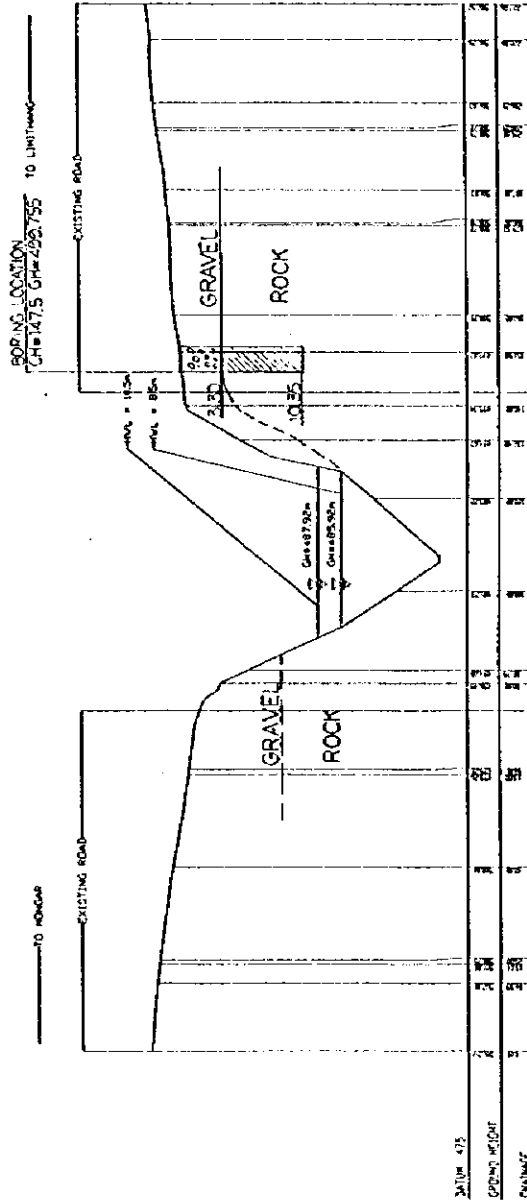


## **F-4 Geological Profile**

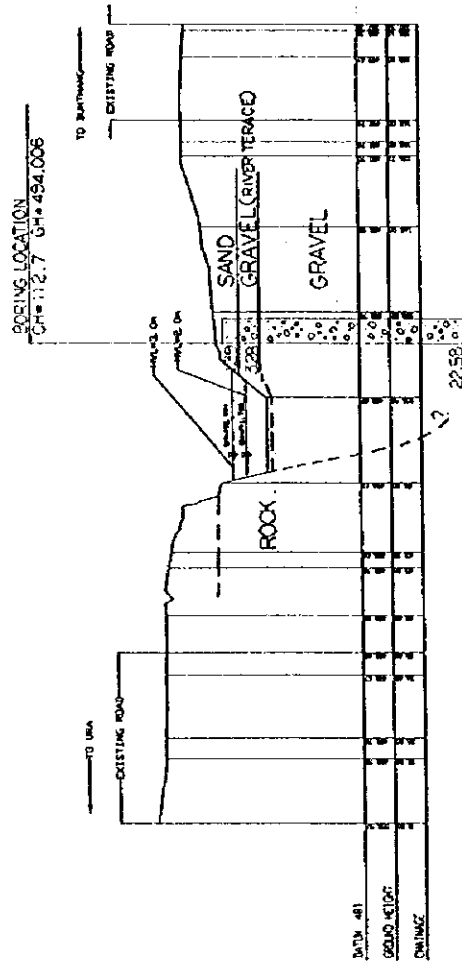




SURVEY AND DESIGN CONSULTANTS  
 100, MARINE DRIVE, SINGAPORE 099910

PROJECT: KINZAMPA BEIDGE STZ  
 ALONG HIGHWAY LOCATION

DRAWING NO: 0909 10 103

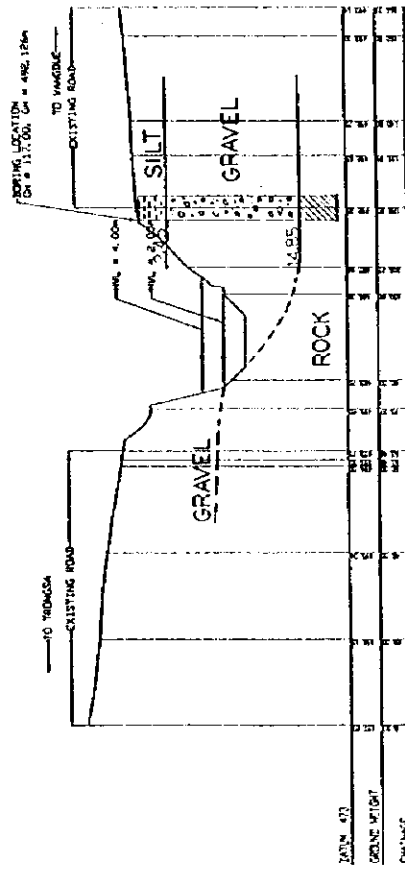


SURVEY AND DESIGN CELL  
 CHANGE BRIDGE SITE  
 SECTION ALONG PROPOSED  
 BRIDGE

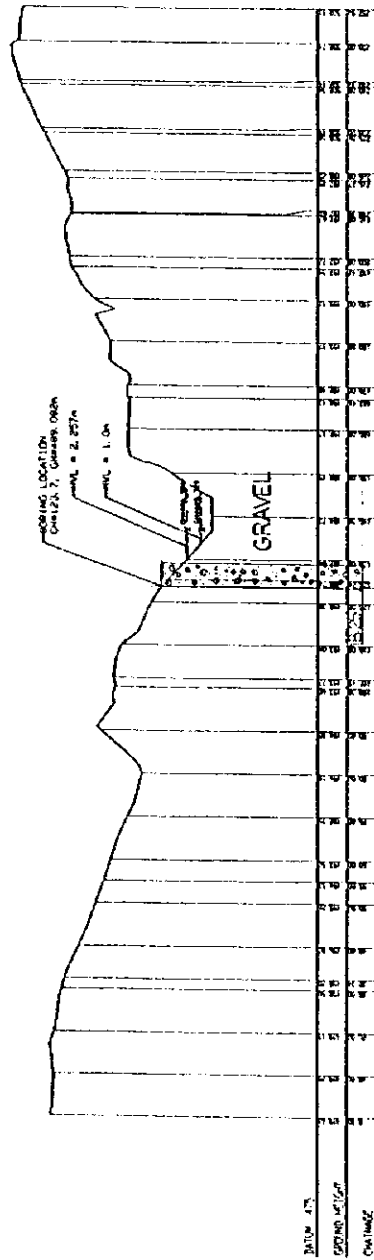


DATE	DESCRIPTION	BY	CHECKED BY	SCALE

NO.	DESCRIPTION	DATE	BY	CHECKED BY



		SURVEY AND DESIGN CELL <small>ROAD AND OFFICE ADDRESS</small>	
TO THONGSA EXISTING ROAD		TO WACDIE EXISTING ROAD	
PORTING LOCATION CH # 117.00, CH # 492.1264	1022 BRIDGE SITE	ALONG HIGHWAY LOCATION	
DISTANCE FROM POINT OF BEGINNING	STATIONING	TOTAL LENGTH	DATE 1919 40 03



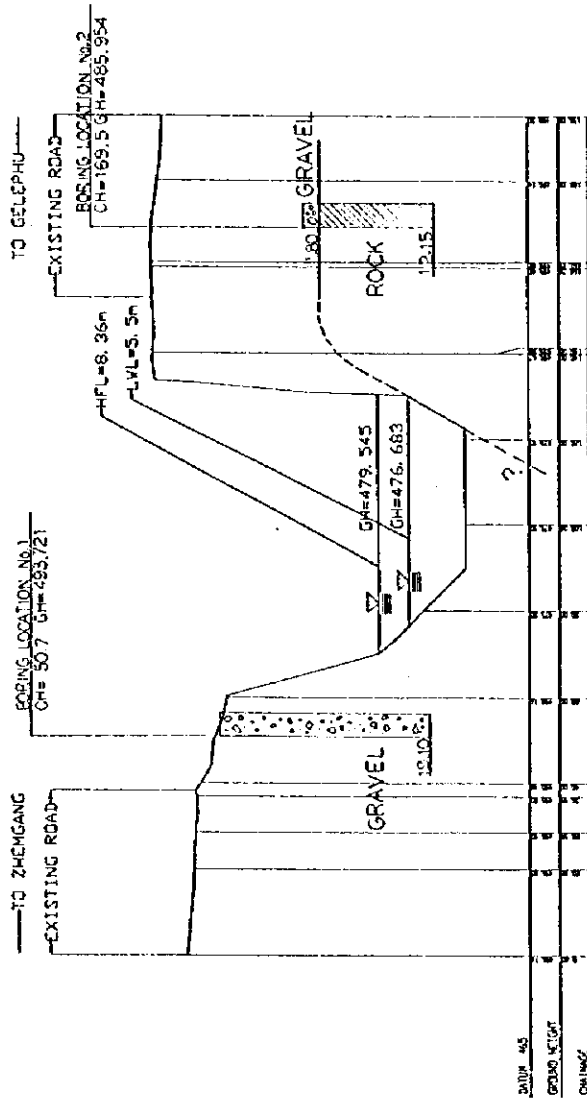
SURVEY AND DESIGN CELL  
PLANS AND SECTIONS - BRIDGE APPROACH

**PAVEMENT ZONE**

**L-SECTION ALONG PROPOSED ROAD & BRIDGE ALIGNMENT**

2020 S8 104

DATE	PROJECT	SCALE	PROJECT NO.	DESIGNER



SURVEY AND DESIGN CELL  
 FOUR STAR ENGINEERING SERVICE  
 1501 50 03

MANAGED ROCK STR  
 L-SECTION ALONG PROPOSED BRIDGE

PROJECT NO. 1501 50 03

DATE: 15/01/2003

DRAWN BY: [Signature]

CHECKED BY: [Signature]

SCALE: 1:100

## **F-5 Laboratory Soil Test**



# SUMMARY OF THE TEST RESULTS

Project: N.H.B.C

Company : JICA

Tested by: KY

Reg. No.58

Prepared by: PD

Checked by: H.A

SL. No.	Location	Sample No.	Depth at (m)	Moisture Content (%)	Specific Gravity	Sieve Analysis				Atterberg Limit			
						D10 (mm)	D30 (mm)	D60 (mm)	Cu (mm)	CC (mm)	LL	PL	PI
1	CHAMKHAR	1 (a)	0.300	9.600	2.000	0.150	1.050	6.300	42.000	1.170	38.000	33.500	4.500
		1 (b)	0.720	12.500	2.400	0.175	0.570	3.900	22.300	0.480	36.000	34.300	1.700
		1 (c)	0.820	10.600	2.100	0.188	4.320	22.500	119.700	4.400	42.000	35.800	6.200
2	KURIZAMPA	2 (a)	0.360	8.300	2.300	0.144	3.400	9.260	64.300	8.700	35.000	33.200	1.800
		2 (b)	0.670	11.400	2.200	0.075	3.930	12.000	160.000	17.200	65.000	53.700	11.300
		2 (c)	1.690	6.000	2.600	0.110	2.260	10.000	90.900	4.600	25.000	18.200	6.800
3	WACHAYZAM	3 (a)	-	6.100	2.300	**	**	**	**	**	**	**	**
		3 (b)	-	6.700	2.200	**	**	**	**	**	**	**	**
4	BJEEZAM	4 (a)	1.000	4.800	*	0.115	1.080	8.900	77.400	1.140	45.000	36.400	8.600
		4 (b)	2.000	2.600	*	0.163	2.360	17.200	105.500	1.990	21.000	19.100	1.900
		4 (c)	2.450	3.400	*	0.094	0.400	5.990	63.700	0.290	*	*	*

NOTE:

- 1) \* Sample not sufficient.
- 2) \*\* Sandy soil.
- 3) - (Dash) Depth not mentioned.

MATERIAL TESTING LABORATORY  
 PUBLIC WORKS DIVISION  
 MINISTRY OF COMMUNICATION  
 THIMPHU BHUTAN

MOISTURE CONTENT TEST

Sample No. (SOIL)		Project: N.H.B.C		Company: JICA	
Tested By: KY		Date: 24.2.98		Location: -	
Computed by: PD		Checked by: HA		Reg. No. 58	
Location	CHAMKHAR	KURIZAMPA	WACHAY	BJEE ZAM	
Depth at (m)	0.30	0.67	1.69	1	2
1. Wt. of empty dish	18.0	17.0	17.0	18.0	19.0
2. Wt. of dish + wet sample	75.0	56.0	70.0	70.0	63.0
3. Wt. of dish + dry sample	70.0	53.0	67.0	67.0	61.0
4. Wt. of dry soil	52.0	36.0	44.0	49.0	42.0
5. Moisture	5.0	3.0	3.0	3.0	2.0
6. Moisture Content	9.6	8.3	11.4	6.1	4.8
					2.4
					20.0
					60.0
					59.0
					39.0
					1.0
					3.4

MATERIAL TESTING LABORATORY  
 PUBLIC WORKS DIVISION  
 MINISTRY OF COMMUNICATION  
 THIMPHU BHUTAN

**SPECIFIC GRAVITY TEST**

Sample: (Soil)	Project: N.H.B.C	Company: JICA
Tested by: KY	Date: 24.2.98	Location: -
Computed by: PD	Checked by: HA	Reg. No. 58

	CHAMKHAR (0.30) (0.72)	KURIZAMPA (0.36) (0.67)	WACHAYZAM (-)
1. Location			
2. Depth at			
3. Weight of Pycnometer (W1)	435.0	435.0	435.0
4. Weight of Pycnometer + dry Sample (W2)	852.0	960.0	958.0
5. Weight of Pycnometer + dry Sample + Water (W3)	1,639.0	1,724.0	1,755.0
6. Weight of Pycnometer + Water (W4)	1,430.0	1,430.0	1,431.0
7. Specific gravity Value (W2 - W1)/(W2 - W1) - (W4 - W3)	2	2.3	2.3

MATERIAL TESTING LABORATORY  
PUBLIC WORKS DIVISION  
THIMPHU BHUTAN

# SIEVE ANALYSIS TEST

<b>Sample No. 1 (a)</b>		<b>Project: N.H.B.C</b>		<b>Location: CHAMKHAR</b>	
Depth at: (0.30 m)		Computed by: PD		Company: JICA	
Tested by: KY		Date: 23.2.98		Checked by: HA	
AS Sieve size mm	Individual Weight Retained		Weight Passing		Total Sample % Passing
	Wet	Dry	Wet	Dry	
80					
63					
50					
40			1550.00	1,414.0	100.0
25		199.0		1,215.0	85.9
20		75.0		1,140.0	80.6
16.00		86.0		1,054.0	74.5
12.50		30.0		1,024.0	72.4
10.00		43.0		981.0	69.4
6.30		131.0		850.0	60.1
4.75		35.0		815.0	57.6
4.75			500.0	456.1	
2.80		145.0		311.1	39.3
710.00		98.0		213.1	26.9
212.00		114.0		99.1	12.5
75.00		75.0		24.1	3.1
Pan		3.0		21.1	2.7

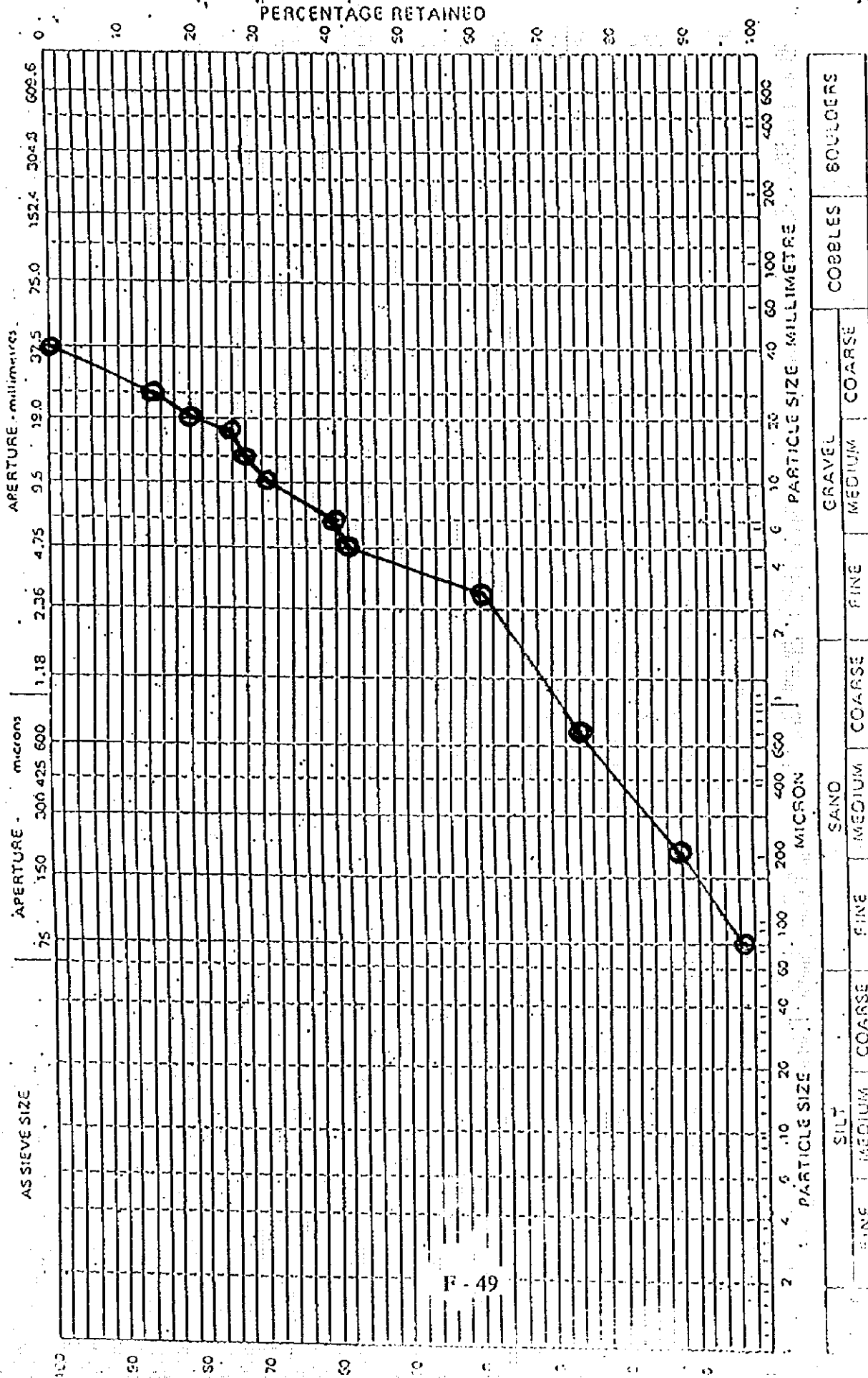
**MOISTURE CONTENT**

Dish A	18.0
X1 + wet soil	75.0
X1 + dry soil	70.0
Dry soil	52.0
Moisture	5.0
Moisture content %	9.6

# PARTICLE SIZE DISTRIBUTION CHART

Tested by KY Plotted by SC Checked by JA SAMPLE NO. 1 (a)

Date 21.2.98 Date 24.2.98 Date 26.2.98 REGISTRATION NO. 58



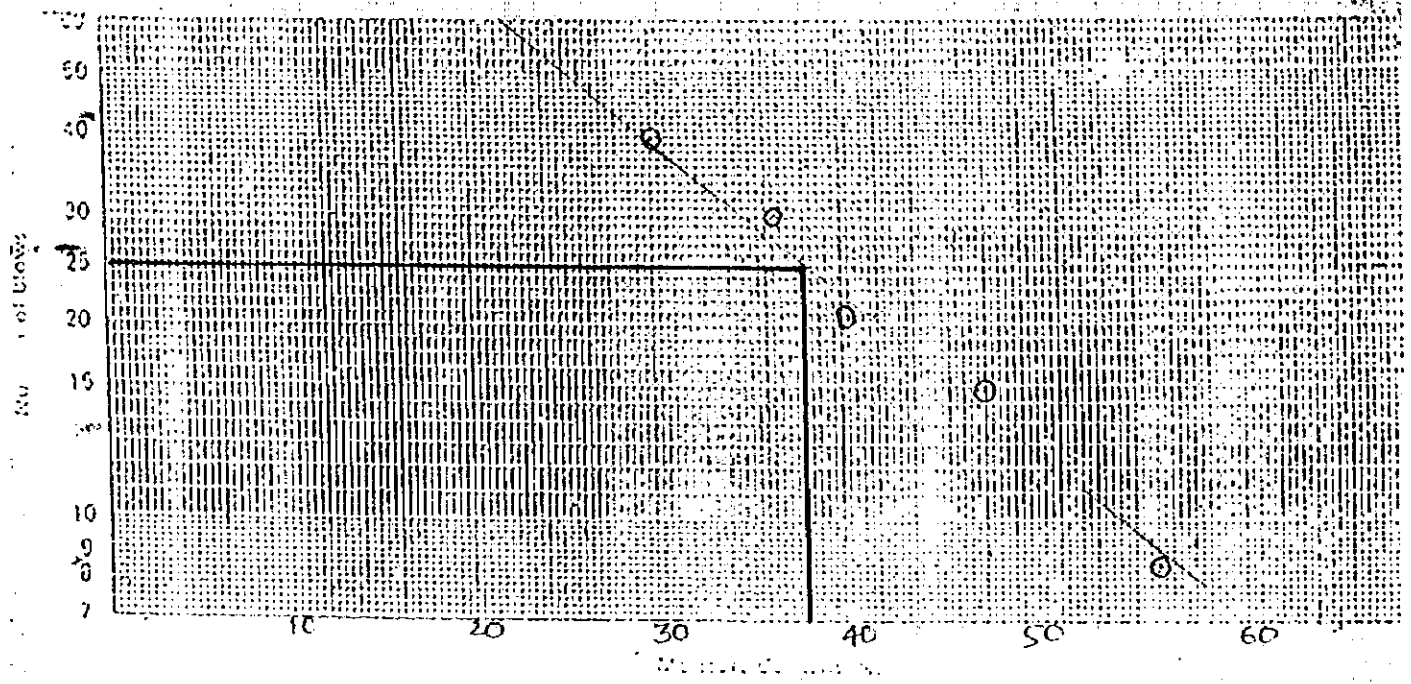
Classification: 0.075-0.150 0.30-0.60 0.85-1.75 2.0-4.75 6.0-12.5 15.0-30.0 42.5-85.0 106-212 250-500 630-1250

Name of material:

ATTERBERG LIMITS AND LINEAR SHRINKAGE METHOD

Tested by                      Computed by 10 Date 26.2.38  
 Date 23.2.38 Use 24.2.33 No. 110.93

FLUX CHART



LIQUID LIMIT  $w_L$

Blow	40	30	21	15	9			
Dist. No.	P	P	E	F	N	E	S	N
Wet soil r. dist.	76	69	69	72	70	69	68	58
Dry soil r. dist.	58	55	54	55	57	58	54	45
Mass of dist.	18	17	17	20	18	17	16	10
Moldate	12	14	15	17	19	11	14	13
Dry soil	40	38	37	35	33	41	38	35
Moisture cont.	30.0	36.8	40.5	46.6	51.6	26.8	36.8	37.0

SUMMARY

Liquid Limit (From Flux Chart)	38
Plastic Limit (Average)	33.5
Plasticity Index $(w_L - w_P)$	4.5
Soil Classification	F-50

MATERIAL TESTING LABORATORY  
PUBLIC WORKS DIVISION  
THIMPHU BHUTAN

## SIEVE ANALYSIS TEST

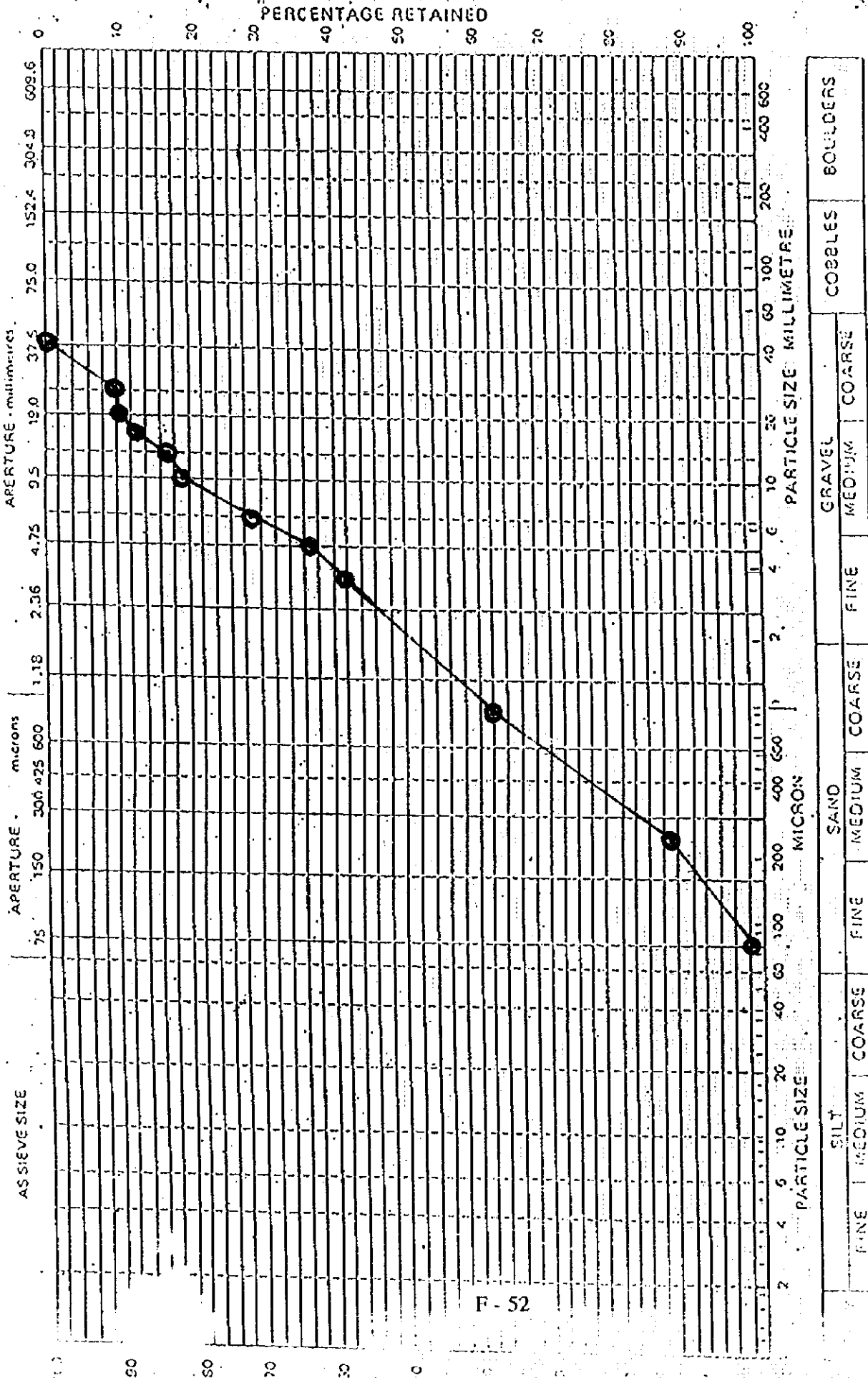
Sample No.1 (b) Depth at: (0.72 m) Tested by: KY		Project: N.H.B.C Computed by:PD Date: 24.2.98		Location: CHAMKHAR Company: JICA Checked by:HA	
AS Sieve size mm	Individual Weight Retained		Weight Passing		Total Sample % Passing
	Wet	Dry	Wet	Dry	
80					
63					
50					
40			1400.00	1,244.4	100.0
25		125.0		1,119.4	90.0
20		9.0		1,110.4	89.2
16.00		26.0		1,084.4	87.1
12.50		40.0		1,044.4	83.9
10.00		37.0		1,007.4	81.0
6.30		122.0		885.4	71.2
4.75		102.0		783.4	63.0
4.75			500.0	444.4	
2.80		43.0		401.4	56.9
710.00		131.0		270.4	38.3
212.00		175.0		95.4	13.5
75.00		85.0		10.4	1.5
Pan		23.0		12.6	0.0

### MOISTURE CONTENT

Wt. of empty dish	14.0
Wt. of dish + wet soil	50.0
Wt. of dish + dry soil	46.0
Wt. of dry soil	32.0
Moisture	4.0
Moisture content (%)	12.5

# PARTICLE SIZE DISTRIBUTION CHART

Tested by ..... Plotted by ..... Checked by ..... SAMPLE NO. 216  
 Date 25.2.77 Date 25.2.77 Date 26.1.78 REGISTRATION 10087



F - 52

Classification:  $C_u = 3.9$ ,  $C_c = 2.3$ ,  $C_u = 6.98$ ,  $C_c = 0.98$

Amount of material

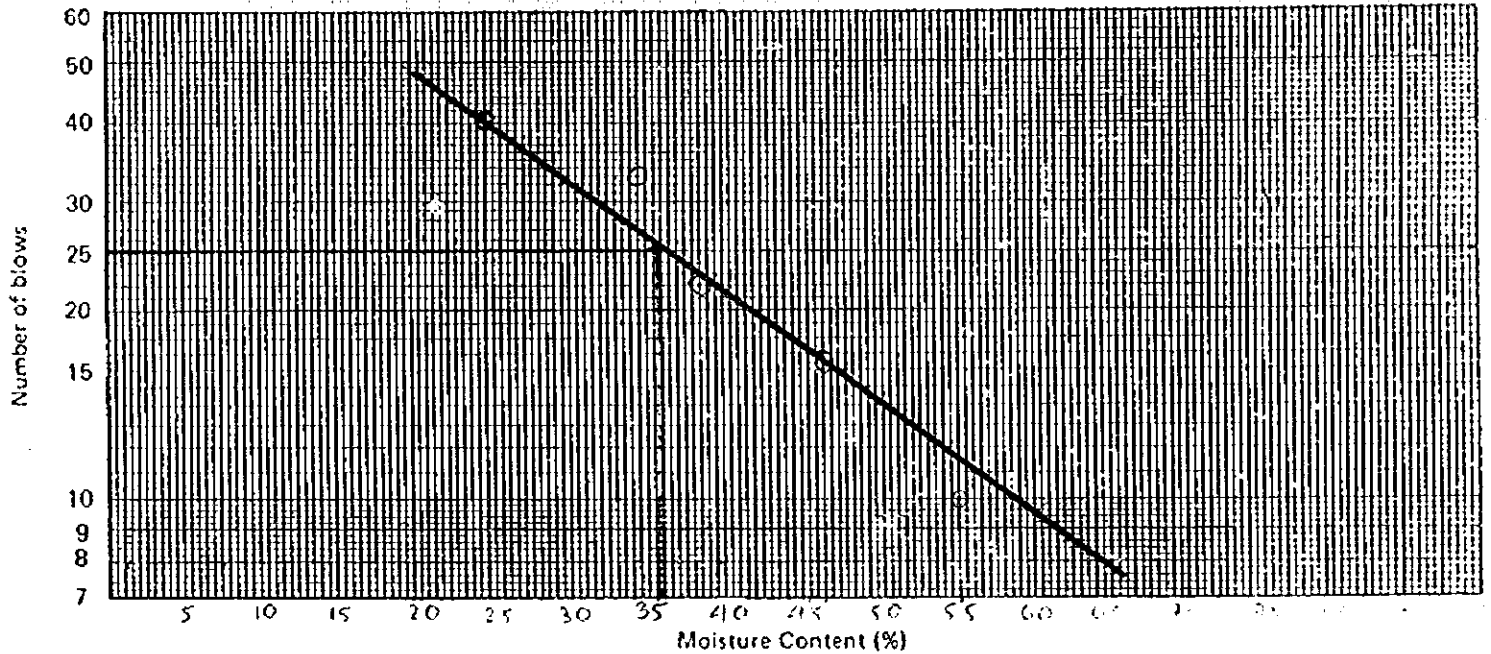


ATTERBERG LIMITS AND LINEAR SHRINKAGE -- MANUAL

(2-5) 1(b)

Tested by KY Computed by KY Checked by HN SAMPLE No. 0.30-0.72  
 Date 24/2/98 Date 25/2/98 Date 26.2.98 REGISTRATION 58

FLOW CHART



LIQUID LIMIT ( $W_L$ )

PLASTIC LIMIT ( $W_p$ )

Blows	45	33	23	19	10				
Dish No.	F	S	K	C	K	K	H	C	
Wet soil + dish	9	65	62	62	63	61	64	65	62
Dry soil + dish	9	55	49	48	47	43	54	52	47
Mass of dish	9	15	12	12	13	11	14	15	12
Moisture	9	10	13	14	16	18	10	13	15
Dry soil	9	40	37	36	34	32	40	37	35
Moisture cont.	%	25.0%	35.1%	38.9	47.1	56.3	25.0	35.1	42.9

SUMMARY

Liquid limit, $W_L$ (From Flow Chart)	%	36.0	
Plastic limit, $W_p$ (average)	%	34.3	
Plasticity index, $I_p$ ( $W_L - W_p$ )		1.7	
Linear shrinkage mould no.			
Decrease in length	mm		
Linear shrinkage, LS		P-53	

INITIAL CONDITIONS

- Air-dried
- At field moisture content

PREPARATION

- Dry sieving only
- Dry sieving with loss of soil to AS Sieve

MATERIAL TESTING LABORATORY  
PUBLIC WORKS DIVISION  
THIMPHU BHUTAN

## SIEVE ANALYSIS TEST

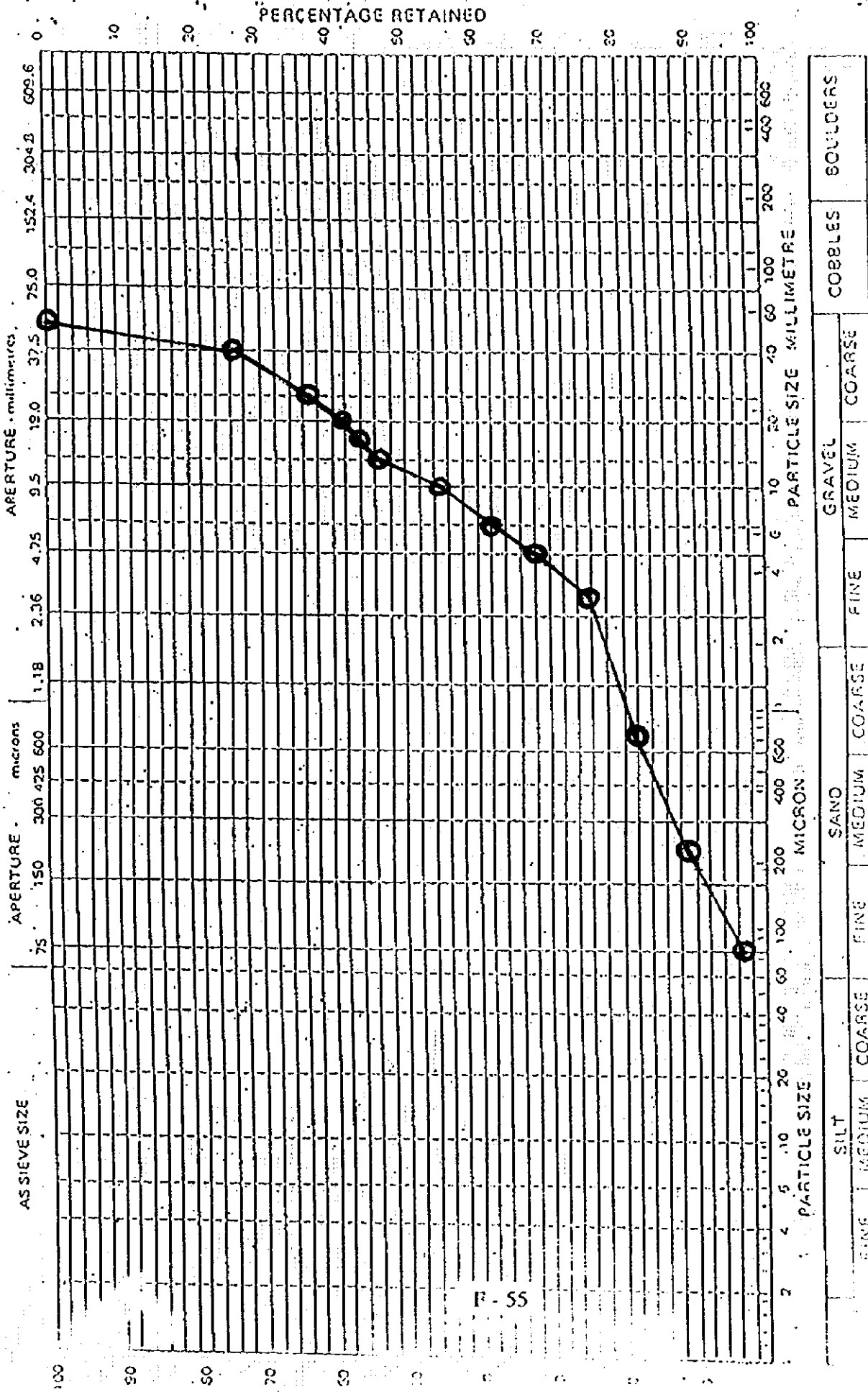
Sample No. 1 (c)		Project: N.H.B.C.		Location: CHAMKHAR	
Depth at: (0.82 m)		Computed by: PD		Company: JICA	
Tested by: KY		Date: 23.2.98		Checked by: HA	
AS Sieve size mm	Individual Weight Retained		Weight Passing		Total Sample % Passing
	Wet	Dry	Wet	Dry	
80					
63					
50			1,417.0	1,280.8	100.0
40		345.0		935.8	73.1
25		125.0		810.8	63.3
20		62.0		748.8	58.5
16.00		24.0		724.8	56.6
12.50		44.0		680.8	53.2
10.00		100.0		580.8	45.3
6.30		87.0		493.8	38.6
4.75		73.0		420.8	32.9
4.75			500.0	451.9	
2.80		116.0		335.9	24.4
710.00		82.0		253.9	18.5
212.00		90.0		163.9	11.9
75.00		120.0		43.9	3.2
Pan		11.0		32.9	2.4

### MOISTURE CONTENT

Wt. of empty dish (X)	20.0
X1 + wet soil	72.0
X1 + dry soil	67.0
Wt. of Dry soil	47.0
Wt. of Water	5.0
Moisture content %	10.6

# PARTICLE SIZE DISTRIBUTION CHART

Tested by KY Plotted by SC Checked by HA SAMPLE NO. 1 (C)  
 Date 29.2.33 Date 21.2.33 Date 27.9.33 REGISTRATION NO. 11938



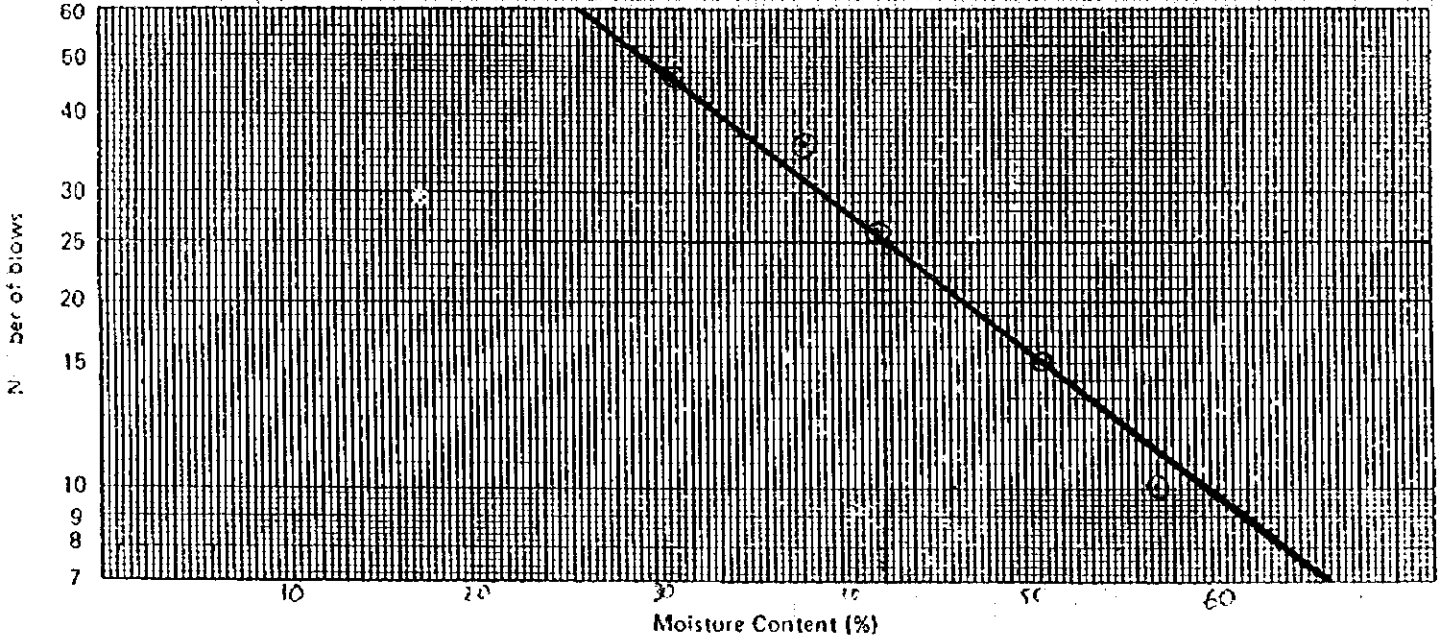
P-55

Classification of material  
 100% of material is retained on 75 microns sieve  
 100% of material is retained on 150 microns sieve  
 100% of material is retained on 300 microns sieve  
 100% of material is retained on 425 microns sieve  
 100% of material is retained on 600 microns sieve  
 100% of material is retained on 1.18 mm sieve  
 100% of material is retained on 2.36 mm sieve  
 100% of material is retained on 4.75 mm sieve  
 100% of material is retained on 9.5 mm sieve  
 100% of material is retained on 19.0 mm sieve  
 100% of material is retained on 37.5 mm sieve  
 100% of material is retained on 75.0 mm sieve  
 100% of material is retained on 152.4 mm sieve  
 100% of material is retained on 304.8 mm sieve  
 100% of material is retained on 609.6 mm sieve

ATTERBERG LIMITS AND LINEAR SHRINKAGE - MANUAL

Tested by ..... Computed by KY ..... Checked by HN ..... LOCATION: CHAMKHAR  
 Date 24/2/98 ..... Date 25/2/98 ..... Date ..... SAMPLE No. 0-72-0-82  
 REGISTRATION 58

FLOW CHART



LIQUID LIMIT ( $W_L$ )

PLASTIC LIMIT ( $W_p$ )

Blows	47	35	26	15	10			
Dish No.	P	N	X	F	E	P	S	N
Wet soil + dish	9	65	65	64	67	64	62	57
Dry soil + dish	9	54	52	50	51	47	53	43
Mass of dish	9	18	18	17	20	17	15	10
Moisture	9	11	13	14	16	17	11	12
Dry soil	9	36	34	33	37	30	36	35
Moisture cont.	%	30.6	38.2	42.4	57.6	58.7	30.6	34.3

SUMMARY

Liquid limit, $W_L$ (From Flow Chart)	%	42.0	
Plastic limit, $W_p$ (average)	%	35.8	
Plasticity index, $I_p$ ( $W_L - W_p$ )		6.2	
Linear shrinkage mould no.			
Decrease in length	mm		
Linear shrinkage, LS	%		

INITIAL CONDITIONS

- Air-dried
- At field moisture content

PREPARATION

- Dry sieving only
- Dry sieving with washing of soil retained on 75  $\mu$ m AS Sieve

MATERIAL TESTING LABORATORY  
PUBLIC WORKS DIVISION  
THIMPHU BHUTAN  
**SIEVE ANALYSIS TEST**

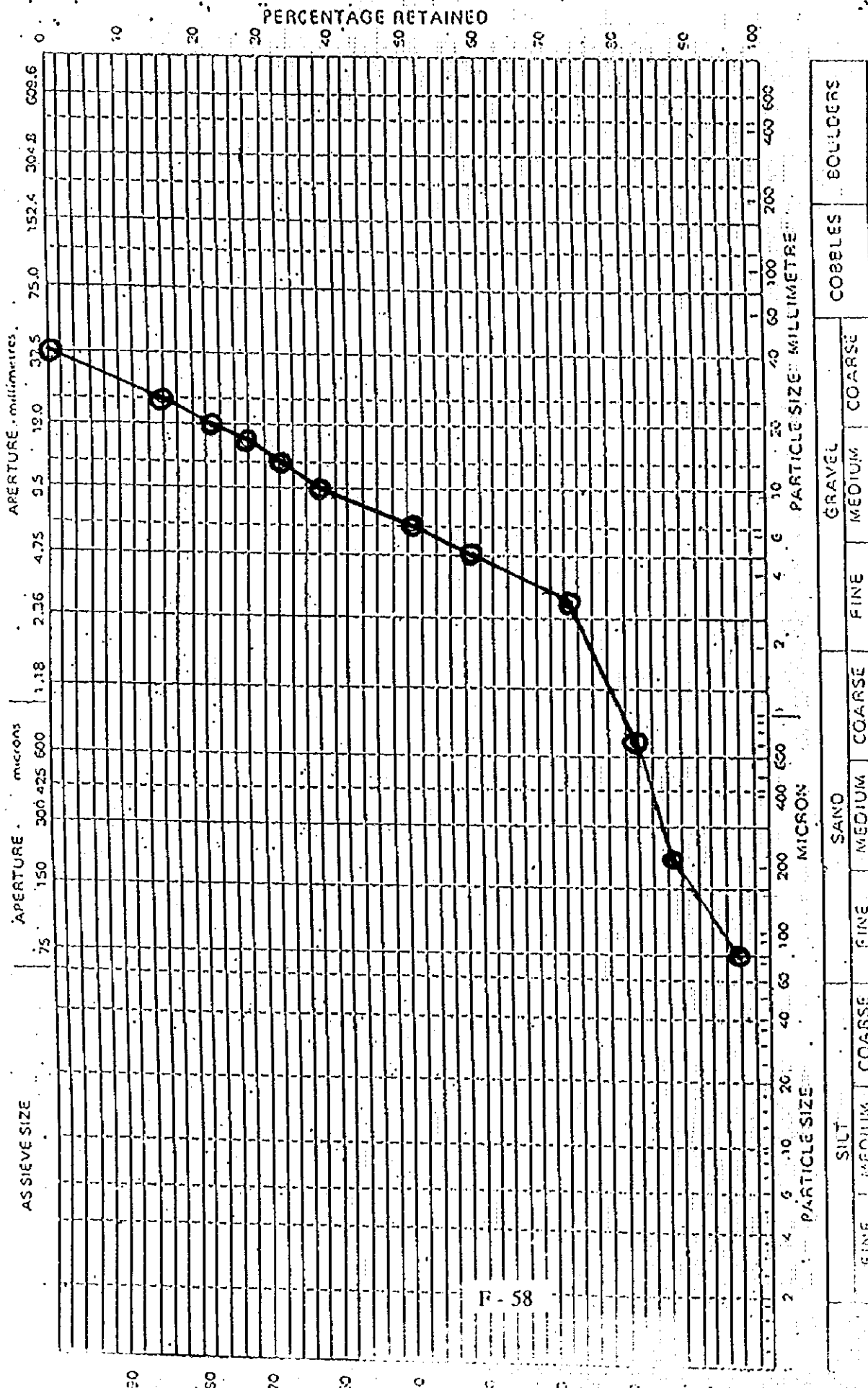
<b>Sample No.2 (a)</b>		<b>Project: N.H.B.C</b>		<b>Location: KURIZAMPA</b>		
<b>Depth at: (0.36 m)</b>		<b>Computed by: PD</b>		<b>Company: JICA</b>		
<b>Tested by: KY</b>		<b>Date: 23.2.98</b>		<b>Checked by: HA</b>		
AS Sieve size mm	Individual Retained	Weight		Weight Passing		Total Sample % Passing
		Wet	Dry	Wet	Dry	
80						
63						
50						
40				1510.00	1,393.8	100.0
25			215.0		1,178.8	84.6
20			103.0		1,075.8	77.2
16.00			72.0		1,003.8	72.0
12.50			45.0		958.8	68.8
10.00			89.0		869.8	62.4
6.30			184.0		685.8	49.2
4.75			109.0		576.8	41.4
4.75				500.0	461.5	
2.80			152.0		309.5	27.8
710.00			101.0		208.5	18.7
212.00			62.0		146.5	13.1
75.00			104.0		42.5	3.8
Pan			20.0		22.5	2.0

**MOISTURE CONTENT**

Dish A	17.0
X1 + wet soil	56.0
X1 + dry soil	53.0
Dry soil	36.0
Moisture	3.0
Moisture content %	8.3

# PARTICLE SIZE DISTRIBUTION CHART

Tested by..... Plotted by..... Checked by HA SAMPLE NO. 2  
 Date 27.2.92 Date 27.2.92 Date 26.2.92 REGISTRATION NO. 50



F - 58

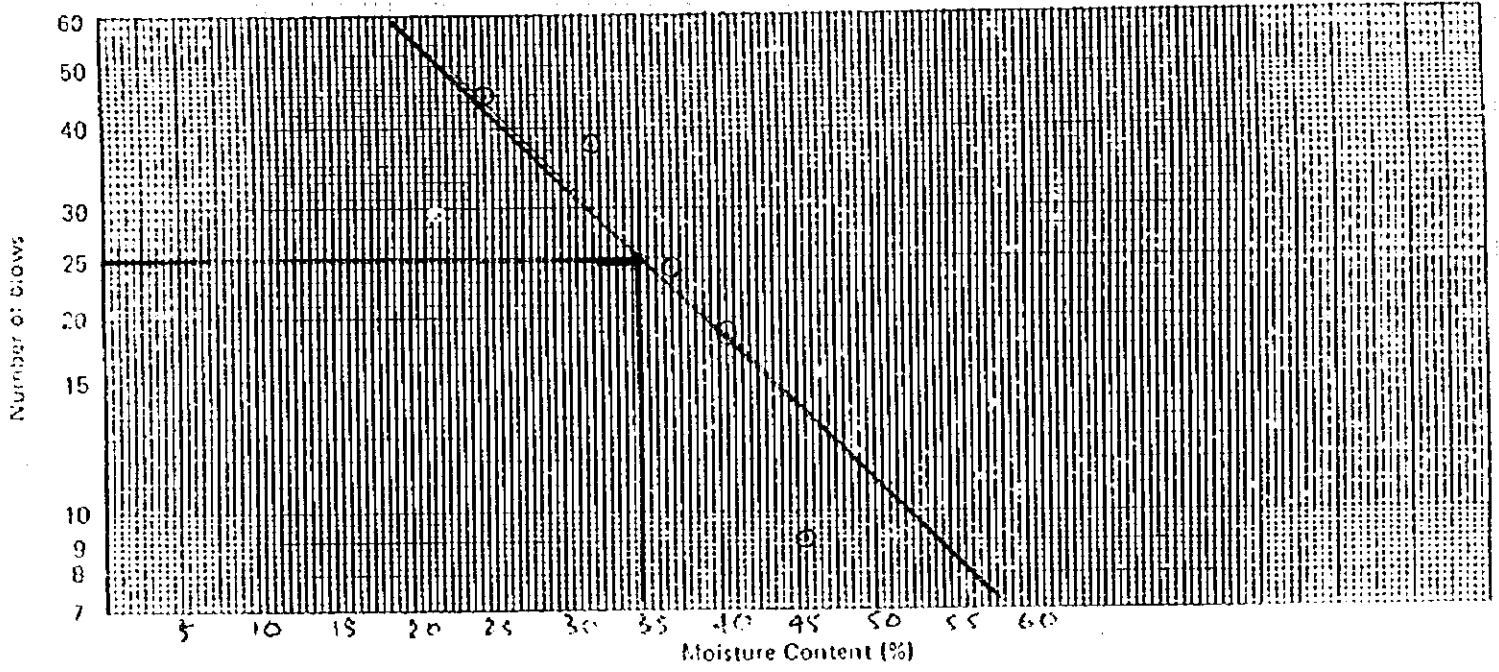
Classification: Sand

Name of material: .....

# ATTERBERG LIMITS AND LIQUID SHRINKAGE -- MANUAL

Test No. 22-2-13      Computed by VJ      Checked by SP      SAMPLE No. 22-2-13  
 Date 22-2-13      Date 22-2-13      Date 22-2-13      REGISTRATION 116-22

## FLOW CHART



### LIQUID LIMIT ( $W_L$ )

### PLASTIC LIMIT ( $W_p$ )

Blows	45	38	24	19	9				
Dish No.	F1	F	K	X	C	H	K	S	
Wet soil / dish	9	60	59	56	59	57	66	55	57
Dry soil / dish	9	51	48	44	46	43	58	44	44
Mass of dish	9	15	14	12	14	12	15	11	12
Moisture	9	9	11	12	13	14	8	11	13
Dry soil	9	36	34	32	32	31	31	33	32
Moisture cont., %		25.0	32.4	37.5	40.6	45.2	25.8	33.3	40.6

### SUMMARY

Liquid limit, $W_L$ (From Flow Chart)	35.0	
Plastic limit, $W_p$ (average)	33.2	
Plasticity index, $I_p$ ( $W_L - W_p$ )	1.8	
Linear shrinkage mould no.		
Moisture content		
Moisture shrinkage, IS	P-59	

### INITIAL CONDITION

- Air-dried
- At field moisture content

### PREPARATION

- Dry sieving
- Dry sieving of soil on AS Sieve

MATERIAL TESTING LABORATORY  
PUBLIC WORKS DIVISION  
THIMPHU BHUTAN  
**SIEVE ANALYSIS TEST**

Sample No. 2 (b)		Project: N.H.B.C.		Location: KURIZAMPA		
Depth at: (0.67 m)		Computed by: PD		Company: JICA		
Tested by: KY		Date: 23.2.98		Checked by: HA		
AS Sieve size mm	Individual Re Wet	Weight retained		Weight Passing		Total Sample % Passing
		Dry	Wet	Wet	Dry	
80						
63						
50						
40				1074.00	964.4	100.0
25		195.0			769.4	79.8
20		26.0			743.4	77.1
16.00		93.0			650.4	67.4
12.50		60.0			590.4	61.2
10.00		50.0			540.4	56.0
6.30		122.0			418.4	43.4
4.75		86.0			332.4	34.5
4.75				500.0	449.0	
2.80		105.0			344.0	26.4
710.00		75.0			269.0	20.6
212.00		51.0			218.0	16.7
75.00		81.0			137.0	10.5
Pan		7.0			130.0	10.0

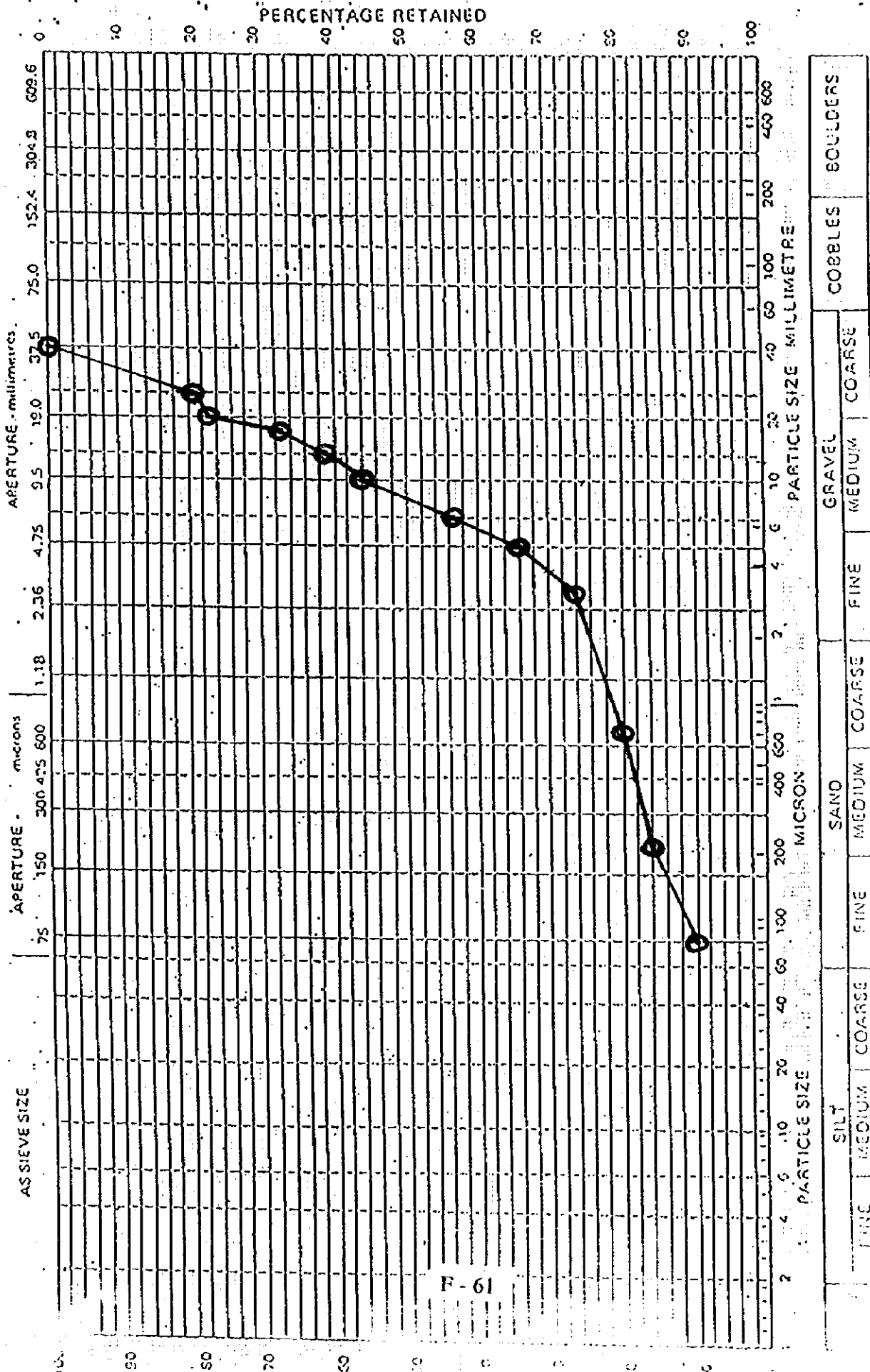
**MOISTURE CONTENT**

Dish A	16.0
X1 + wet soil	65.0
X1 + dry soil	60.0
Dry soil	44.0
Moisture	5.0
Moisture content %	11.4



# PARTICLE SIZE DISTRIBUTION CHART

Tested by KV Plotted by HA Checked by HA SAMPLE NO. 2 (b)  
 Date 23.2.33 Date 24.2.33 Date 25.2.33 REGISTRATION NO. 58

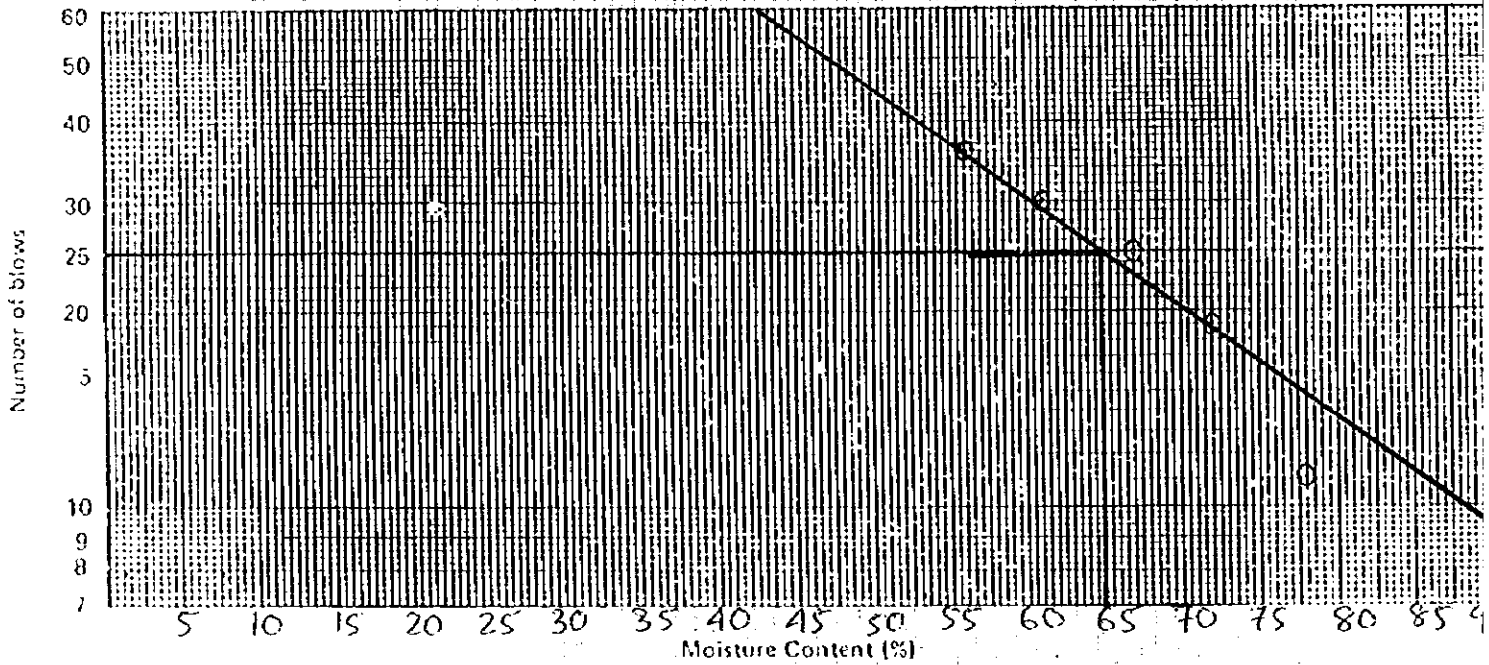


SILT			SAND			GRAVEL			BOULDERS	
FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COBBLES	BOULDERS
0.075	0.425	2.0	0.075	0.425	2.0	2.0	4.75	75.0		
C <sub>60</sub> 14.0	C <sub>60</sub> 14.0	C <sub>60</sub> 14.0	C <sub>60</sub> 14.0	C <sub>60</sub> 14.0	C <sub>60</sub> 14.0	C <sub>60</sub> 14.0	C <sub>60</sub> 14.0	C <sub>60</sub> 14.0		
Classification: C <sub>60</sub> 14.0										

# ATTERBERG LIMITS AND LINEAR SHRINKAGE -- MANUAL

Computed by                      Checked by                      SAMPLE No.                       
 Date                      Date                      REGISTRATION                     

## FLOW CHART



### LIQUID LIMIT ( $W_L$ )

### PLASTIC LIMIT ( $W_p$ )

Blows	35	30	25	19	11				
Dish No.	F	P	N	E	X	K	F	C	
Wet soil (dish)	9	70	68	68	67	67	51	50	51
Dry soil (dish)	9	52	49	48	46	45	38	37	36
Mass of dish	9	20	18	18	17	17	12	14	12
Moisture	9	18	19	20	21	22	12	13	14
Dry soil	9	32	31	30	29	28	26	23	24
Moisture cont.	%	56.3	61.3	66.7	72.4	78.6	46.2	56.5	58.3

### SUMMARY

Liquid limit, $W_L$ (From Flow Chart)	65.0	
Plastic limit, $W_p$ (average)	53.7	
Shrinkage index, $I_p$ ( $W_L - W_p$ )	11.3	
Shrinkage mould no.		
Shrinkage length		
Shrinkage, %		

### INITIAL CONDITIONS

- Air-dried
- At field moisture content

### PREPARATION

- Dry sieving
- Dry sieving to 75  $\mu$  sieve
- AS Sieve

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# SIEVE ANALYSIS TEST

<b>Sample No. 2 (c)</b>		<b>Project: N.H.B.C</b>		<b>Location: KURIZAMPA</b>	
<b>Depth at: (0.67 m)</b>		<b>Computed by: PD</b>		<b>Company: JICA</b>	
<b>Tested by: KY</b>		<b>Date: 23.2.98</b>		<b>Checked by: HA</b>	
AS Sieve size mm	Individual Retained	Weight		Total Sample	
		Wet	Dry	Wet	Dry
80					
63					
50					
40				1598.00	1,507.5
25			172.0		1,335.5
20			131.0		1,204.5
16.00			127.0		1,077.5
12.50			62.0		1,015.5
10.00			122.0		893.5
6.30			126.0		767.5
4.75			70.0		697.5
4.75				500.0	471.7
2.80			117.0		354.7
710.00			105.0		249.7
212.00			55.0		194.7
75.00			145.0		49.7
Pan			10.0		39.7
					100.0
					86.6
					79.9
					71.5
					67.4
					59.3
					50.9
					46.3
					34.8
					24.5
					19.1
					4.9
					3.9

**MOISTURE CONTENT**

Dish A	17.0
X1 + wet soil	70.0
X1 + dry soil	67.0
Dry soil	50.0
Moisture	3.0
Moisture content %	6.0

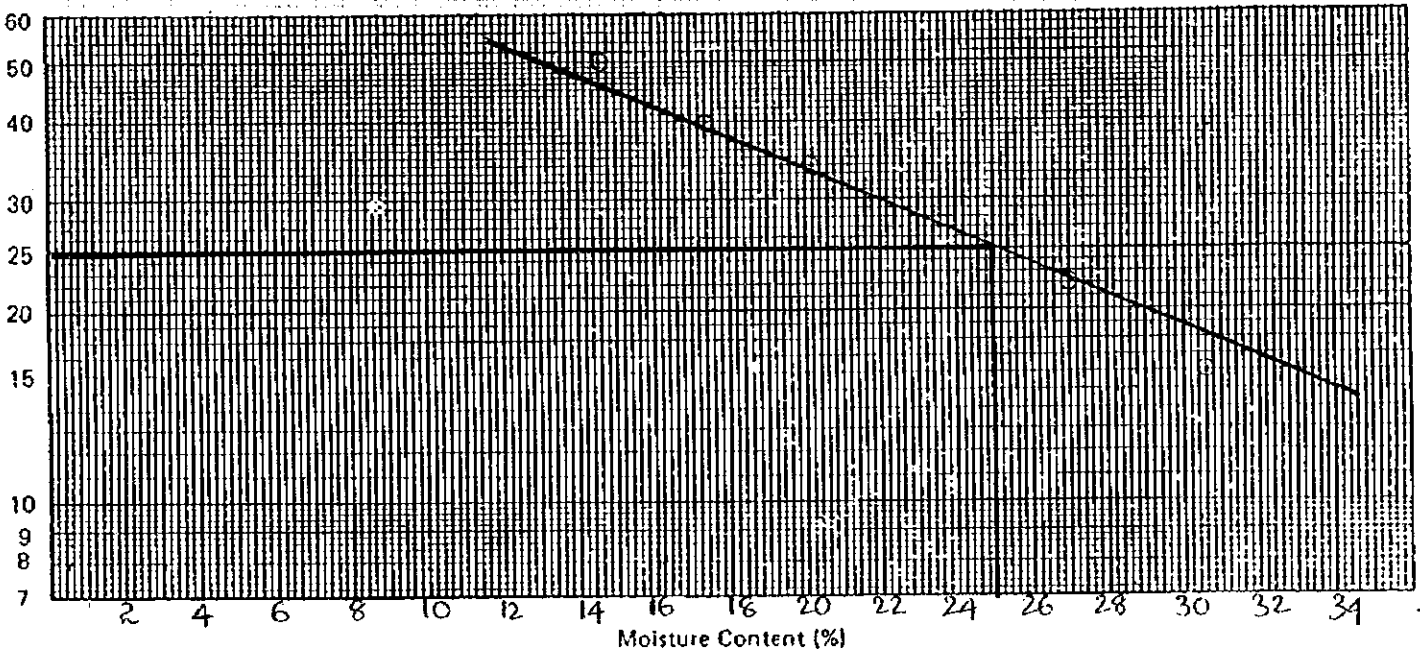


ATTERBERG LIMITS AND LINEAR SHRINKAGE - MANUAL

25

Tested by KY Computed by PD Checked by HA SAMPLE No. ....  
 Date 25.2.98 Date 26.2.98 Date 26.2.98 REGISTRATION No. 98

FLOW CHART



LIQUID LIMIT ( $W_L$ )

PLASTIC LIMIT ( $W_p$ )

Blows	50	40	34	22	15				
Dish No.	P	S	X	F	F	K	S	H	
Wet soil + dish	9	65	63	63	62	64	60	61	60
Dry soil + dish	9	59	56	55	52	53	52	54	53
Mass of dish	9	18	16	16	15	17	11	12	15
Moisture	9	6	7	8	10	11	8	7	7
Dry soil	9	41	40	39	37	36	41	42	38
Moisture cont.	%	14.6	17.5	20.5	27.0	30.6	19.5	16.7	18.4

SUMMARY

Liquid limit, $W_L$ (From Flow Chart)	%	25.0	
Plastic limit, $W_p$ (average)	%	18.2	
Plasticity index, $I_p$ ( $W_L - W_p$ )		6.8	
Linear shrinkage mould no.			
Decrease in length	mm		
Linear shrinkage, LS	%		P-65

INITIAL CONDITIONS

- Air-dried  
 At field moisture content

PREPARATION

- Dry sieving only  
 Dry sieving with washing of soil retained on 75  $\mu$ m AS Sieve

No.

MATERIAL TESTING LABORATORY  
PUBLIC WORKS DIVISION  
THIMPHU BHUTAN

# SIEVE ANALYSIS TEST

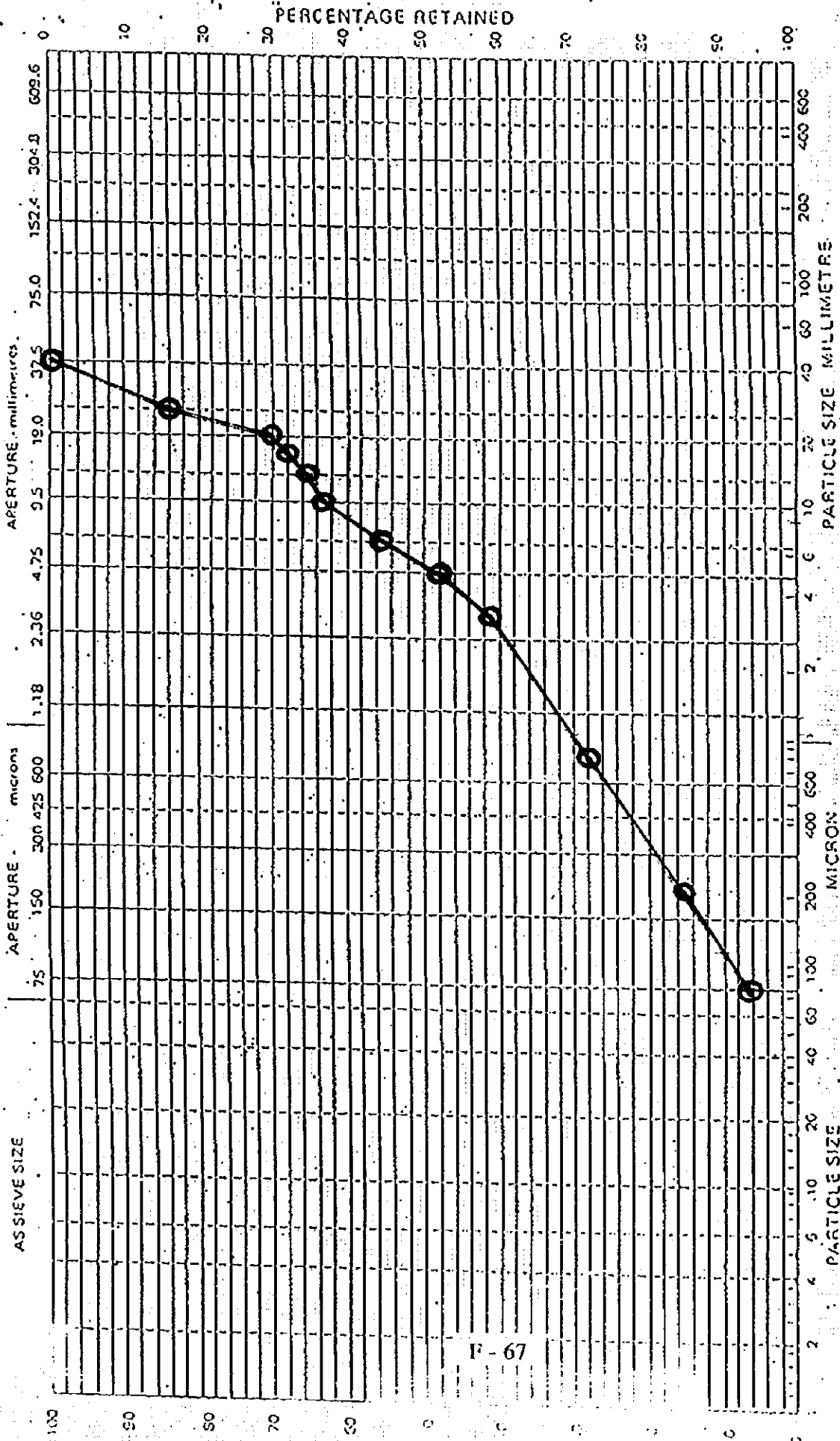
Sample No. 4 (a)		Project: N.H.B.C		Location: BJEEZAM	
Depth at: (1.0 m)		Computed by: PD		Company: JICA	
Tested by: KY		Date: 26.1.98		Checked by: HA	
AS Sieve size mm	Individual Weight Retained		Weight Passing		Total Sample % Passing
	Wet	Dry	Wet	Dry	
80					
63					
50					
40			1500.00	1,431.8	100.0
25		220.0		1,211.8	84.6
20		202.0		1,009.8	70.5
16.00		24.0		985.8	68.9
12.50		55.0		930.8	65.0
10.00		27.0		903.8	63.1
6.30		117.0		786.8	55.0
4.75		87.0		699.8	48.9
4.75			500.0	477.3	
2.80		74.0		403.3	41.3
710.00		127.0		276.3	28.3
212.00		130.0		146.3	15.0
75.00		90.0		56.3	5.8
Pan		20.0		36.3	3.7

### MOISTURE CONTENT

Wt. of empty dish	19.0
Wt. of dish + wet soil	63.0
Wt. of dish + dry soil	61.0
Wt. of dry soil	42.0
Moisture	2.0
Moisture content (%)	4.8

# PARTICLE SIZE DISTRIBUTION CHART

Tested by RS Plotted by SS Checked by NA SAMPLE NO. 1 (A)  
 Date 20.1.73 Date 29.1.73 Date 25.2.73 REGISTRATION NO. 53



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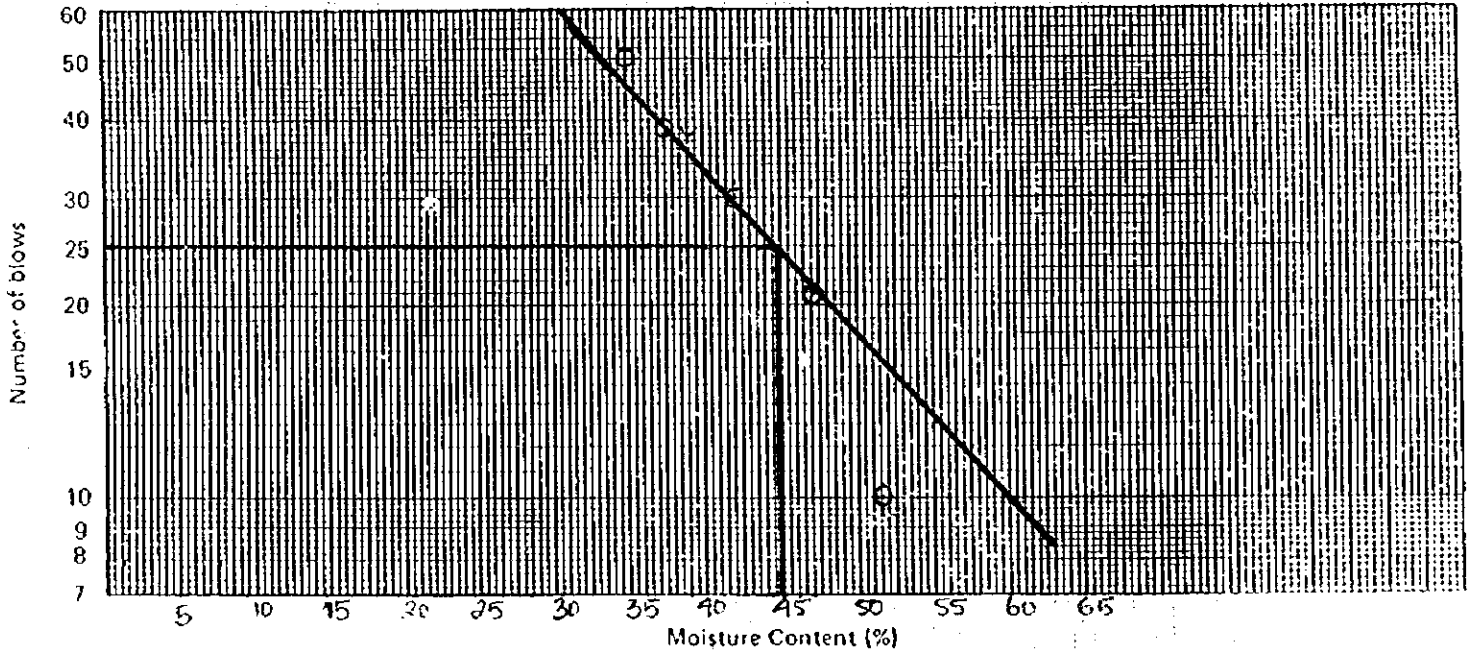
SILT		SAND		GRAVEL		COBBLES		BOULDERS	
FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE
0	0	0	0	0	0	0	0	0	0

Classification of material: Clayey Silty Sand  
 (Based on U.S. Bureau of Reclamation Classification)

ATTERBERG LIMITS AND LINEAR SHRINKAGE - MANUAL

Tested by ..... Computed by ..... Checked by ..... SAMPLE No. 4 (1)  
 Date 24.2.78 Date 25.2.78 Date 26.2.78 REGISTRATION NO. 58

FLOW CHART



LIQUID LIMIT ( $W_L$ )

PLASTIC LIMIT ( $W_p$ )

		50	39	30	21	10			
Blows									
Dish No.		F	N	E	X	P	P	K	P
Wet soil + dish	g	70	68	67	67	67	68	61	68
Dry soil + dish	g	57	54	52	51	50	55	48	54
Mass of dish	g	20	18	17	17	17	18	11	18
Moisture	g	13	14	15	16	17	13	13	14
Dry soil	g	37	36	35	34	33	37	37	36
Moisture cont.	%	35.2	38.9	42.9	47.1	51.5	35.1	35.1	38.9

SUMMARY

Liquid limit, $W_L$ (From Flow Chart)	%	45.0	
Plastic limit, $W_p$ (average)	%	36.4	
Plasticity index, $I_p$ ( $W_L - W_p$ )		8.6	
Linear shrinkage mould no.			
Decrease in length	mm		
Linear shrinkage, LS	%		

INITIAL CONDITIONS

- Air-dried
- At field moisture content

PREPARATION

- Dry sieved
- Dry sieved of soil per AS Sieve



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**SIEVE ANALYSIS TEST**

Sample No. 4 (b)		Project: N.H.B.C		Location: BJEEZAM	
Depth at: (2.0 m)		Date: 26.1.98		Company: JICA	
Tested by: KY		Computed by: PD		Checked by: HA	
AS Sieve size mm	Individual Weight Retained		Weight Passing		Total Sample % Passing
	Wet	Dry	Wet	Dry	
80					
63			1500.00	1,462.5	100.0
50		206.0		1,256.5	85.9
40		68.0		1,188.5	81.3
25		174.0		1,014.5	69.4
20		74.0		940.5	64.3
16.00		77.0		863.5	59.0
12.50		67.0		796.5	54.5
10.00		88.0		708.5	48.4
6.30		117.0		591.5	40.4
4.75		92.0		499.5	34.2
4.75			500.0	487.5	
2.80		32.00		455.5	31.9
710.00		140.0		315.5	22.1
212.00		140.0		175.5	12.3
75.00		120.0		55.5	3.9
Pan		21.0		34.5	2.4

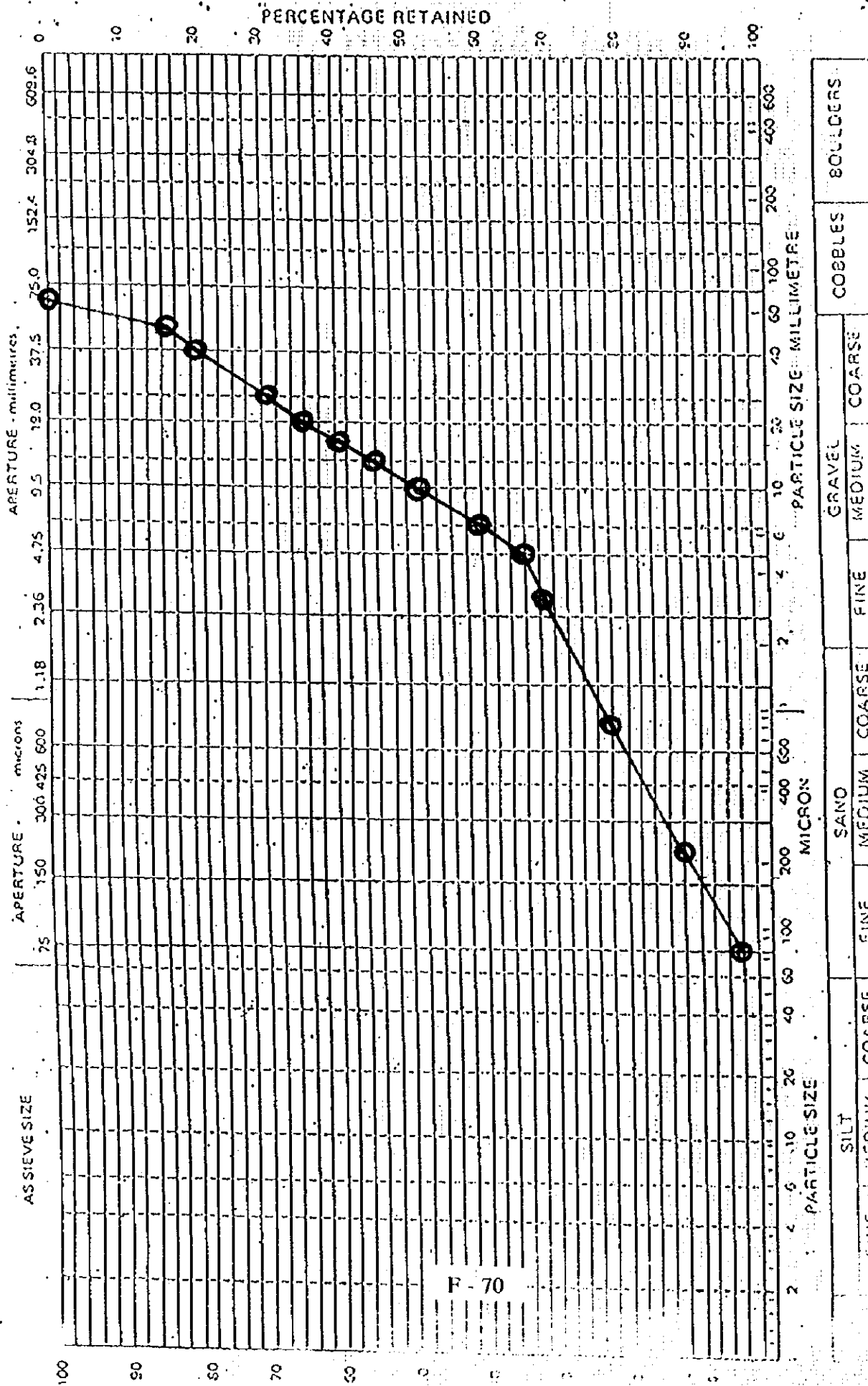
MOISTURE CONTENT

Wt. of empty dish (X)	20.0
X + wet soil	60.0
X + dry soil	59.0
Wt. of Dry soil	39.0
Wt. of Water	1.0
Moisture content %	2.6

# PARTICLE SIZE DISTRIBUTION CHART

Tested by ..... Plotted by ..... Checked by ..... SAMPLE NO. ....

Date 2.1.33 Date 24.2.33 Date 25.2.33 REGISTRATION NO. 15.83



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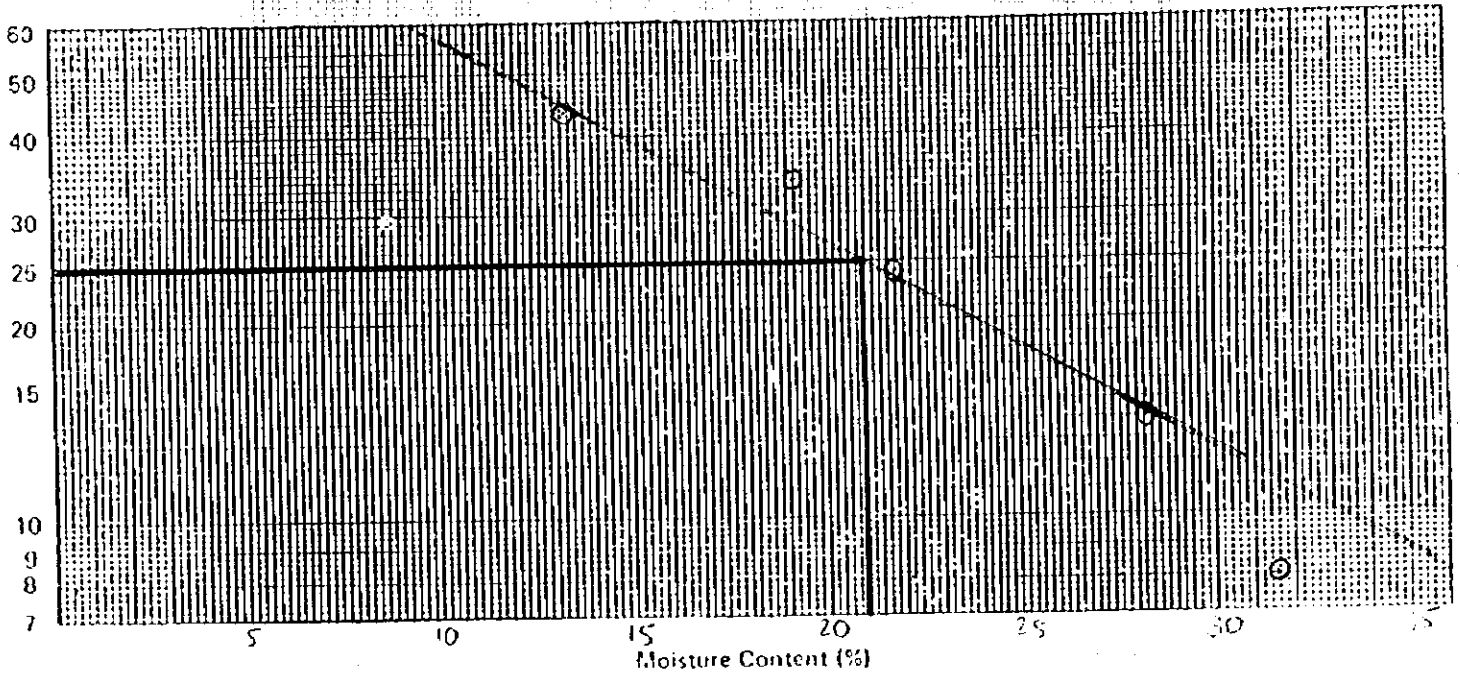
Classification: 2.5 mm to 0.075 mm

Name of material: .....

# ATTERBERG LIMITS AND LIQUID SHRINKAGE - MANUAL

Computed by                      Checked by                      SAMPLE No.                       
 Date 23.2.2008 Date                      REGISTRATION ID.                     

## FLOW CHART



### LIQUID LIMIT ( $W_L$ )

### PLASTIC LIMIT ( $W_p$ )

	15	34	24	13	8				
Blows	15	34	24	13	8				
Dish No.	X	X	K	L	Y	H	J	H	
Wet soil (dish)	9	65	64	62	63	65	64	60	
Dry soil (dish)	9	59	56	53	52	59	56	56	
Mass of dish	9	15	14	12	13	15	14	10	
Moisture	9	6	8	9	11	6	8	10	
Dry soil	9	44	42	41	39	44	42	40	
Moisture cont.	%	13.3	19.2	21.9	28.2	31.5	13.3	19.1	25.0

### SUMMARY

Liquid limit, $W_L$ (From Flow Chart)	21.0	
Plastic limit, $W_p$ (average)	19.1	
Plasticity index, $I_p$ ( $W_L - W_p$ )	1.9	
Linear shrinkage mould no.		
Shrinkage in length		
Shrinkage, IS	F-71	

### INITIAL CONDITIONS

- Air-dried
- At field moisture content

### PREPARATION

- Dry sieved
- Dry sieved of soil retained on AS Sieve

MATERIAL TESTING LABORATORY  
PUBLIC WORKS DIVISION  
THIMPHU BHUTAN  
**SIEVE ANALYSIS TEST**

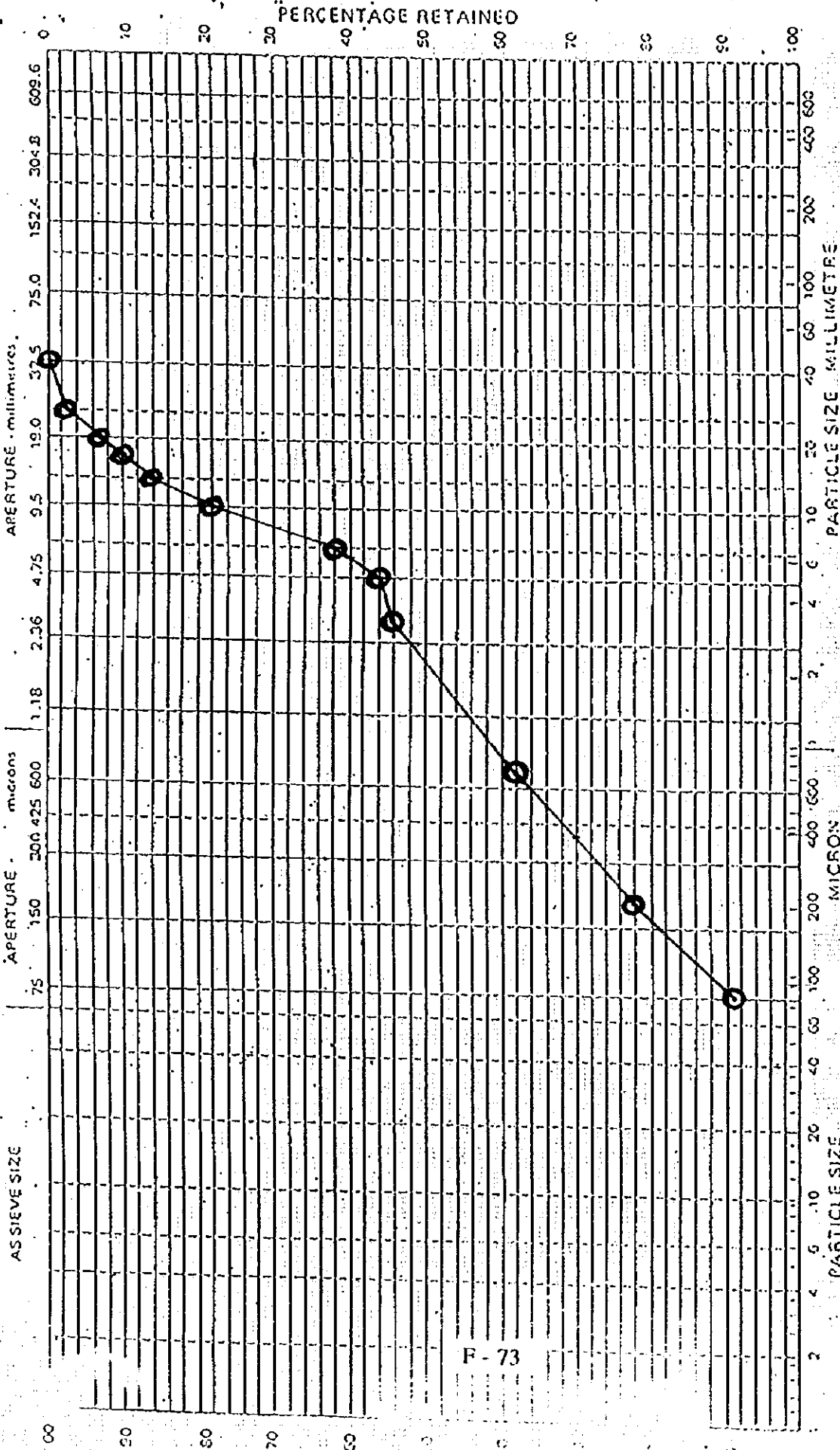
<i>Sample No. 4 (c)</i>		<i>Project: N.H.B.C</i>		<i>Location: BJEEZAM</i>	
<i>Depth at: (2.45 m)</i>		<i>Computed by: PD</i>		<i>Company: JICA</i>	
<i>Tested by: KY</i>		<i>Date: 26.1.98</i>		<i>Checked by: HA</i>	
AS Sieve size mm	Individual Weight Retained		Weight Passing		Total Sample % Passing
	Wet	Dry	Wet	Dry	
80					
63					
50					
40			1400.00	1,353.3	100.0
25		30.0		1,323.3	97.8
20		54.0		1,269.3	93.8
16.00		48.0		1,221.3	90.2
12.50		52.0		1,169.3	86.4
10.00		103.0		1,066.3	78.8
6.30		216.0		850.3	62.8
4.75		80.0		770.3	56.9
4.75			500.0	483.3	
2.60		23.0		460.3	54.2
710.00		116.0		344.3	40.6
212.00		156.0		188.3	22.2
75.00		110.0		78.3	9.2
Pan		44.0		34.3	4.0

**MOISTURE CONTENT**

Wt. of empty dish	20.0
Wt. of dish + wet soil	50.0
Wt. of dish + dry soil	49.0
Wt. of dry soil	29.0
Moisture	1.0
Moisture content (%)	3.4

# PARTICLE SIZE DISTRIBUTION CHART

Tested by ..... Plotted by ..... Checked by ..... SAMPLE NO. ....  
 Date ..... Date ..... Date ..... REGISTRATION 114



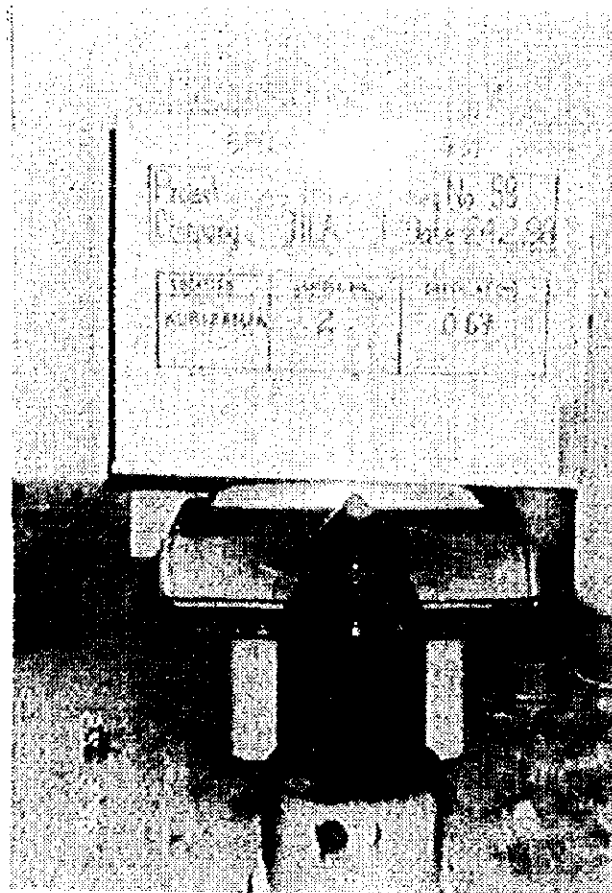
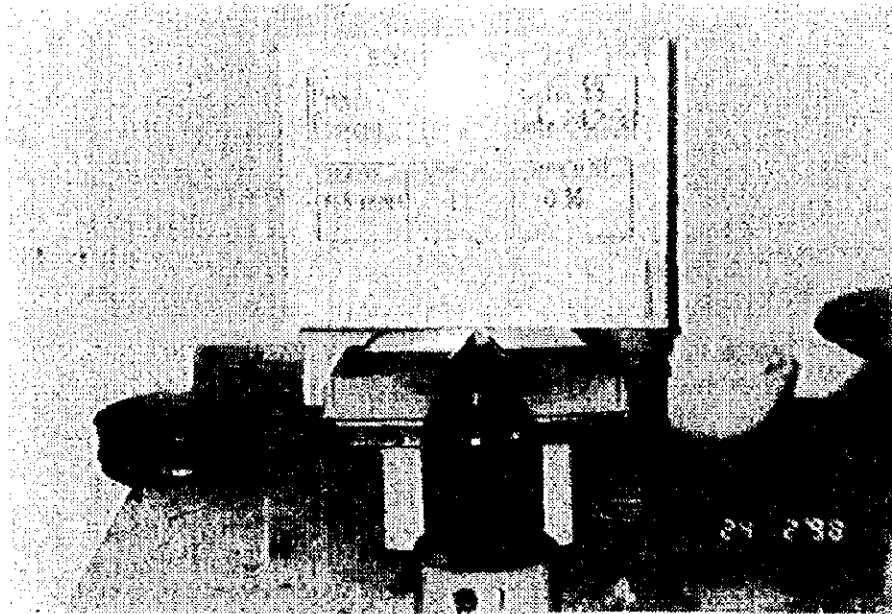
F-73

SILT			SAND			GRAVEL			COBBLES			BOULDERS		
FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Classification of material

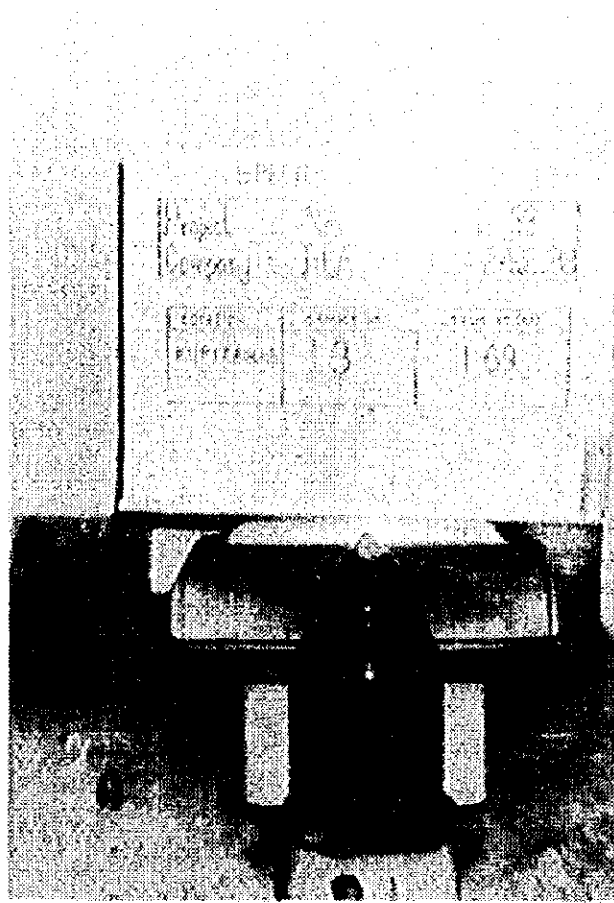
# Specific Gravity Test

Kurizampa

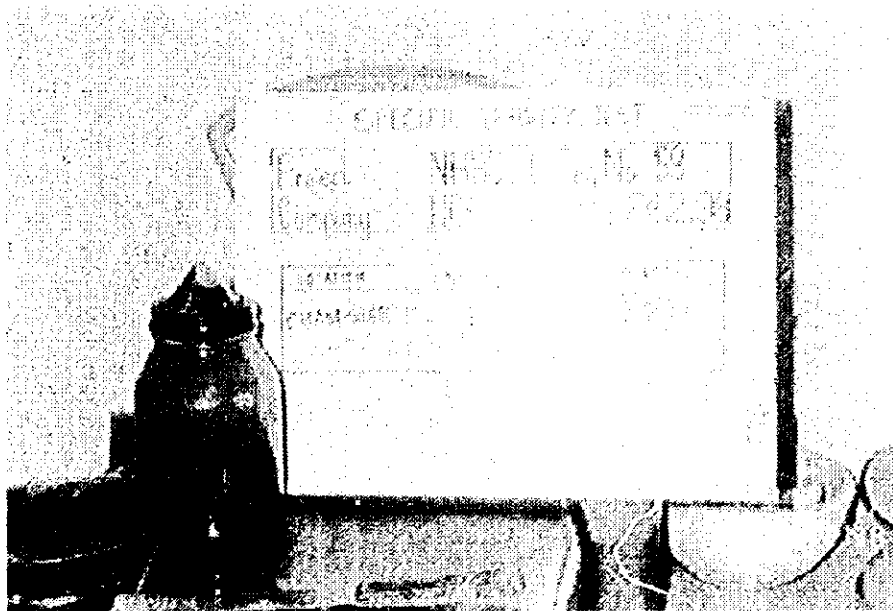


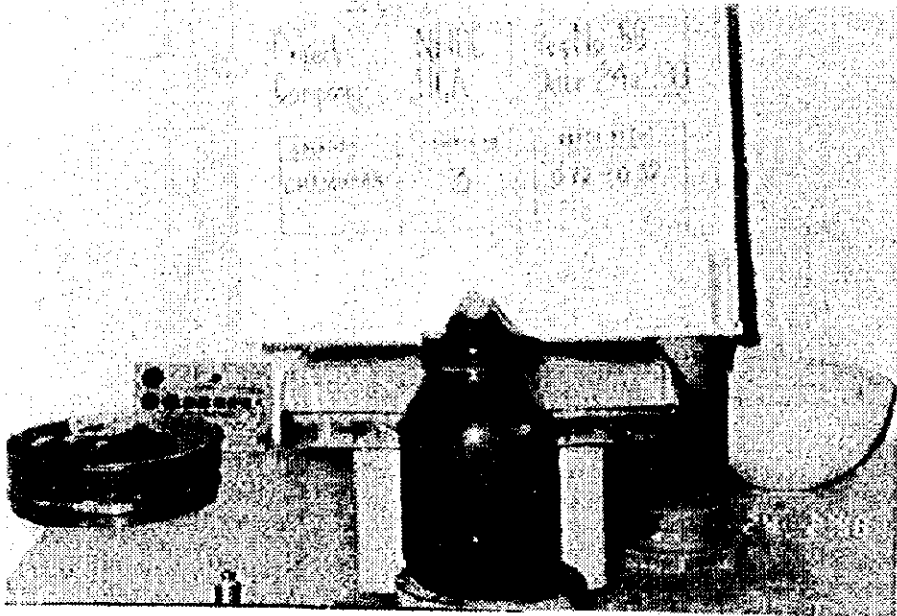
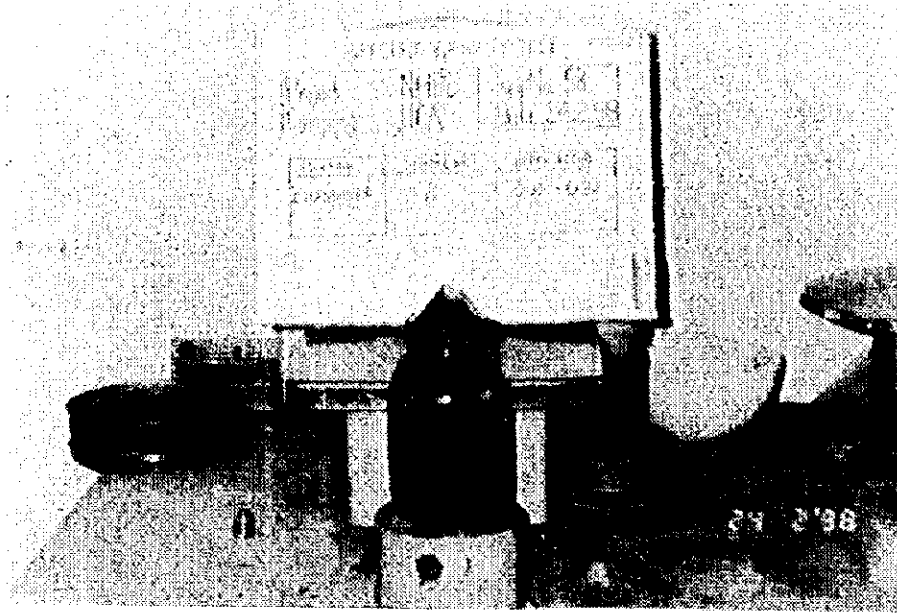
# Specific Gravity Test

Kurizampa



Chamkar







Bjee

*SPECIFIC GRAVITY TEST*

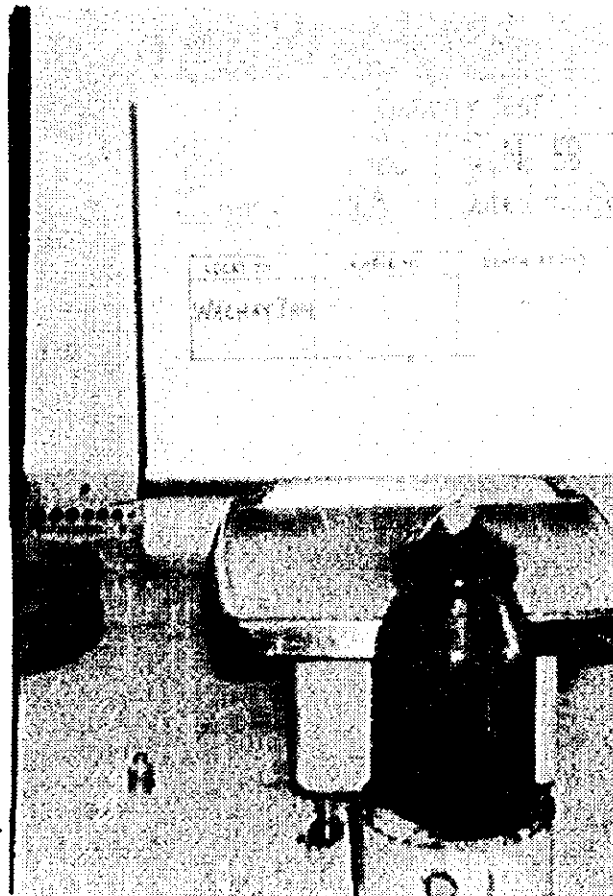
Project	NIHC	Req No. 58
Company	JICA	Date: 26.1.98

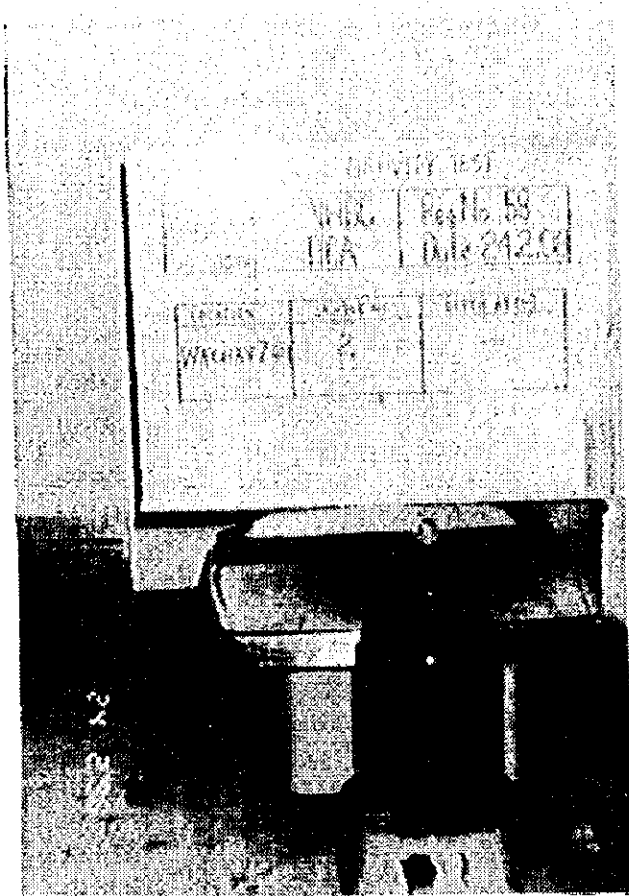
  

LOCATION	SAMPLE NO.	DEPTH AT (m)
BJEE	1	1.0
	2	2.0
	3	2.45

Remarks → Unsufficient sample for above test, therefore the test was not conducted.

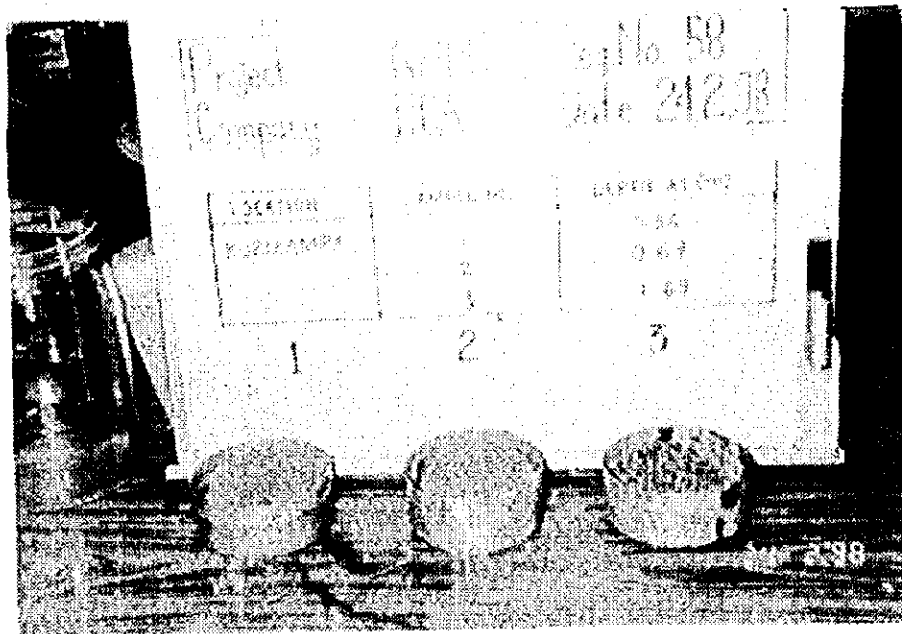
Wachy Zam



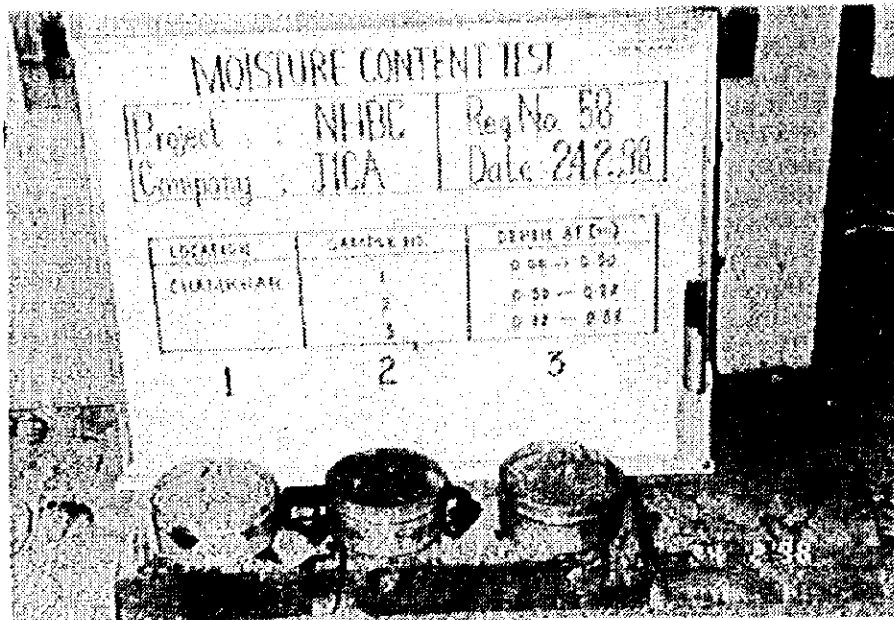


Moisture Content

Kurizampa



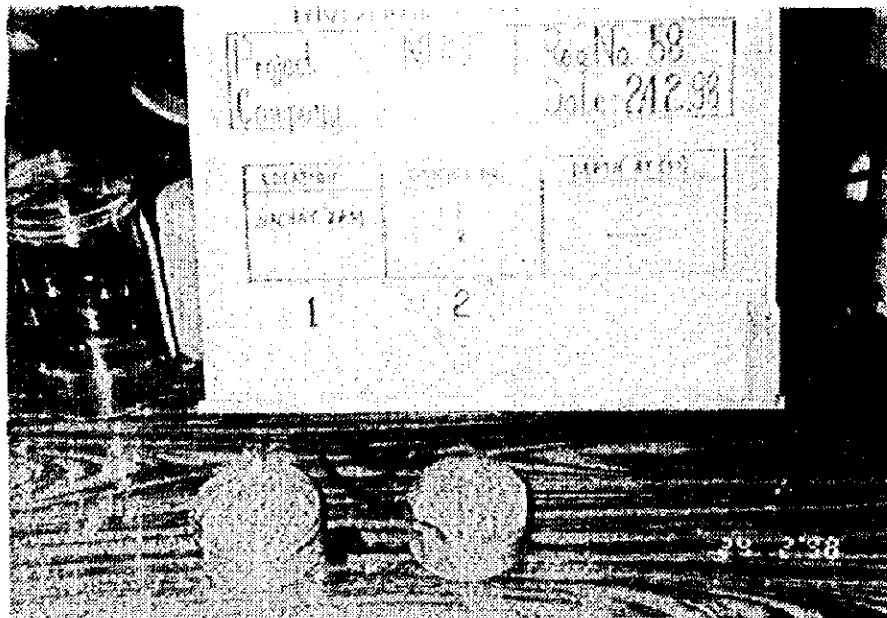
Chamkar



Bjee



Wachy Zam

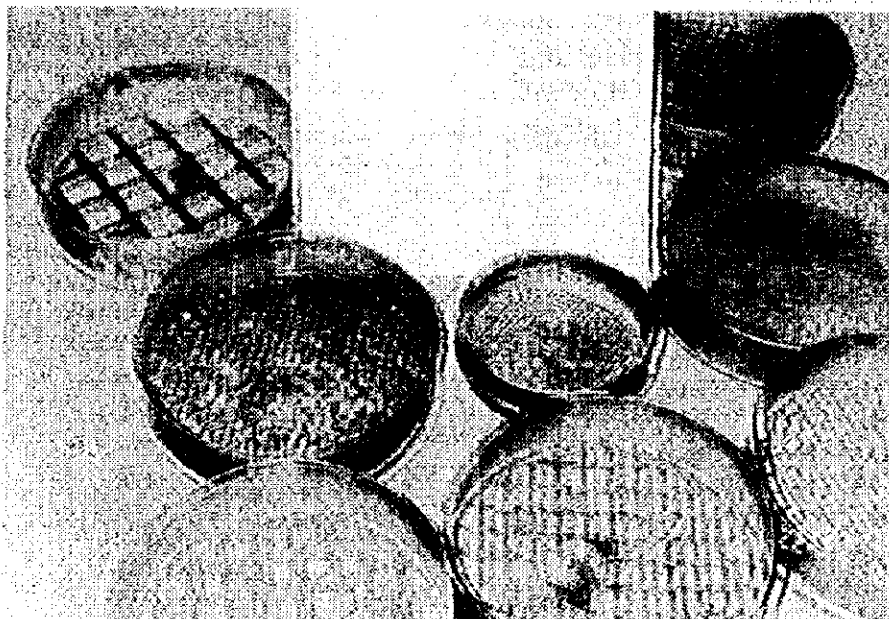


**Grading Test (Sieve Analysis Test )**

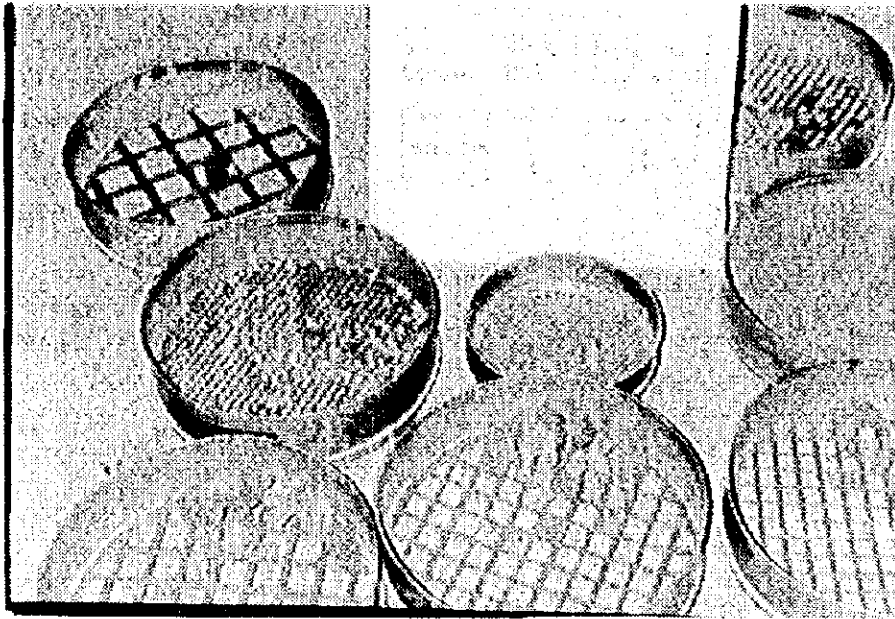
**Kurizampa**



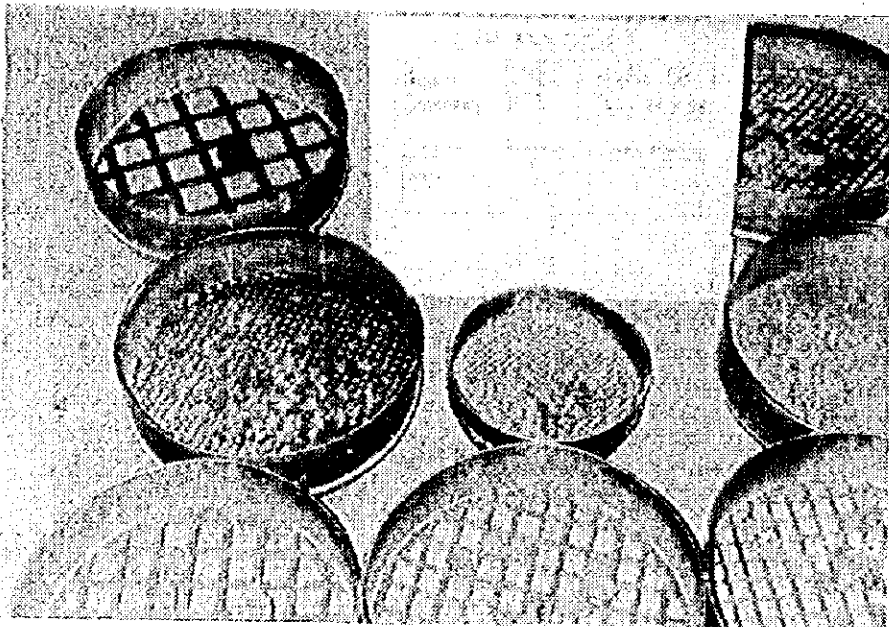
**Chamkar**



Bjee

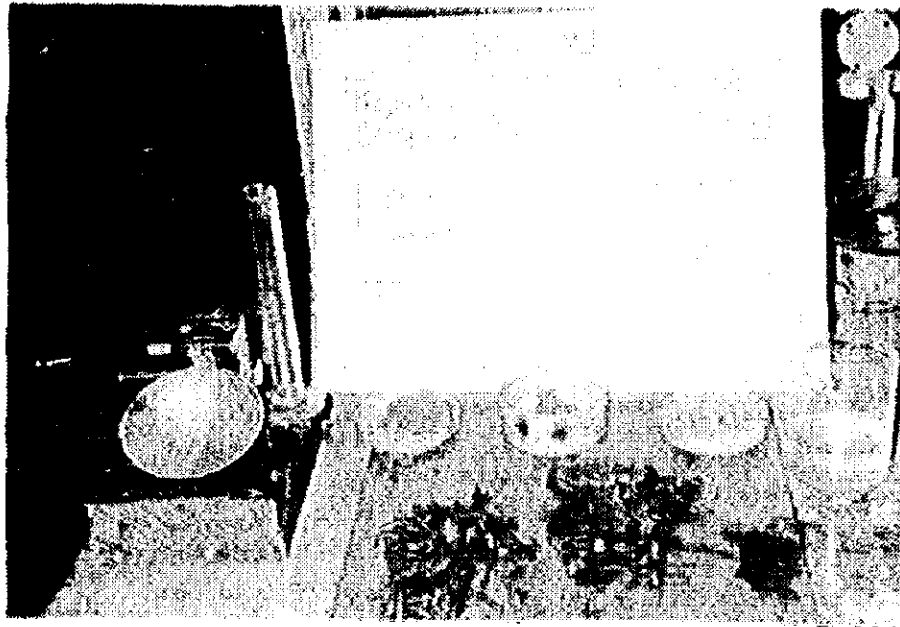


Wachy Zam

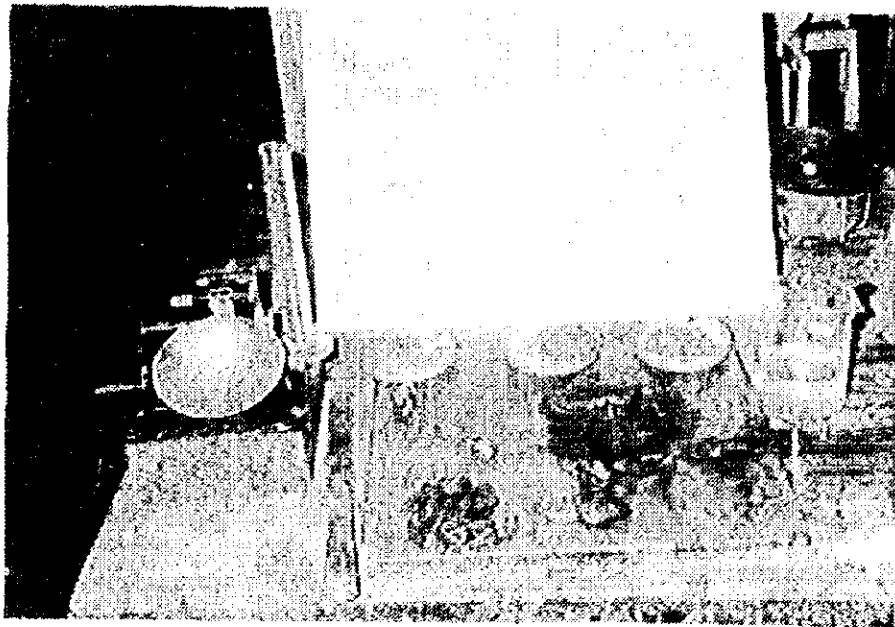


# Liquid and Plastic Limit Test (Atterberg Limit)

Kurizampa



Chamkar



Bjee

