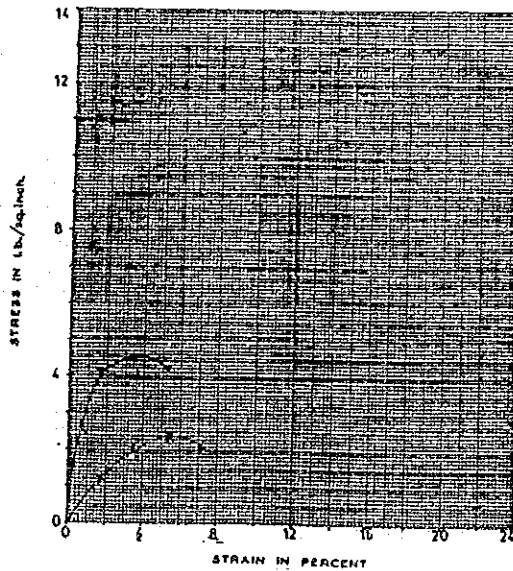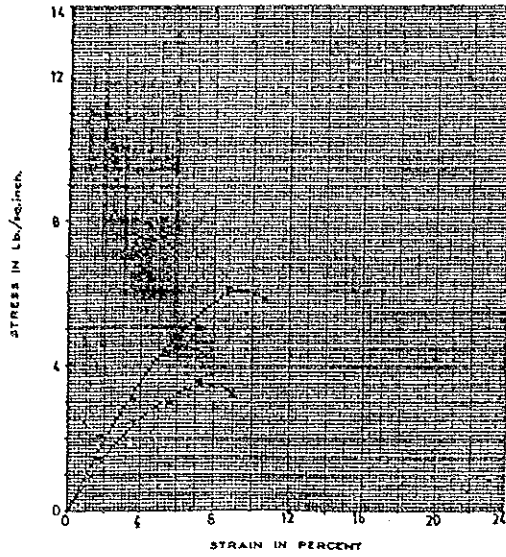Remoulded Sample _ _ _ _ _

UNCONFINED CONPRESSION TEST
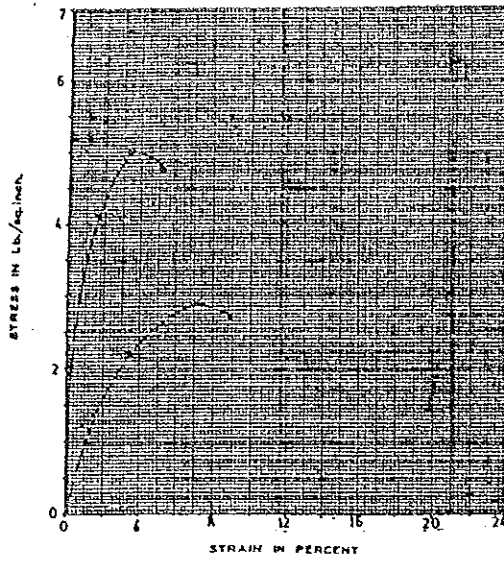
BORING No. A-7 2 (9840481)
Depth : 3.10 m to 3.55 m
Unconfined compressive strength 0.326 t/sft
Percent Strain at failure 3.57
Sensitivity 5.06/2.92 = 1.732
Moisture content (%) 33.96
Dry Density (lb/cft) 106.96
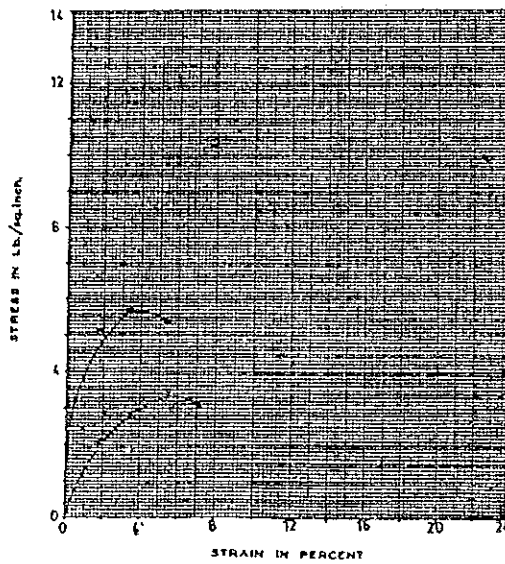
Un-disturbed Sample _____
Remoulded Sample _ _ _ _
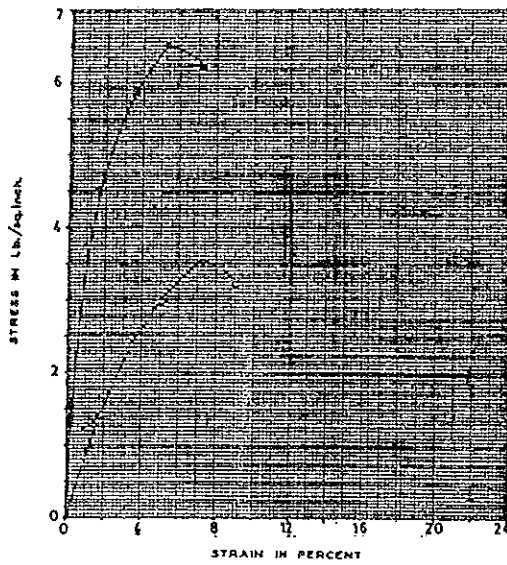
BORING No. A-7-2 (9840481)
Depth : 10.10 m to 10.55 m
Unconfined compressive strength 0.422 t/sft
Percent Strain at failure 5.35
Sensitivity 6.56/3.51 = 1.868
Moisture content (%) 27.19
Dry Density (lb/cft) 100.77
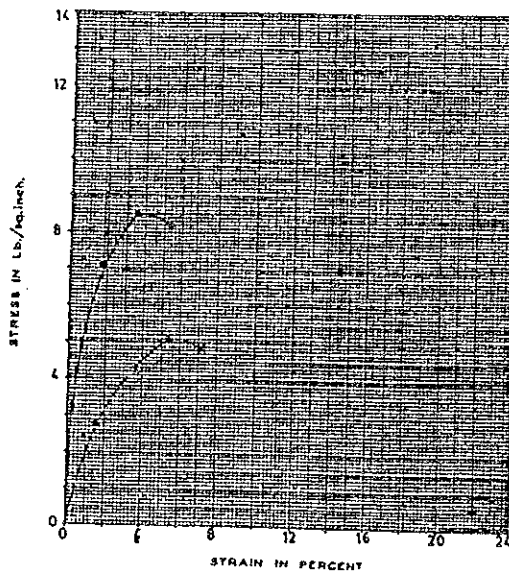
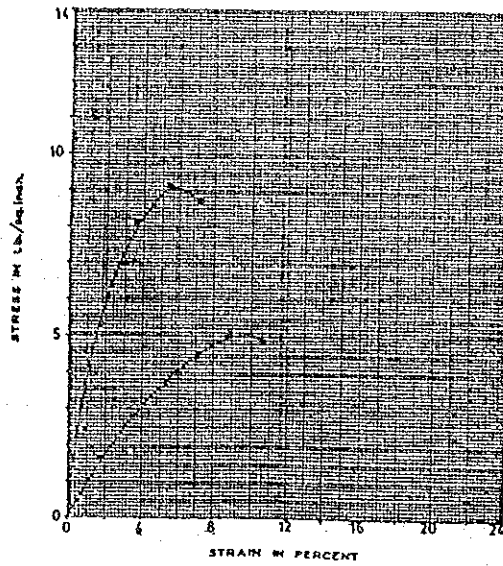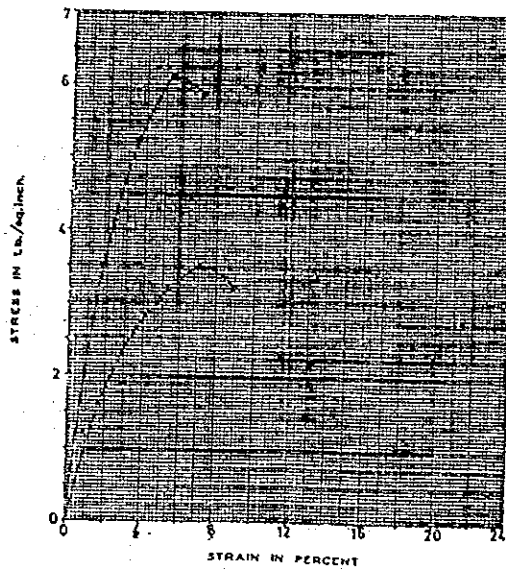Un-disturbed Sample _____
Remoulded Sample _ _ _ _
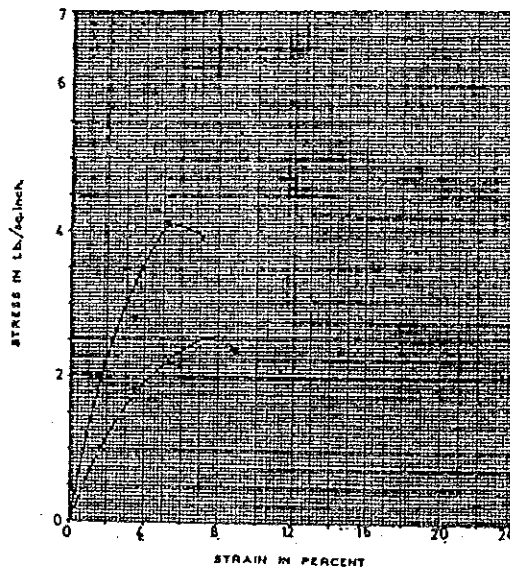
BORING No. A-7 2 (9840481)
Depth : 12.10 m to 12.55 m
Unconfined compressive strength 0.268 t/sft
Percent Strain at failure 5.35
Sensitivity 4.17/2.53 = 1.648
Moisture content (%) 36.54
Dry Density (lb/cft) 84.66

Un-disturbed Sample _____
Remoulded Sample _ _ _ _

UNCONFINED CONPRESSION TEST

SAMPLE NO.	UNCONFINED COMP. STRENGTH (psi)	% STRAIN AT FAILURE	WATER CONTENT	DENSITY (lbs/ft³) DRY	WET
1	3.19	8.33	62.79	59.26	96.46
2	3.805	10.00	65.07	60.05	99.12
3	2.024	18.33	68.39	55.67	93.74

BRTC No. : 1744/92-93 DATE : 15-12-92
Client : SOIL TREAT, EQUIPMENT & ENGG. LTD.   9900183 - 1
Ref. : STEEL/HO/105/367/92 DATE : 15-12-92
TYPE OF SAMPLE: UNDISTURBED
BH. NO.: A-3-1 SAMPLE NO.: UD3 LOCATION: BADOR KHALI
SAMPLE DESCRIPTION: GREY SOFT SILT
SAMPLE DEPTH: 3 m
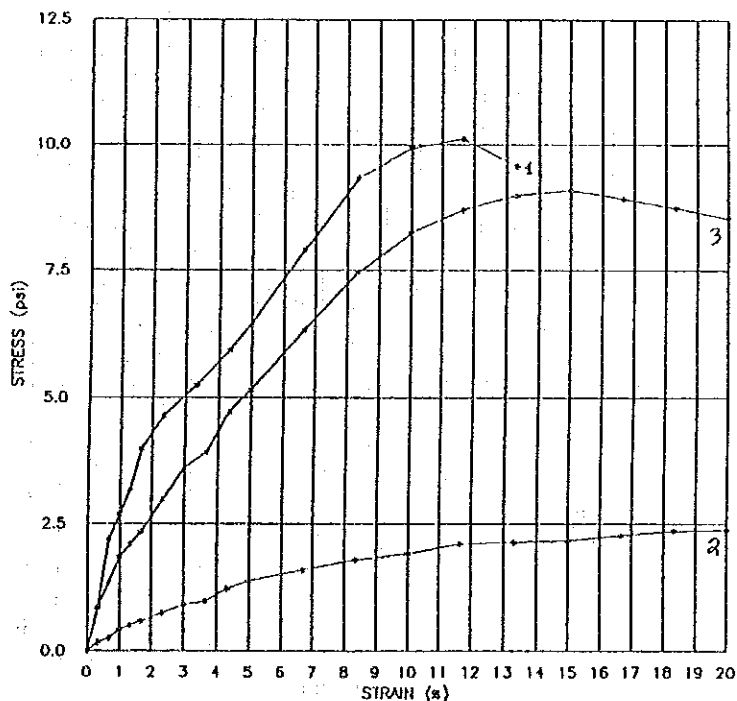
SAMPLE NO.	UNCONFINED COMP. STRENGTH (psi)	% STRAIN AT FAILURE	WATER CONTENT	DENSITY (lbs/ft³) DRY	WET
1	10.12	11.67	32.22	88.92	117.58
2	2.38	20.00	38.31	80.23	110.97
3	9.09	15.00	32.35	87.92	118.36

A-81   UNCONFINED CONPRESSION TEST

BRTC No. : 1744/92-93 DATE : 15-12-92
Client : SOIL TREAT, EQUIPMENT & ENGG. LTD.
Ref. : STEEL/IIO/105/367/92 DATE : 15-12-92
TYPE OF SAMPLE: UNDISTURBED
BH. NO.: A-3-2 SAMPLE NO.: UD1 LOCATION: BADOR KHALI
SAMPLE DESCRIPTION: GREY SOFT SILT WITH SOME ORGANIC CONTENT
SAMPLE DEPTH: 1 m

SAMPLE NO.	UNCONFINED COMP. STRENGTH (psi)	% STRAIN AT FAILURE	WATER CONTENT	DENSITY (lbs/ft³) DRY	WET
1	11.99	11.67	38.17	82.03	113.34
2	7.79	10.00	36.89	80.80	110.61
3	9.82	6.67	41.47	78.29	110.76

BRTC No. : 1744/92-93 DATE : 15-12-92
Client : SOIL TREAT, EQUIPMENT & ENGG. LTD.
Ref. : STEEL/IIO/105/367/92 DATE : 15-12-92
TYPE OF SAMPLE: UNDISTURBED
BH. NO.: A-3-2 SAMPLE NO.: UD3 LOCATION: BADOR KHALI
SAMPLE DESCRIPTION: GREY SOFT SILT
SAMPLE DEPTH: 3 m
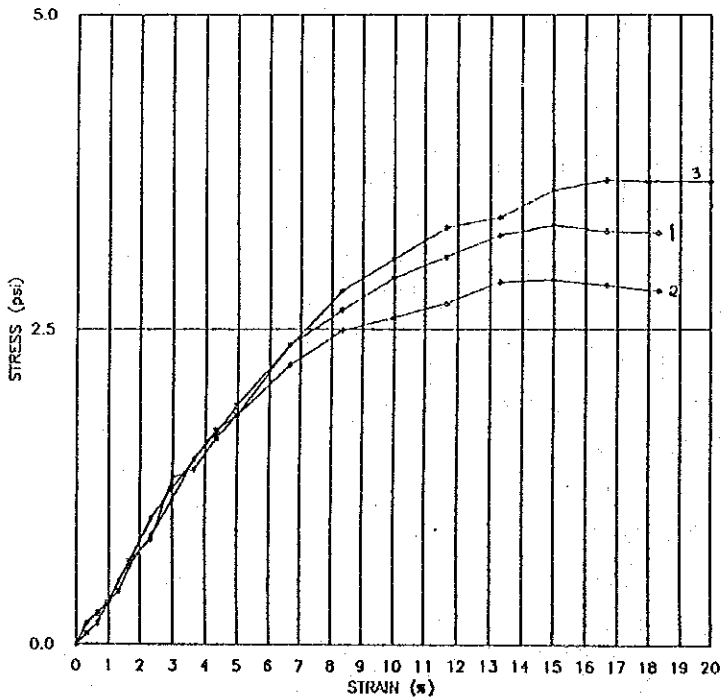
SAMPLE NO.	UNCONFINED COMP. STRENGTH (psi)	% STRAIN AT FAILURE	WATER CONTENT	DENSITY (lbs/ft³) DRY	WET
1	3.32	15.00	48.89	71.40	106.30
2	2.89	15.00	54.33	67.16	103.65
3	3.68	16.67	47.40	73.05	107.60

A-82   UNCONFINED CONPRESSION TEST

BRTC No. : 1744/92-93 DATE : 15-12-92
Client : SOIL TREAT, EQUIPMENT & ENGG. LTD.
Ref. : STEEL/HO/105/367/92 DATE : 15-12-92
TYPE OF SAMPLE: UNDISTURBED
BH. NO.: A-4-1 SAMPLE NO.: UD1 LOCATION: BADOR KHALI
SAMPLE DESCRIPTION: BROWNISH GREY SOFT CLAY
SAMPLE DEPTH: 1 m
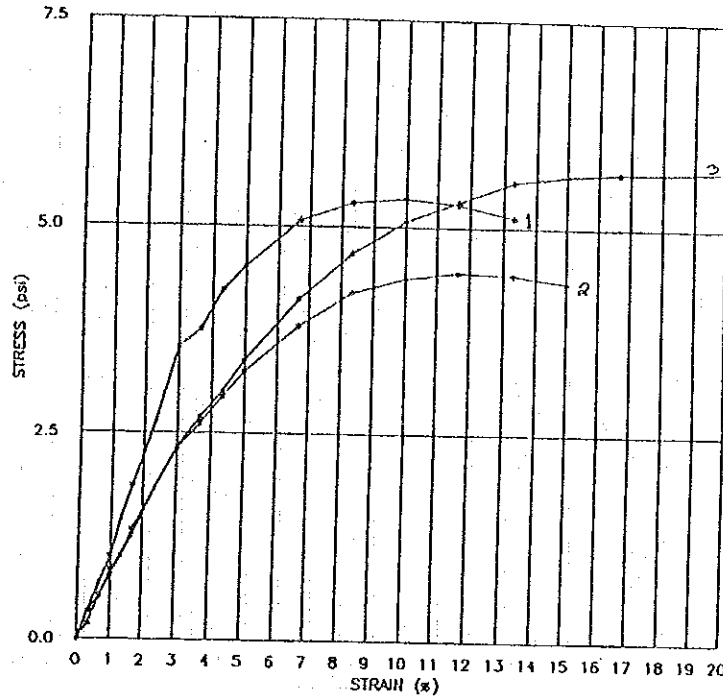
SAMPLE NO.	UNCONFINED COMP. STRENGTH (psi)	% STRAIN AT FAILURE	WATER CONTENT	DENSITY (lbs/ft³)	
				DRY	WET
1	5.35	10.00	43.22	73.62	105.44
2	4.45	11.66	44.52	73.41	106.10
3	5.70	20.00	39.55	79.01	110.25

BRTC No. : 1744/92-93 DATE : 15-12-92
Client : SOIL TREAT, EQUIPMENT & ENGG. LTD.
Ref. : STEEL/HO/105/367/92 DATE : 15-12-92
TYPE OF SAMPLE: UNDISTURBED
BH. NO.: A-4-1 SAMPLE NO.: UD1 LOCATION: BADOR KHALI
SAMPLE DESCRIPTION: GREY SOFT SILT
SAMPLE DEPTH: 3 m
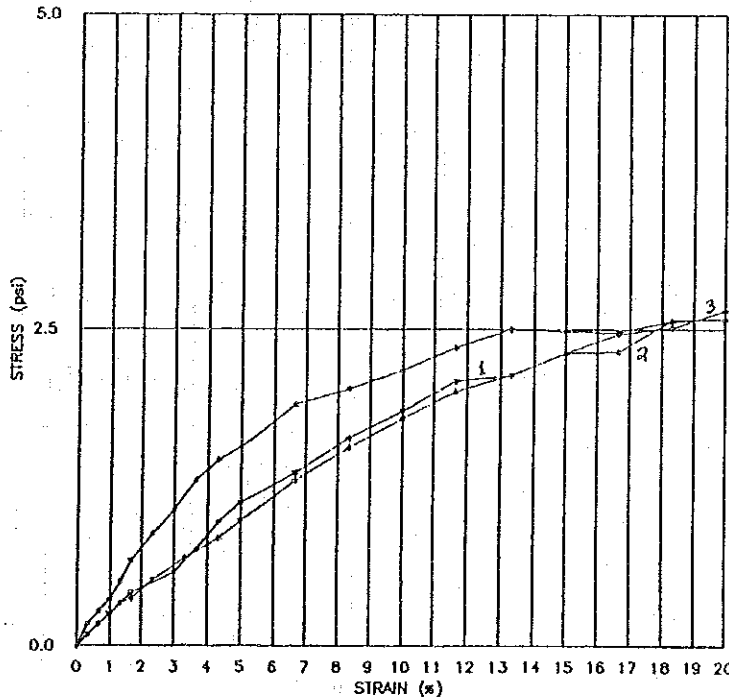
SAMPLE NO.	UNCONFINED COMP. STRENGTH (psi)	% STRAIN AT FAILURE	WATER CONTENT	DENSITY (lbs/ft³)	
				DRY	WET
1	2.58	20	45.93	75.06	109.54
2	2.58	20	51.60	67.52	102.35
3	2.65	20	50.80	69.31	104.51

A-83 UNCONFINED COMPRESSION TEST

BRTC No. : 1744/92-93 DATE : 15-12-92 9900185-2
Client : SOIL TREAT, EQUIPMENT & ENGG. LTD.
Ref. : STEEL/HO/105/367/92 DATE : 15-12-92
TYPE OF SAMPLE: UNDISTURBED
BH. NO.: A-4-2 SAMPLE NO.: UD1 LOCATION: BADOR KHALI
SAMPLE DESCRIPTION: GREY SOFT SILT WITH ORGANIC CONTENT
SAMPLE DEPTH: 1 m

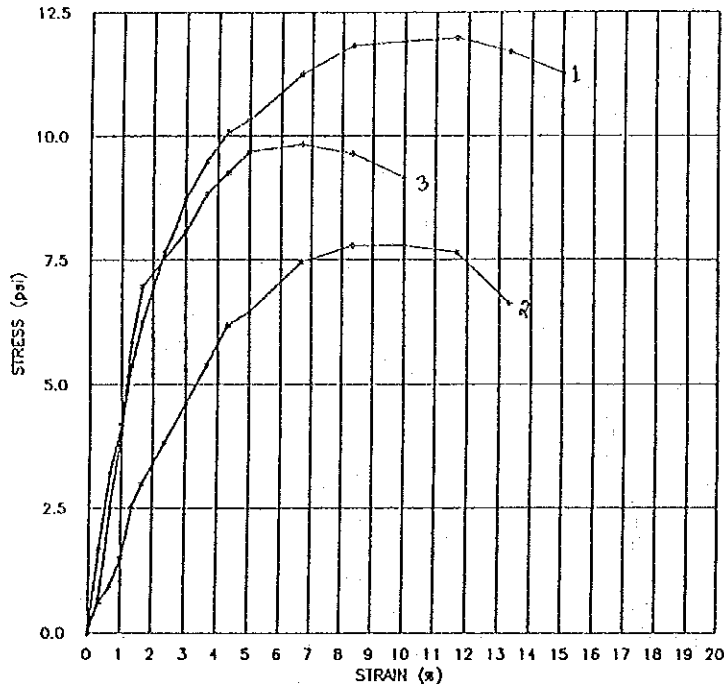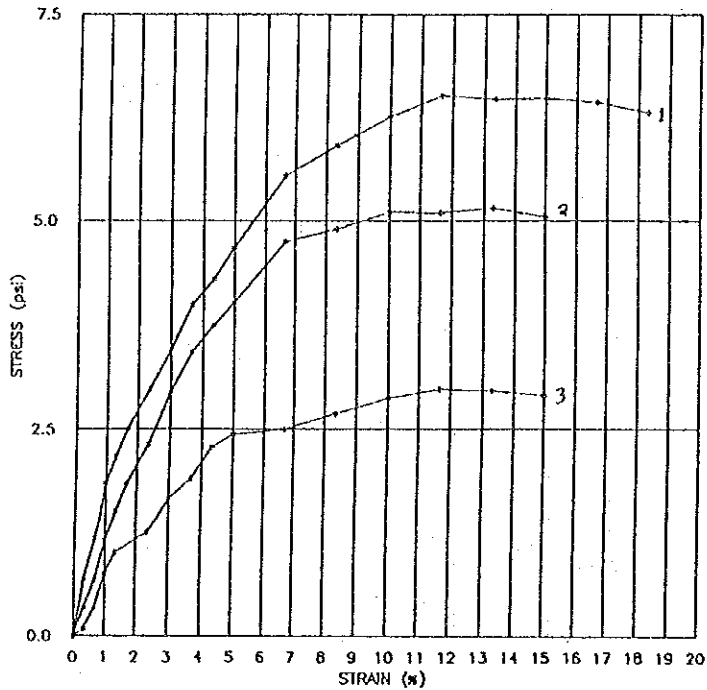| SAMPLE NO.	UNCONFINED COMP. STRENGTH (psi)	% STRAIN AT FAILURE	WATER CONTENT	DENSITY (lbs/ft³) DRY	WET
1	6.524	11.67	53.44	67.73	103.93
2	5.15	13.33	49.64	70.18	105.01
3	3.00	11.66	54.10	65.72	101.28

BRTC No. : 1744/92-93 DATE : 15-12-92 9 900 185-2
Client : SOIL TREAT, EQUIPMENT & ENGG. LTD.
Ref. : STEEL/HO/105/367/92 DATE : 15-12-92
TYPE OF SAMPLE: UNDISTURBED
BH. NO.: A-4-2 SAMPLE NO.: UD3 LOCATION: BADOR KHALI
SAMPLE DESCRIPTION: GREY SOFT SILT WITH SOME ORGANIC CONTENT
SAMPLE DEPTH: 3 m
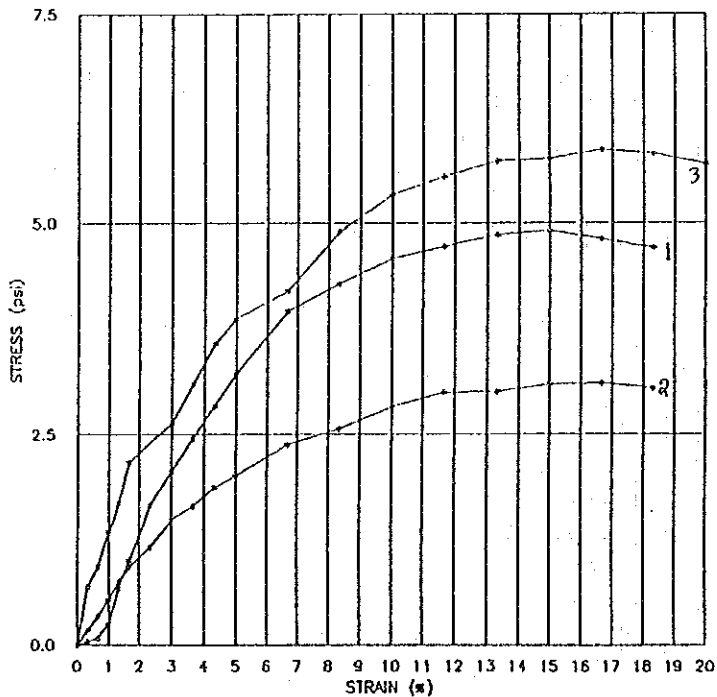
SAMPLE NO.	UNCONFINED COMP. STRENGTH (psi)	% STRAIN AT FAILURE	WATER CONTENT	DENSITY (lbs/ft³) DRY	WET
1	4.91	15.00	49.85	69.74	104.5
2	3.11	16.66	59.55	63.93	102.00
3	5.87	16.66	42.46	78.15	111.33

A-84 UNCONFINED CONPRESSION TEST

BRTC No. : 1553/92-93 DATE : 29-11-92
Client   : SOIL TREAT, EQUIPMENT & ENGG. LTD.
Ref.   : STEEL/HO/105/367/92 DATE : 29-11-92
TYPE OF SAMPLE: UNDISTURBED
BH. NO.: A-8-1   LOCATION: CHAR CLARK
SAMPLE DESCRIPTION: GRAY SILT
SAMPLE DEPTH: 4 m
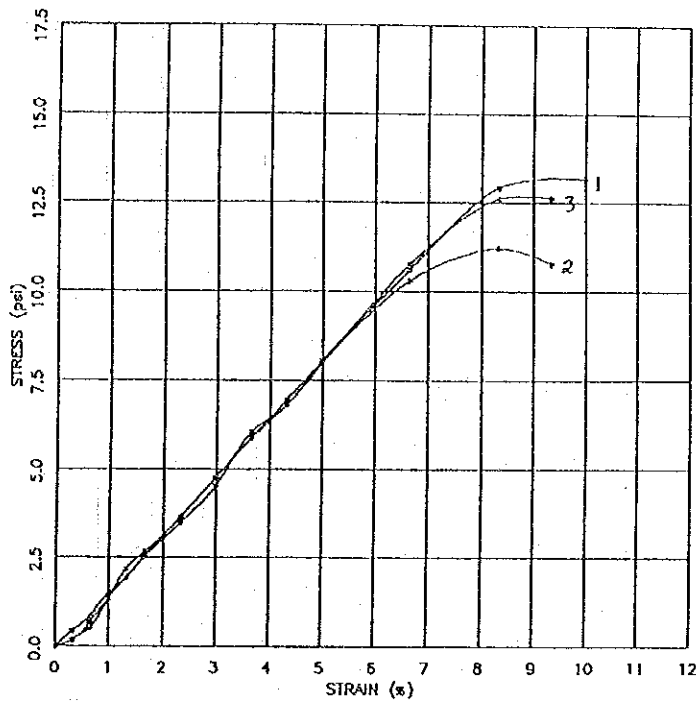
9840680-1

SAMPLE NO.	UNCONFINED COMP. STRENGTH (psi)	% STRAIN AT FAILURE	WATER CONTENT	DENSITY (lbs/ft³) DRY	WET
1	13.14	10	35	87.05	118.73
2	11.21	8.33	35	86.12	117.08
3	12.62	9.33	35	82.67	113.70

BRTC No. : 1553/92-93 DATE : 29-11-92
Client   : SOIL TREAT, EQUIPMENT & ENGG. LTD.
Ref.   : STEEL/HO/105/367/92 DATE : 29-11-92
TYPE OF SAMPLE: UNDISTURBED
BH. NO.: A-8-1   LOCATION: CHAR CLARK
SAMPLE DESCRIPTION: BROWN SILT
SAMPLE DEPTH: 2 m
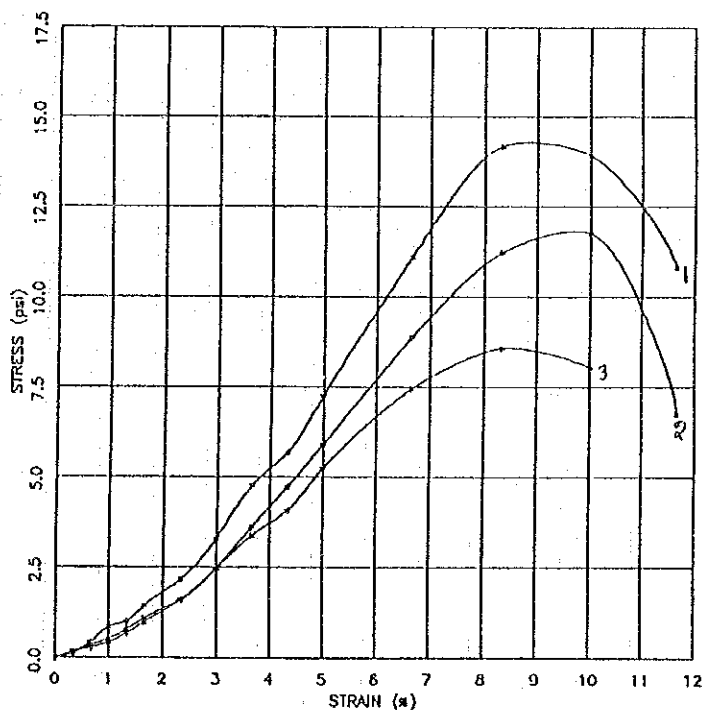
9840680-1

SAMPLE NO.	UNCONFINED COMP. STRENGTH (psi)	% STRAIN AT FAILURE	WATER CONTENT	DENSITY (lbs/ft³) DRY	WET
1	14.16	8.33	38.38	88.61	119.18
2	11.74	10	38.38	85.47	115.43
3	8.56	8.33	38.38	80.66	112.05

A-85   UNCONFINED COMPRESSION TEST

BRTC No. : 1553/92-93 DATE : 29-11-92
Client   : SOIL TREAT, EQUIPMENT & ENGG. LTD.
Ref.   : STEEL/HO/105/367/92 DATE : 29-11-92

9840680-2

TYPE OF SAMPLE: UNDISTURBED
BH. NO.: A-8-2   LOCATION: CHAR CLARK
SAMPLE DESCRIPTION: GRAY SILT
SAMPLE DEPTH: 2.3 m
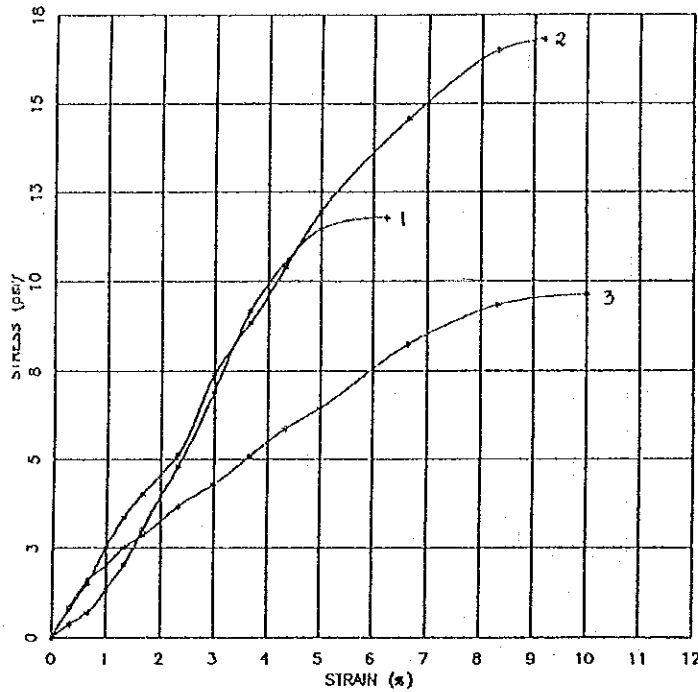
SAMPLE NO.	UNCONFINED COMP. STRENGTH (psi)	% STRAIN AT FAILURE	WATER CONTENT	DENSITY (lbs/ft³) DRY	WET
1	11.78	6.27	34.67	85.40	116.0
2	16.81	9.17	34.67	89.88	119.23
3	9.63	10	34.67	84.61	114.92

BRTC No. : 1553/92-93 DATE : 29-11-92
Client   : SOIL TREAT, EQUIPMENT & ENGG. LTD.
Ref.   : STEEL/HO/105/367/92 DATE : 29-11-92

9840680-2

TYPE OF SAMPLE: UNDISTURBED
BH. NO.: A-8-2   LOCATION: CHAR CLARK
SAMPLE DESCRIPTION:BROWN SILT
SAMPLE DEPTH: 4.3 m
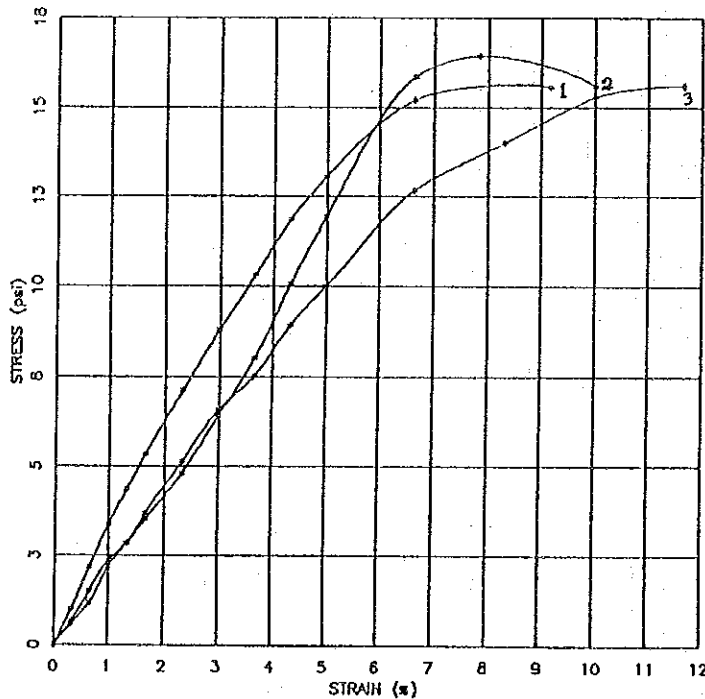
SAMPLE NO.	UNCONFINED COMP. STRENGTH (psi)	% STRAIN AT FAILURE	WATER CONTENT	DENSITY (lbs/ft³) DRY	WET
1	15.58	9.17	35.6	85.54	115.57
2	16.43	7.83	35.6	86.55	115.28
3	15.60	11.66	35.6	85.83	116.57

A-86   UNCONFINED CONPRESSION TEST

APPENDIX 2.6   EXAMINATION OF CONSOLIDATION

The settlement due to consolidation can be estimated as follows:

$$Sc = \frac{Cc}{1+e_0} \cdot H \cdot \log \frac{p_z + \Delta P}{p_z}$$

in which Sc :   Settlement due to Consolidation

Cc :   Compression Index

e_0 :   Void Ratio

H :   Thickness of Compressible Layer

p_z :   Original Intergranular Pressure at the Depth of Mid-height of the Layer

Δp :   Increase in pressure

$$\Delta P = 4 \, I\sigma \cdot \Delta W / (B \cdot L)$$

ΔW :   Load of Structure

B, L :   Width and Length of the Basement of Structure

$I\sigma$:   Coefficient of influence

$$I\sigma = \frac{1}{4\pi} \left(\frac{2mn\sqrt{m^2+n^2+1}}{m^2+n^2+m^2n^2+1} \cdot \frac{m^2+n^2+2}{m^2+n^2+1} + \tan^{-1}\frac{2mn\sqrt{m^2+n^2+1}}{m^2+n^2+m^2n^2+1} \right)$$

$$m = B/z, \quad n = L/z, \quad z: \text{Depth}$$
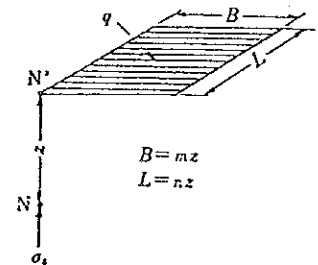
According to the report on The Multipurpose Cyclone Shelter Programme,

$$\frac{Cc}{1+e_0} = -0.076 + 0.0049 \, W_L$$

in which W_L :   Liquid Limit

The result of examination of consolidation settlement on the each proposed sites are shown as follows:
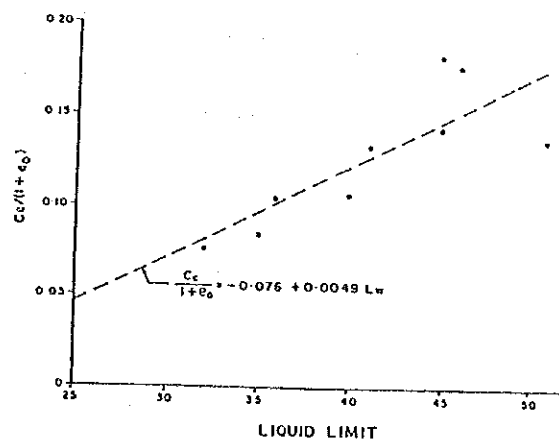
1) Site No. 9880980

  Foundation : Indipendent Footing $Df = 3.0m$

  G.W.Level : GL-1.50m

  Soil Layer :

	Upper	Lower
Thickness, H	4.0m	5.5m
N-value	1-3	3-4
W_L	48.3	34.6
$Cc/(1+e_0)$	0.132	0.073
γt	1.65	1.90
p_z	4.75	8.53
ΔI_σ	0.88	0.79
Δp	2.64	2.37

$$Sc = Sc_1 + Sc_2 = 0.132 \times 4.0 \log \frac{4.75+2.64}{4.75} + 0.073 \times 5.5 \log \frac{8.53+2.37}{8.53}$$

$$= 0.101+0.043 \ (m) \ = 14.4 \ (cm)$$

2) Site No. 9880982

 ① Foundation : Indipendent Footing $Df = 2.0m$

  G.W.Level : GL-1.00m

  Soil Layer :

	Silt with Organic Matter
Thickness, H	4.0m
N-value	1-3
W_L	55.40
$Cc/(1+e_0)$	0.162
γt	1.65
p_z	3.60
ΔI_σ	0.99
Δp	2.96

$$Sc = 0.162 \times 4.0 \log \frac{3.60+2.96}{3.60}$$

$$= 0.168 \ (m) \ = 16.8 \ (cm)$$

② Foundation : Indipendent Footing   Df = 3.0m
   G.W.Level : GL-1.00m
   Soil Layer :   Silt with Organic Matter

Thickness, H	3.0m
N-value	1-3
W_L	55.40
$Cc/(1+e_0)$	0.162
γt	1.65
p_z	3.93
41σ	0.99
Δp	2.96

$$Sc = 0.162 \times 3.0 \log \frac{3.93+2.96}{3.93}$$
$$= 0.118 \ (m) \ = 11.8 \ (cm)$$

3) Site No.9900182

   Foundation : Indipendent Footing   Df = 3.0m
   G.W.Level : GL-1.00m
   Soil Layer :   Silt

Thickness, H	2.2m
N-value	1-2
W_L	49.3
$Cc/(1+e_0)$	0.136
γt	1.75
p_z	4.08
41σ	1.00
Δp	3.00

$$Sc = 0.136 \times 2.2 \log \frac{4.08+3.00}{4.08}$$
$$= 0.072 \ (m) \ = 7.2 \ (cm)$$

4) Site No.9900183

   Foundation : Cast in place piling
   Compressible layer is not found under the bearing stratum.

5) Site No.9900185

   Foundation : Cast in place piling
   Compressible layer is not found under the bearing stratum.

6) Site No. 9900485

      Foundation : Indipendent Footing $Df = 3.5m$

      G.W.Level   : GL-1.50m

      Soil Layer :

	Sand(non-compressible)	Silt
Thickness, H	1.75	2.25
N-value	–	2
W_L	–	30.0
$Cc/(1+e_0)$	–	0.053
γt	1.95	1.70
p_z	–	6.46
ΔI_σ	–	1.00
Δp	(Dispersion)	2.10

$$Sc = 0.053 \times 2.25 \log \frac{6.46+2.10}{6.46} = 0.015 \ (m) = 1.5 \ (cm)$$

7) Site No. 9840381

      Foundation : Indipendent footing   Df=1.0m

      Compressible layer (N $\leqq$ 4) is not found under the basement of footing.

8) Site No. 9840480

   ① Foundation : Indipendent Footing $Df = 2.0m$

      G.W.Level   : GL-3.00m

      Soil Layer :

	Silt
Thickness, H	1.5m
N-value	3-4
W_L	38.85
$Cc/(1+e_0)$	0.091
γt	1.90
p_z	5.23
ΔI_σ	1.00
Δp	3.00

$$Sc = 0.091 \times 1.5 \log \frac{5.23+3.00}{5.23} = 0.027 \ (m) = 2.7 \ (cm)$$

   ② Foundation : Indipendent Footing $Df = 3.5m$

      Compressible layer (N $\leq$ 4) is not found under the basement of footing.

9) Site No. 9840481

   ① Foundation : Indipendent Footing   Df = 3.5m

     G.W.Level : GL-2.70m

     Soil Layer :

	Silt
Thickness, H	2.5m (depth:5.0-7.5m)
N-value	4
W_L	28.90
$C_c/(1+e_0)$	0.048
γt	1.85
p_2	9.26
$4I\sigma$	0.97
Δp	2.92

$$Sc = 0.048 \times 2.5 \log \frac{9.26+2.92}{9.26} = 0.014 \text{ (m)} = 1.4 \text{ (cm)}$$

   ② Foundation : Indipendent Footing   Df = 2.0m

     As the load will be dispersed in the silty sand layer, the settelment will be less than the result examined above.

10) Site No. 9840680

    Foundation : Indipendent footing   Df=1.0m

    Compressible layer (N ≦ 4) is not found under the basement of footing.

APPENDIX 3

APPENDIX 3.1   COUNTRY DATA (BANGLADESH)

(I)   Basic Indicies

(1)   Name of the Country   :   The People's Republic of Bangladesh
       Capital   :   Dhaka
       Independence day   :   March 26, 1971

(2)   Land and population
       Area   :   144 thousand km^2
       Population   :   109.9 million (March, 1991)
       Population density   :   740 persons/km^2
       Population increase rate   :   2.026% (1981-1991)
       Municipal population ratio   :   10.7% (1991)
       Life expectancy at birth   :   56.1 (1991)

(3)   Political system
       The President shall, as head of state, take precedence over all other persons in the State, and
       shall exercise the power and perform the duties conferred and imposed on him by the
       constitution and by any other law. The President shall act in accordance with the advice of the
       Prime Minister.

       The President shall hold office for a term of five years from the date on which he enters upon
       his office. No person shall hold office as President for more than two terms, whether or not
       the terms are consecutive.

       There shall be a cabinet for Bangladesh having the Prime Minster at its head and comprising
       also such other Ministers as the Prime Minister may from time to time designate. The
       executive power of the Republic shall be executed by or on the authority of the Prime
       Minister.

(4)   Religion
       About 86.7% Moslems, 12.1% Hindu, with 1.2% Buddhists and Christians.

(5)   Language
       Bengali is the official language. English is popularized although English speaking ability is
       dependent upon the age and education levels.

(6)   Ethnic composition

   The population is overwhelmingly Bengal consisting of various mixed races, and largely divided into Travidian, Mongolian and Aryan races although it is impossible to identify these races in a strict sense

(7)   Education

   Literacy rate for all ages   :   24.8% (1991)
   Percent of participation rate
      Primary (5-9 years)   :   94.6%
      Secondary (10-14 years)   :   27.6%
      Higher (15-24 years)   :   4.20%

(8)   Currency and exchange rate
   Currency Unit   :   Taka (TK)
   Exchange rate   :   TK 38.63 to US$1 (in December 1992)

(9)   Climate, Geology/Geography and Latitude

   1) Climate

   The climate belongs to a typical semi-tropical monsoom climate. According to the climatic feastures, one year is divided into the following three seasons: namely, (1) North-western season (Summer: March through May); (2) Monsoon season (Rainy season: June through October); and (3) Dry season (November through February). The atomospheric temperature is highest in April and reasches 35.06°C in maximum in Dhaka, while the lowest temperature is 11.72°C in January in the dry season. The rainfall is concentrated in the rainy season as roughly 80% of the yearly rainfall takes place during this season.

   The rainfall is generally large in the eastern part of the country, and that in the western part is small.

   2) Geology/Geography

   Located at the eastern edge of the Indian Subcontinent, the majority of the land is occupied by the lower reaches (downstream river sections) of the big three rivers, the Ganges, Jamuna and Meghna rivers, and featured by a typical delta zone where tributaries and distributaries flow in. The land is mostly comprised of vast, low and flat alluvial plain, and the ground consists of weak silty formations.

3) Latitude

Bangladesh is located within lat. 20° 75' - 25° 75' and longitude 88° 30' - 92° 75'. While its western part borders West Bengal of India, its northern part borders Assam and Maharaya of the country. Moreover, its eastern part successively borders Tripura Mezoram and other various states of India, the south-eastern part of the country faces Myanmar (Burma) on the Chittagong area hill zone.

(II) Socio-economic Indices

(1)   Gross domestic products (GDP)

GDP (1990-1991)	: US$21.6 billion
GDP per capita	: US$185 (1991)
Annual growth rate	: 2.6% (1988)

(2)   Gross national products (GNP)

GNP	: US$21.0 billion
GNP per capita	: US$191 (1991)

(3)   Sectoral shares of GDP (REfer to Table 1)

(4)   Configuration of major export/import products (Refer to Tabla 2)

(5)   International balance of payment (Refer to Table 3)

(6)   Foreign exchange reserves (Refer to Table 4)

(7)   Debt service payments of foreign loans (Refer to Table 5)

(8)   Trade with Japan

Import from Japan	: US$304 million (1990/91)
Export to Japan	: US$53 million (1990/91)

(9)   Financial balance (Refer to Table 6)

(10) Population Distribution (Refer to Table 7)

Table 1

Sectoral shares of GDP at current market prices

(Percentage)

Sector	1987-88	1988-89	1989-90	1990-91
1. Agriculture :	38.8	37.2	36.8	36.0
i) Crops	28.1	26.7	26.3	26.1
ii) Forestry	4.2	3.7	3.6	3.4
iii) Livestock	3.0	3.2	3.4	3.2
iv) Fisheries	3.5	3.6	3.5	3.3
2. Mining & quarrying	0.001	0.001	0.01	0.01
3. Manufacturing	8.5	8.4	8.8	8.7
i) Large scale	4.8	4.8	5.1	5.1
ii) Small scale	3.7	3.6	3.7	3.6
4. Construction	5.8	6.0	5.8	5.7
5. Power, gas, water & sanitary services	0.8	1.0	1.2	1.3
6. Transport, storage & communication	11.0	10.9	10.2	11.7
7. Trade servies	8.4	8.3	8.4	8.2
8. Housing services	8.4	9.1	9.0	8.8
9. Public admn. and defence	4.1	4.4	4.4	4.6
10. Banking and Insurance	1.9	2.0	2.1	2.0
11. Professional & Miscellaneous services	12.3	12.7	13.3	13.0
12.GDP at market price	100.0	100.0	100.0	100.0

Source : National Income Section, BBS.

Sectoral shares of GDP at constant (1984-85) prices

(Percentage)

	1987-88	1988-89	1989-90	1990-91
1. Agriculture:	38.4	37.1	38.3	37.6
i) Crops	30.1	28.8	30.3	29.6
ii) Forestry	2.7	2.6	2.5	2.5
iii) Livestock	2.8	2.9	2.8	2.8
iv) Fisheries	2.8	2.8	2.7	2.7
2. Mining & quarrying	0.001	0.001	0.01	0.02
3. Manufacturing	9.8	9.8	9.9	9.8
i) Large scale	5.5	5.5	5.8	5.7
ii) Small scale	4.3	4.3	4.1	4.1
4. Construction	6.0	6.2	6.0	6.1
5. Power, gas water & sanitry services	0.8	1.0	1.1	1.3
6. Transport, storage & communication	11.9	12.1	11.9	11.8
7. Trade services	9.2	9.4	9.0	9.1
8. Housing services	7.8	7.9	7.6	7.6
9. Public administration & defence	4.1	4.3	4.1	4.3
10. Banking & Insurance	2.1	2.0	1.9	1.9
11. Professional & Miscellaneous services	9.9	10.2	10.2	10.5
12. GDP at market prices	100.0	100.0	100.0	100.0

Source: National Income Section, BBS.

Table 2

Quantity of export of selected items

(In '000' ton)

	1987-88	1988-89	1989-90(R)	1990-91
Jute Raw	250	274	326	237
Jute Manufacture	614	511	531	446
Tea	29	23	21	27
Leather	24	20	25	12
Frozen Fish	6	3	4	5
Frog legs	4	3	1	—
Fertilizer	247	370	115	232
News print	1	—	—	—

Source : Foreign Trade Section, BBS.

Quantity of Import of selected Items

(In '000' ton)

Items	1986-87	1987-88	1988-89	1989-90(R)	1990-91
Rice	260	674	63	380	16
Wheat	1511	2331	2147	1157	1562
Edible oil	283	456	244	233	237
Milk powder	40	30	67	63	60
Fertilizer	152	298	403	267	296
Petroleum oil crude	1000	1212	1019	2192	1060
Raw cotton	65	51	75	111	132
Pharmaceutical Prod.	2	1	2	3	2
Coal	229	192	49	558	156
Sugar	135	121	155	91	138
Cement	1601	1563	1629	1606	1611
Pig Iron	98	54	27	79	26
Old garments	24	15	3	7	8
Dyes	3	7	3	4	4
Chemical Products	20	22	17	19	21

Source : Foreign Trade Section, BBS.

Table 3

Balance of payments

(Crore Taka)

Items	1987-88	1988-89	1989-90	1990-91(p)
Current Accounts:				
Import (c.i.f.)	8393	9749	11125	11151
Export (f.o.b.)	3705	4116	4893	5956
Freight & Insurance:				
a) On Import	940	1063	1250	1229
b) Earned	6	4	8	9
c) Net	(-)934	(-)1059	(-)1242	(-)1221
Other goods and services-net	(-)34	(-)49	42	266
Balance	(-)5657	(-)6777	(-)7433	(-)6150
Investment-net	(-)415	(-)433	(-)405	(-)366
Transfer by Bangladesh nationals	2461	2686	2631	3017
Grants, donations etc. cash or kind	2579	2185	2462	2966
Deficit on Current Account	(-)1033	(-)2339	(-)2680	(-)532
Capital Account:				
Aid and loans-net	1475	2490	2122	1969
a) Long term-net	1900	2793	2710	2402
b) Short term-net	(-)426	(-)303	(-)587	(-)433
Other capital tran-sactions-net	(-)405	(-)20	807	(-)1095
Errors and omissions	(-)37	(-)130	(-)250	(-)342
Surplus on Capital Accounts	1033	2339	2680	532

Notes: Trade data may differ from those compiled by BBS
Source: Bangladesh Bank

Balance of trade

(Crore taka)

Year	Export	Import	Balance
1977-78	718	1822	- 1104
1978-79	963	2207	- 1244
1979-80	1100	3052	- 1952
1980-81	1148	3729	- 2581
1981-82	1239	3873	- 2634
1982-83	1802	4526	- 2724
1983-84	2014	5087	- 3073
1984-85	2622	6826	- 4204
1985-86	2740	6293	- 3553
1986-87	3368	6850	- 3482
1987-88	4116	9159	- 5043
1988-89	4269	9508	- 5239
1989-90	5141	11330	-6189
1990-91	6027	11155	-5128

Source: Foreign Trade Section, BBS.

Table 4

Money supply and foreign exchange reserve

		Money Supply		(Million Taka)
	Currency outside bank	Demand Deposit	Total money supply	Foreign exchange reserve*
1981	9148	10715	19863	4523
1982	8775	11346	20121	2698
1983	11386	14957	26343	8765
1984	15563	19936	35499	13595
1985	17229	25089	42318	11068
1986	19531	29748	49279	14408
1987	20749	31879	52628	22151
1988	24150	26327	50477	26963
1989	26156	28451	54607	29454
1990	31883	31804	63687	18161
1991	36118	35919	72037	31501

Excluding inter-bank items.
Include reserve position in the IMF
Source : Bangladesh Bank Bulletin, October-December, 1991and Economic Trends, June, 1992.

Table 5

Debt-Service payments on foreign loans

	Interest	Principal*	(Million US Dollar) Total
1983-84	57.7	70.6	128.3
1984-85	64.0	106.0	170.0
1985-86	72.8	110.9	183.7
1986-87	81.1	151.7	232.8
1987-88	123.0	166.0	289.0
1988-89	123.6	170.1	293.7
1989-90	116.1	185.6	301.7
1990-91	120.0	197.2	317.2

* Include downpayment
a) Payment in foreign exchange means free foreign exchange remitted to the donors.
Source: External Resources Division, Ministry of Finance.

Table 6

Consolidated receipts and expenditure

Classification	1988-89	1989-90	(Million Taka) 1990-91(BE)
A. Total receipts	108427	120254	138194
Total receipts as % of GDP	16.44	16.30	16.56
1. Total revenue receipts	61015	65194	98220
a) Tax	49560	55725	63828
Tax revenue as % of GDP	7.51	7.56	7.65
b) Non-Tax	11455	9469	14392
2. Development receipts	47412	55060	59974
Dev. receipts as % of GDP	7.18	7.47	7.19
a) Project	27228	33362	36650
b) Food & Commodities	24924	24893	28714
c) Internal resource	(-)4740	(-)3195	(-)5390
B. Total expenditure	108339	119405	124969
Total exp. as % of GDP	16.42	16.19	14.98
1. Revenue exp.	61885	65098	72070
a) Wages & Salaries	24643	23676	25715
b) Commodities & services	26303	15371	18223
c) Transfer	7735	7078	8496
d) Others	3204	18973	19636
2. Dev. Expenditure	46454	54307	52899
Dev. expenditure as % of GDP	7.04	7.36	6.34
a) Agri. Flood control, water resources & rural institutions	12214	15916	15455
b) Industry	5197	5847	8468
c) Trans. & Comm.	9449	10486	10095
d) Others	19594	22058	18881

Source : National Income Section, BBS.

Table 7

Numerical and Percentage distribution of 1981 Census Population adjusted for under count by age and sex

Groups	Bangladesh			Urban			Rural		
	Both sex	Male	Fem.	Both sex	Male	Fem.	Both sex	Male	Fem.
Number In thousand									
All ages	89912	46295	43617	14089	7862	6227	75823	38433	37390
0-4	15333	7718	7615	2025	1015	1000	13308	6703	6605
5-9	14544	7363	7181	1930	981	949	12614	6382	6232
10-14	12037	6442	5595	1902	1005	897	10135	5437	4698
15-19	8513	4290	4223	1470	803	667	7043	3487	3556
20-24	6994	3359	3635	1395	802	593	5599	2557	3042
25-29	6630	3369	3261	1271	769	502	5359	2600	2759
30-34	5071	2551	2520	919	561	358	4152	1990	2162
35-39	4554	2426	2128	767	485	282	3787	1941	1846
40-44	3793	1982	1811	626	387	239	3167	1595	1572
45-49	2917	1613	1304	442	276	166	2475	1337	1138
50-54	2761	1440	1321	428	244	184	2333	1196	1137
55-59	1653	932	721	221	136	85	1432	796	636
60-64	2030	1074	956	283	160	123	1747	914	833
65+	3082	1736	1346	410	238	172	2672	1498	1174
Percent									
All ages	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
0-4	17.1	16.7	17.5	14.4	12.9	16.1	17.6	17.4	17.7
5-9	16.2	15.9	16.5	13.7	12.5	15.2	16.5	16.6	16.7
10-14	13.4	13.9	13.8	13.5	12.8	14.4	13.4	14.1	12.6
0-14	46.7	46.5	46.8	41.6	38.2	45.7	47.6	48.1	47.0
15-19	9.5	9.3	9.7	10.4	10.2	10.7	9.3	9.1	9.5
20-24	7.8	7.3	8.3	9.9	10.2	9.5	7.4	6.6	8.1
25-29	7.4	7.3	7.5	9.1	9.8	8.1	7.1	6.8	7.4
30-34	5.6	5.5	5.7	6.5	7.1	5.7	5.5	5.2	5.8
35-39	5.1	5.2	4.9	5.4	6.2	4.5	5.0	5.0	4.9
40-44	4.2	4.3	4.2	4.4	4.9	3.8	4.2	4.2	4.2
45-49	3.2	3.5	2.9	3.1	3.5	2.7	3.3	3.5	3.0
50-54	3.1	3.1	3.0	3.1	3.1	3.0	3.1	3.1	3.0
55-59	1.8	2.0	1.7	1.6	1.7	1.4	1.7	2.1	1.7
60-64	2.2	2.3	2.2	2.0	2.0	2.0	2.3	2.4	2.2
65+	3.4	3.7	3.1	2.9	3.0	2.8	3.5	3.9	3.1

Source: Population Census, 1981, BBS.

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