

REPORT ON  
SOIL INVESTIGATION WORK FOR THE PROPOSED  
MULTISTORIED BUILDING OF M/S BOFAN VYAPAR PVT. LTD.  
NEAR BUDGE BUDGE STATION UNDER P.S. & MUNICIPALITY-  
BUDGE BUDGE, KOLKATA 700137

CLIENT : M/S. BOFAN VYAPAR PVT LTD

SOIL INVESTIGATION DONE BY:-  
ASSOCIATED FOUNDATION ENGINEERS  
20, K. N. SEN ROAD,  
KOLKATA-700 042  
DIAL:- 2442-5085 (O)  
2418-4018 (R)

98310-69856 (M)  
94331-37299 (M)

OCTOBER – 2012



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**SHEET  
NO.  
1**

### LIST OF CONTENTS

<u>Subject</u>	<u>Sheet Number</u>
A. General	2
Bore Hole Location Map	3
B. Field Operations	4
Boring, Sampling and Standard Penetration Tests	4
C. Laboratory Testing	5
D. Sub-Soil Stratification and Properties	6 - 12
I. Sub-Soil Stratification	6 - 11
Generalized Sub-Soil Profile	7
'N' Vs. Depth Plot	8
II. Sub-Soil Properties	11
Average Sub-Soil Profile with Properties	12
E. Foundation Considerations and Bearing Capacity	13 - 14
F. Recommendations	15&16
 <u>APPENDIX</u>	 17 - 38
Laboratory tests results table	18
Bore Hole Log Data Sheets \ Field Records	19 - 23
Consolidation Characteristics	24 - 33
Grain Size Distribution Curves	34 - 38



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**SHEET  
NO.  
2**

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**A. GENERAL**

It has been proposed to construct a multistoried building at the above location.

For ascertaining the safe bearing capacity of soil, it was decided to carry out a detailed sub-soil investigation and M/s. Associated Foundation Engineers was awarded this work for suggesting the most suitable type of foundation for the above project.

The scope of the work comprised of sinking 5 nos. of bore holes (3x20m, 1x22m, 1x25m).

The bore holes were of 150mm. in diameter. Standard penetrometer tests were conducted at close intervals of depth. Undisturbed soil samples were recovered at suitable intervals and tested in the laboratory. Disturbed soil samples were also recovered at close intervals of depth for logging & identification purposes.

Depending on the above, this report presents bore logs, soil profiles & laboratory tests results. It is seen that the sub-soils are of poor quality.





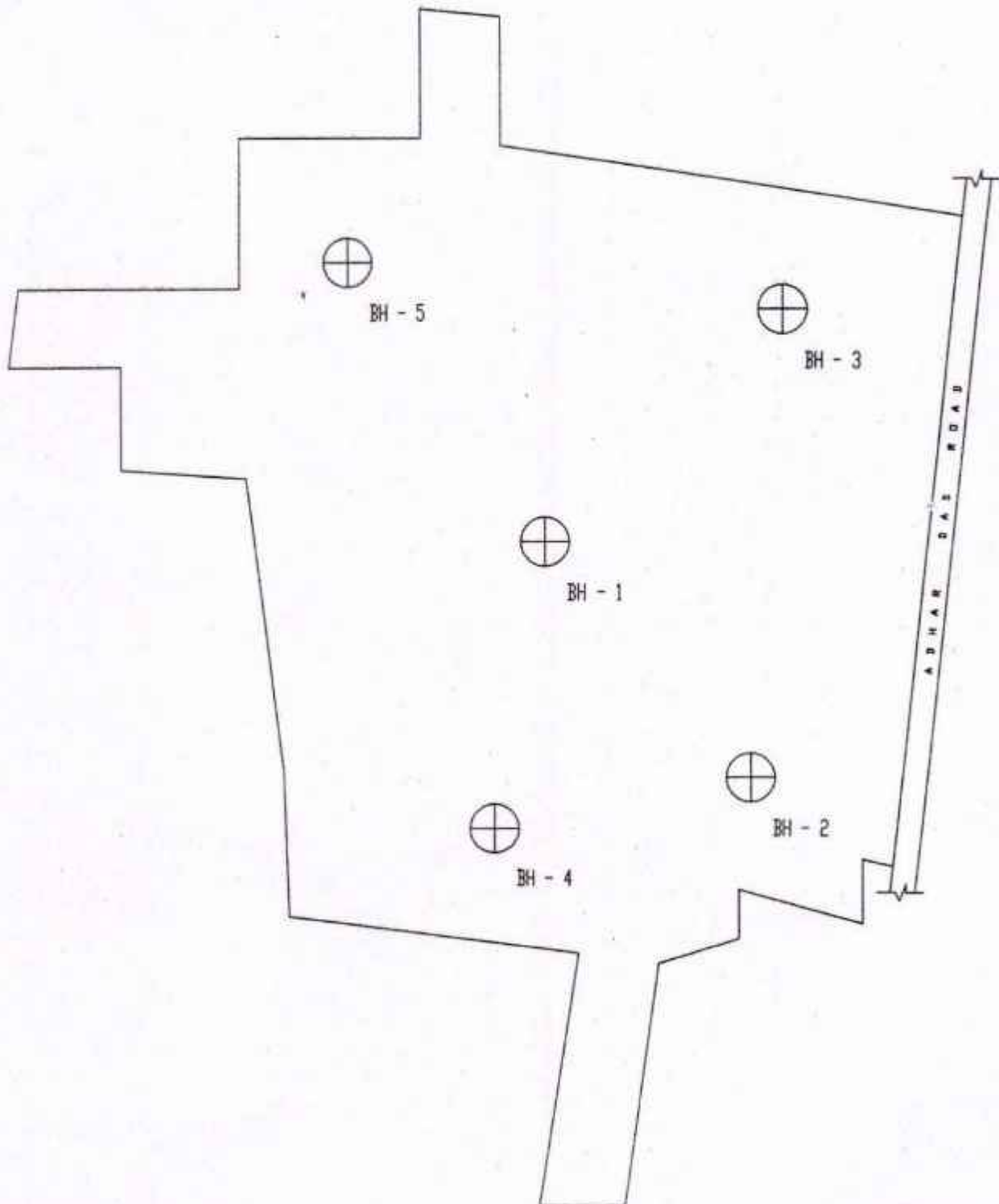


FIG.-1. SCHEMATIC PLAN OF BORE HOLES.



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**SHEET  
NO.  
4**

## **B. FIELD INVESTIGATION**

The various operations adopted during the course of this investigation are discussed in brief below.

### **BORING**

For sinking the bore holes, the shell and auger method of boring was adopted. The holes were of 150mm. in diameter. These were advanced up to the required depth. Casing pipes of 150mm. diameter were used initially and bentonite slurry later on for side stabilisation of bore holes.

### **SAMPLING**

During the course of boring, undisturbed and disturbed samples were collected at fairly regular intervals. Undisturbed samples of 10cm. diameter were recovered ( whenever feasible ) by means of open drive sampling using samplers of standard length 45cm. A two tier assembly was used with a cutting shoe attached to the lower end of the tube. This was driven by a jarring link as far as practicable. After withdrawal, both ends of the tubes were sealed with paraffin wax capped, labeled and transported to the laboratory. A number of disturbed samples were also collected at suitable intervals for identification and logging purposes.

### **STANDARD PENETRATION TESTS**

A number of standard penetration tests were conducted at regular intervals in the bore holes. The tests were conducted by driving a standard split spoon sampler by means of a monkey of 65kg. weight falling freely from a height of 75cm. The number of blows required for every 7.5cm. Penetration was recorded up to a total penetration of 60cm. The S.P.T. or 'N' value was estimated as the number of blows required for the middle 30cm. penetration.



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**SHEET  
NO.  
5**

The split spoon sampler conformed to I.S. specification with an outer diameter of 50.8mm. and an inner diameter of 35mm. After completion of the test the sampler was withdrawn, It was opened and the soil specimen was preserved for logging and identification purposes.

### C. LABORATORY TESTING

The following laboratory tests were performed on undisturbed and disturbed samples to determine the engineering properties of the sub-soil at different depths. All the tests were carried out according to Indian standard specifications.

1. Natural Moisture Content.
2. Atterberg Limits (LL. & PL.)
3. Hydrometer and Sieve Analysis.
4. Bulk Density (wet & dry)
5. Specific Gravity.
6. Strength Tests.
7. Consolidation.

The results of these tests have been presented systematically in result sheets later on.





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**SHEET  
NO.  
6**

**D. SUB-SOIL STRATIFICATION AND PROPERTIES**

**I. SUB-SOIL STRATIFICATION**

The exploratory borings at the site revealed a poor quality of sub-soil. The generalised soil profile encountered at the site is shown in fig.2 and in the enclosed bore hole log data sheets in the appendix. The variation of 'N' values with depth is shown in figure 3 & in the bore hole log data sheets. The average sub-soil profile with properties are shown in fig. 4. The results of the laboratory tests conducted to determine the engineering properties of the sub-soil are presented in the appendix. The other back-up sheets are also presented therein. Based on visual classification and results of field & laboratory tests seven major strata including filled-up materials are identified.

Brief descriptions of the various soil strata are given below :-

**1. TOP - SOIL**

The top layer consists of very loose filling of fly ash, clayey silt etc extending down to 1.66 m. depth below the E.G.L.

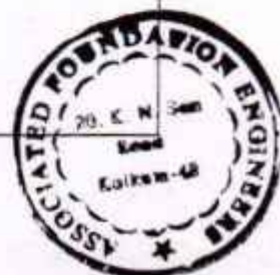
**2. STRATUM - I**

Soft light grey to brownish grey clayey silt extends from 1.66 m. down to a depth of 4.1 m. below I.G.L.

The maximum & minimum values of 'N' observed in this layer are 04 & 02 respectively while the average 'N' value is 03.

The average engineering properties are as follows :-

Bulk density	1.82	gm /c.c.
Dry density	1.46	gm /c.c
Water content	24	%
Specific gravity	2.70	
Void ratio	0.87	
Cohesion	0.31	kg /sq.cm
Friction angle	0°	degree
Liquid limit	42	%
Plastic limit	23	%
Sand size particle	07	%





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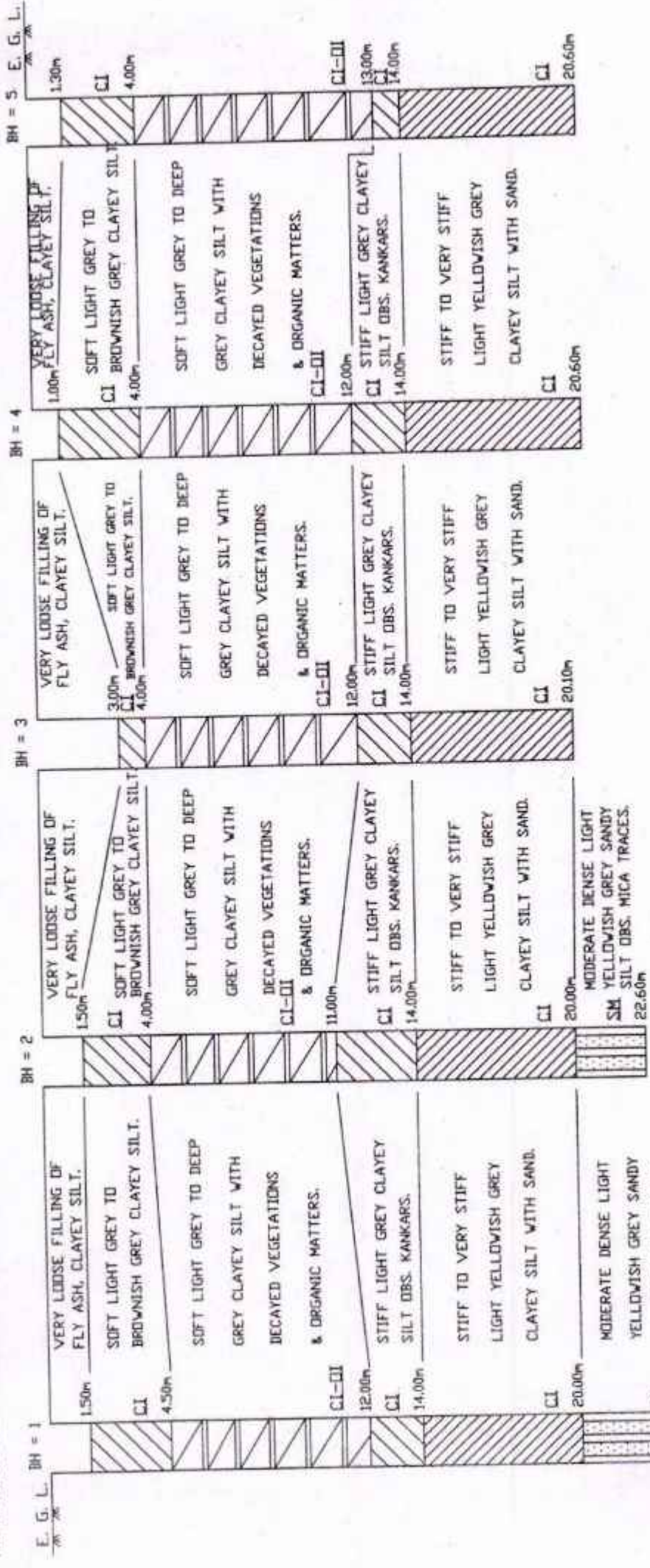


FIG-2. GENERALISED SUB-SOIL PROFILE.





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VALUES OF 'N' → Sheet No:- 08

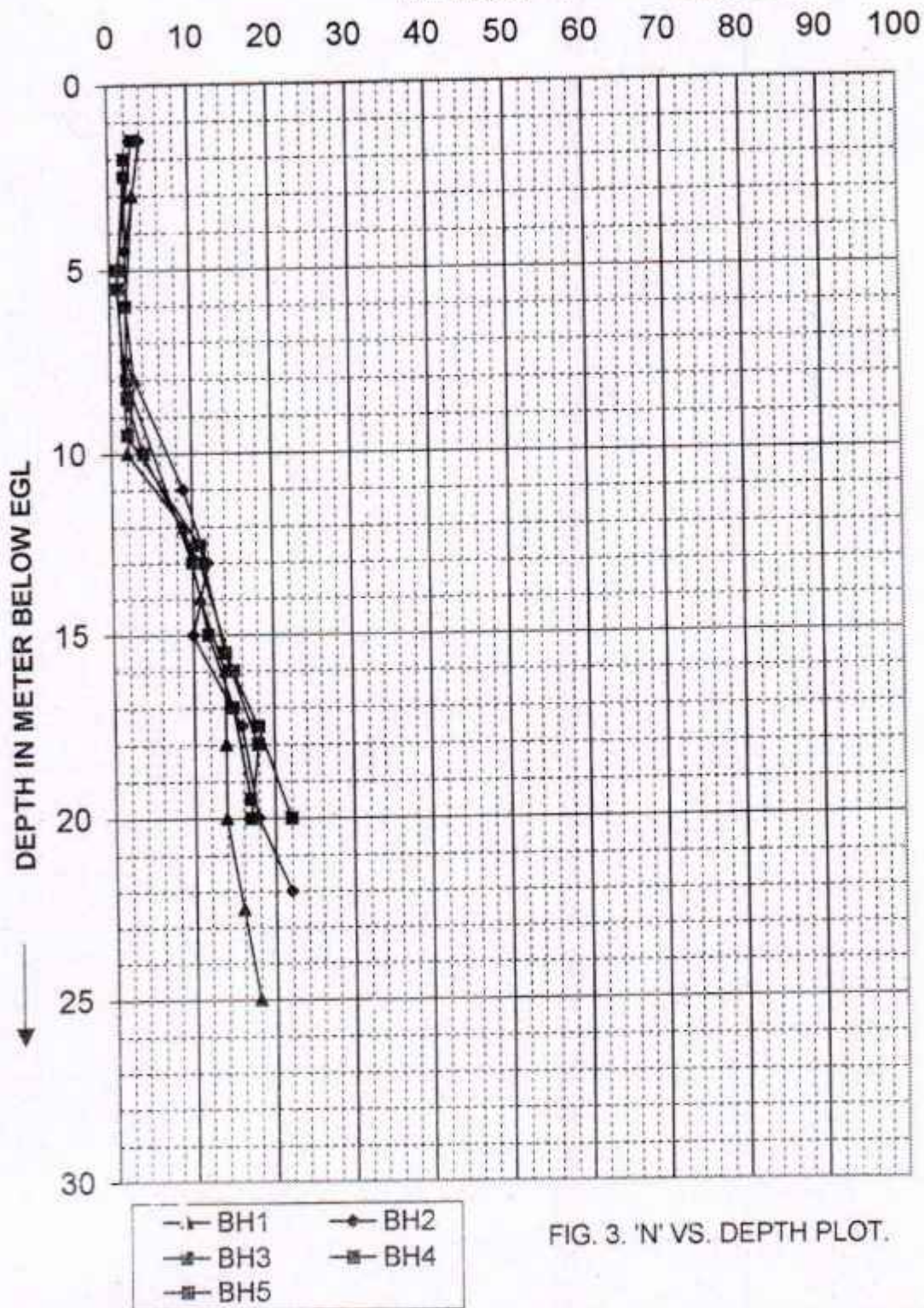


FIG. 3. 'N' VS. DEPTH PLOT.





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**SHEET  
NO.  
9**

Silt size particle	62	%
Clay size particle	31	%

According to IS classification system , it may be symbolised as CI combination.

### 3. STRATUM - II

Soft light grey to deep grey clayey silt with decayed vegetations and organic matters extends from 4.1 m. down to a depth of 12.0 m. below E.G.L.

The maximum & minimum values of 'N' observed in this layer are 04 & 01 respectively while the average 'N' value is 03.

The average engineering properties are as follows :-

Bulk density	1.60	gm /c.c.
Dry density	1.16	gm /c.c
Water content	39	%
Specific gravity	2.60	
Void ratio	1.44	
Cohesion	0.21	kg /sq.cm
Friction angle	0°	degree
Liquid limit	43	%
Plastic limit	24	%
Sand size particle	07	%
Silt size particle	64	%
Clay size particle	29	%

According to IS classification system , it may be symbolised as CI-OI combination.

### 4. STRATUM - III

Stiff light grey clayey silt with kankars extends from 12.0 m. down to a depth of 14.0 m. below E.G.L

The maximum & minimum values of 'N' observed in this layer are 12 & 09 respectively while the average 'N' value is 11.



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**SHEET  
NO.  
10**

The average engineering properties are as follows :-

Bulk density	1.89	gm /c.c.
Dry density	1.57	gm /c.c
Water content	21	%
Specific gravity	2.72	
Void ratio	0.63	
Cohesion	0.53	kg /sq.cm
Friction angle	0°	degree
Liquid limit	48	%
Plastic limit	29	%
Sand size particle	05	%
Silt size particle	55	%
Clay size particle	40	%

According to IS classification system , it may be symbolised as CI combination.

#### 5 STRATUM - IV

Stiff to very stiff light yellowish grey clayey silt with sand extends from 14.0 m. down to a depth of 20.26 m. below E.G.L

The maximum & minimum values of 'N' observed in this layer are 18 & 10 respectively while the average 'N' value is 15.

The average engineering properties are as follows :-

Bulk density	1.90	gm /c.c.
Dry density	1.57	gm /c.c
Water content	21	%
Specific gravity	2.71	
Void ratio	0.61	
Cohesion	0.60	kg /sq.cm
Friction angle	0°	degree
Liquid limit	46	%
Plastic limit	22	%
Sand size particle	08	%
Silt size particle	57	%
Clay size particle	35	%

According to IS classification system , it may be symbolised as CI combination





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**SHEET  
NO.  
. 11**

## **6 STRATUM - V**

Mod:rate dense light yellowish grey sandy silt with mica traces extends from 20.6 m. down to a depth of 24.0 m. below E.G.L.

The maximum & minimum values of 'N' observed in this layer are 22 & 14 respectively while the average 'N' value is 18.

According to IS classification system , it may be symbolised as SM combination.

## **7 STRATUM - VI**

Very stiff light yellowish grey clayey silt extends from 24.0m. down to the termination depth of 25.60 m. below E.G.L.

The value of 'N' observed in this layer is 18.

According to IS classification system , it may be symbolised as CI combination.

From the above, it can be said that the sub-soils are of poor quality.

## **II. SUB - SOIL PROPERTIES**

The details of laboratory tests results have been presented sequentially in the appendix. The other back-up sheets are given therein as below :-

1. Laboratory tests results tables.
2. Bore Hole log data sheets/ field records.
3. Consolidation characteristics.
4. Grain size distribution curves from sieve & hydrometer analysis.

Based on the bore logs and the laboratory tests results, the average sub-soil profile with the average properties are presented in fig. 4.



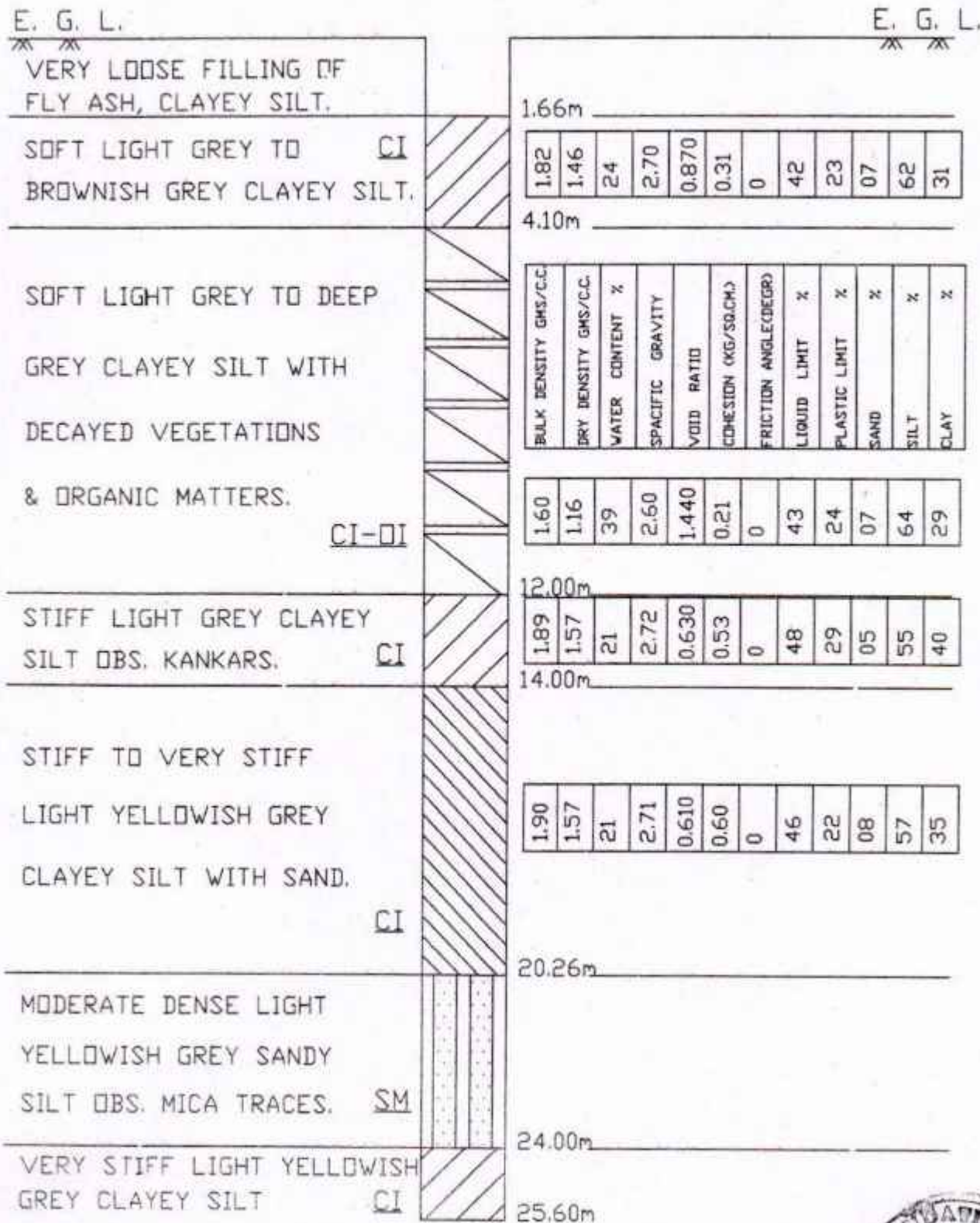


FIG.-4. AVERAGE SUB-SOIL PROFILE WITH PROPERTIES





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**SHEET  
NO.  
13**

### E. FOUNDATION CONSIDERATIONS AND BEARING CAPACITY

The proposed construction would be a multistoried building. Accordingly the loading would be moderate which would depend also on column spacing for the proposed RCC framed structure. However, the foundation design would not only depend on the height and loading but also on the sub-soil condition. For the sub-soil condition the two necessary conditions are to be satisfied i.e. the soil would not fail in shear and the settlement should be within permissible limit.

In view of the existing soft soil deposit at the top, deep foundations in the form of bored cast-in-situ R.C.C. piles have been investigated for the proposed construction. These should rest at (-) 22.0 m. having cut-off at (-) 1.5 m. below the E.G.L. depending on functional requirement.

### PILE CAPACITY DETERMINATION

Ultimate Load Capacity,  $P_u = P_f + P_t$

$$P_f = \pi \times D \times [2.6 \times 3.1 \times 0.85 + 7.9 \times 2.1 \times 0.95 + 2.0 \times 5.3 \times 0.8 + 6.2 \times 6.0 \times 0.75] \\ = 185 D$$

$$P_t = A_t q_t = \pi D^2 / 4 \times 0.7 \times 10 \times (20 - 1) = 104.5 D^2$$

$$\therefore P_u = 185 D + 104.5 D^2$$

$$\therefore P_{all} = 74 D + 41.8 D^2 \text{ (F.O.S. = 2.5)}$$

For 400 mm. dia pile,  $P_a = 36 t$

The following safe load carrying capacity values may be used depending on requirement :-

PILE DIA, mm.	PILE TIP, m.	CUT-OFF, m.	SAFE CAPACITY, t
400	(-) 22.0	(-) 1.5	36
450	(-) 22.0	(-) 1.5	42
500	(-) 22.0	(-) 1.5	48

However, the actual load carrying capacity should be determined by carrying out load tests at site as per IS code of practice. A minimum distance of 2.5D - 3D should be maintained between the center to center of piles, where D is the pile diameter.



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SHEET NO-14

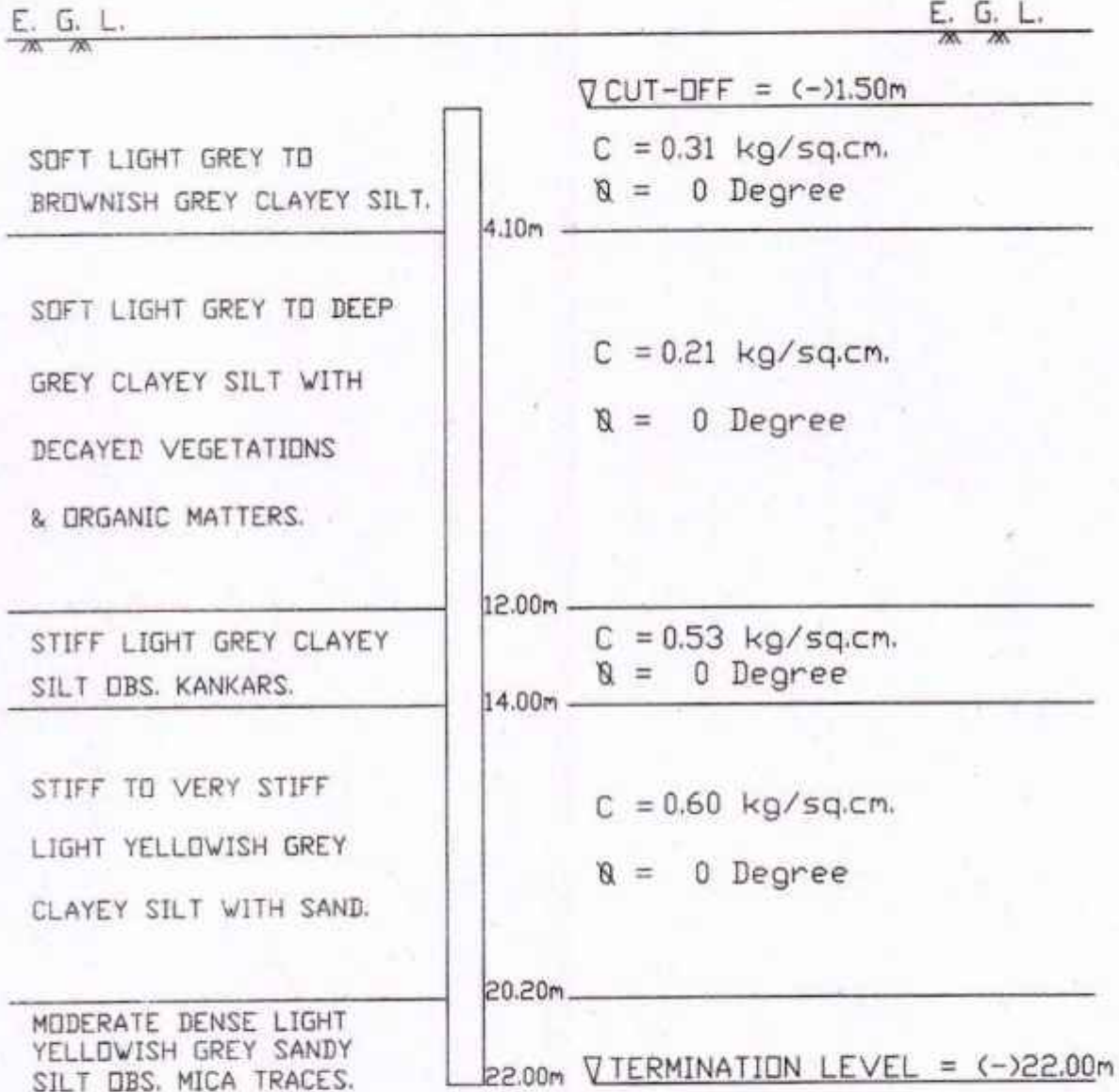


FIG. - 5. FOUNDATION DESIGN MODEL FOR DEEP FOUNDATIONS





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SHEET  
NO.  
15

#### F. RECOMMENDATIONS

Based on the field and the laboratory tests results and the above discussions, the followings are summarised :-

1. The sub-soils are of poor quality.
2. The top layer consists of very loose filling of fly ash, clayey silt etc extending down to 1.66 m. depth below the E.G.L.
3. Soft light grey to brownish grey clayey silt extends from 1.66 m. down to a depth of 4.1 m. below E.G.L. The strength of this layer is low ( $C = 0.31$  kg/sq.cm.) and compressibility is medium ( $M_v = 0.033$  sq.cm./kg for 0.50 to 1.0 kg/sq.cm. pressure range).
4. Soft light grey to deep grey clayey silt with decayed vegetations and organic matters extends from 4.1 m. down to a depth of 12.0 m. below E.G.L. The strength of this layer is low ( $C = 0.21$  kg/sq.cm.) and compressibility is medium ( $M_v = 0.0747$  sq.cm./kg for 0.50 to 1.0 kg/sq.cm. pressure range).
5. Stiff light grey clayey silt with kankars extends from 12.0 m. down to a depth of 14.0 m. below E.G.L.
6. Stiff to very stiff light yellowish grey clayey silt with sand extends from 14.0 m. down to a depth of 20.26 m. below E.G.L.
7. Moderate dense light yellowish grey sandy silt with mica traces extends from 20.6 m. down to a depth of 24.0 m. below E.G.L.
8. Very stiff light yellowish grey clayey silt extends from 24.0m. down to the termination depth of 25.60 m. below E.G.L.
9. The standing water level was observed at (-) 1.4 m. below the E.G.L. during boring.
10. Isolated footings, if used, are suggested to be tied at the foundation level to reduce the differential settlement. Construction in stages is recommended.
11. In view of the existing soft soil deposit at the top, deep foundations in the form of bored cast-in-situ R.C.C. piles have been investigated for the proposed construction. These should rest at (-) 22.0 m. having cut-off at (-) 1.5 m. below the E.G.L. depending on functional requirement.



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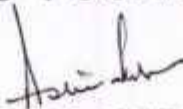
SHEET  
NO.  
16

12. The following safe load carrying capacity values may be used depending on requirement :-

PILE DIA. mm.	PILE TIP, m.	CUT-OFF, m.	SAFE CAPACITY, t
400	(-) 22.0	(-)1.5	36
450	(-) 22.0	(-)1.5	42
500	(-) 22.0	(-)1.5	48

However, the actual load carrying capacity should be determined by carrying out load tests at site as per IS code of practice . A minimum distance of  $2.5D - 3D$  should be maintained between the center to center of piles , where D is the pile diameter.

FOR ASSOCIATED FOUNDATION ENGINEERS

  
( ASIM SARKAR )

ASIM SARKAR  
BCE, ME (SOIL), MIGS





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SHEET  
NO.  
17

A P P E N D I X  
- - - - -

17 - 38

LABORATORY TESTS RESULTS TABLE

18

BORE HOLE LOG DATA SHEETS/FIELD RECORDS

19 - 23

CONSOLIDATION CHARACTERISTICS

24 - 33

GRAIN SIZE DISTRIBUTION CURVES

34 - 38



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TABLE : 1. LABORATORY TESTS RESULT

BORE HOLE	SAMPLE NO	DEPTH (M.)	BULK DENSITY (gms/c.c.)	DRY DENSITY (gms/cc)	W %	G	eo	C (kg/sqc m)	0° (Degree)	LL %	PL %	SAND %	SILT %	CLAY %
BH-1	UDS-1	1.50-1.95	1.80	1.44	25	2.70	0.839	0.30	0°	44	24	7	62	31
BH-1	UDS-2	4.50-4.95	1.59	1.12	42	2.60	1.820	0.20	0°	45	27	4	63	33
BH-1	UDS-3	7.50-7.95	1.64	1.22	34	2.61	1.034	0.22	0°	43	25	5	64	31
BH-1	UDS-4	15.00-15.45	1.90	1.57	21	2.70	0.607	0.60	0°	45	20	6	59	35
BH-2	UDS-1	3.00-3.45	1.81	1.46	24	2.70	0.839	0.30	0°	42	25	5	63	32
BH-2	UDS-2	6.00-6.45	1.74	1.34	30	2.64	0.926	0.24	0°	44	26	7	63	30
BH-2	UDS-3	12.50-12.95	1.89	1.58	20	2.71	0.629	0.52	0°	48	29	5	56	39
BH-2	UDS-4	17.00-17.45	1.92	1.59	21	2.70	0.593	0.62	0°	46	20	7	59	34
BH-3	UDS-1	4.00-4.45	1.50	1.02	47	2.58	1.905	0.19	0°	41	17	8	64	28
BH-3	UDS-2	10.00-10.45	1.48	0.97	52	2.55	2.104	0.18	0°	40	16	12	69	19
BH-3	UDS-3	14.50-14.95	1.88	1.54	22	2.70	0.630	0.52	0°	46	24	8	53	39
BH-4	UDS-1	2.50-2.95	1.82	1.47	24	2.70	0.827	0.32	0°	42	25	6	61	33
BH-4	UDS-2	7.50-7.95	1.62	1.20	35	2.61	1.197	0.22	0°	44	26	5	64	31
BH-4	UDS-3	12.00-12.45	1.89	1.55	22	2.72	0.621	0.54	0°	48	29	4	56	40
BH-4	UDS-4	17.00-17.45	1.91	1.57	21	2.70	0.587	0.61	0°	47	22	8	53	39
BH-5	UDS-1	1.50-1.95	1.82	1.48	23	2.70	0.963	0.32	0°	42	24	5	63	32
BH-5	UDS-2	3.50-3.95	1.83	1.46	25	2.68	0.869	0.32	0°	40	17	12	61	27
BH-5	UDS-3	8.00-8.45	1.63	1.22	34	2.62	1.124	0.22	0°	45	26	11	59	30
BH-5	UDS-4	15.50-15.95	1.90	1.58	20	2.74	0.619	0.59	0°	47	29	9	59	32
BH-5	UDS-5	17.00-17.45	1.90	1.59	21	2.70	0.598	0.65	0°	45	18	10	56	34





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SHEET  
NO  
19

BORE LOG DATA SHEET

BORE HOLE NO : 1

PENETROMETER (SPT)	NOS.		NOS.	COMMENCED ON :	11-05-2012
PENETROMETER (SPT)	11	UNDISTURBED (UDS)	4	COMPLETED ON :	12-05-2012
CONE (PC)		PENETROMETER (SPT)	11	BORE HOLE DIA :	150mm
VANE (V)		DISTURBED (DS)	1	R.L. OF GROUND :	
				WATER STRUCK AT :	1.50m
				STANDING WATER LEVEL :	1.40m

DESCRIPTION	SYMBOL	N - VALUE				SAMPLES	
		6	12	18	24	REF NO.	DEPTH (M)
VERY LOOSE FILLING OF FLY ASH, CLAYEY SILT. 1.50m						DS - 1	1.00
SOFT LIGHT GREY TO BROWNISH GREY CLAYEY SILT. 4.50m		N = 3				UDS - 1	1.50 - 1.95
SOFT LIGHT GREY TO DEEP GREY CLAYEY SILT WITH DECAYED VEGETATIONS & ORGANIC MATTERS. 12.00m		N = 2				SPT - 1	3.00 - 3.60
		N = 3				UDS - 2	4.50 - 4.95
		N = 2				SPT - 2	6.00 - 6.60
STIFF LIGHT GREY CLAYEY SILT OBS. KANKARS. 14.00m		N = 3				UDS - 3	7.50 - 7.95
		N = 2				SPT - 3	8.00 - 8.60
		N = 9				SPT - 4	10.00 - 10.60
STIFF TO VERY STIFF LIGHT YELLOWISH GREY CLAYEY SILT WITH SAND. 20.00m		N = 11				SPT - 5	12.00 - 12.60
		N = 14				SPT - 6	14.00 - 14.60
		N = 14				UDS - 4	15.00 - 15.45
		N = 14				SPT - 7	16.00 - 16.60
MODERATE DENSE LIGHT YELLOWISH GREY SANDY SILT OBS. MICA TRACES. 24.00m		N = 16				SPT - 8	18.00 - 18.60
		N = 18				SPT - 9	20.00 - 20.60
VERY STIFF LIGHT YELLOWISH GREY CLAYEY SILT 25.60m						SPT - 10	22.50 - 23.10
						SPT - 11	25.00 - 25.60



PROJECT: PROPOSED MULTISTORIED BUILDING AT  
P.S. & MUNICIPALITY-BUDGE BUDGE, KOLKATA 700137

ASSOCIATED  
FOUNDATION  
ENGINEERS

SHEET  
NO  
20

BORE LOG DATA SHEET

BORE HOLE NO : 2

PENETROMETER (SPT)	NDS.		NDS.	COMMENCED ON :	12-05-2012
PENETROMETER (SPT)	9	UNDISTURBED (UDS)	4	COMPLETED ON :	13-05-2012
CDNE (PC)		PENETROMETER (SPT)	9	BORE HOLE DIA :	150mm
VANE (V)		DISTURBED (DS)	1	R.L. OF GROUND :	
				WATER STRUCK AT :	1.50m
				STANDING WATER LEVEL :	1.40m

DESCRIPTION	SYMBOL	N - VALUE				SAMPLES	
		6	12	18	24	REF NO.	DEPTH (M)
VERY LOOSE FILLING OF FLY ASH, CLAYEY SILT. 1.50m						DS - 1	0.00
SOFT LIGHT GREY TO BROWNISH GREY CLAYEY SILT. 4.00m		N = 4				SPT - 1	1.50 - 2.10
SOFT LIGHT GREY TO DEEP GREY CLAYEY SILT WITH DECAYED VEGETATIONS & ORGANIC MATTERS. 11.00m		N = 2				UDS - 1	3.00 - 3.45
		N = 2				SPT - 2	4.50 - 5.10
		N = 2				UDS - 2	6.00 - 6.45
STIFF LIGHT GREY CLAYEY SILT OBS. KANKARS. 14.00m			N = 9			SPT - 3	7.50 - 8.10
			N = 12			SPT - 4	11.00 - 11.60
			N = 10			UDS - 3	12.50 - 12.95
STIFF TO VERY STIFF LIGHT YELLOWISH GREY CLAYEY SILT WITH SAND. 20.00m				N = 16		SPT - 5	13.00 - 13.60
				N = 13		SPT - 6	15.00 - 15.60
MODERATE DENSE LIGHT YELLOWISH GREY SANDY SILT OBS. MICA TRACES. 22.60m				N = 22		UDS - 4	17.00 - 17.45
						SPT - 7	17.50 - 18.10
						SPT - 8	20.00 - 20.60
						SPT - 9	22.00 - 22.60





PROJECT: PROPOSED MULTISTORIED BUILDING AT	ASSOCIATED	SHEET
P.S. & MUNICIPALITY-BUDGE BUDGE, KOLKATA 700137	FOUNDATION	NO
	ENGINEERS	21

BORE LOG DATA SHEET	BORE HOLE NO : 3
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PENETROMETER (SP1)	NOS.		NOS.	COMMENCED ON :	13-05-2012
PENETROMETER (SP1)	7	UNDISTURBED (UDS)	3	COMPLETED ON :	14-05-2012
CDNE (PC)		PENETROMETER (SPT)	7	BORE HOLE DIA :	150mm
VANE (V)		DISTURBED (DS)	2	R.L. OF GROUND :	
				WATER STRUCK AT :	1.50m
				STANDING WATER LEVEL :	1.50m

DESCRIPTION	SYMBOL	N - VALUE				SAMPLES	
		6	12	18	24	REF NO.	DEPTH (M)
VERY LOOSE FILLING OF FLY ASH, CLAYEY SILT.						DS - 1	1.00
						DS - 2	2.00
						SPT - 1	2.50 - 3.10
SOFT LIGHT GREY TO BROWNISH GREY CLAYEY SILT. 3.00m						UDS - 1	4.00 - 4.45
						SPT - 2	6.00 - 6.60
SOFT LIGHT GREY TO DEEP GREY CLAYEY SILT WITH DECAYED VEGETATIONS & ORGANIC MATTERS. 4.00m						SPT - 3	8.00 - 8.60
						UDS - 2	10.00 - 10.45
STIFF LIGHT GREY CLAYEY SILT OBS. KANKARS. 12.00m						SPT - 4	13.00 - 13.60
						UDS - 3	14.50 - 14.95
STIFF TO VERY STIFF LIGHT YELLOWISH GREY CLAYEY SILT WITH SAND. 14.00m						SPT - 5	15.00 - 15.60
						SPT - 6	17.00 - 17.60
						SPT - 7	19.50 - 20.10



PROJECT: PROPOSED MULTISTORIED BUILDING AT  
P.S. & MUNICIPALITY-BUDGE BUDGE, KOLKATA 700137

ASSOCIATED  
FOUNDATION  
ENGINEERS

SHEET  
NO  
22

BORE LOG DATA SHEET

BORE HOLE NO : 4

PENETROMETER (SPT)	NOS.		NOS.	COMMENCED ON :	14-05-2012
PENETROMETER (SPT)	7	UNDISTURBED (UDS)	4	COMPLETED ON :	15-05-2012
CONE (PC)		PENETROMETER (SPT)	7	BORE HOLE DIA :	150mm
VANE (V)		DISTURBED (DS)	1	R.L. OF GROUND :	
				WATER STRUCK AT :	1.40m
				STANDING WATER LEVEL :	1.40m

DESCRIPTION	SYMBOL	N - VALUE				SAMPLES	
		6	12	18	24	REF NO.	DEPTH (M)
VERY LOOSE FILLING OF FLY ASH, CLAYEY SILT. 1.00m						DS - 1	0.50
SOFT LIGHT GREY TO BROWNISH GREY CLAYEY SILT. 4.00m		N = 3				SPT - 1	1.50 - 2.10
SOFT LIGHT GREY TO DEEP GREY CLAYEY SILT WITH DECAYED VEGETATIONS & ORGANIC MATTERS. 12.00m		N = 1				UDS - 1	2.50 - 2.95
STIFF LIGHT GREY CLAYEY SILT OBS. KANKARS. 14.00m		N = 2				SPT - 2	5.00 - 5.60
STIFF TO VERY STIFF LIGHT YELLOWISH GREY CLAYEY SILT WITH SAND. 20.60m		N = 11				UDS - 2	7.50 - 7.95
		N = 14				SPT - 3	9.50 - 10.10
		N = 18				UDS - 3	12.00 - 12.45
		N = 17				SPT - 4	12.50 - 13.10
						UDS - 4	15.50 - 16.10
						SPT - 5	17.00 - 17.45
						SPT - 6	18.00 - 18.60
						SPT - 7	20.00 - 20.60





PROJECT: PROPOSED MULTISTORIED BUILDING AT  
P.S. & MUNICIPALITY-BUDGE BUDGE, KOLKATA 700137

ASSOCIATED  
FOUNDATION  
ENGINEERS

SHEET  
NO  
23

BORE LOG DATA SHEET

BORE HOLE NO : 4

PENETROMETER (SPT)	NDS.		NDS.	COMMENCED ON :	14-05-2012
PENETROMETER (SPT)	7	UNDISTURBED (UDS)	5	COMPLETED ON :	15-05-2012
CONE (PC)		PENETROMETER (SPT)	7	BORE HOLE DIA :	150mm
VANE (V)		DISTURBED (DS)	1	R.L. OF GROUND :	
				WATER STRUCK AT :	1.50m
				STANDING WATER LEVEL :	1.40m

DESCRIPTION	SYMBOL	N - VALUE				SAMPLES	
		6	12	18	24	REF NO.	DEPTH (M)
VERY LOOSE FILLING OF FLY ASH, CLAYEY SILT.						DS - 1	0.90
1.30m						UDS - 1	1.50 - 1.95
SOFT LIGHT GREY TO BROWNISH GREY CLAYEY SILT.		N = 2				SPT - 1	2.00 - 2.60
4.00m		N = 1				UDS - 2	3.50 - 3.95
SOFT LIGHT GREY TO DEEP GREY CLAYEY SILT WITH DECAYED VEGETATIONS & ORGANIC MATTERS.		N = 2				SPT - 2	5.50 - 6.10
13.00m		N = 4				UDS - 3	8.00 - 8.45
STIFF LIGHT GREY CLAYEY SILT OBS. KANKARS.						SPT - 3	8.50 - 9.10
14.00m						SPT - 4	10.00 - 10.60
STIFF TO VERY STIFF LIGHT YELLOWISH GREY CLAYEY SILT WITH SAND.						UDS - 4	13.00 - 13.60
20.60m						SPT - 5	15.50 - 15.95
						UDS - 5	16.00 - 16.60
						SPT - 6	17.00 - 17.45
						SPT - 7	17.50 - 18.10
						SPT - 8	

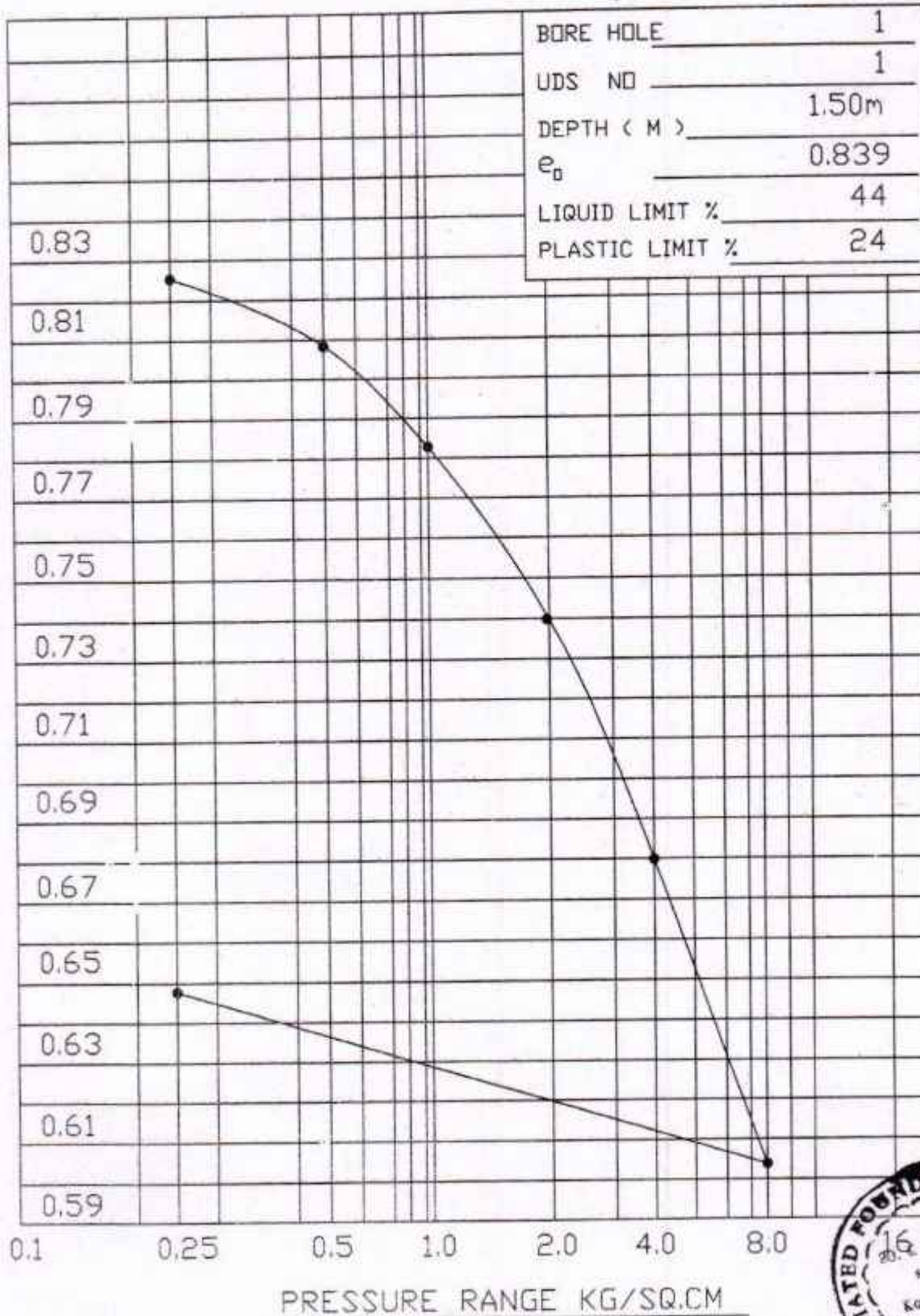


PROJECT: PROPOSED MULTISTORIED BUILDING AT  
 P.S. & MUNICIPALITY-BUDGE BUDGE, KOLKATA 700137

ASSOCIATED  
 FOUNDATION  
 ENGINEERS

SHEET  
 NO.  
 24

e VS LOG p CURVE



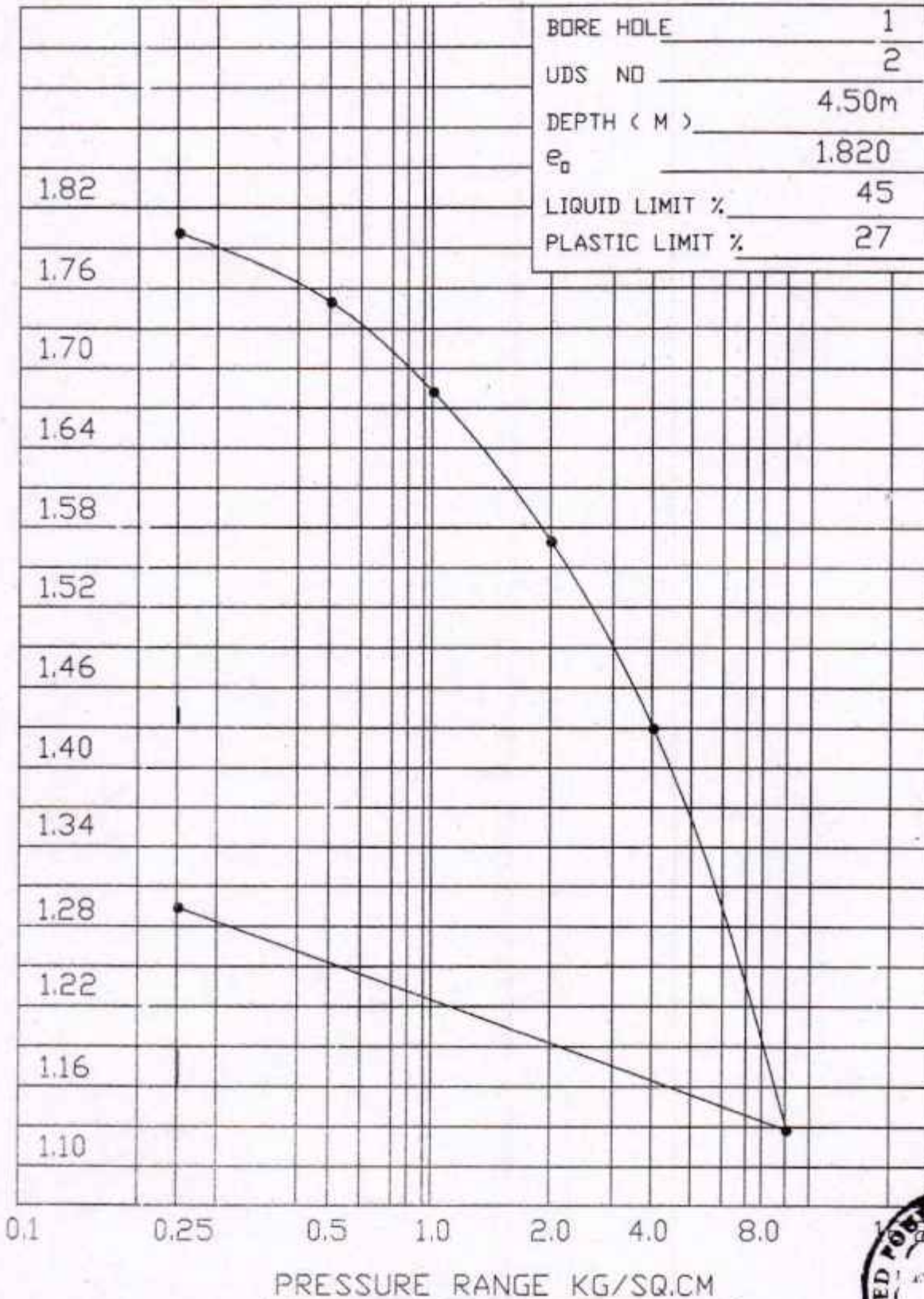


PROJECT: PROPOSED MULTISTORIED BUILDING AT  
 P.S. & MUNICIPALITY-BUDGE BUDGE, KOLKATA 700137

ASSOCIATED  
 FOUNDATION  
 ENGINEERS

SHEET  
 NO.  
 25

e VS LOG p CURVE

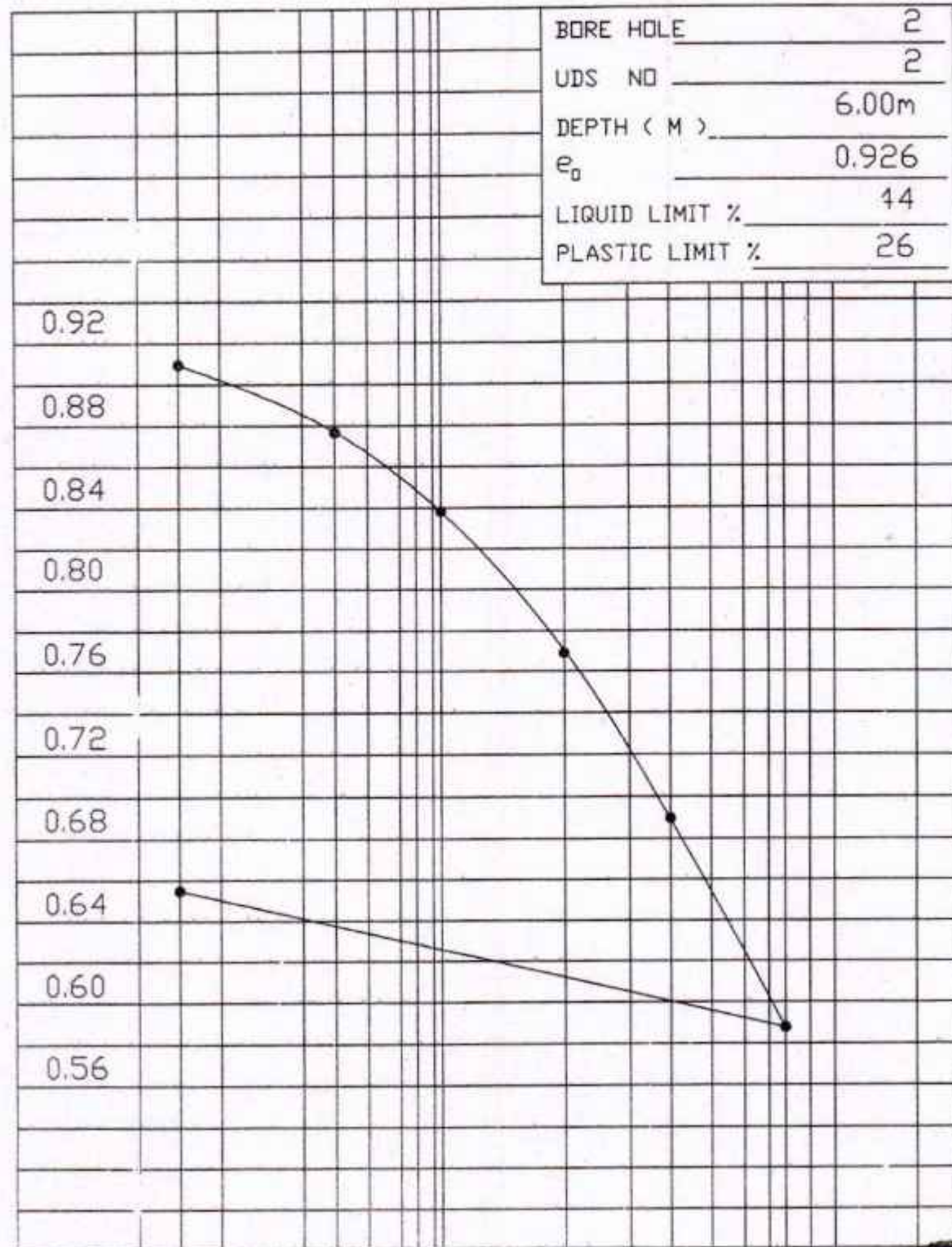


PROJECT: PROPOSED MULTISTORIED BUILDING AT  
 P.S. & MUNICIPALITY-BUDGE BUDGE, KOLKATA 700137

ASSOCIATED  
 FOUNDATION  
 ENGINEERS

SHEET  
 NO.  
 26

e VS LOG p CURVE



BORE HOLE	2
UDS NO	2
DEPTH ( M )	6.00m
$e_0$	0.926
LIQUID LIMIT %	44
PLASTIC LIMIT %	26

0.1      0.25      0.5      1.0      2.0      4.0      8.0

PRESSURE RANGE KG/SQ.CM



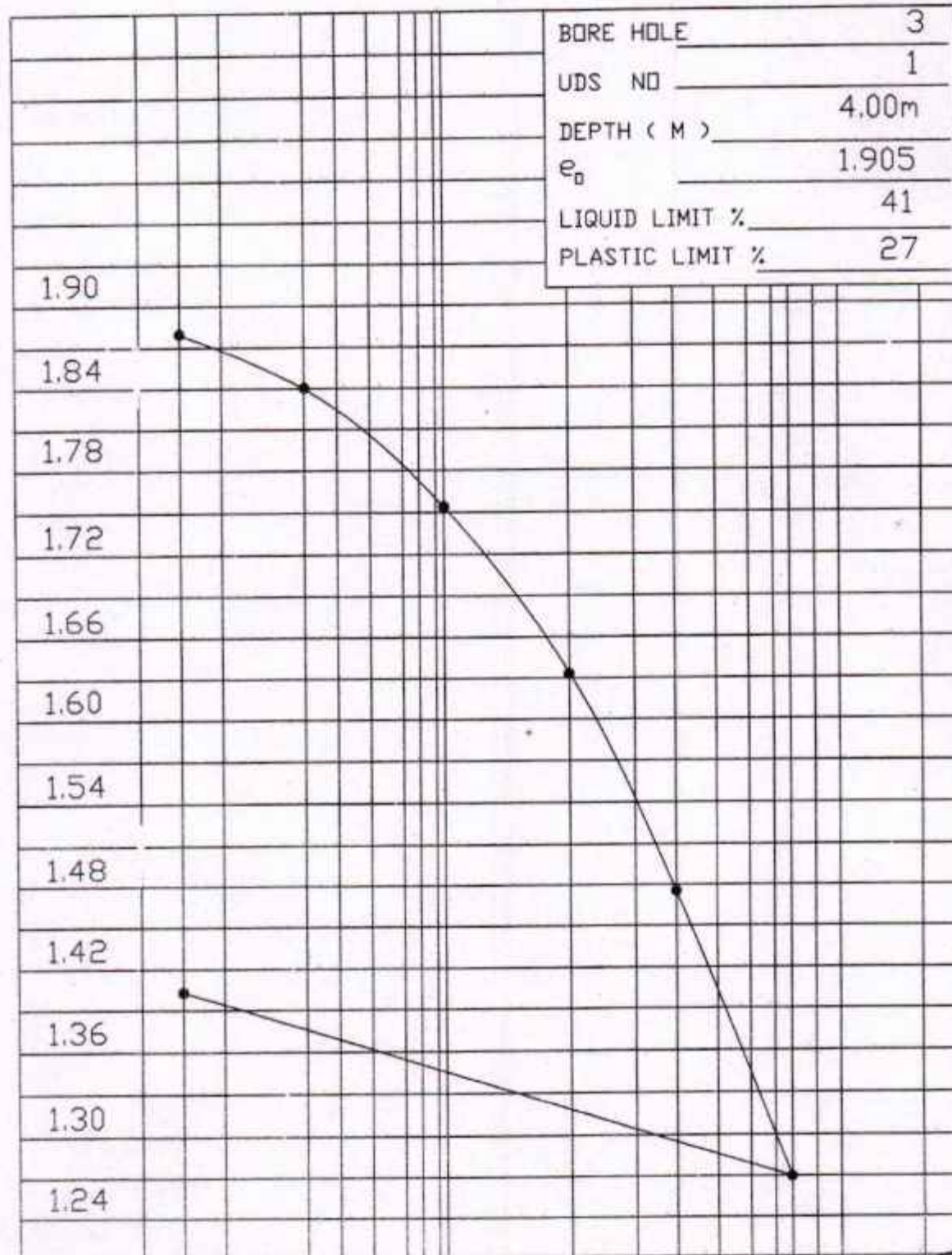


PROJECT: PROPOSED MULTISTORIED BUILDING AT  
 P.S. & MUNICIPALITY-BUDGE BUDGE, KOLKATA 700137

ASSOCIATED  
 FOUNDATION  
 ENGINEERS

SHEET  
 NO.  
 27

e VS LOG p CURVE



BORE HOLE	3
UDS NO	1
DEPTH ( M )	4.00m
$e_0$	1.905
LIQUID LIMIT %	41
PLASTIC LIMIT %	27

0.1      0.25      0.5      1.0      2.0      4.0      8.0

PRESSURE RANGE KG/SQ.CM

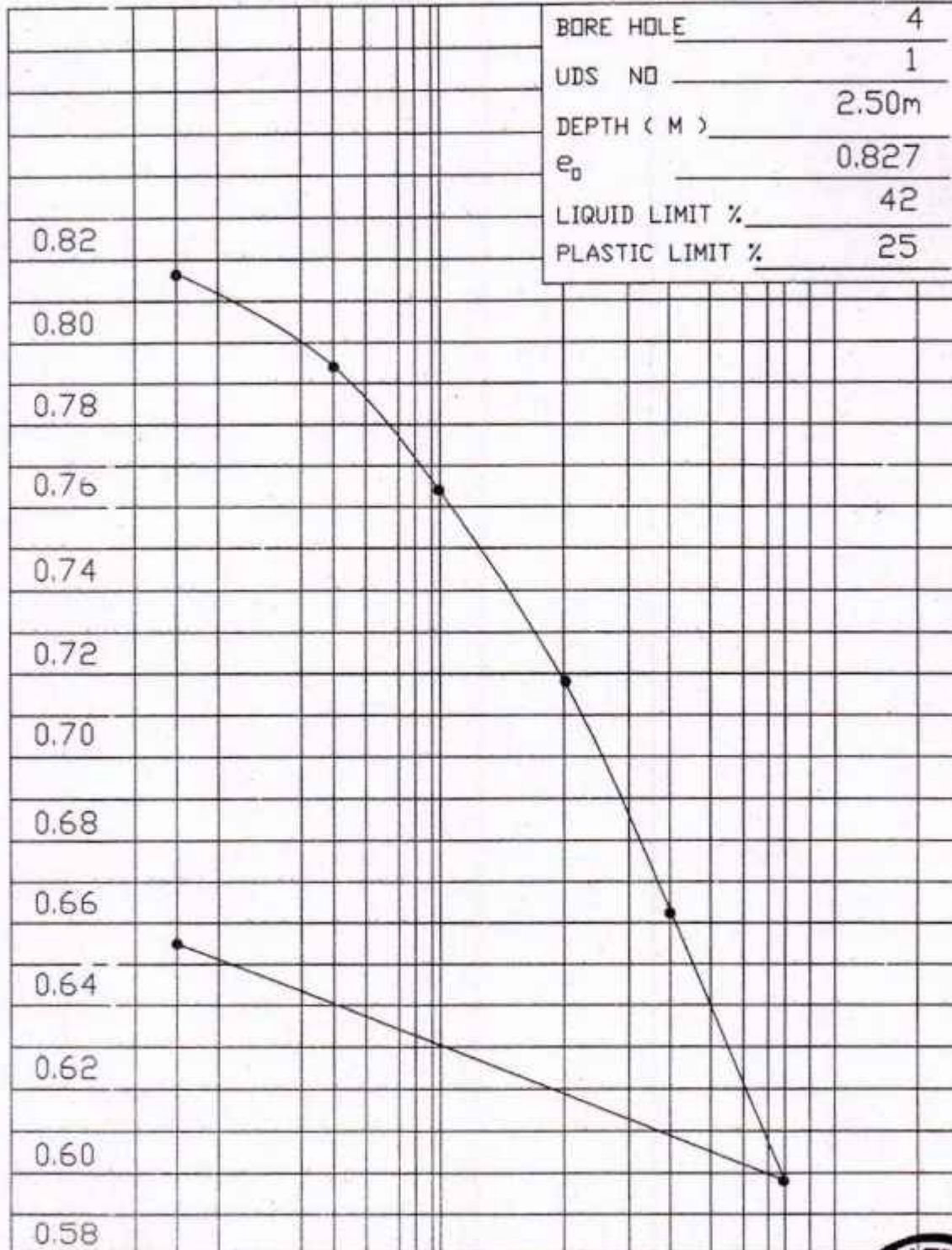


PROJECT: PROPOSED MULTISTORIED BUILDING AT  
P.S. & MUNICIPALITY-BUDGE BUDGE, KOLKATA 700137

ASSOCIATED  
FOUNDATION  
ENGINEERS

SHEET  
NO.  
28

e VS LOG p CURVE



0.1      0.25      0.5      1.0      2.0      4.0      8.0  
PRESSURE RANGE KG/SQ.CM



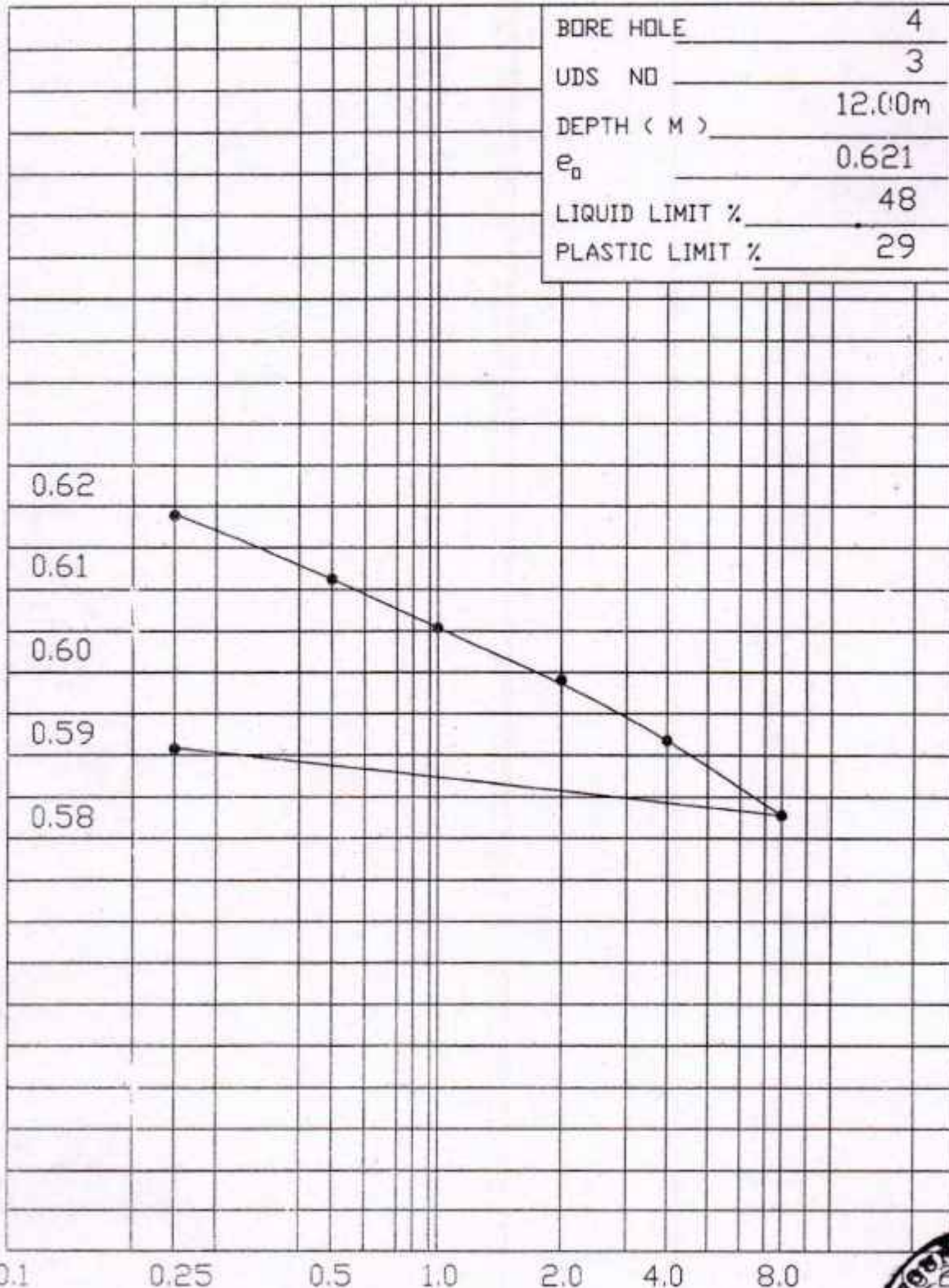


PROJECT: PROPOSED MULTISTORIED BUILDING AT  
P.S. & MUNICIPALITY-BUDGE BUDGE, KOLKATA 700137

ASSOCIATED  
FOUNDATION  
ENGINEERS

SHEET  
NO.  
29

e VS LOG p CURVE



PRESSURE RANGE KG/SQ.CM

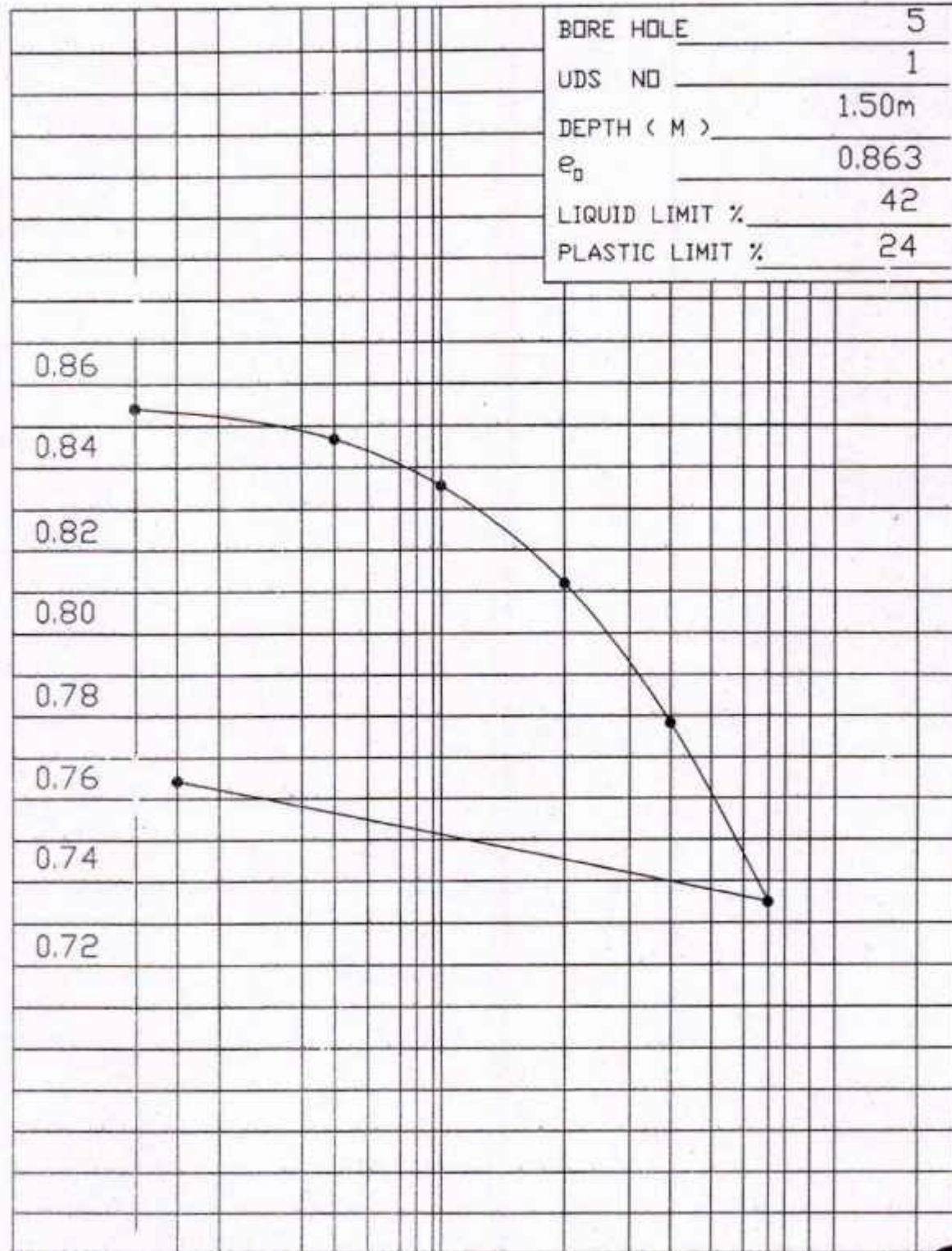


PROJECT: PROPOSED MULTISTORIED BUILDING AT  
P.S. & MUNICIPALITY-BUDGE BUDGE, KOLKATA 700137

ASSOCIATED  
FOUNDATION  
ENGINEERS

SHEET  
NO.  
30

e VS LOG p CURVE



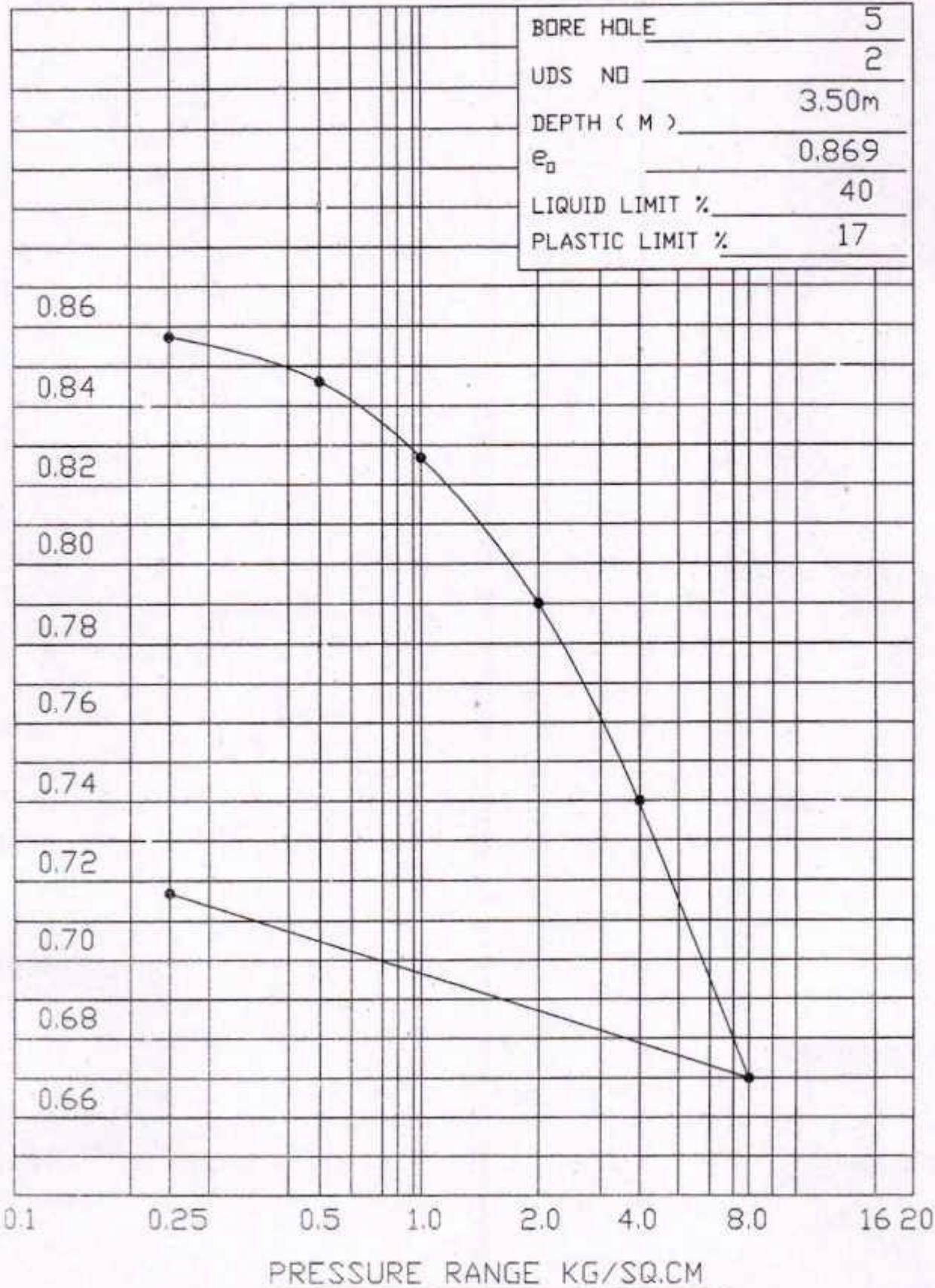
0.1      0.25      0.5      1.0      2.0      4.0      8.0

PRESSURE RANGE KG/SQ.CM





e VS LOG p CURVE



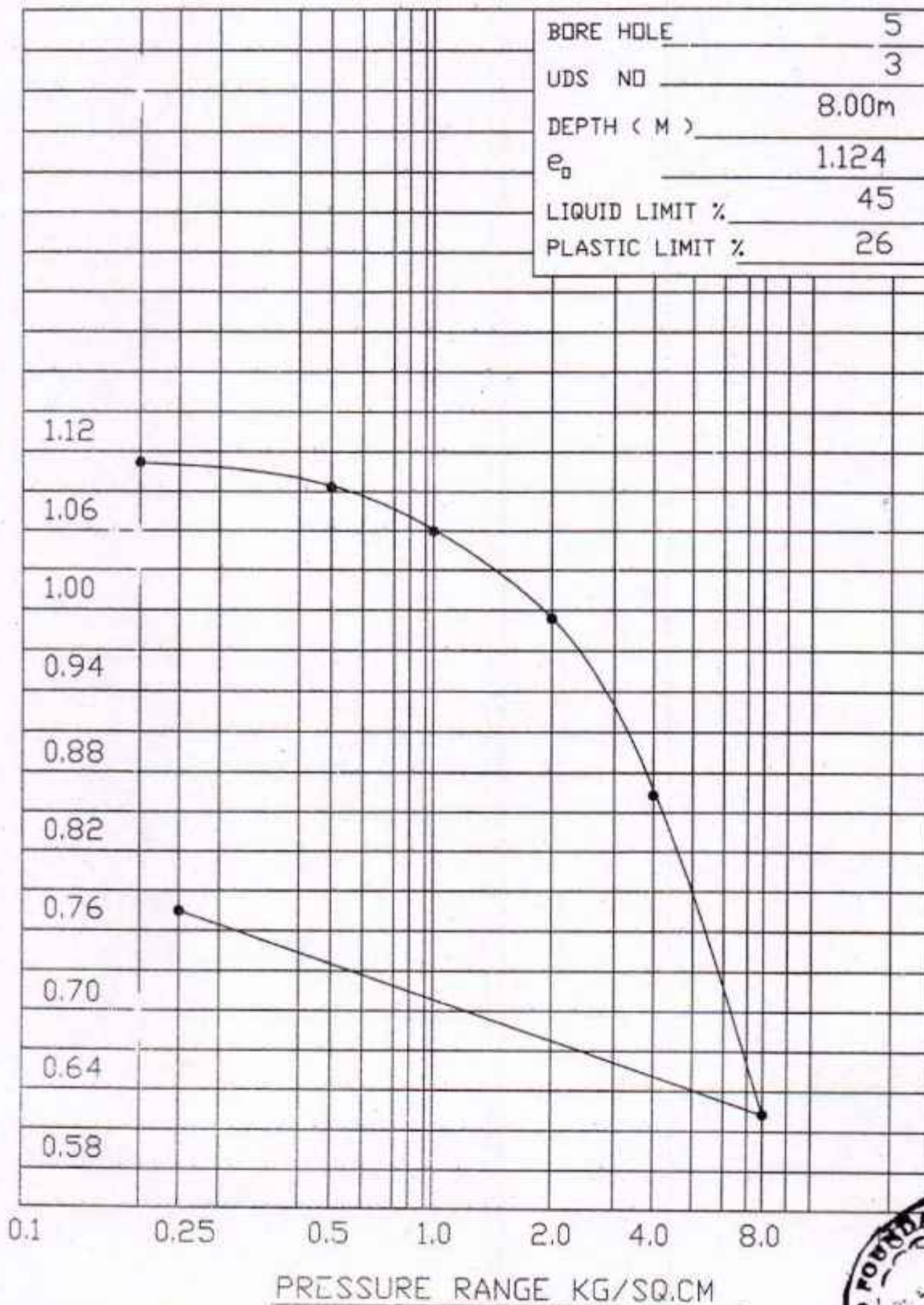
PROJECT: PROPOSED MULTISTORIED BUILDING AT  
 P.S. & MUNICIPALITY-BUDGE BUDGE, KOLKATA 700137

ASSOCIATED  
 FOUNDATION  
 ENGINEERS

SHEET  
 NO.  
 32

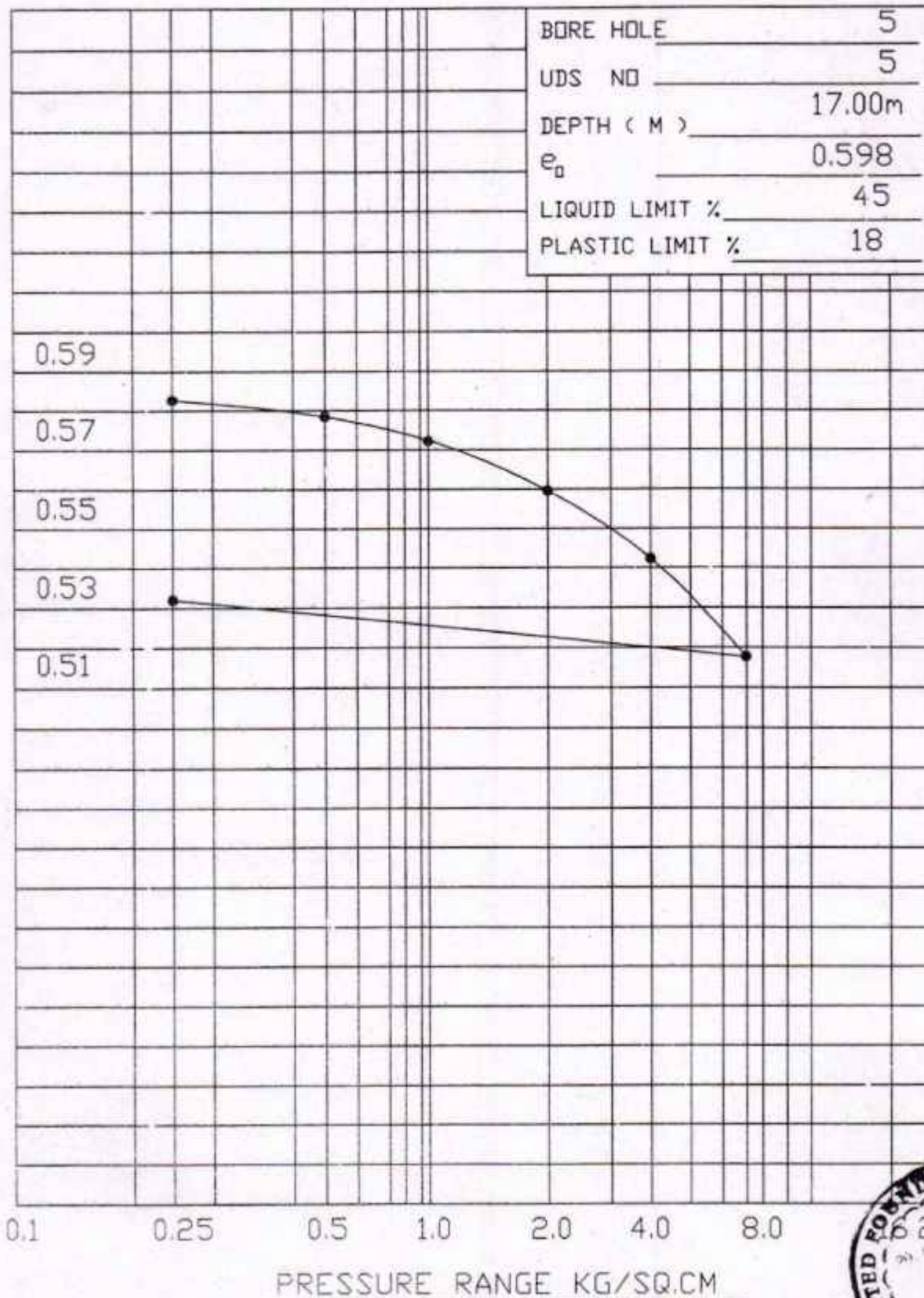
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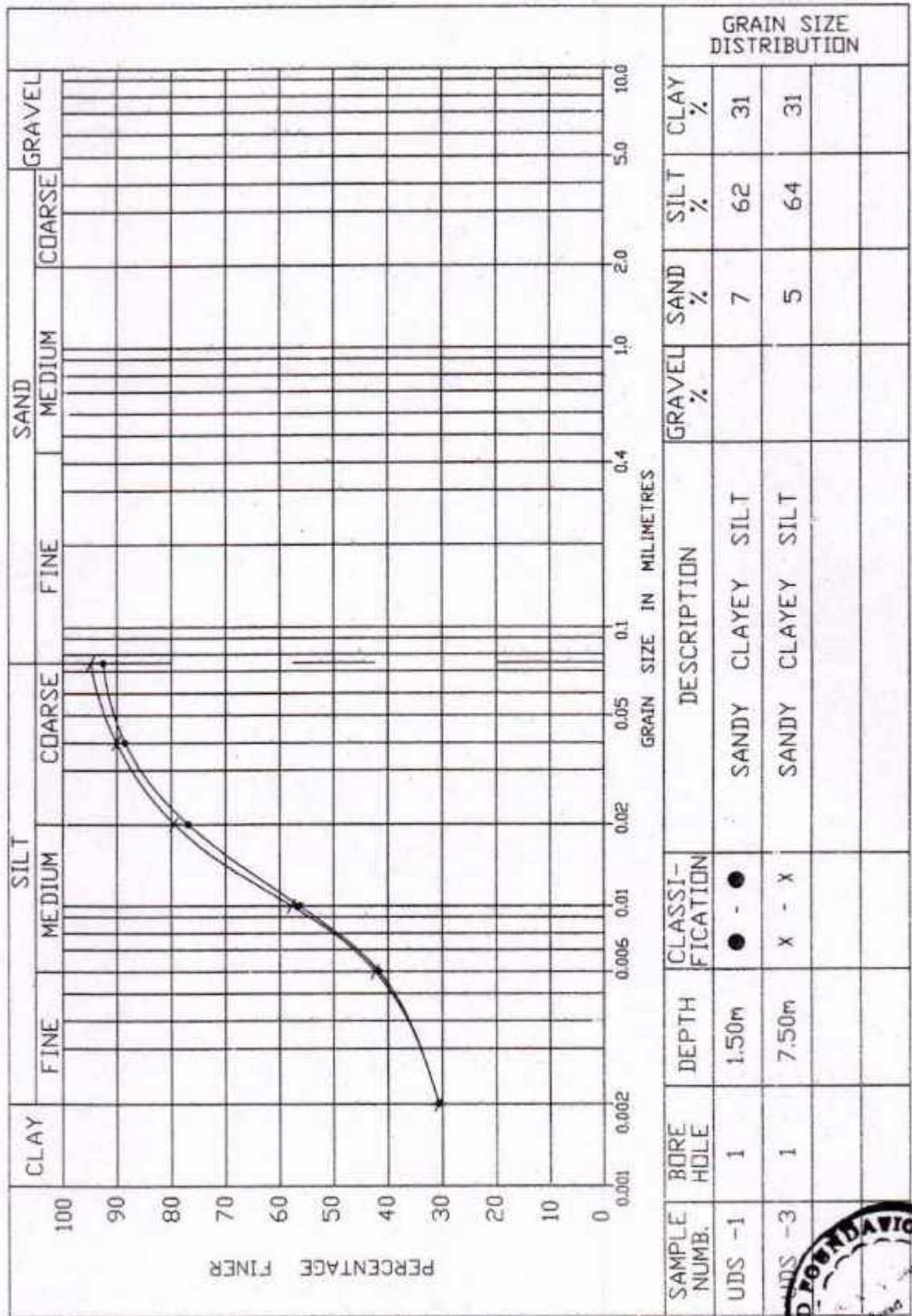
BORE HOLE	5
UDS NO	3
DEPTH ( M )	8.00m
$e_0$	1.124
LIQUID LIMIT %	45
PLASTIC LIMIT %	26



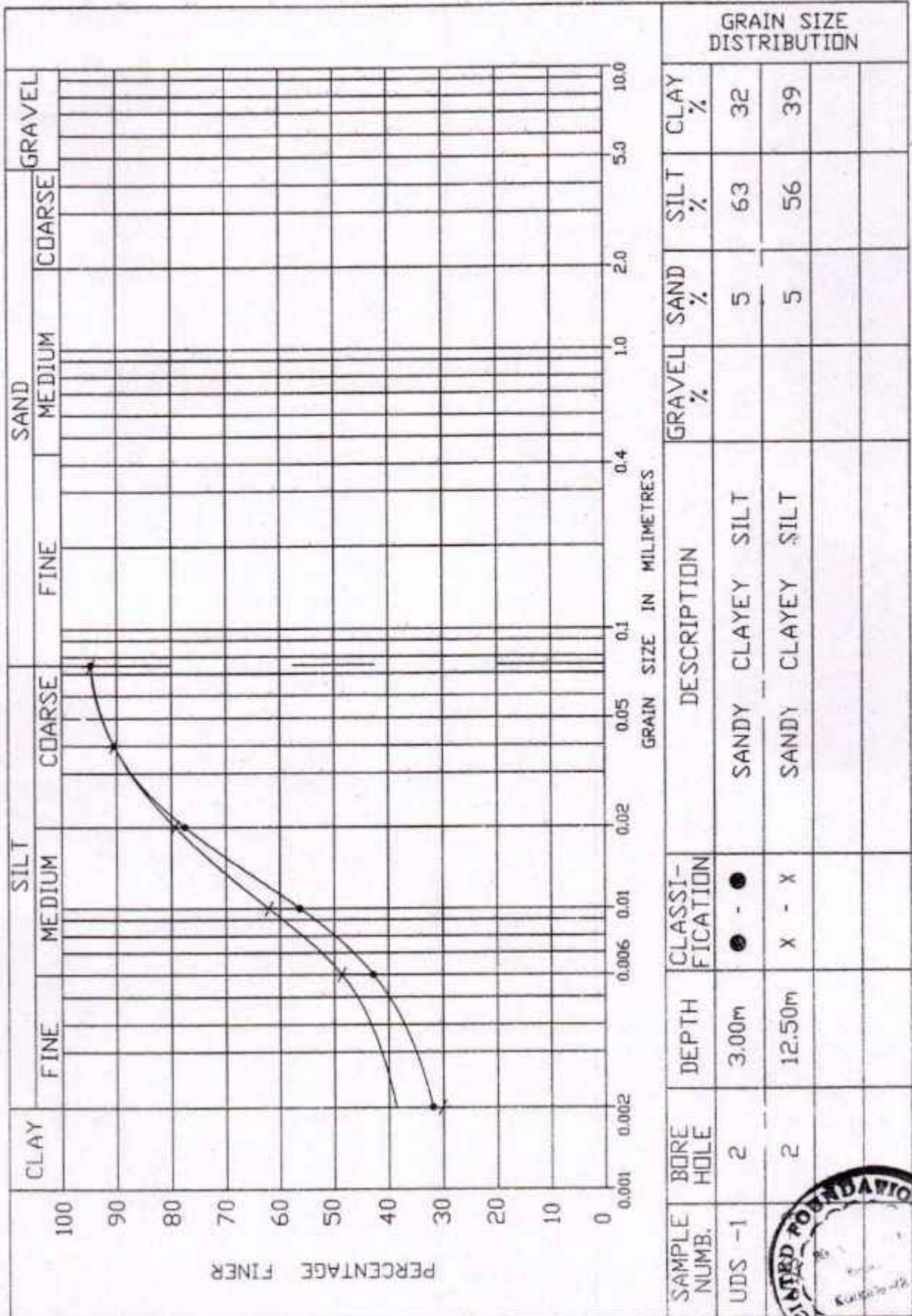


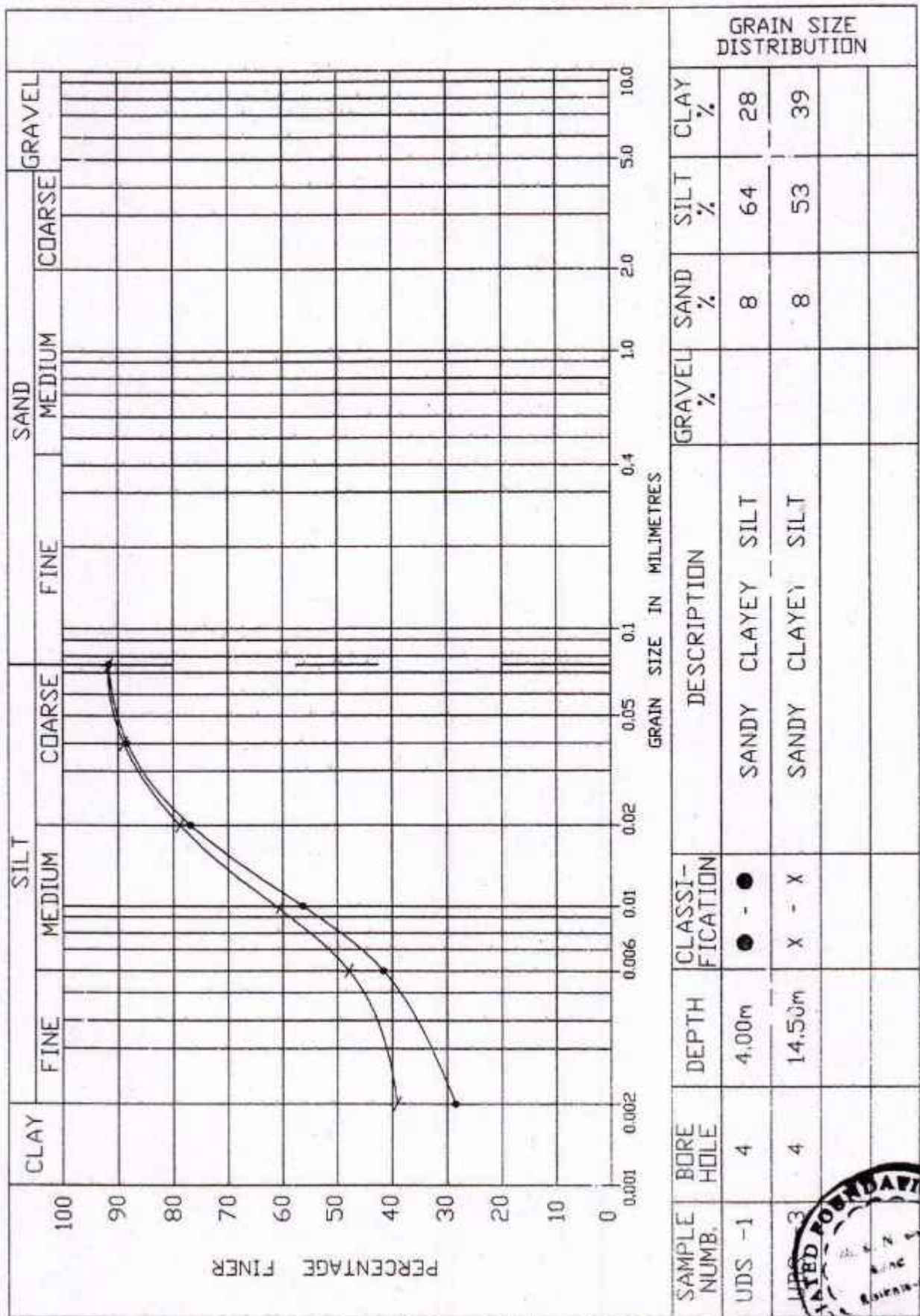
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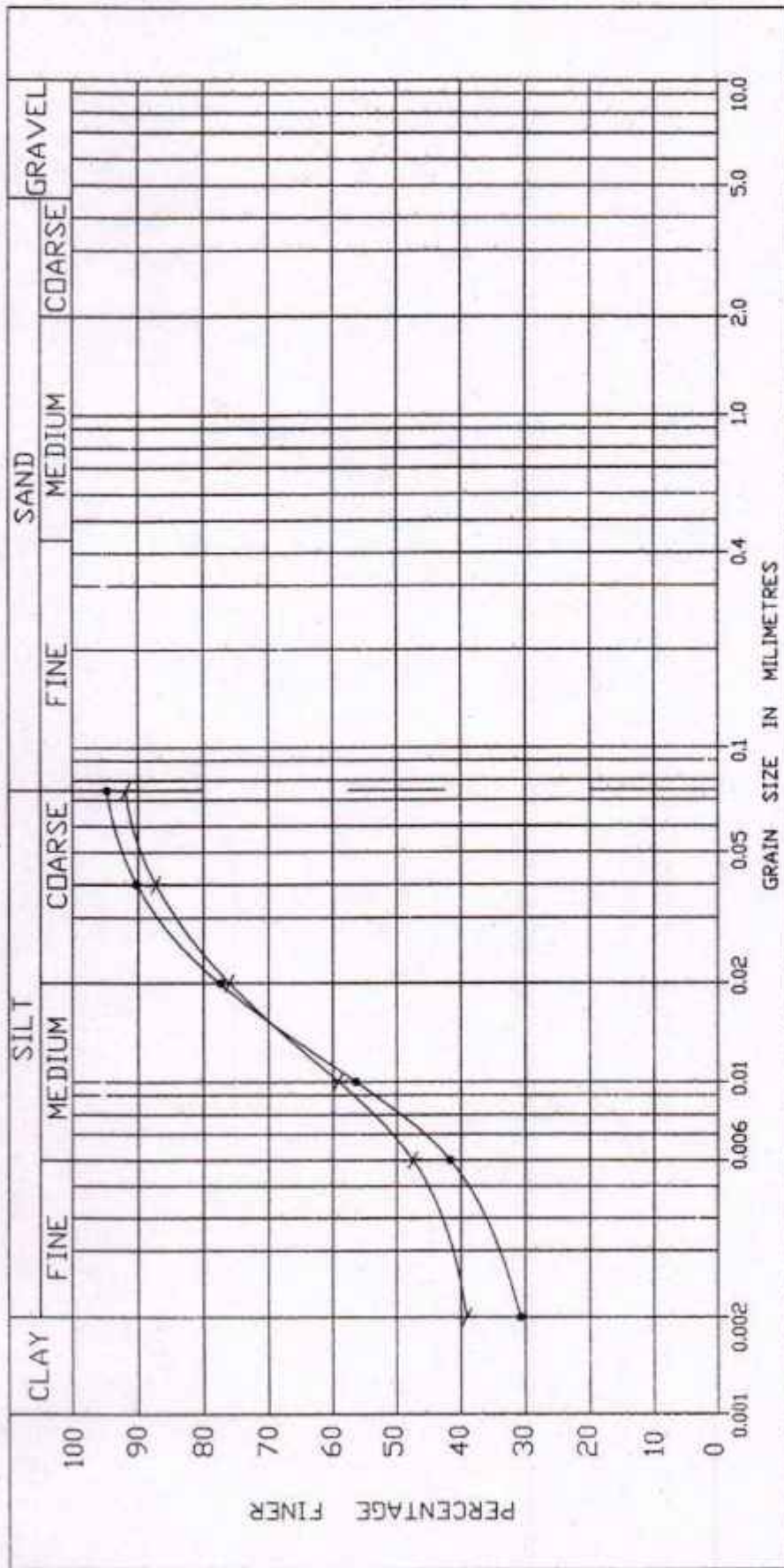












SAMPLE NUMB.	BORE HOLE	DEPTH	CLASSIFICATION	GRAIN SIZE DISTRIBUTION				
				GRAVEL %	SAND %	SILT %	CLAY %	
UBS -2	4	3.00m	● - ●		5	64	31	
	4	5.50m	x - x		8	53	39	

