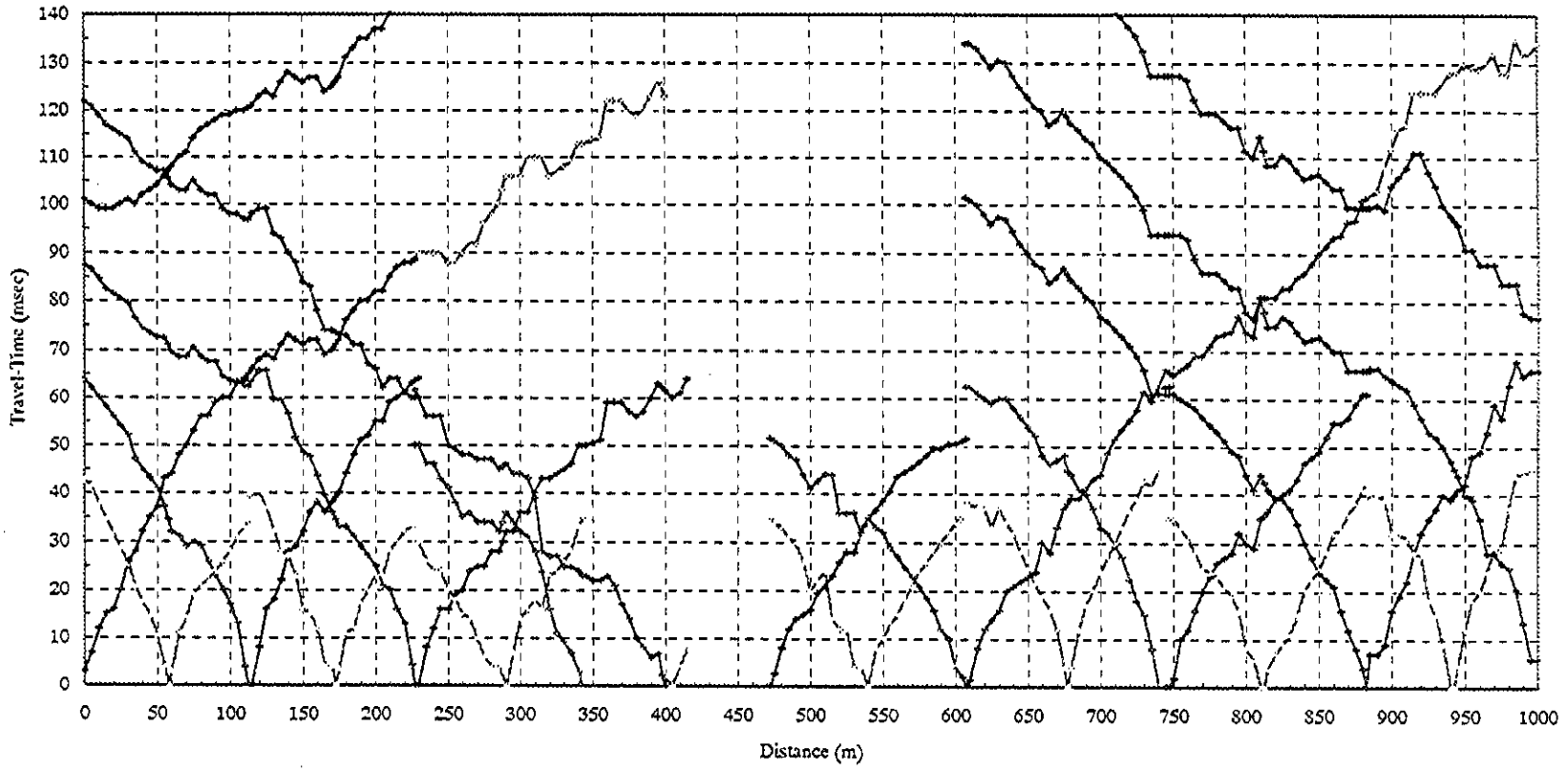
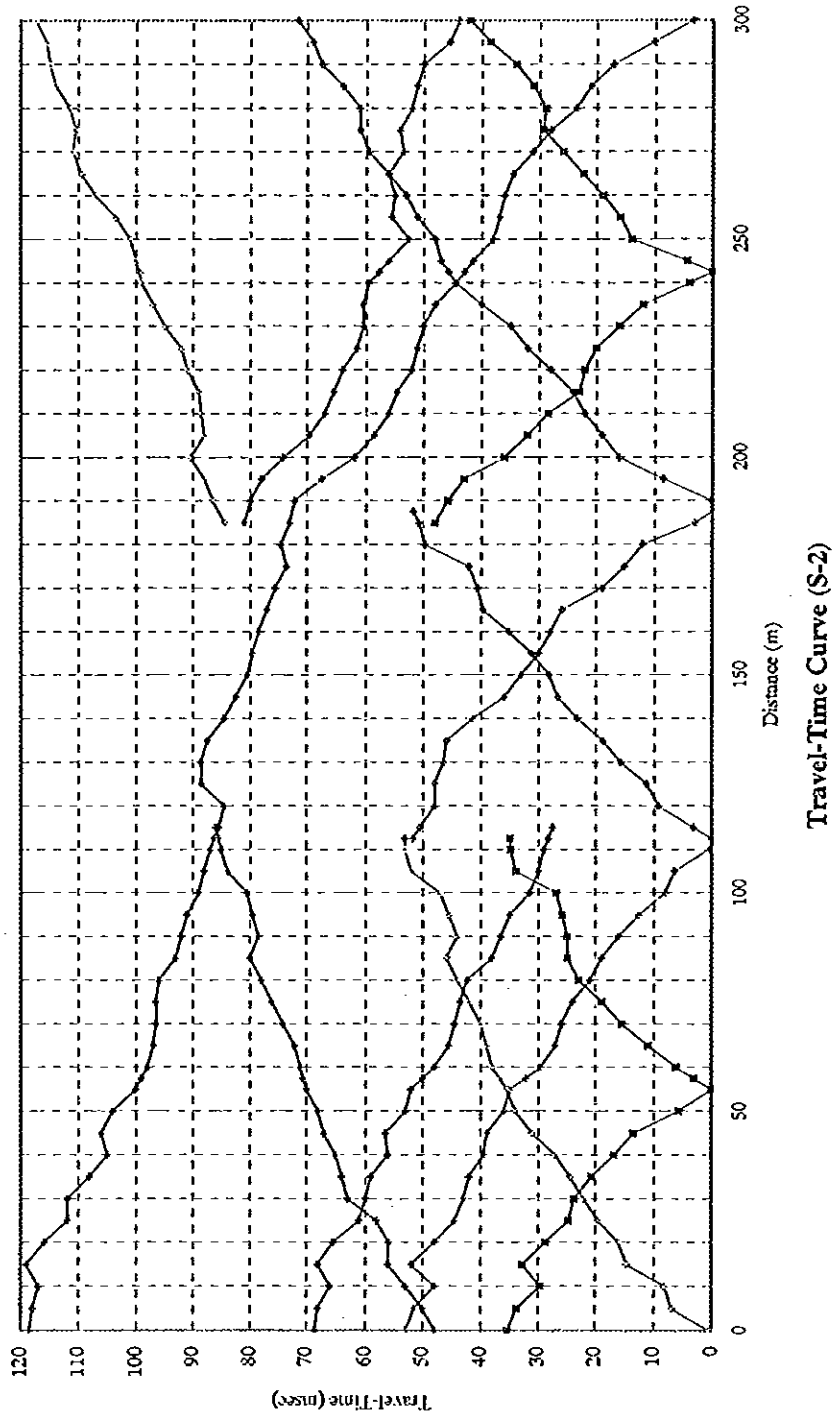
GE3.

SEISMIC REFRACTION PROSPECTING, TRAVEL-TIME CURVE

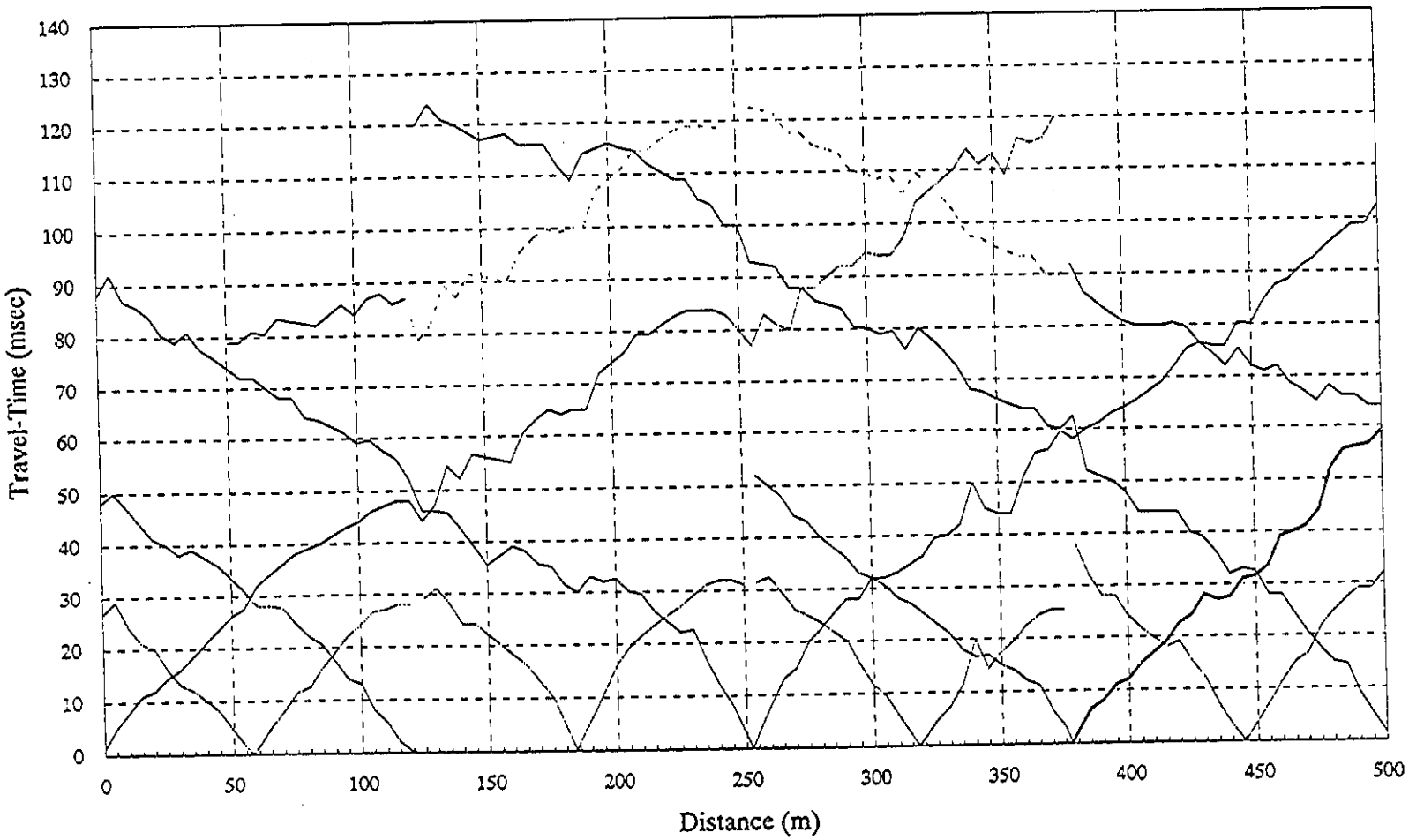


Travel-Time Curve (S-1)

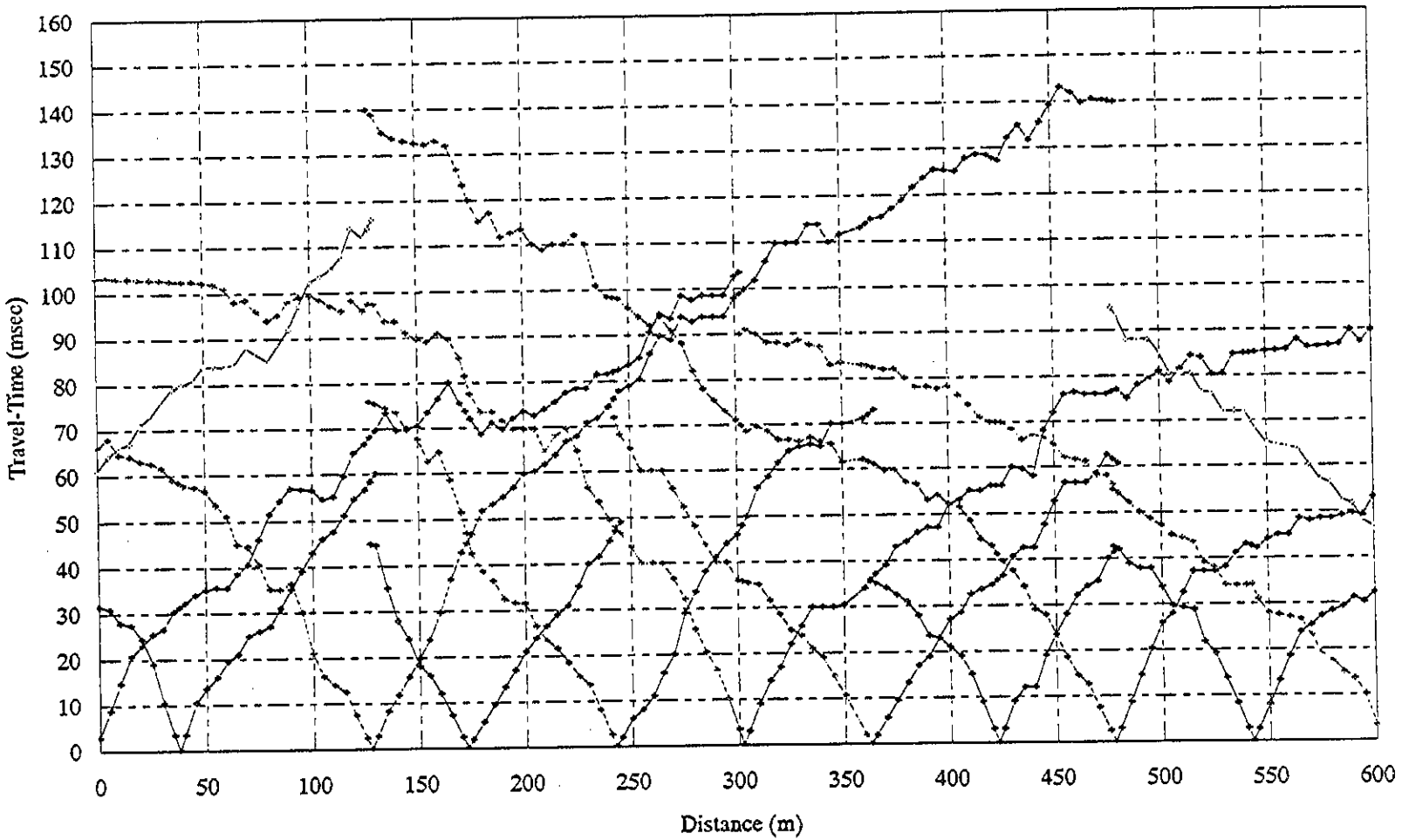


Travel-Time Curve (S-2)

GE3 - 3

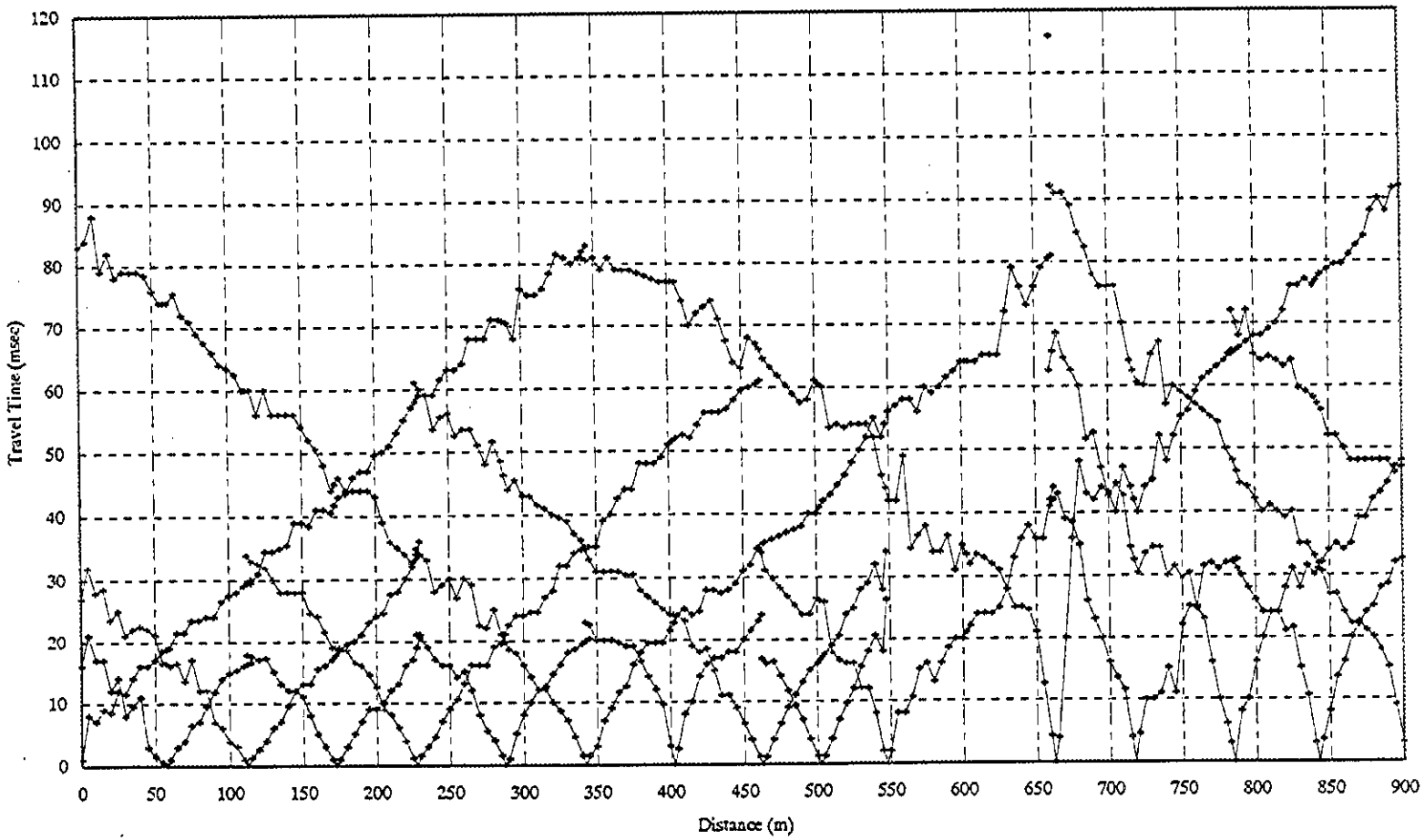


Travel-Time Curve (S-3)



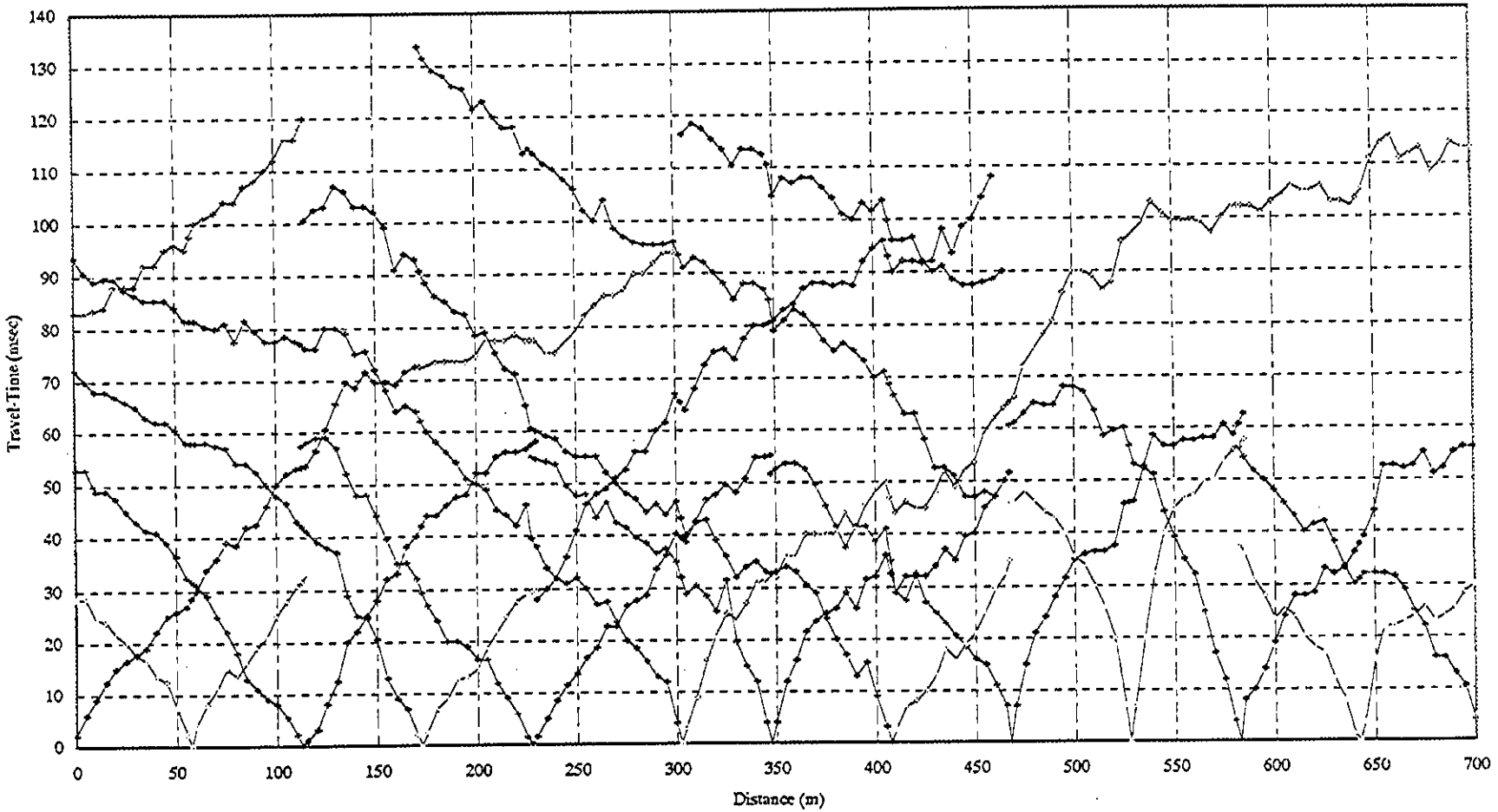
Travel-Time Curve (S-4)

GE3 - 5

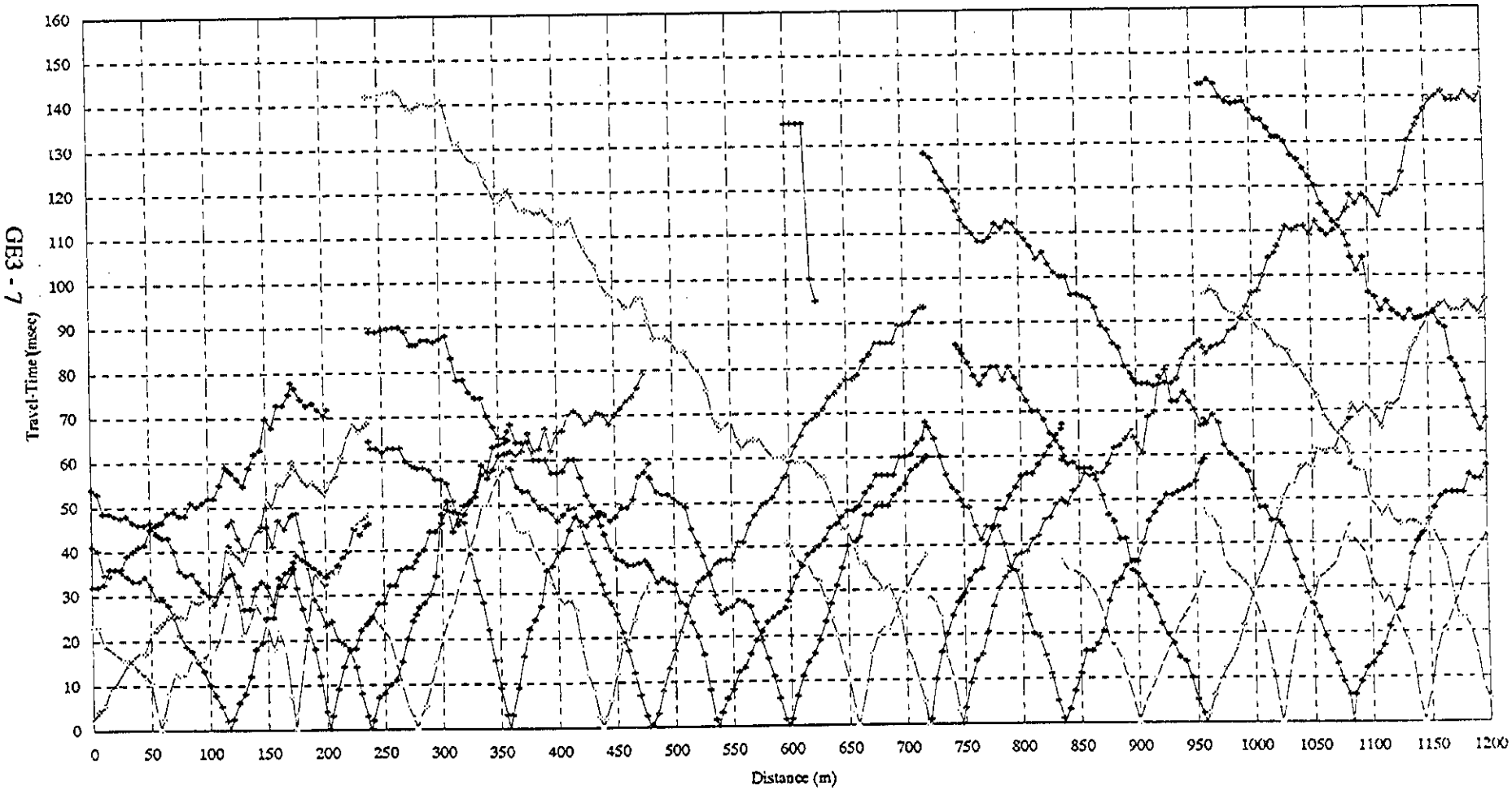


Travel-Time Curve (S-5)

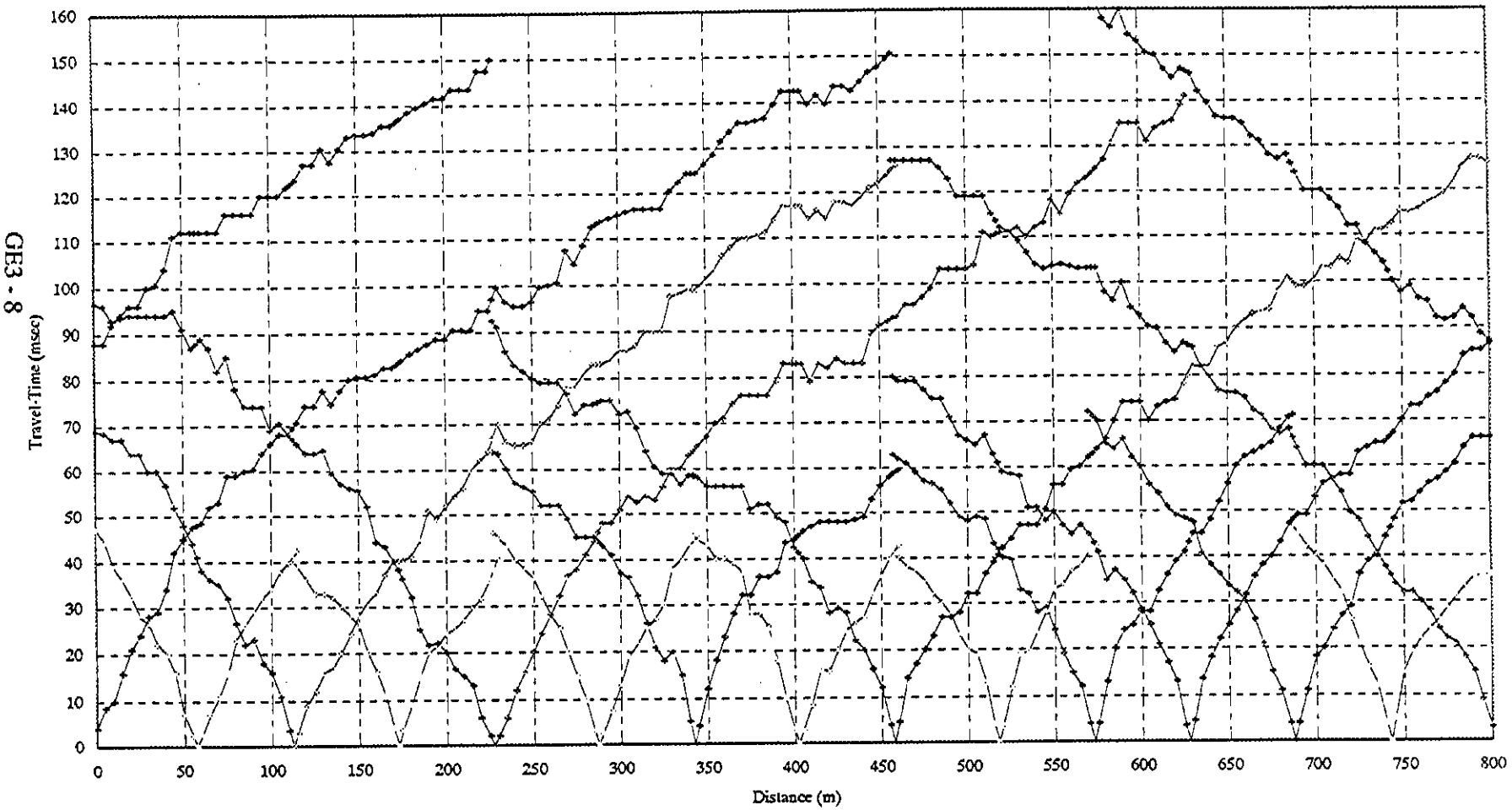
GE3 - 6



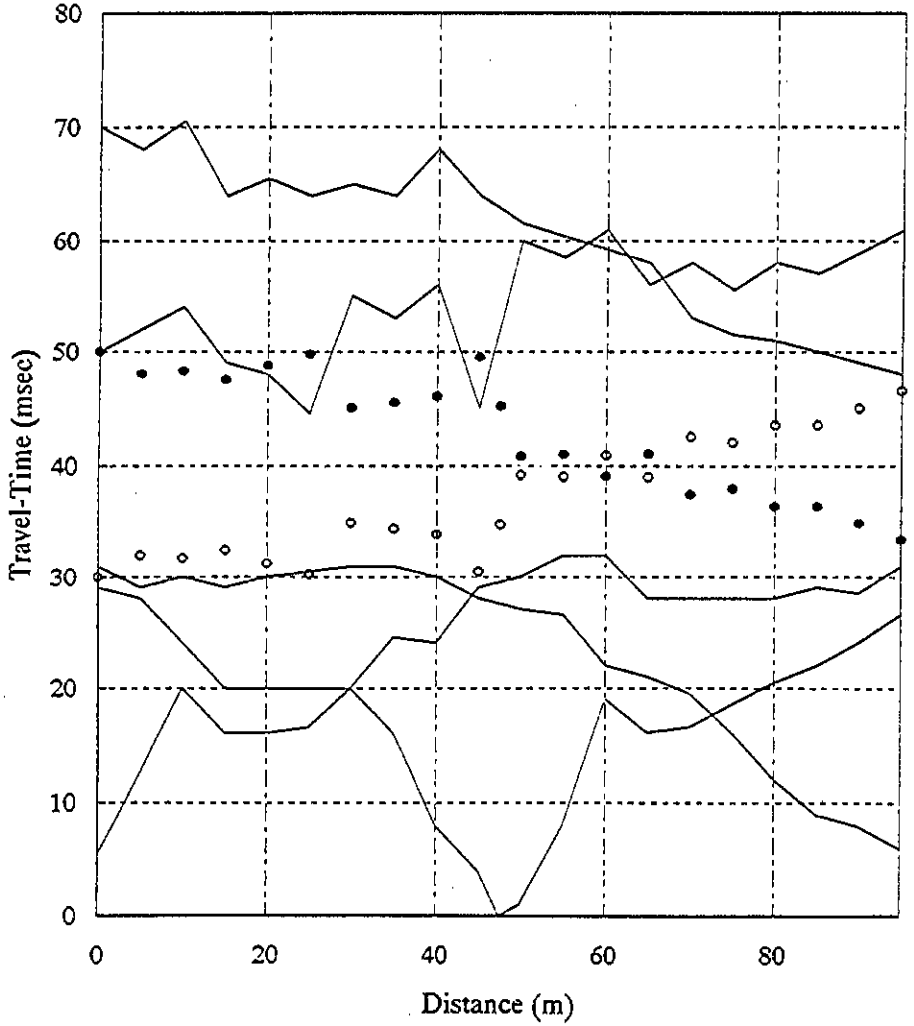
Travel-Time Curve (S-6)



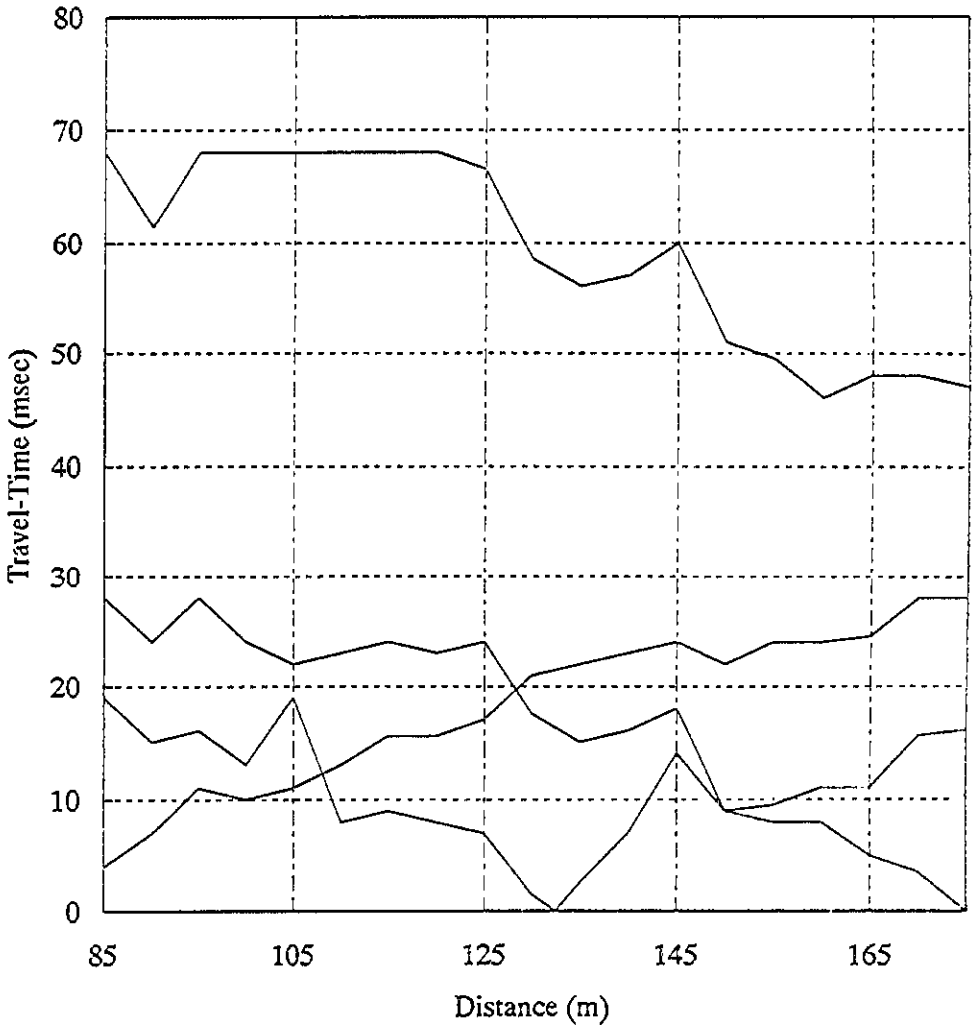
Travel-Time Curve (S-7)



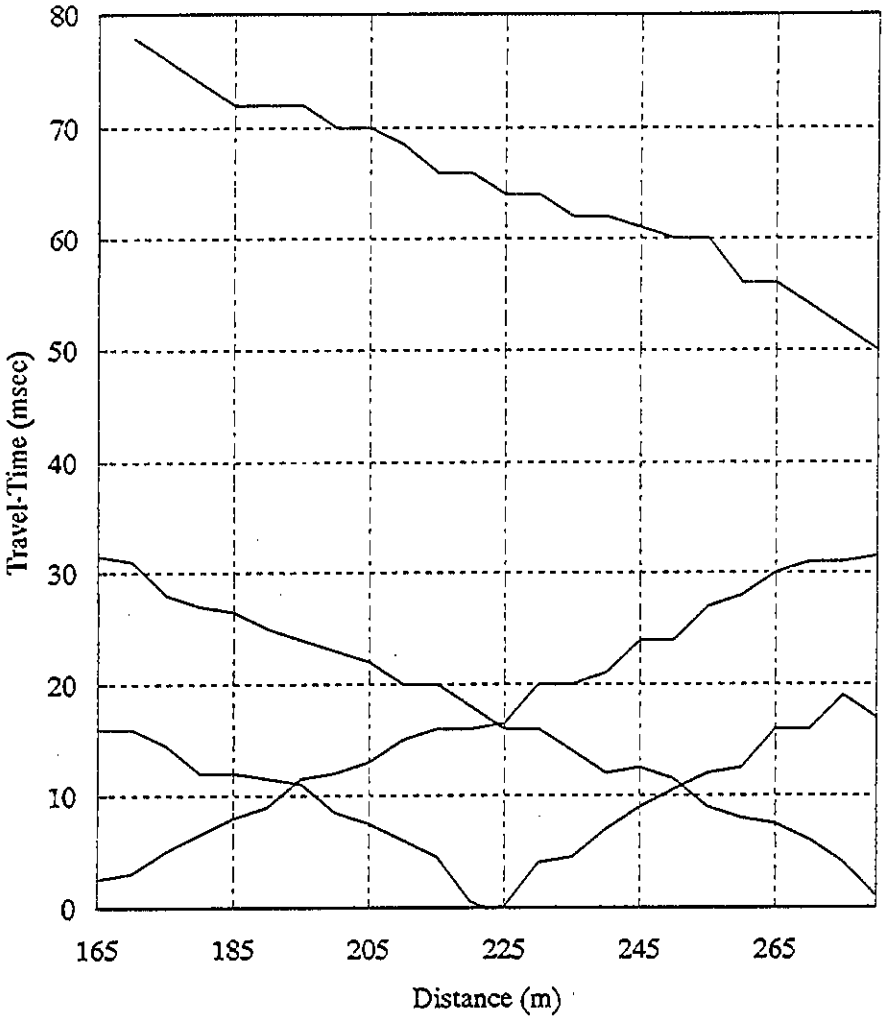
Travel-Time Curve (S-8)



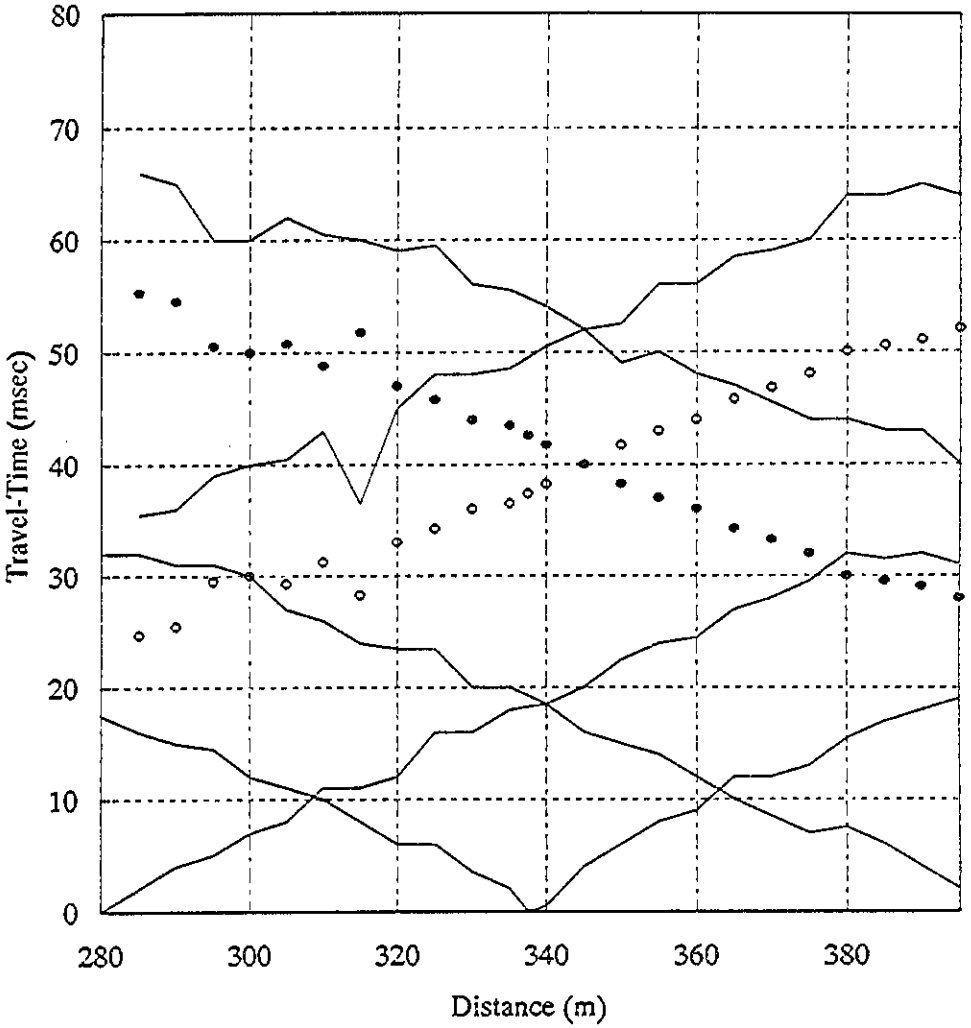
Travel-Time Curve (Ls-1{0～95m})



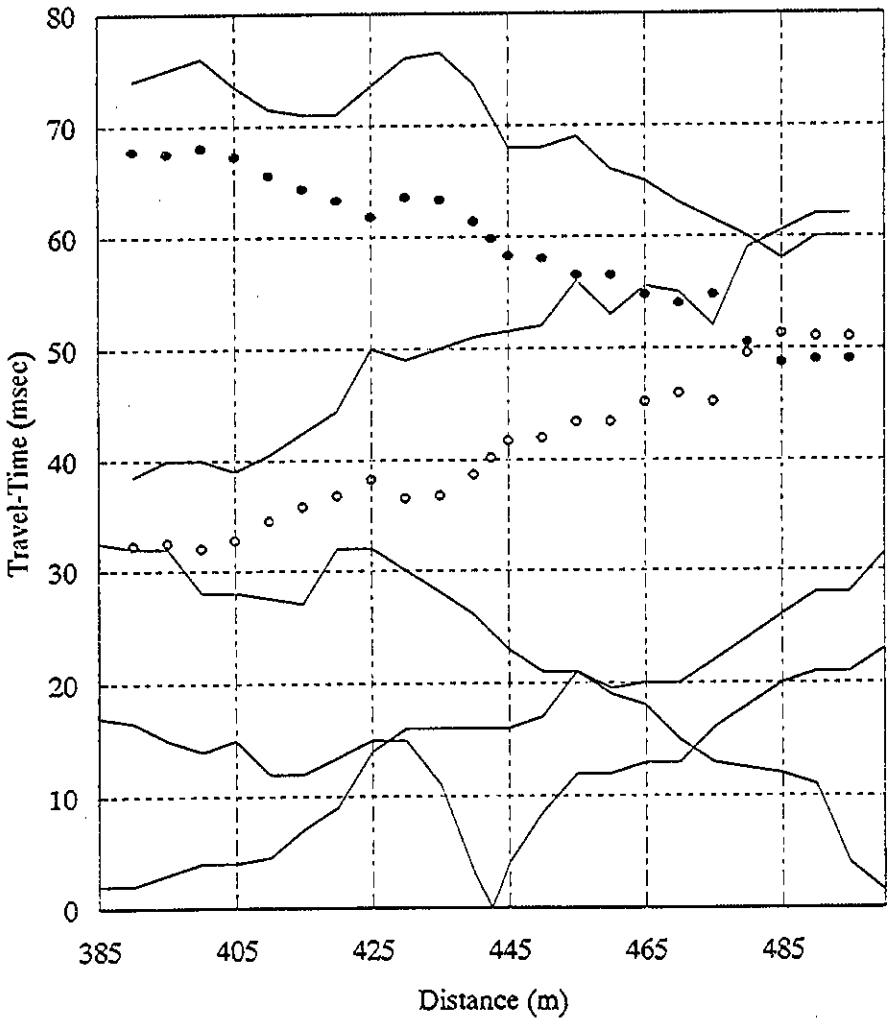
Travel-Time Curve (Ls-1{85～175m})



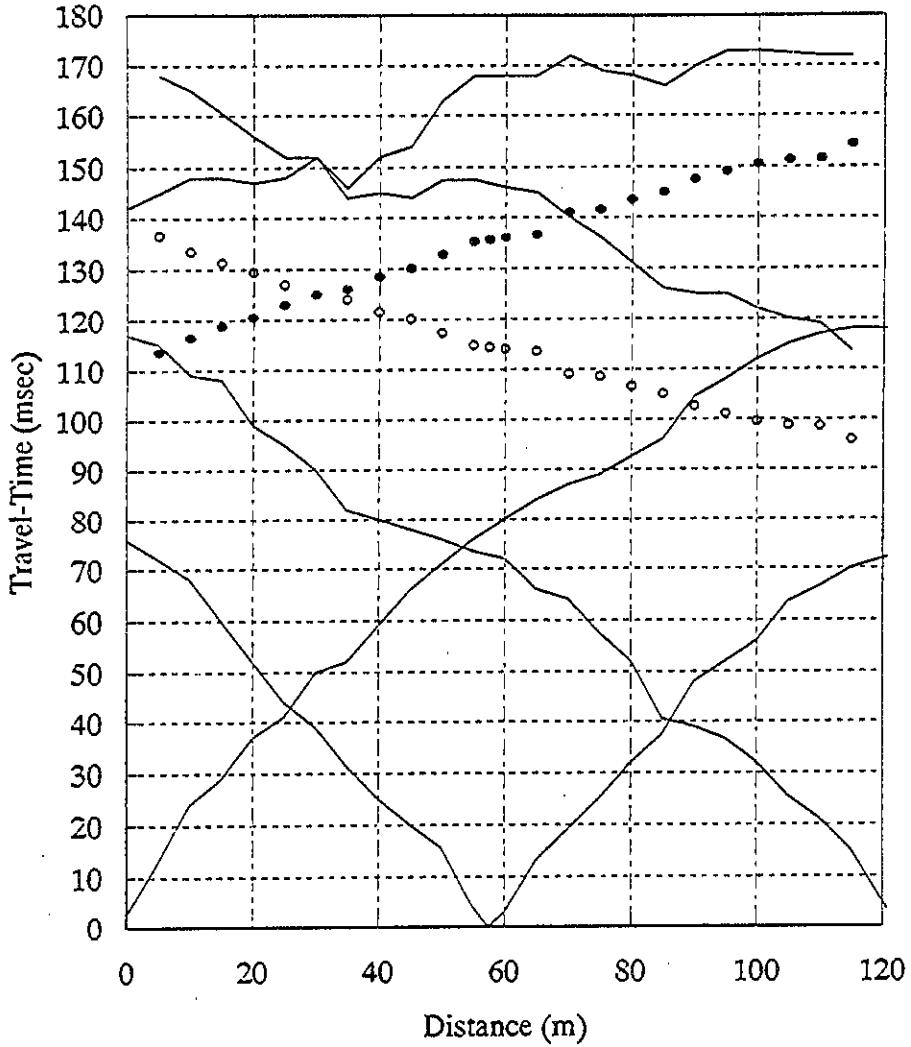
Travel-Time Curve (Ls-1{165～280m})



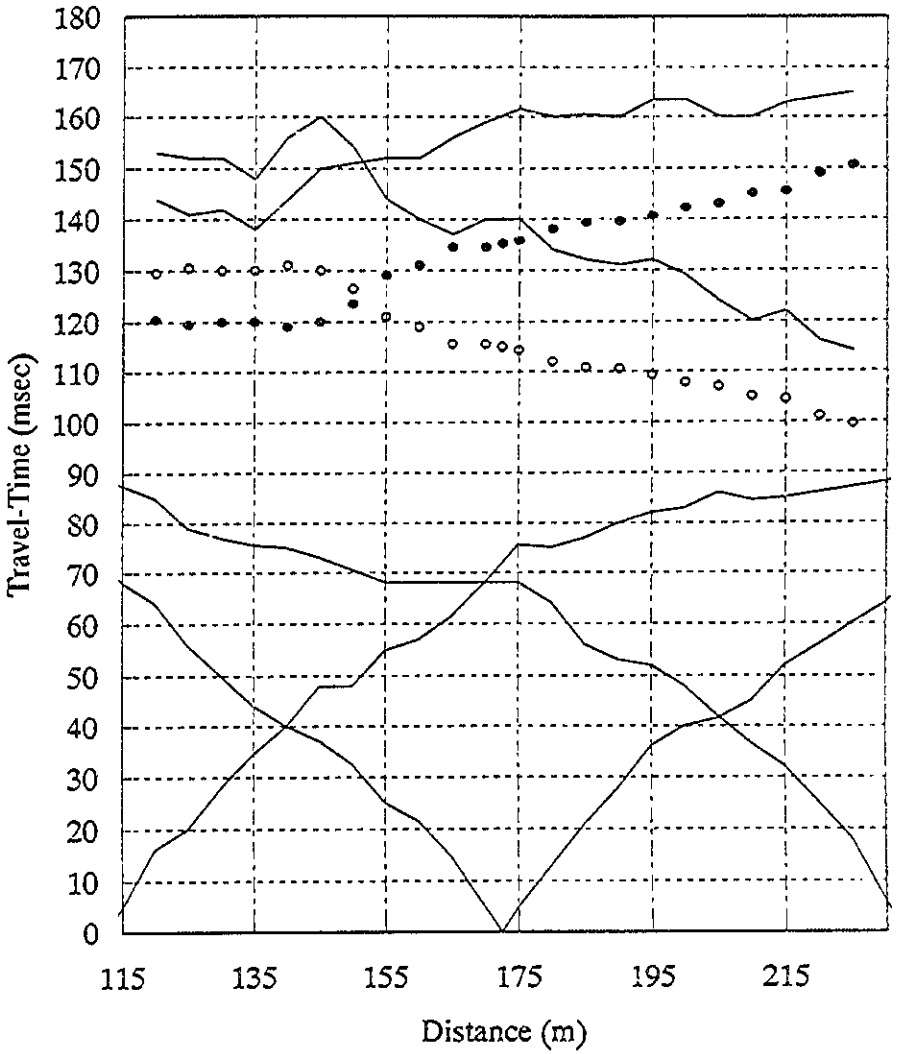
Travel-Time Curve (Ls-1{280～395m})



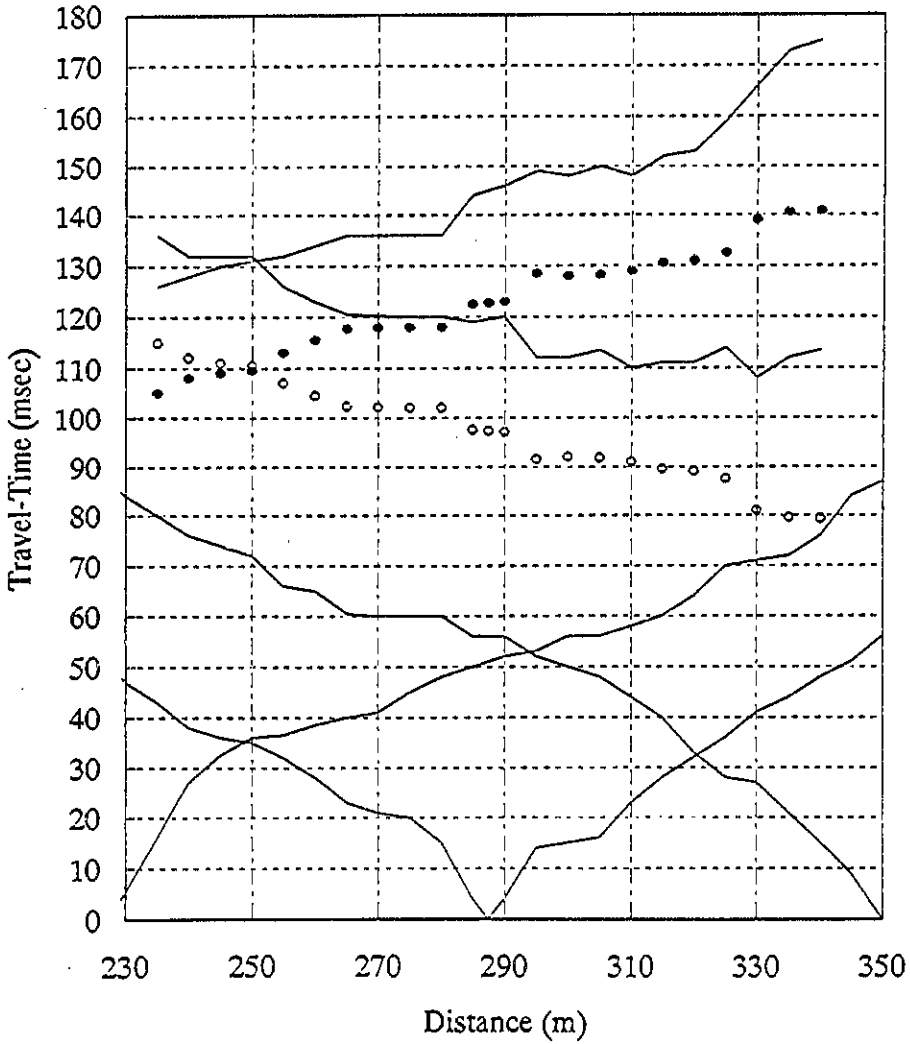
Travel-Time Curve (Ls-1{385~500m})



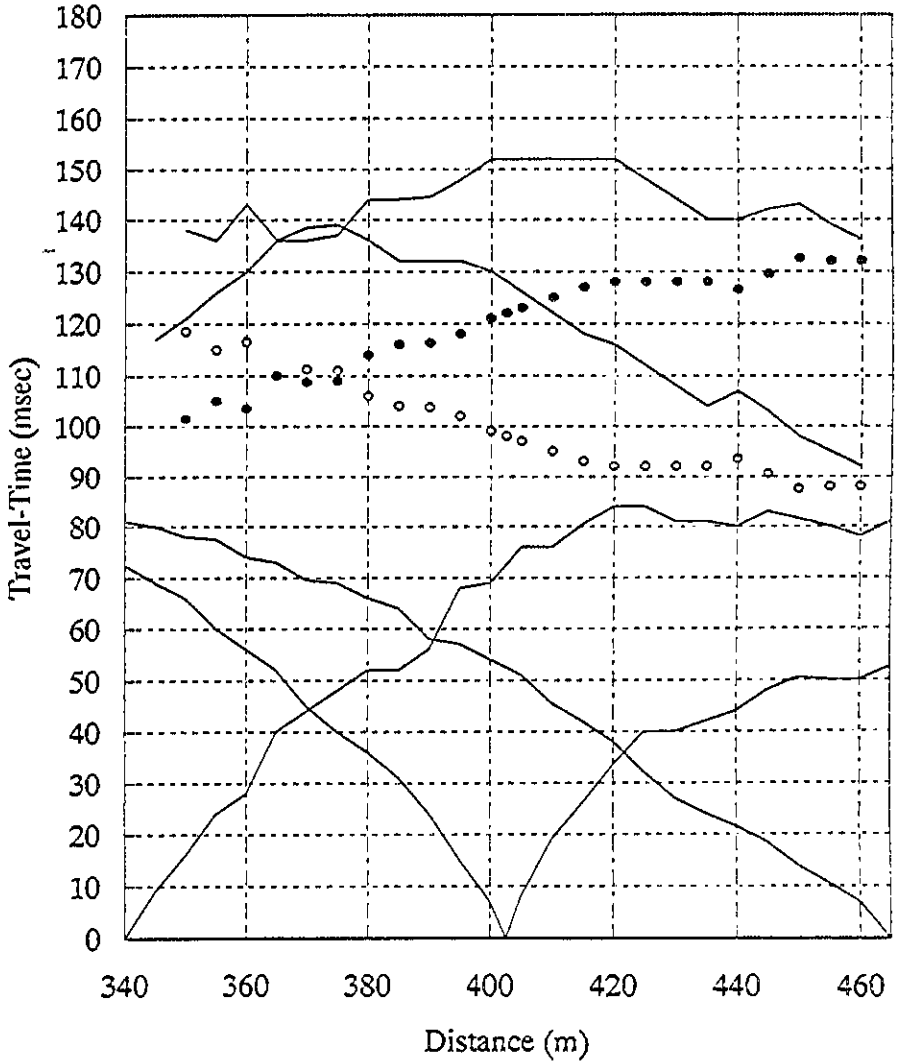
Travel-Time Curve (Lt-1{ 0～115m})



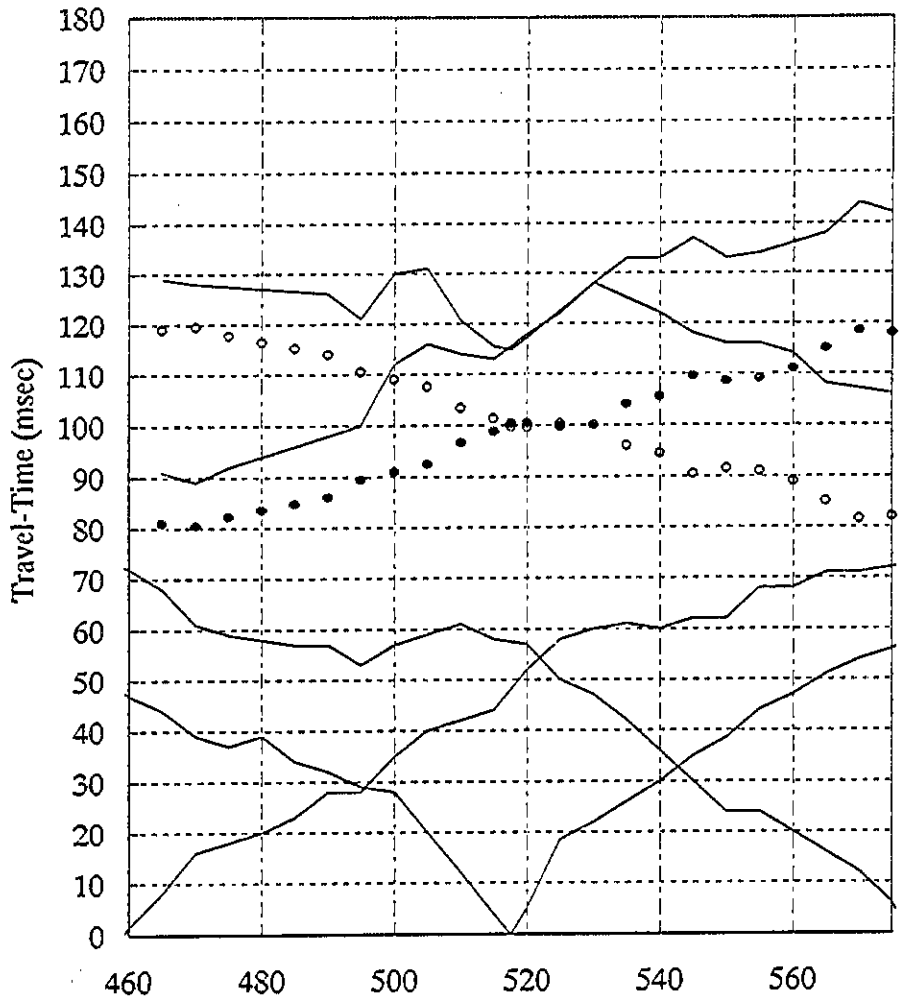
Travel-Time Curve (Lt-1 {115～230m})



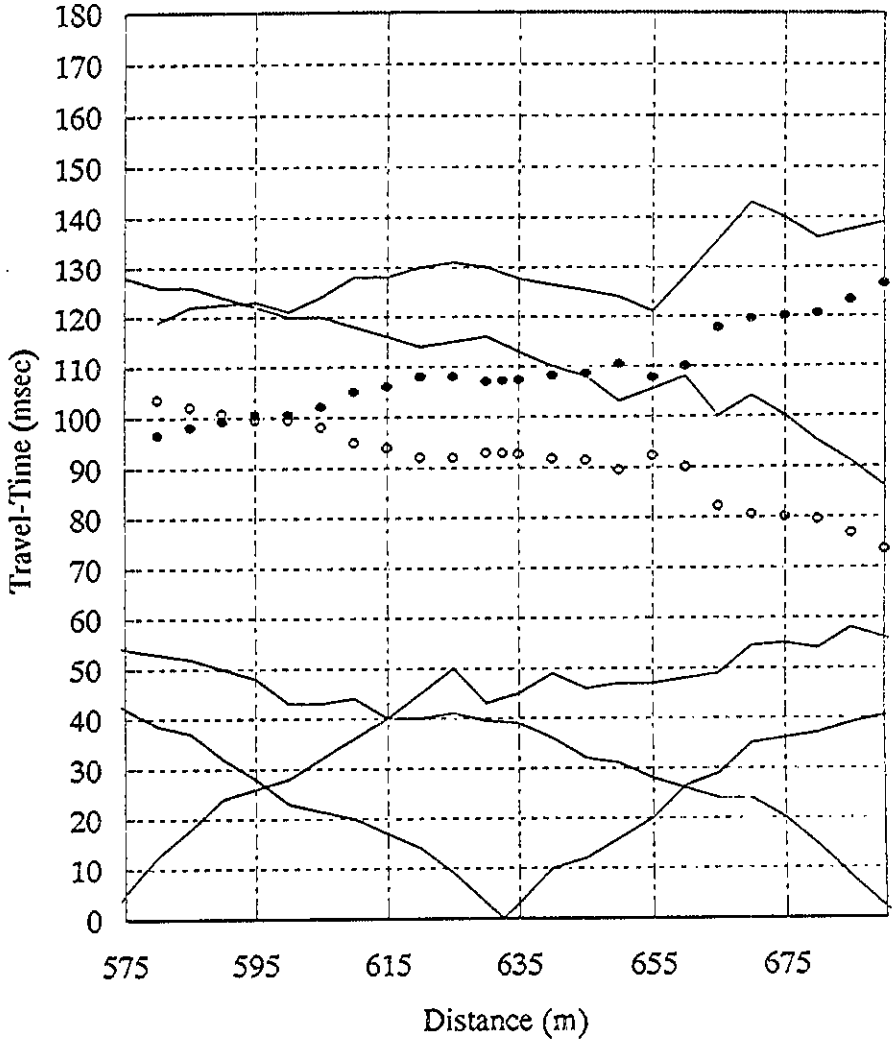
Travel-Time Curve (Lt-1{230～350m})



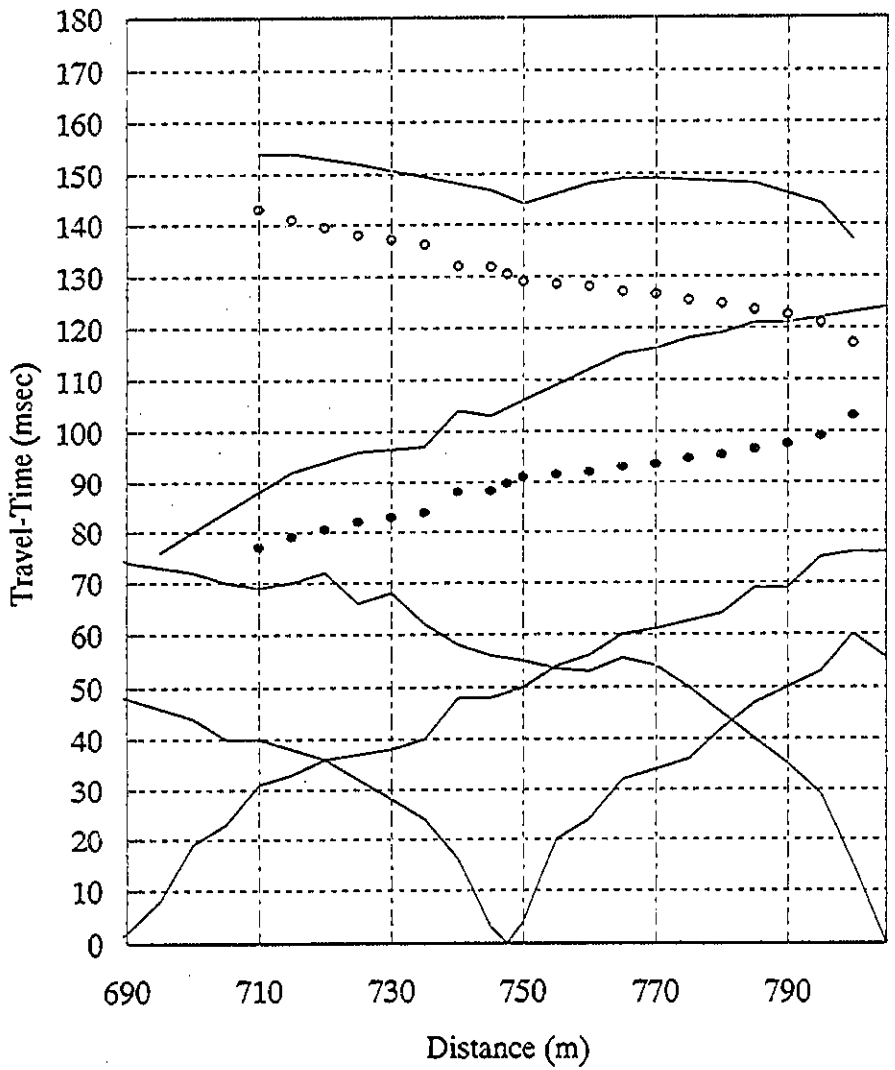
Travel-Time Curve (Lt-1{340～465m})



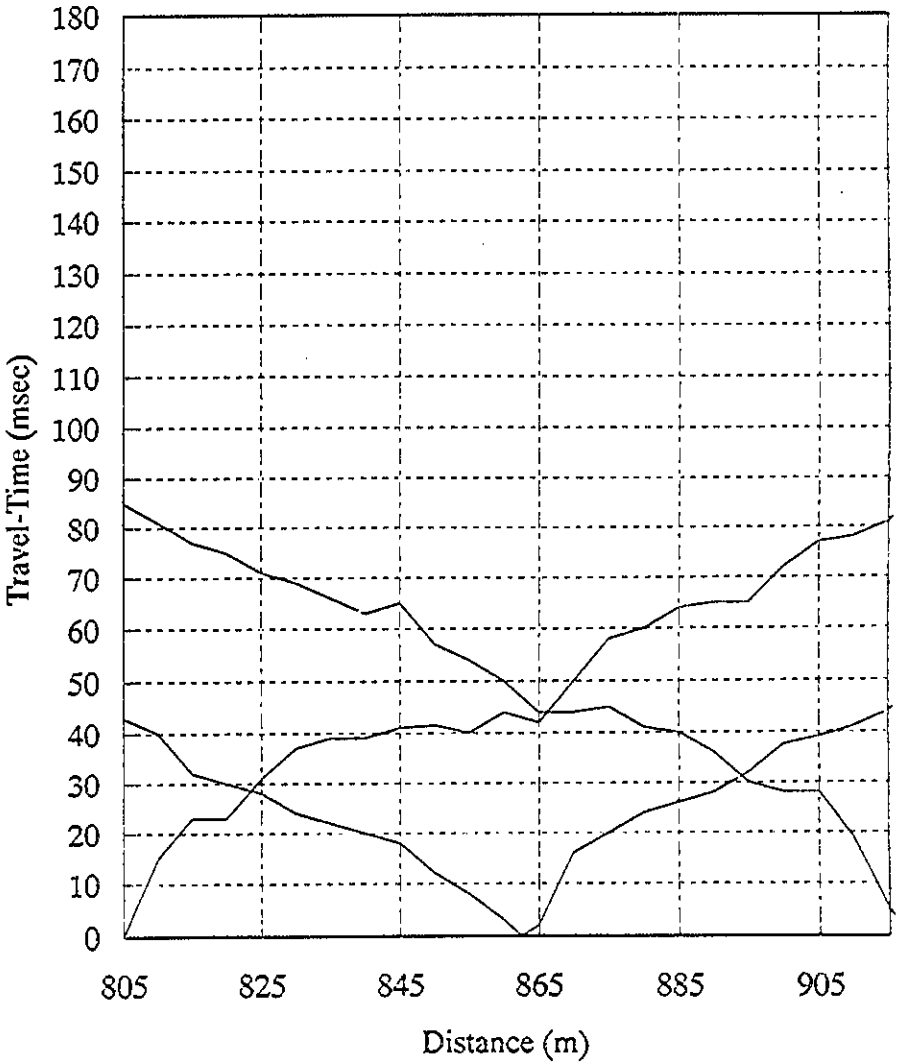
Travel-Time Curve (Lt-1{460～575m})



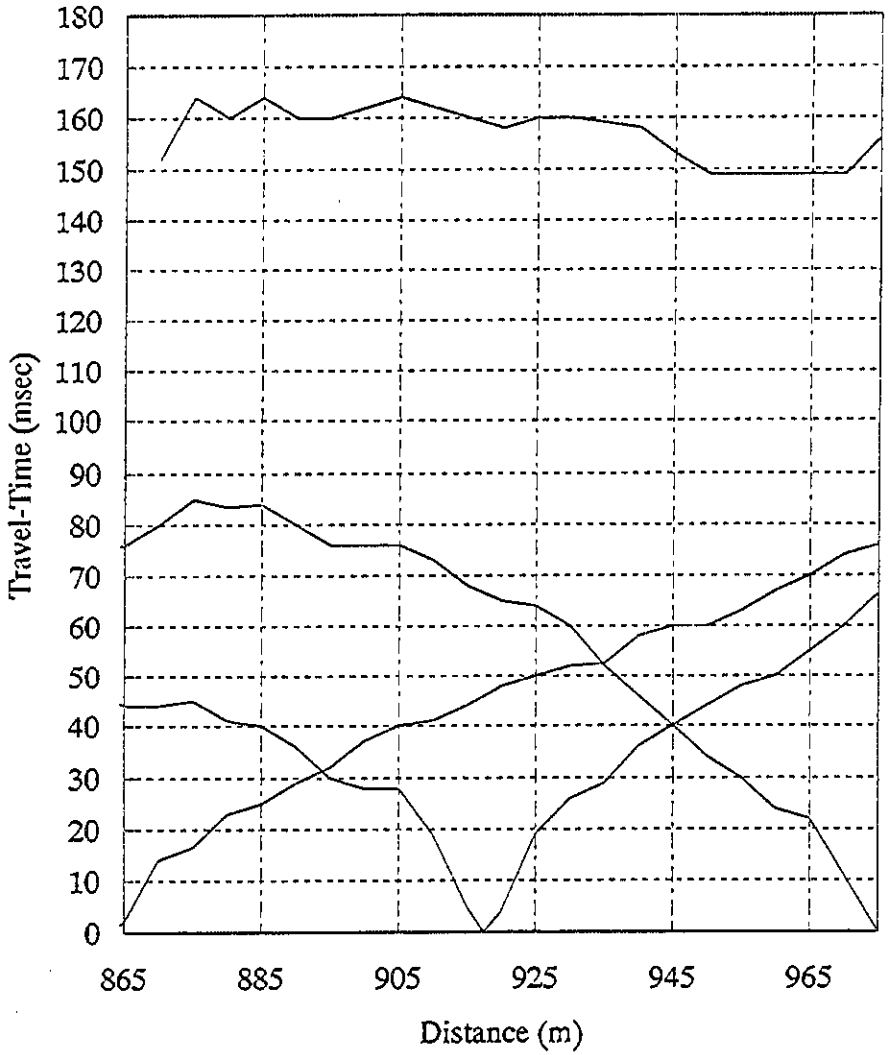
Travel-Time Curve (Lt-1{575～690m})



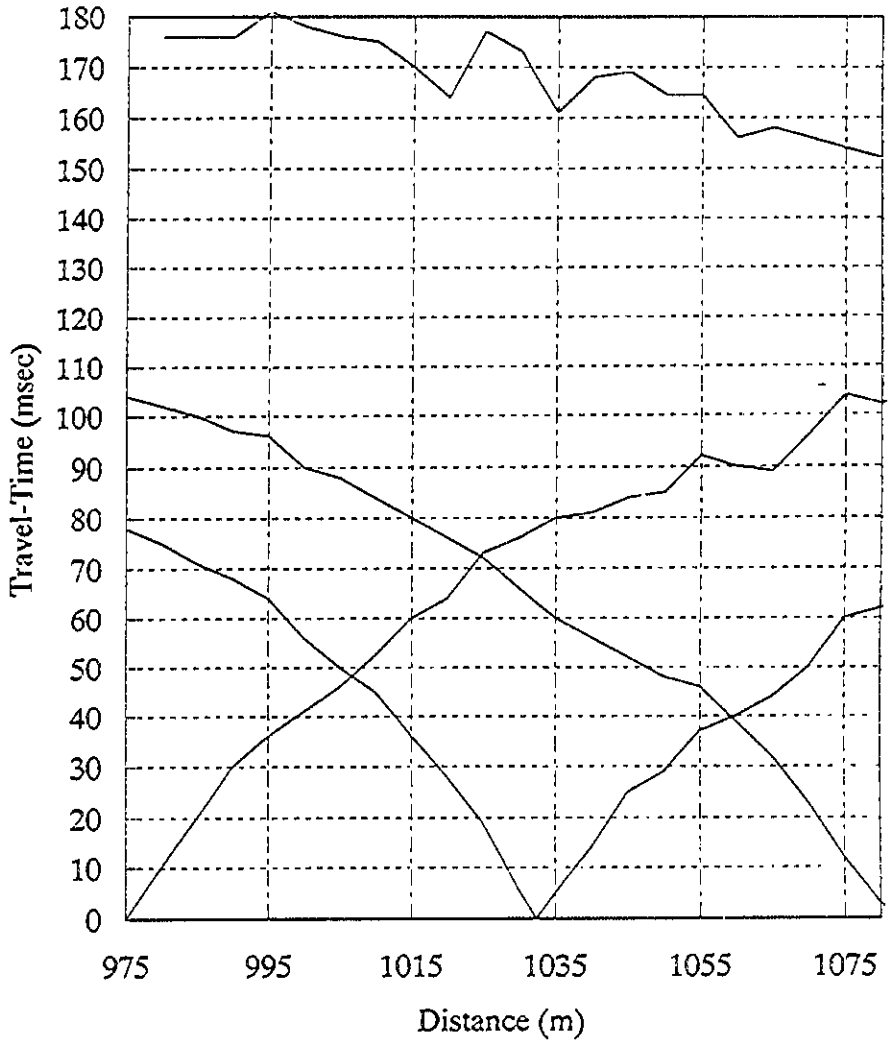
Travel-Time Curve (Lt-1{690～805m})



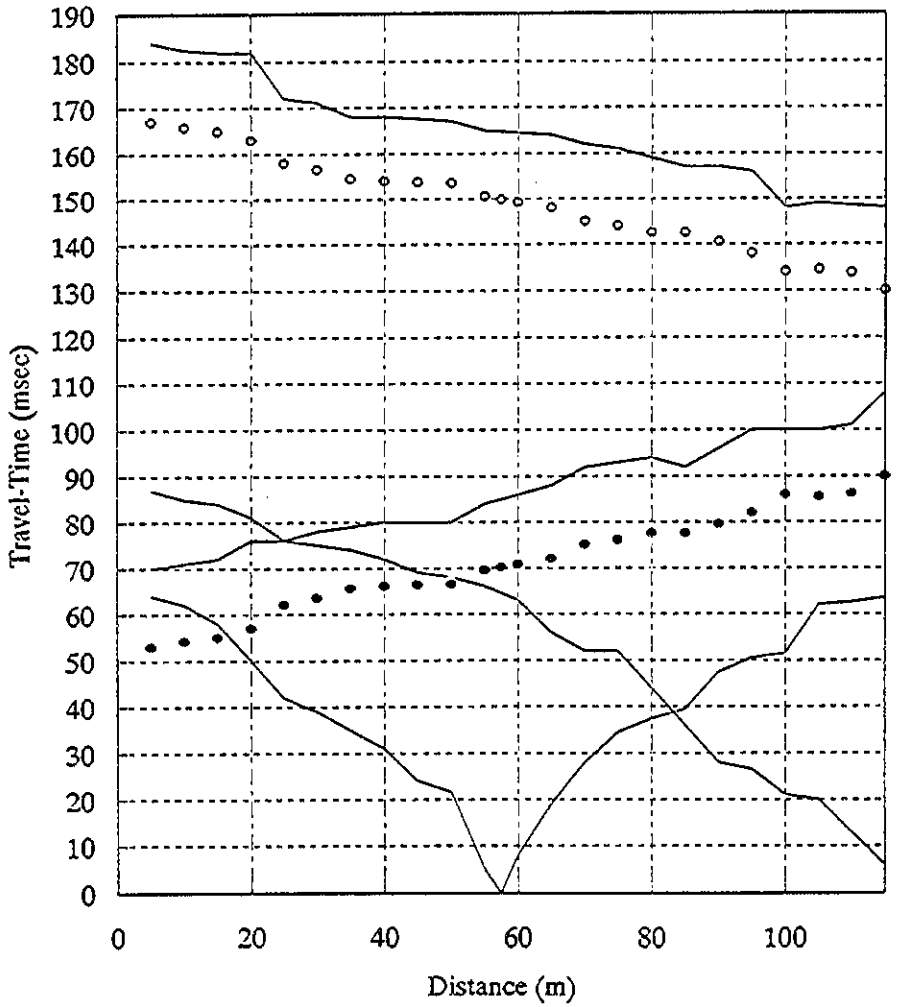
Travel-Time Curve (Lt-1{805～915m})



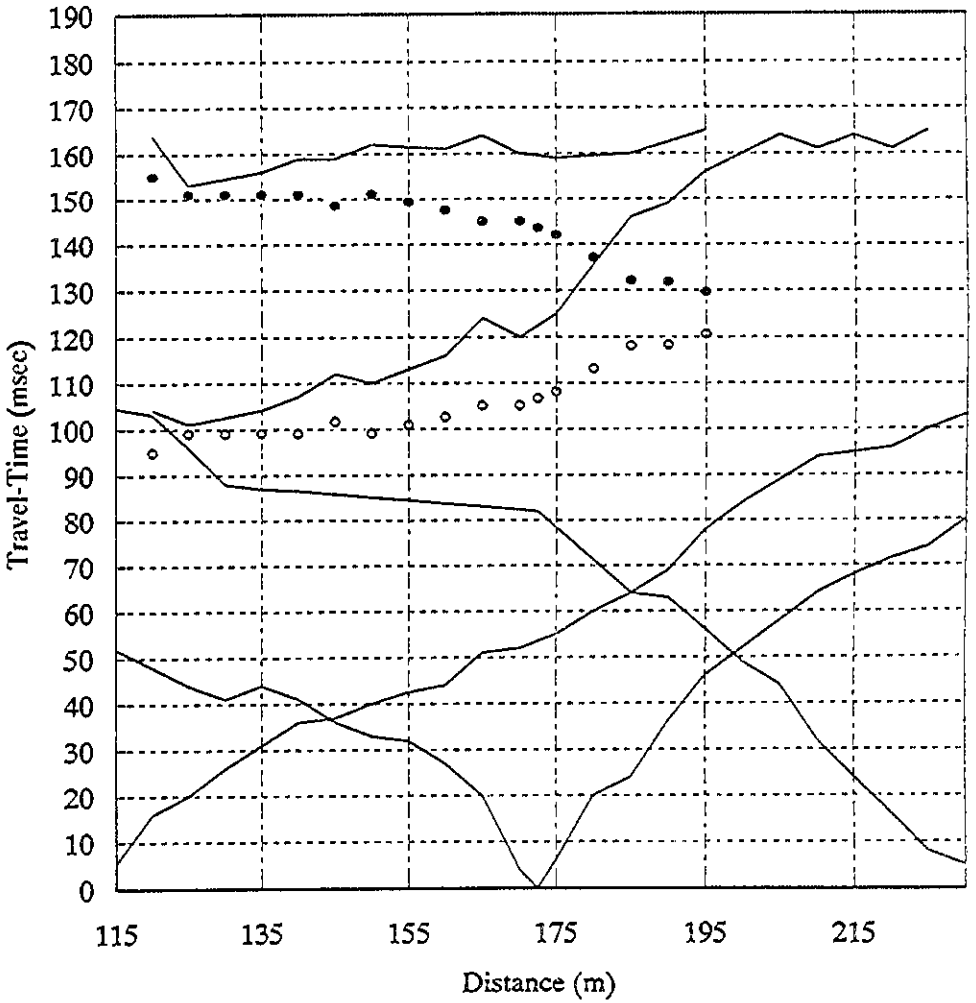
Travel-Time Curve (Lt-1{865～975m})



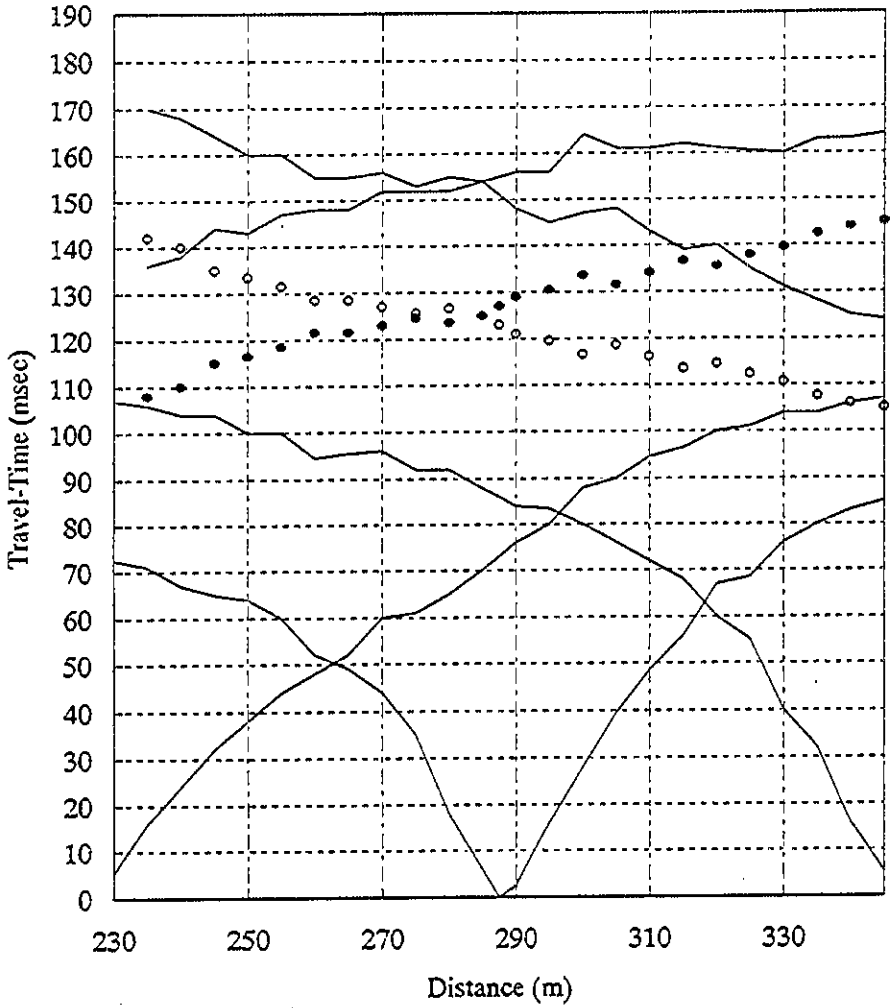
Travel-Time Curve (Lt-1{975～1080m})



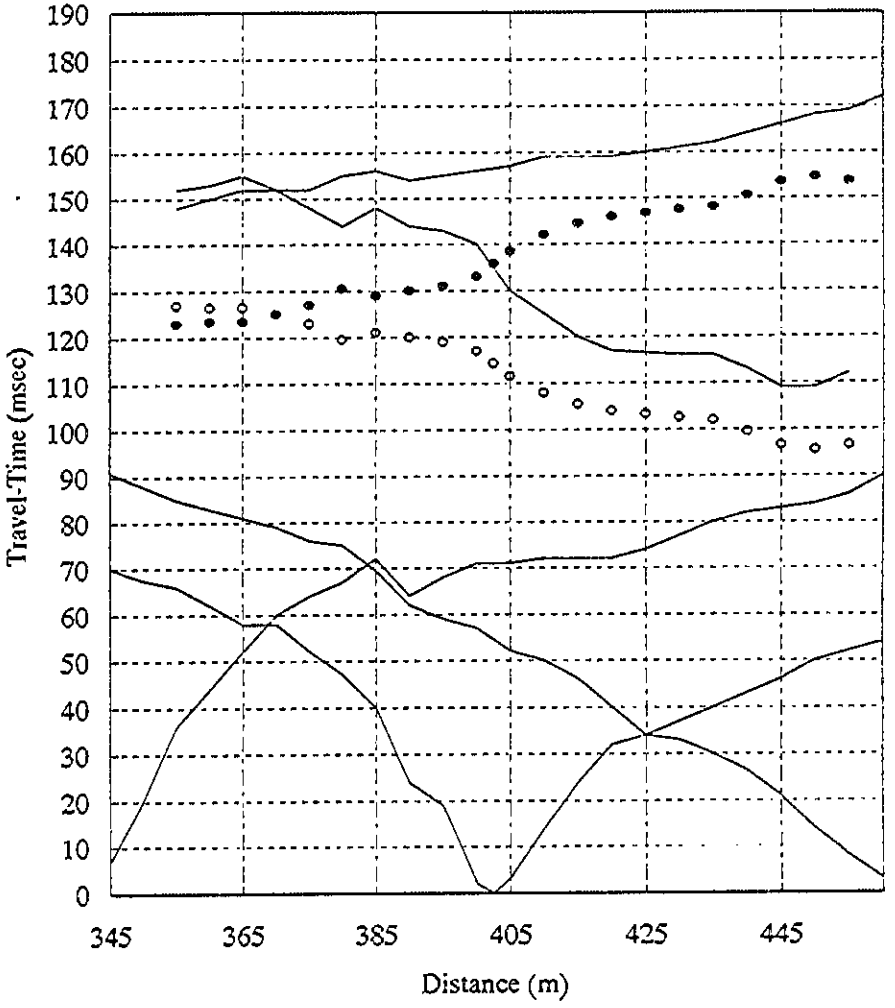
Travel-Time Curve (Lt-2{0～115m})



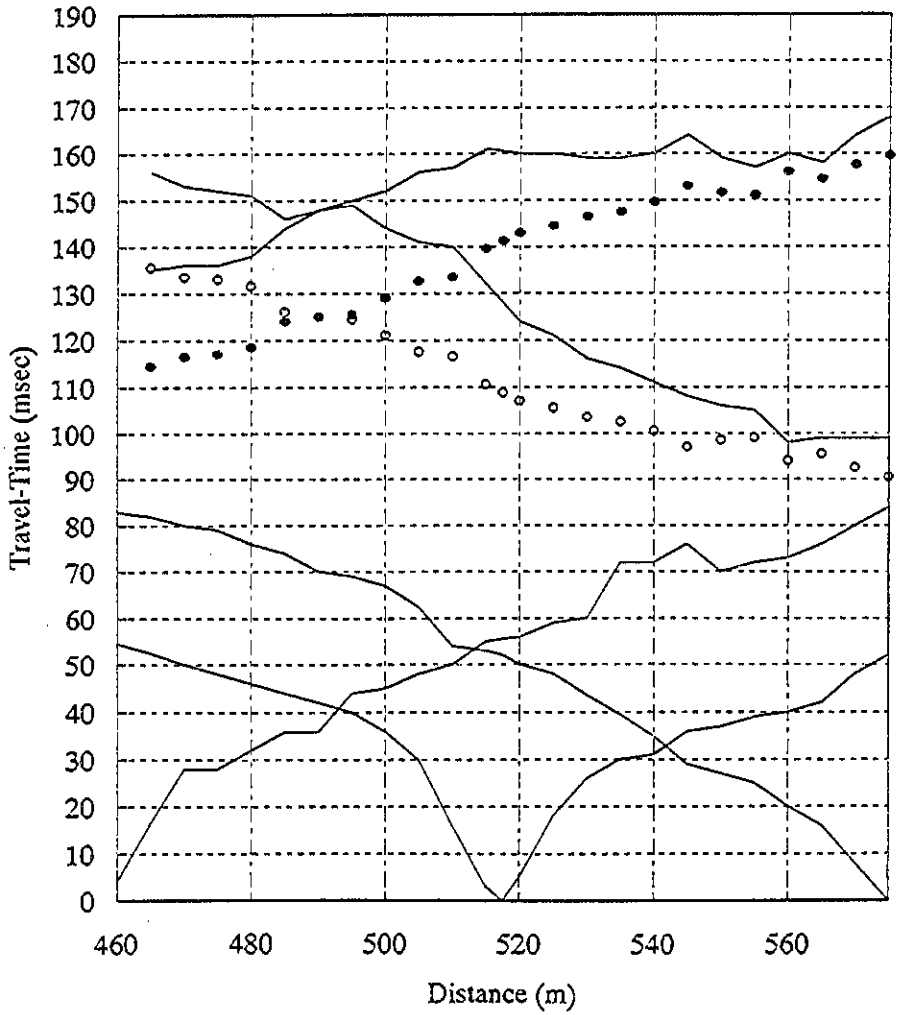
Travel-Time Curve (Lt-2{115～230m})



Travel-Time Curve (Lt-2{230～345m})



Travel-Time Curve (Lt-2{345～460m})



Travel-Time Curve (Lt-2{460～575m})

GE4.

LOG OF PIT

List of Test Pits

Pit No.	Depth (m)	Location
P-1	1.50	Sand & gravel at Swat river bed d/s Munda Headwork
P-2	1.50	Sand & gravel at Swat river bed d/s Munda Headwork
P-3	1.50	Sand & gravel at Swat river bed d/s Munda Headwork
P-4	1.50	Sand & gravel at Swat river bed d/s Munda Headwork
P-5	2.00	Sand & gravel at Swat river bed d/s Munda Headwork
P-6	5.00	Gravel deposit on the left bank hill near Munda Headwork
P-7	5.00	Gravel deposit on the left bank hill near Munda Headwork
P-8	5.00	Earth borrow area at Kas Koruna
P-9	5.00	Earth borrow area at Kas Koruna
P-10	5.00	Earth borrow area at Kas Koruna
P-11	3.00	Earth borrow area at Kas Koruna
P-12	5.00	Earth borrow area at Tangi
P-13	5.00	Earth borrow area at Tangi
P-14	2.50	Earth borrow area at Tangi
P-15	5.00	Earth borrow area at West Sadar Garhi

LOG OF PIT

Project Munda | Location Swat river bed D/S of H/works | Co-ordinatres
Ground Elevation | Top of Rock Elev. | Water Table
Dimension of Pit 1.5x1.5x1.5m | Date Started 08/Dec/1998 | Date Completed 09/Dec/1998
Logged by MEHBOOB/AZEE | Contractor

Depth (M)	Lithic Symbol	Description of Material	Sample for testing	Laboratory identification	Remarks
0		Sandy Gravel / Cobbles Subrounded, clean, hard, wellgraded (GW), some boulders, max. size 30x20 cm with 20-25% greyish, fine to medium sand. The strata is dry and loose to medium compact. At 1m depth there is 4 cm thick layer of silt/fine-sand, light brown in colour and moist. Below this, the deposit is compact-dense and pebbly (5 - 10%).	500 kg sample		
1					
2		Pit Completed			

LOG OF PIT

Project Munda | Location Swat river bed D/S of H/works | Co-ordinates
Ground Elevation | Top of Rock Elev. | Water Table
Dimension of Pit 1.3x1.4x1.5m | Date Started 09/Dec/1998 | Date Completed 10/Dec/1998
Logged by AZEEM/MEHBOO | Contractor

Depth (M)	Lithic Symbol	Description of Material	Sample for testing	Laboratory identification	Remarks
0		Sandy Gravel / Cobbles / Boulders Mostly subrounded, clean, hard, well graded, max. size 42x34 cm, with fine-medium, greyish 15 - 20% sand. The strata is loose to medium compact and dry to slightly moist in the lower part.	500 kg sample		
1					
		Pit Completed			
2					
3					
4					
5					
6					
7					

LOG OF PIT

Project Munda | Location Swat river bed D/S of H/works | Co-ordinatres
Ground Elevation | Top of Rock Elev. | Water Table
Dimension of Pit 1.4x1.4x1.5m | Date Started 09/Dec/1998 | Date Completed 10/Dec/1998
Logged by MEHBOOB/AZEE | Contractor

Depth (M)	Lithic Symbol	Description of Material	Sample for testing	Laboratory identification	Remarks
0		Silty Sand (SM) Brownish, fine, loose and dry having organic matters (grass roots)			
1		Sandy Gravel / Cobbles Subrounded, clean, hard, well graded, some boulders max. size 31x26 cm along with 20-25% brownish, fine to medium sand. The strata is loose to slightly compact in the lower part and dry.	500 kg sample		
2		Pit Completed			
3					
4					
5					
6					
7					

LOG OF PIT

Project Munda | Location Swat river bed D/S of H/works | Co-ordinatres
Ground Elevation | Top of Rock Elev. | Water Table
Dimension of Pit 1.2x1.3x1.5m | Date Started 10/Dec/1998 | Date Completed 11/Dec/1998
Logged by MEHBOOB/AZEE | Contractor

Depth (M)	Lithic Symbol	Description of Material	Sample for testing	Laboratory identification	Remarks
0		Silty Sand (SM) Light brown, loose, dry with moderate amount of grass roots.			
1		Sandy Gravel / Cobbles Generally Subrounded, hard, clean, medium to coarse, with 20-25% greyish, fine to medium grained sand. Strata is loose-slightly compact and dry.			
2		Sand Greyish, fine to medium grained, loose to medium compact and slightly moist with some coarse gravels / cobbles.			
		Pit Completed			
3					
4					
5					
6					
7					

LOG OF PIT

Project Munda | Location Swat river bed D/S of H/works | Co-ordinatres

Ground Elevation | Top of Rock Elev. | Water Table

Dimension of Pit 1.3x1.4x1.5m | Date Started 10/Dec/1998 | Date Completed 11/Dec/1998

Logged by MEHBOOB/AZEE | Contractor

Depth (M)	Lithic Symbol	Description of Material	Sample for testing	Laboratory identification	Remarks
0		Sandy Gravel / Cobbles Subrounded-rounded, hard, clearn, poorly graded, rare boulders max. size 36x26 cm with fine-medium grained, brownish grey sand (approx. 20%).	500 kg sample		
1		Micaceous Sand Brownish grey, fine to medium grained, slightly moist.	45 kg sample		
2		Pit Completed			
3					
4					
5					
6					
7					

LOG OF PIT

Project Munda | Location Near Munda Kili NE of Munda H/W | Co-ordinatres
Ground Elevation | Top of Rock Elev. | Water Table
Dimension of Pit 2.0x2.0x5.0m | Date Started 12/Dec/1998 | Date Completed 14/Dec/1998
Logged by MEHBOOB/AZEE | Contractor

Depth (M)	Lithic Symbol	Description of Material	Sample for testing	Laboratory identification	Remarks
0		Sandy Gravel / Cobbles (GW) Mostly subrounded, flat, medium hard to hard, slightly dirty, well graded, with some boulders max. size 30x20 cm, weathered at places, having light brown, approx. 30-35% fine sand, varying amount of non-plastic fines. The strata is dry and medium compact to compact.			
4		Silty Sand (SM) Light grey, fine grained, medium dense, 15-20 % non-plastic fines.			
5		Pit Completed			
6					
7					

LOG OF PIT

Project Munda | Location Near Munda Kali NE of Munda H/W | Co-ordinates
Ground Elevation | Top of Rock Elev. | Water Table
Dimension of Pit 1.5x1.5x.5.0m | Date Started 13/Dec/1998 | Date Completed 15/Dec/1998
Logged by MEHBOOB/AZEE | Contractor

Depth (M)	Lithic Symbol	Description of Material	Sample for testing	Laboratory identification	Remarks
0		Sandy Gravel / Cobbles (GW) Subrounded, slightly dirty, medium hard to hard, some boulders, max. size 38x28 cm, weathered at places, with light brown, approx. 30% fine sand, little silt. The strata is dry, medium compact-compact. Upper 30-40 cm contains grass roots.	500 kg sample		
1					
2					
3					
4					
5		Pit Completed			
6					
7					

LOG OF PIT

Project Munda | Location Kas Koruna | Co-ordinates
Ground Elevation | Top of Rock Elev. | Water Table
Dimension of Pit 1.3x1.6x5.0m | Date Started 15/Dec/1998 | Date Completed 17/Dec/1998
Logged by MEHBOOB/AZEE | Contractor

Depth (M)	Lithic Symbol	Description of Material	Sample for testing	Laboratory identification	Remarks
0		Silty Sandy Gravel (GW) Subrounded, elongated and flat too, dirty, hard, few cobbles, max. size 18x10 cm, some fine sand and silt (30 to 35%), little or no clay. The deposit is dry, medium compact to compact with slight weathering effects.	50 kg sample		
4		Silty Sand (SM) Light brownish grey, fine, some specks of silt, slightly moist in the bottom, slightly dense.	50 kg sample		
5		Pit Completed			

LOG OF PIT

Project Munda | Location Kas Koruna | Co-ordinates
Ground Elevation | Top of Rock Elev. | Water Table
Dimension of Pit 1.3x1.6x5.0m | Date Started 15/Dec/1998 | Date Completed 17/Dec/1998
Logged by MEHBOOB/AZEE | Contractor

Depth (M)	Lithic Symbol	Description of Material	Sample for testing	Laboratory identification	Remarks
0		Silty Sandy Gravel (GW) Subrounded, elongated and flat too, dirty, hard, few cobbles, max. size 18x10 cm, some fine sand and silt (30 to 35%), little or no clay. The deposit is dry, medium compact to compact with slight weathering effects.	50 kg sample		
1					
2					
3					
4		Silty Sand (SM) Light brownish grey, fine, some specks of silt, slightly moist in the bottom, slightly dense.	50 kg sample		
5		Pit Completed			
6					
7					

LOG OF PIT

Project Munda | Location Kas Koruna | Co-ordinatres
Ground Elevation | Top of Rock Elev. | Water Table
Dimension of Pit 1.2x1.3x5.0m | Date Started 17/Dec/1998 | Date Completed 23/Dec/1998
Logged by MEHBOOB/AZEE | Contractor

Depth (M)	Lithic Symbol	Description of Material	Sample for testing	Laboratory identification	Remarks
0		Silty Clay with Gravel Subrounded, medium to coarse, dirty gravels, greyish, loose to firm, dry silty clay, small roots at places.	50 kg sample		
1		Silty Clay / Clayey Silt Brownish, no or poorly stratified, dry to slightly moist, slightly plastic, firm to stiff, having low to medium dry strength.			
2			50 kg sample		
3					
4		At 4.4 m to 4.6 m depth, yellowish, very stiff band of clay.			
5		Pit Completed			
6					
7					

LOG OF PIT

Project Munda | Location Kas Koruna | Co-ordinatres
Ground Elevation | Top of Rock Elev. | Water Table
Dimension of Pit 1.5x1.5x5.0m | Date Started 16/Dec/1998 | Date Completed 18/Dec/1998
Logged by MEHBOOB/AZEE | Contractor

Depth (M)	Lithic Symbol	Description of Material	Sample for testing	Laboratory identification	Remarks
0		Silty sand / Sandy Silt (SM/ML) Greyish brown in colour, firm-dense, low dry strength, small amounts of grass roots, slightly moist.	50 kg sample		
1		Silt Light brown in colour, stiff to very stiff, slightly moist, low dry strength, poorly to well stratified, little or no clay, non-plastic.	50 kg sample		
2					
3					
4					
5		Pit Completed			
6					
7					

LOG OF PIT

Project Munda | Location Kas Koruna | Co-ordinatres
Ground Elevation | Top of Rock Elev. | Water Table
Dimension of Pit 1.5x1.5x3.0m | Date Started 16/Dec/1998 | Date Completed 24/Dec/1998
Logged by MEHBOOB/AZEE | Contractor

Depth (M)	Lithic Symbol	Description of Material	Sample for testing	Laboratory Identification	Remarks
0		Silty Clay / Clayey Silt Light brown, dry to slightly moist, firm to stiff, with 15 - 20 cm thick alternating bands of yellowish brown, very stiff clay, poorly stratified.	50 kg sample		
1					
2		Clay stone Yellowish, brown, hard and indurated.	50kg sample		
3		Pit Completed			
4					
5					
6					
7					

LOG OF PIT

Project Munda | Location Saro-station Killi (Around Tangi) | Co-ordinatres
Ground Elevation | Top of Rock Elev. | Water Table
Dimension of Pit 1.5x1.5x5.0m | Date Started 19/Dec/1998 | Date Completed 24/Dec/98
Logged by MEHBOOB/AZEE | Contractor

Depth (M)	Lithic Symbol	Description of Material	Sample for testing	Laboratory identification	Remarks
0 – 1		Silty Clayey Gravels Subrounded, fine to coarse, dirty gravels, few cobbles. max. size of cobbles 13 x 20 cm with reddish colour silty clay, little sand (fiens percentage 35 - 40 %) Deposit is moist and compact.	50 kg sample		
1 – 2 – 3 – 4 – 5		Silty Sandy Gravels Subrounded, well graded hard gravels with greyish fine to medium silty sand, (20 - 25 %), some cobbles (max. 10x11 cm). Cobbles size max. 19x11 cm. Deposit is compact and slightly moist.	50 kg sample		
5 – 6 – 7		Pit Completed			

LOG OF PIT

Project Munda | Location Saro-station Killi (Around Tangi) | Co-ordinatres
Ground Elevation | Top of Rock Elev. | Water Table
Dimension of Pit 1.4x1.4x5.0m | Date Started 19/Dec/1998 | Date Completed 23/Dec/1998
Logged by MEHBOOB/AZEE | Contractor

Depth (M)	Lithic Symbol	Description of Material	Sample for testing	Laboratory identification	Remarks
0		Silty Sandy Gravel Subrounded, hard, dirty, well graded gravels with 20-30% reddish brown, fine silty sand, trace clay, rare cobbles, max. size 14x9 cm. The deposit is slightly moist and compact, within top layer grass roots are common.	50 kg sample		
1					
2		Silty Clay Light redeish brown, little or no fine sand, slightly plastic, moist, having medium dry strength.	50 kg sample		
3					
4					
5		Pit Completed			
6					
7					

LOG OF PIT

Project Munda | Location Sholela Village (Around Tangi) | Co-ordinatres
Ground Elevation | Top of Rock Elev. | Water Table 2.2m
Dimension of Pit 1.2x1.4x2.5m | Date Started 20/Dec/1998 | Date Completed 23/Dec/1998
Logged by MEHBOOB/AZEE | Contractor

Depth (M)	Lithic Symbol	Description of Material	Sample for testing	Laboratory identification	Remarks
0		Silty Clay Reddish, moist to wet, firm, medium plastic. few plant roots are present within top 45 cm layer.	50 kg sample		
1					
2		Sand Reddish, fine to medium, little non-plastic fines, wet, loose, contains grass roots, slightly plastic.	50 kg sample		
	GW ▽				
3		Pit Completed			
4					
5					
6					
7					

LOG OF PIT

Project Munda | Location West Sadar Ghari | Co-ordinatres
Ground Elevation | Top of Rock Elev. | Water Table
Dimension of Pit 1.2x1.4x5.0m | Date Started 23/Dec/1998 | Date Completed 26/Dec/1998
Logged by MEHBOOB/AZEE | Contractor

Depth (M)	Lithic Symbol	Description of Material	Sample for testing	Laboratory identification	Remarks
0		Silty Clay / Clayey Silt Light brown, slightly moist, firm to stiff, slightly plastic, low to medium dry strength	50 kg sample		
3		Sandy Gravels / Cobbles Subrounded, hard, clean gravels with cobbles, max. size 15x9 cm, some weathered to soft, greyish, fine to medium sand (approx 10%), traces of silt. The deposit is dry and compact. Boulders max. size 29x14 cm encountered below 4.0 m depth.			
5		Pit Completed			

GE5.

LABORATORY TEST DATA

LABORATORY TEST ON EARTH CORE MATERIAL

	Samples
Particle size analysis by sieve and hydrometer (ASTM D422)	18
Liquid limit, plastic limit, plastic index (ASTM D431)	18
Specific gravity of soil (ASTM D854)	15
Natural water content of soil (ASTM D4959)	18
Proctor compaction test (ASTM D698)	15
Permeability test of compacted soil (USBR E-13)	5
Triaxial compression, UU (ASTM D2850)	5
Triaxial compression, CU with pore pressure observation (ASTM D4767)	5
Dispersive characteristics (ASTM D4221)	3

CENTRAL MATERIAL TESTING LABORATORY

SUMMARY OF TEST RESULTS

PROJECT: MUNDA DAM PROJECT

Sr. No.	Pit No	Sample Description		Grain Size Aanalysis					Atterberg Limits			Compaction				Triaxial Test				Permeability Cm/Sec
		Lab. No.	Depth Mtr.	Coobles	Gravels	Clay %	Silt %	Sand %	LL%	PL %	PI%	Max. γd	OMC	Specific Gravity	NMC	CU C. KPa	ϕ	UU C. KPa	ϕ Deg.	
1	P-8/1	15538	00/00	5	72	-200#	12	11	25	18	7	2.11	8.5	2.67	2.3					K=1.653x10⁻⁴
2	8/2	"	00/00			-200#	8	92	Non Plastic			1.689	13.5	2.76	2.09					
3	P-9/1	"	0.00/1.00		8	17	60	15	33	23	10	1.68	19	2.66	13.8					
4	P-9/2	"	0.00/4.00		23	10	32	35	26	21	5	1.89	13	2.68	11.11	5	32	96	0	K=1.00x10⁻⁴
5	P-10/1	"	0.00/0.00		1	11	29	59	Non Plastic			1.64	19	2.67	3.73					
6	P-10/2	"	0.00/0.00			6	58	36		"		1.67	16	2.68	5	18	28	125	0	K=2.389x10⁻⁴
7	P-10/2	"	With Distilled water			0	72	28						2.68	.5					
8	P-11/1	"	0.5			13	85	2	43	30	13	1.43	25	2.69	15.28					
9	P-11/2	"	3			20	79	1	40	28	12	1.59	19	2.69	9.56	20	3°	50	0	
10	P-12/1	"	1		80	6	7	7	30	23	7	2.07	11.6	2.67	4.86					
11	P-12/2	"	4		75	2	3	20	Non Plastic			2.03	10.7	2.75	1.4					
12	P-13/1	"	0.00/2.00		62	5	13	20		"		2.03	10.2	2.69	3.8					
13	P-13/2	"	With Distilled Water		2	0	74	24	26	22	4	1.69	17.7	2.69	9.83	19	30	62	0	K=6.630x10⁻⁵
14	P-13/2	"	With Calgon		2	14	70	14	26	22	4			2.69	9.83					
15	P-14/1	"	0.00/0.00		1	14	55	30	27	22	5	1.81	13.5	2.68	17.8					
16	P-14/2	"	0.00/0.00		3	3	33	61	Non Plastic			1.95	11	2.7	18.6					
17	P-15/1	"	3 Mt. with Distilled Water		4	0	50	46	30	24	6	1.83	14.3	2.67	6.3	24	29	44	0	K=3.462x10⁻⁵
18	P-15/1	"	3 Mt. with calgon		4	14	40	42	30	24	6			2.67	6.3					

Compiled by

Tested by:

Checked by:

Approved by:

PD; CMTL

GE5 - 2

SIEVING
Preperation
Mass gm
Wet BS1377
29680.00
SEDIMENTATION
Pretreatment
Mass g
PERCENTAGE PARTICLE SIZES
Clay Silt Sand Gravel Cobbles
12% 200 11 72 5
LL = 25
PI = 7
PL = 18
Sp.Gr. = 2.67
NMC = 2.3
um ← → mm
British Standard Sieve Sizes
PERCENTAGE PASSING
Tested by:
Checked by:
Approved by:
P.D; CMTL
CLAY
SILT
SAND
GRAVEL
COBBLES
BOULDERS
Particle Size Distribution
Borehole No. PIT-B/1
Depth 0.00 - 0.00 M
Sample No. 05/1/A
Date 07/01/99
CENTRAL MATERIAL TESTING LABORATORY.
Client JICA
Location Munda Dam Project
Loc No.
Fig. 7.

SIEVING
Preperation
Wet BS1377
Mass g
100.00
SEDIMENTATION
Pretreatment
Mass g
PERCENTAGE PARTICLE SIZES
Clay Silt Sand Gravel Cobbles
8% 200 %
NP (Non Plastic)
Sp.Gr. = 2.76 (Iron exists)
NMC = 2.09
um < mm
British Standard Sieve Sizes
63 150 212 300 425 600 1.18 2 3.35 5 6.3 10 14 20 28 37.5 50 63 75
PERCENTAGE PASSING
100 90 80 70 60 50 40 30 20 10 0
mm 0.002 0.006 0.02 0.06 0.2 0.6 2 6 20 60 200 600
CLAY
Fine Medium Coarse
SILT
Fine Medium Coarse
SAND
Fine Medium Coarse
GRAVEL
COBBLES
BOULDERS
Tested by:
Checked by:
Approved by:
P.D, CMTL
Particle Size Distribution
Borehole No. PIT-8 /1
Depth 0.00 - 0.00 M
Sample No. DS/2/A
Date 09/01/99
CENTRAL MATERIAL TESTING LABORATORY.
Client JICA
Location Munda Dam Project
Loc. No.
Fig. 8

SIEVING
Preperation
Mass g
Wet BS1377
14837.00
SEDIMENTATION
Pretreatment
Mass g
BS1377 9.5
40.00
PERCENTAGE PARTICLE SIZES
Clay
Silt
Sand
Gravel
Cobbles
17
60
15
8
LL = 33
PL = 23
PI = 10
Sp.Gr. = 2.66
NMC = 13.8
um
mm
British Standard Sieve Sizes
PERCENTAGE PASSING
Tested by:
Checked by:
Approved by:
P.D: CMTL
Particle Size Distribution
Borehole No PIT-9/1
Depth 0.00 - 1.00 M
Sample No DS/15538/A
Date 30/01/99
CENTRAL MATERIAL TESTING LABORATORY.
Client JICA
Location Munda Dam Project
Loc No
Fig. 9

SIEVING
Preperation
Mass g
Wet BS1377
3526.70
SEDIMENTATION
Pretreatment
Mass g
BS1377 9.5
40.00
PERCENTAGE PARTICLE SIZES
Clay
Silt
Sand
Gravel
Cobbles
10
32
35
23
-
LL = 26
PL = 21
PI = 5
Sp.Gr. 2.68
NMC = 11.11
um <——> mm
British Standard Sieve Sizes
PERCENTAGE PASSING
CLAY
SILT
SAND
GRAVEL
COBBLES
BOULDERS
Tested by:
Checked by:
Approved by:
Particle Size Distribution
Borehole No. PIT-9/2 Depth 0.00 - 4.00 M
Sample No. DS/15538/A Date 30/01/99
CENTRAL MATERIAL TESTING LABORATORY.
Client JICA
Location Munda Dam Project
Loc No.
Fig. 10

GES - 7

CENTRAL MATERIAL TESTING LABORATORY.

Particle Size Distribution

Client JICA

Location Munda Dam Project

Borehole No. PIT-10/1 Depth 0.00 - 0.00 M.

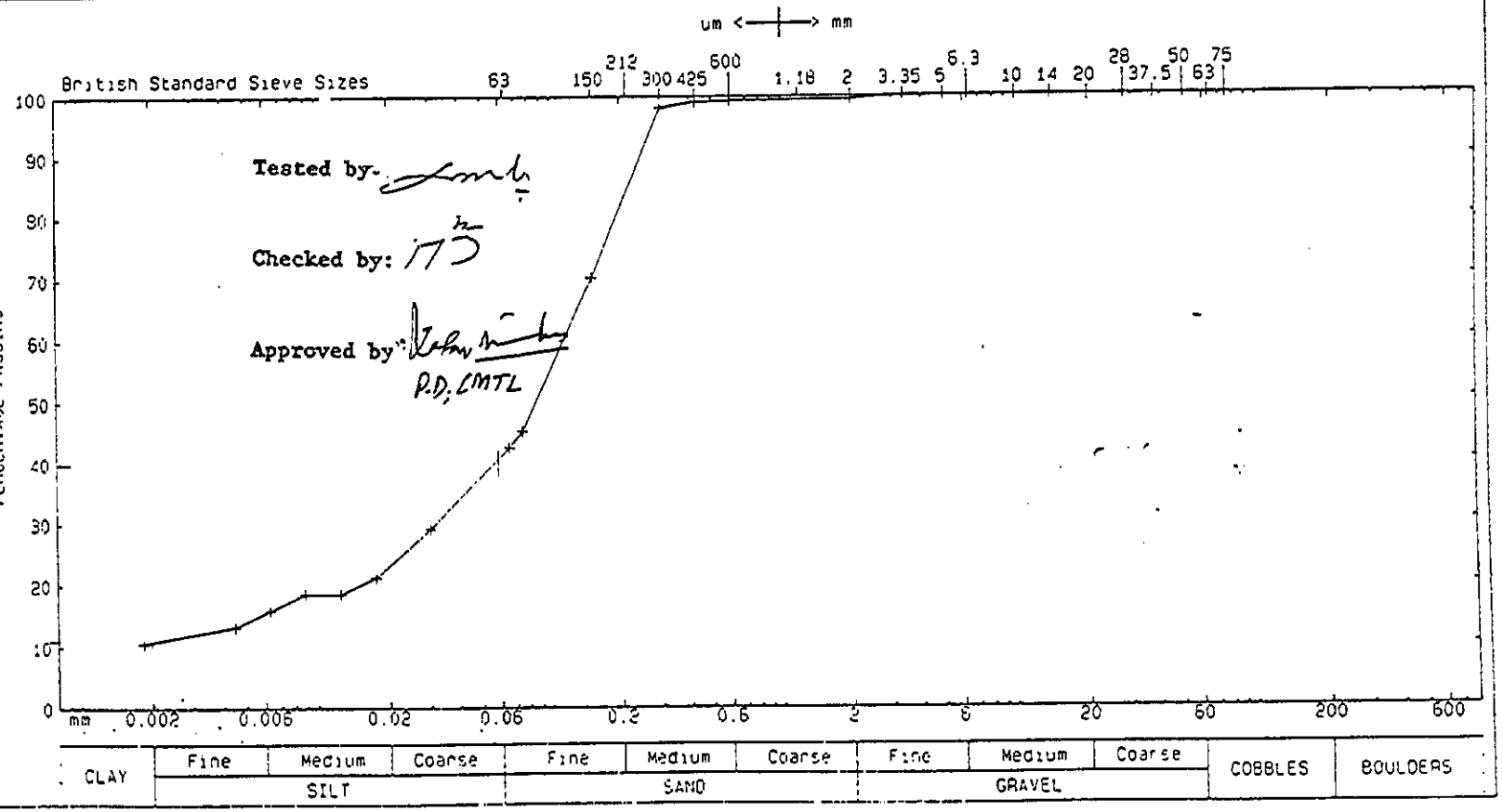
Sample No. DS/1553B/A Date 15/01/99

Loc No.

Fig. 11

NP
Sp.Gr. = 2.67
NMC = 3.72

SIEVING		SEDIMENTATION		PERCENTAGE PARTICLE SIZES				
Preperation	Mass g	Pretreatment	Mass g	Clay	Silt	Sand	Gravel	Cobbles
Wet BS1377	100.00	BS1377 9.5	30.00	11	29	59	1	-



SIEVING			SEDIMENTATION			PERCENTAGE PARTICLE SIZES			
Preperation	Mass g		Pretreatment	Mass g	Clay	Silt	Sand	Gravel	Cobbles
Wet BS1377	100.00		BS1377 9.5	40.00	6	58	36	-	-

WITH CAIGON

Non Dispersive
Non Plastic
S.Gr. 2.68
NMC = 5.0

Particle Size Distribution

Borehole No. PII-10/2 Depth 0.00 - 0.00 M
Sample No. 05/15538/A Date 14/01/99

CENTRAL MATERIAL TESTING LABORATORY.

Client JICA
Location Munda Dam Project

Loc No

Fig. 12

CENTRAL MATERIAL TESTING LABORATORY

Particle Size Distribution

Client JICA

Location Munda Dam Project

Borehole No. PIT-10/2 Depth 0.00 - 0.00 m

Sample No. GS/1553B/A Date 14/01/99

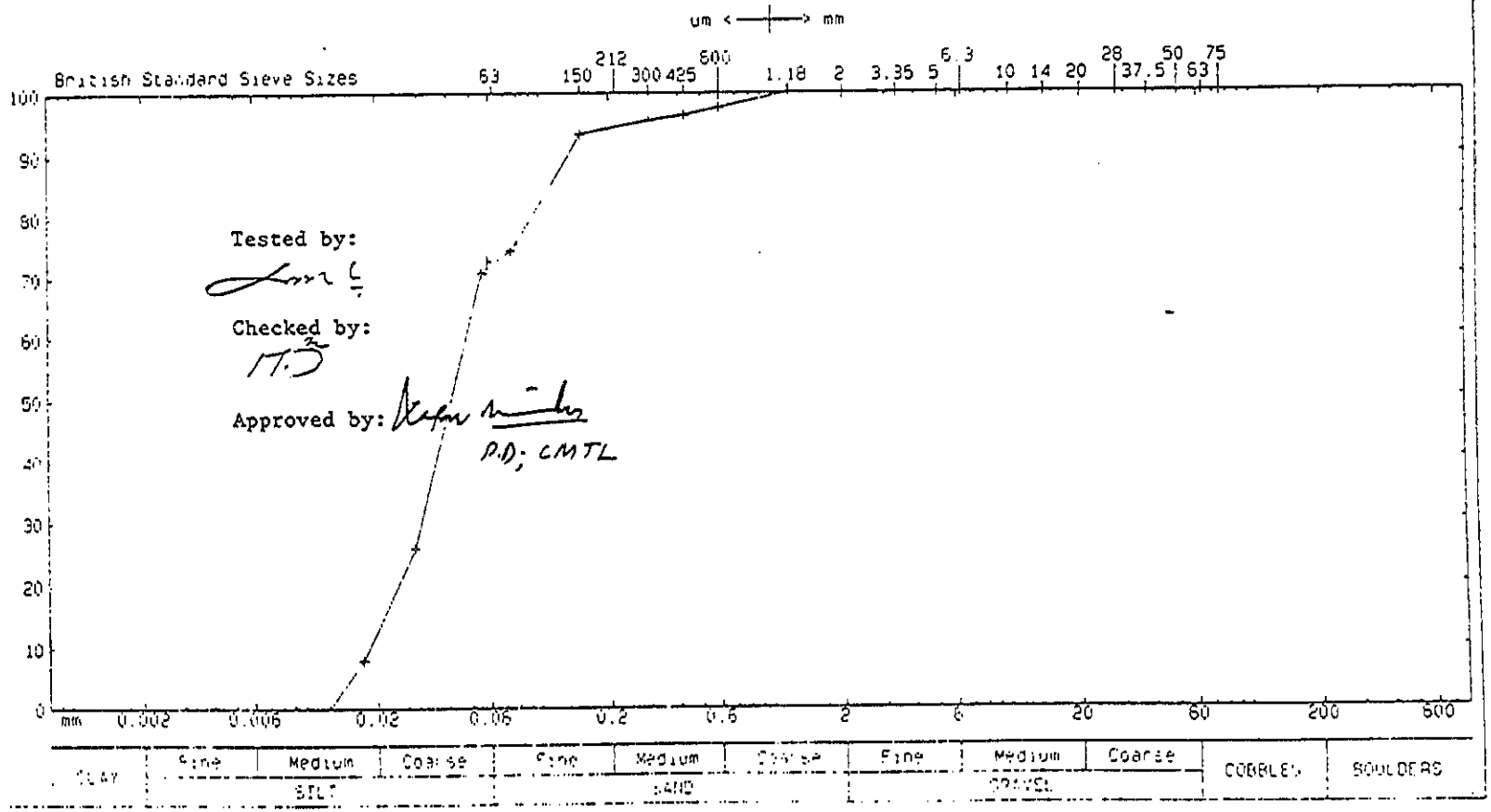
Loc No.

Fig. 13

SIEVING		SEDIMENTATION		PERCENTAGE PARTICLE SIZES				
Preperation	Mass g	Pretreatment	Mass g	Clay	Silt	Sand	Gravel	Cobbles
Wet BS1377	100.00	BS1377 9.5	40.00	0	72	28		

Non Dispersive
Sp.Gr. 2.68
NMC = 5.0
Non Plastic

WITH DIST. WATER



Tested by:

Checked by:

Approved by:

D.D; CMTL

PERCENTAGE PARTICLE SIZES
SIEVING
Preparation
Mass g
Wet BS1377
100.00
SED. TATION
Pretreatment
Mass g
BS1377 9.5
40.00
Clay
Silt
Sand
Gravel
Cobbles
13
85
2
LL = 43
PL = 30
PI = 13
Sp.Gr. = 2.69
NMC = 15.28
um
mm
British Standard Sieve Sizes
PERCENTAGE PASSING
Tested by:
Checked by:
Approved by:
Particle Size Distribution
Borehole No. PIT-11/1
Depth 0.50 - 0.00 M
Sample No. 09/1553B/A
Date 13/01/99
CENTRAL MATERIAL TESTING LABORATORY.
Client JICA
Location Munda Dam Project
Loc No.
Fig. 14

PERCENTAGE PARTICLE SIZES
SIEVING
Preperation
Mass g
Wet BS1377
100.00
SEDIMENTATION
Pretreatment
Mass g
BS1377 9.5
20.00
Clay
Silt
Sand
Gravel
Cobbles
20
79
1
LL = 40
PL = 28
PI = 12
Sp.Gr = 2.69
NMC = 9.66
um
mm
British Standard Sieve Sizes
PERCENTAGE PASSING
CLAY
SILT
SAND
GRAVEL
COBBLES
BOULDERS
Fine
Medium
Coarse
Tested by:
Checked by:
Approved by:
P.D, CMTL
Particle Size Distribution
Borehole No. PIT-11/2
Depth 3.00 - 0.00 M
Sample No. OS/15538/A
Date 13/01/99
CENTRAL MATERIAL TESTING LABORATORY.
Client JICA
Location Munda Dam Project
Loc No.
Fig. 15

Particle Size Distribution

Borehole No. PIT-12/1 Depth 1.00 - 0.00 M.

Sample No. DS/15538/A Date 15/01/99

CENTRAL MATERIAL TESTING LABORATORY.

Client JICA

Location Munda Dam Project

Loc No.

Fig. 16

CENTRAL MATERIAL TESTING LABORATORY.

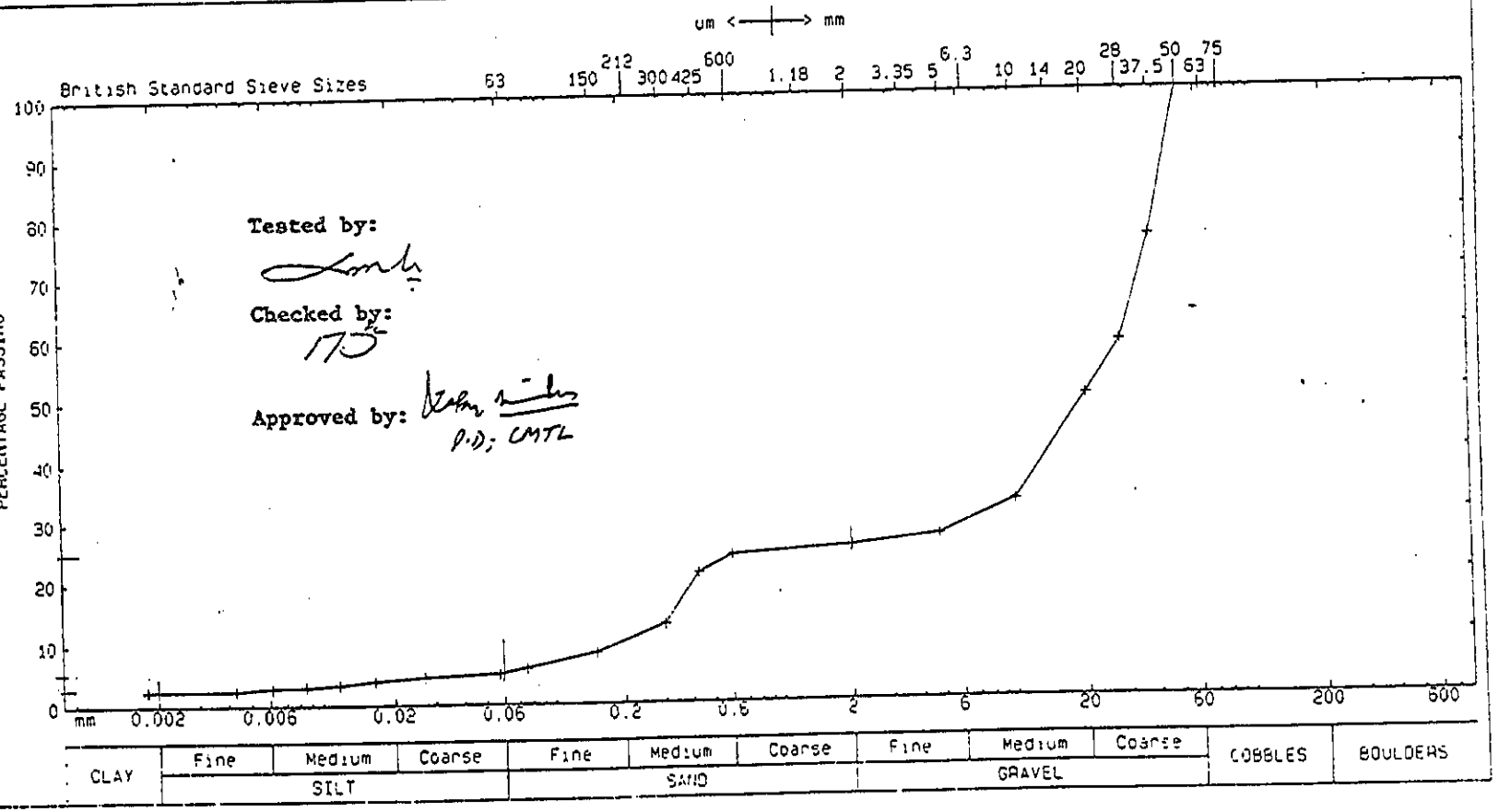
Particle Size Distribution

Client: JICA
Location: Munda Dam Project
Loc No.
Fig. 17

Borehole No. PIT-12/2 Depth 4.00 - 0.00 M
Sample No. DS/15538/A Date 15/01/99

Non plastic
Sp.Gr. = 2.75 (Iron exists)
NMC = 1.4

SIEVING		SEDIMENTATION		PERCENTAGE PARTICLE SIZES				
Preperation	Mass g	Pretreatment	Mass g	Clay	Silt	Sand	Gravel	Cobbles
Wet BS1377	1667.40	BS1377 9.5	40.00	2	3	20	75	



Tested by:

Checked by:

Approved by:
D.D; CMTL

SIEVING		SEDIMENTATION		PERCENTAGE PARTICLE SIZES			
Preperation	Mass g	Pretreatment	Mass g	Clay	Silt	Sand	Gravel Cobbles
Wet BS1377	3312.80	BS1377 9.5	34.00	5	13	20	62

Non plastic
Sp.Gr. 2.69
NMC 3.8

British Standard Sieve Sizes

um ← → mm

PERCENTAGE PASSING

Tested by:

Checked by:

Approved by:

Particle Size Distribution	Borehole No. PIT-13/1 Depth 0.00 - 2.00 M Sample No. 05/15530/A Date 26/01/99	
CENTRAL MATERIAL TESTING LABORATORY.	Client JICA Location Munda Dam Project	Loc No. Fig. 18

CENTRAL MATERIAL TESTING LABORATORY.

Particle Size Distribution

Client JICA

Location Munda Dam Project

Borehole No. PIT-13/2 Depth 0.00 - 0.00 M

Sample No. MS/1553B/A Date 15/01/99

Loc No.

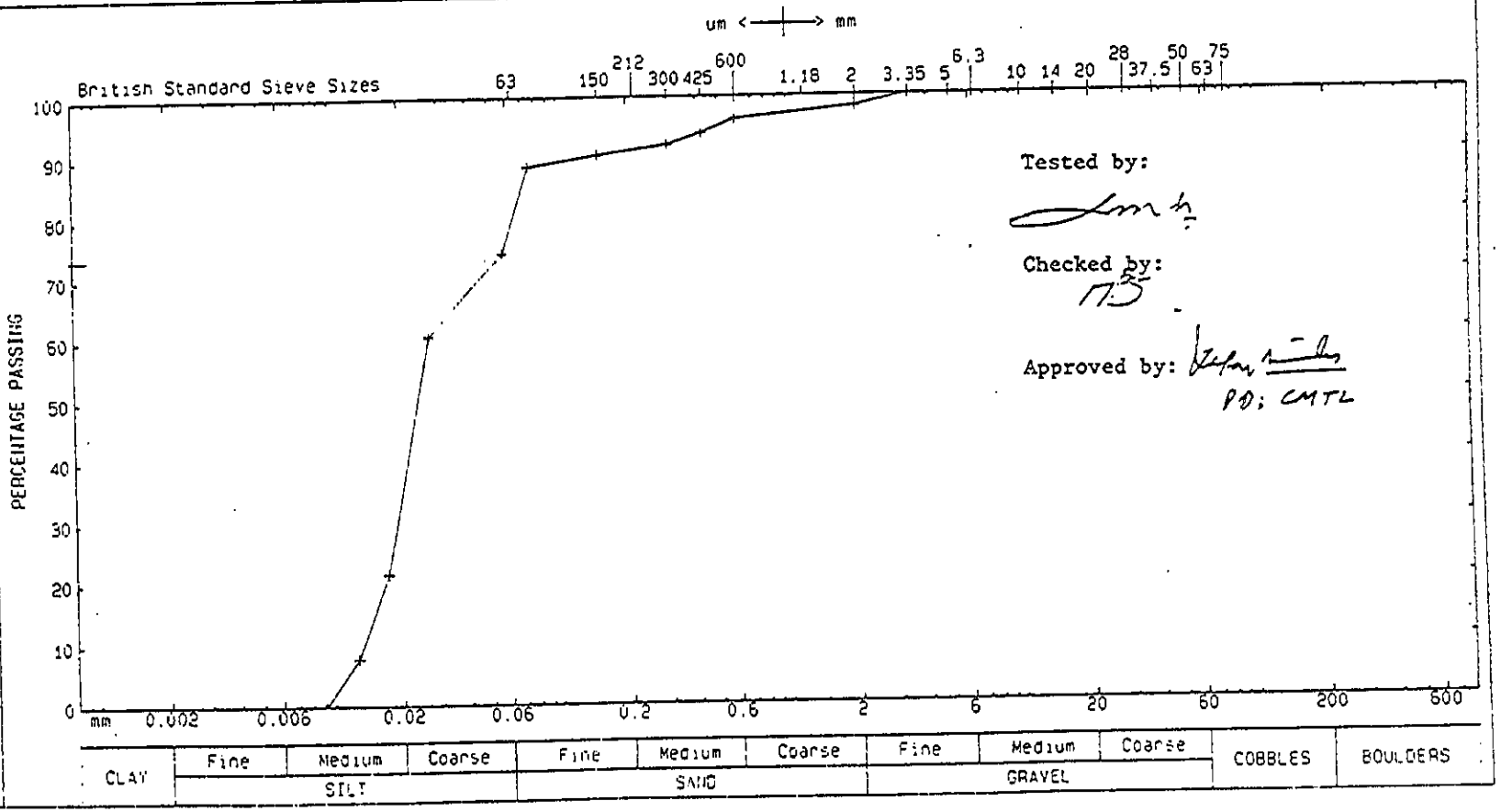
Fig. 19

Non Dispersive
LL = 26
PL = 22
PI = 4
Sp.Gr. 2.69

NMC = 9.83

SIEVING		SEDIMENTATION		PERCENTAGE PARTICLE SIZES				
Preperation	Mass g	Pretreatment	Mass g	Clay	Silt	Sand	Gravel	Cobbles
Wet BS1377	100.00	BS1377 9.5	40.00	0	74	24	2	

WITH DIST.WATER



Tested by:

Checked by:

Approved by:
PD; CMTL

CENTRAL MATERIAL TESTING LABORATORY.

Particle Size Distribution

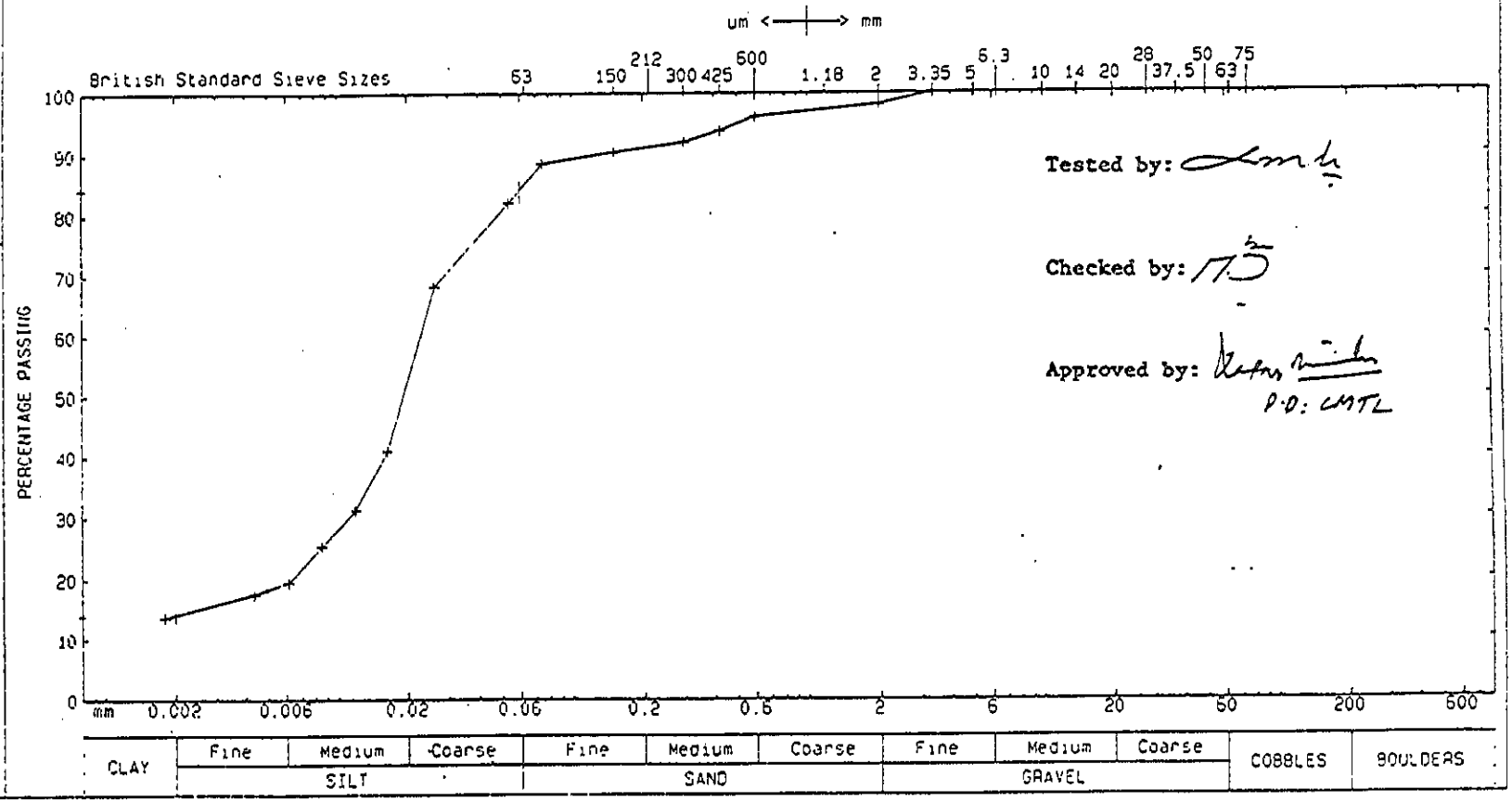
Non Dispersive

LL = 26
PL = 22
PI = 4
S.Gr. 2.69
NMC = 9.83

SIEVING		SEDIMENTATION		PERCENTAGE PARTICLE SIZES				
Preperation	Mass g/g	Pretreatment	Mass g	Clay	Silt	Sand	Gravel	Cobbles
Wet BS1377	100.00	BS1377 9.5	40.00	14	70	14	2	

WITH CALGON

Client JICA
Location Munda Dam Project
Borehole No. PIT-13/2 Depth 0.00 - 0.00 M
Sample No. OS/15538/A Date 15/01/99
Loc No.
Fig. 20



Tested by:

Checked by:

Approved by:
P.O: CMTL

CENTRAL MATERIAL TESTING LABORATORY.

Particle Size Distribution

Client: JICA

Location: Munda Dam Project

Borehole No. PIT-14/1 Depth 0.00 - 0.00 m

Sample No. OS/15538/A Date 26/01/99

Loc No.

Fig. 21

LL = 27

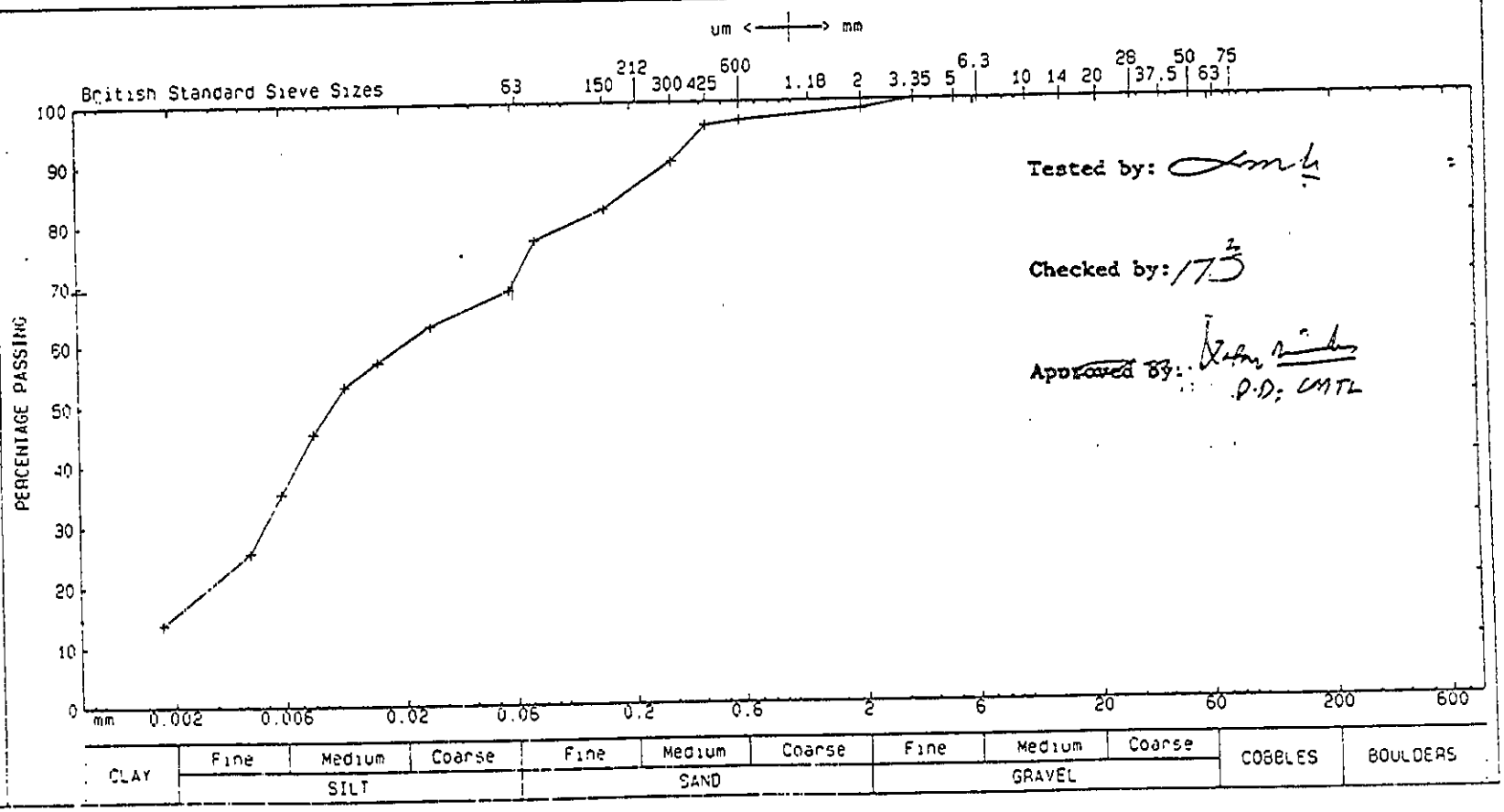
PL = 22

PI = 5

Sp.Gr. 2.68

NMC = 17.8

SIEVING		SEDIMENTATION		PERCENTAGE PARTICLE SIZES				
Preperation	Mass g	Pretreatment	Mass g	Clay	Silt	Sand	Gravel	Cobbles
Wet BS1377	100.00	BS1377 9.5	40.00	14	55	30	1	



Tested by:

Checked by:

Approved by: P.D. CMTL

SIEVING
Preperation
Mass g
Wet BS:377
100.00
SEDIMENTATION
Pretreatment
Mass g
BS1377 9.5
40.00
PERCENTAGE PARTICLE SIZES
Clay
Silt
Sand
Gravel
Cobbles
3
33
61
3
N.P
Sp.Gr. 2.70
NMC 18.6
British Standard Sieve Sizes
um < ——— > mm
PERCENTAGE PASSING
Tested by:
Checked by:
Approved by:
P.D; CMTL
CLAY
SILT
SAND
GRAVEL
COBBLES
BOULDERS
Particle Size Distribution
Borehole No. PIT-14/2 Depth 0.00 - 0.00 M
Sample No. DS/15538/A Date 26/01/99
CENTRAL MATERIAL TESTING LABORATORY.
Client JICA
Location Munda Dam Project
Loc No.
Fig. 22

CENTRAL MATERIAL TESTING LABORATORY.

Particle Size Distribution

Client JICA

Location Munda Dam Project

Borehole No. PIT-15/1 Depth 0.00 - 3.00 m

Sample No. 05/1553B/A Date 23/01/99

Loc No.

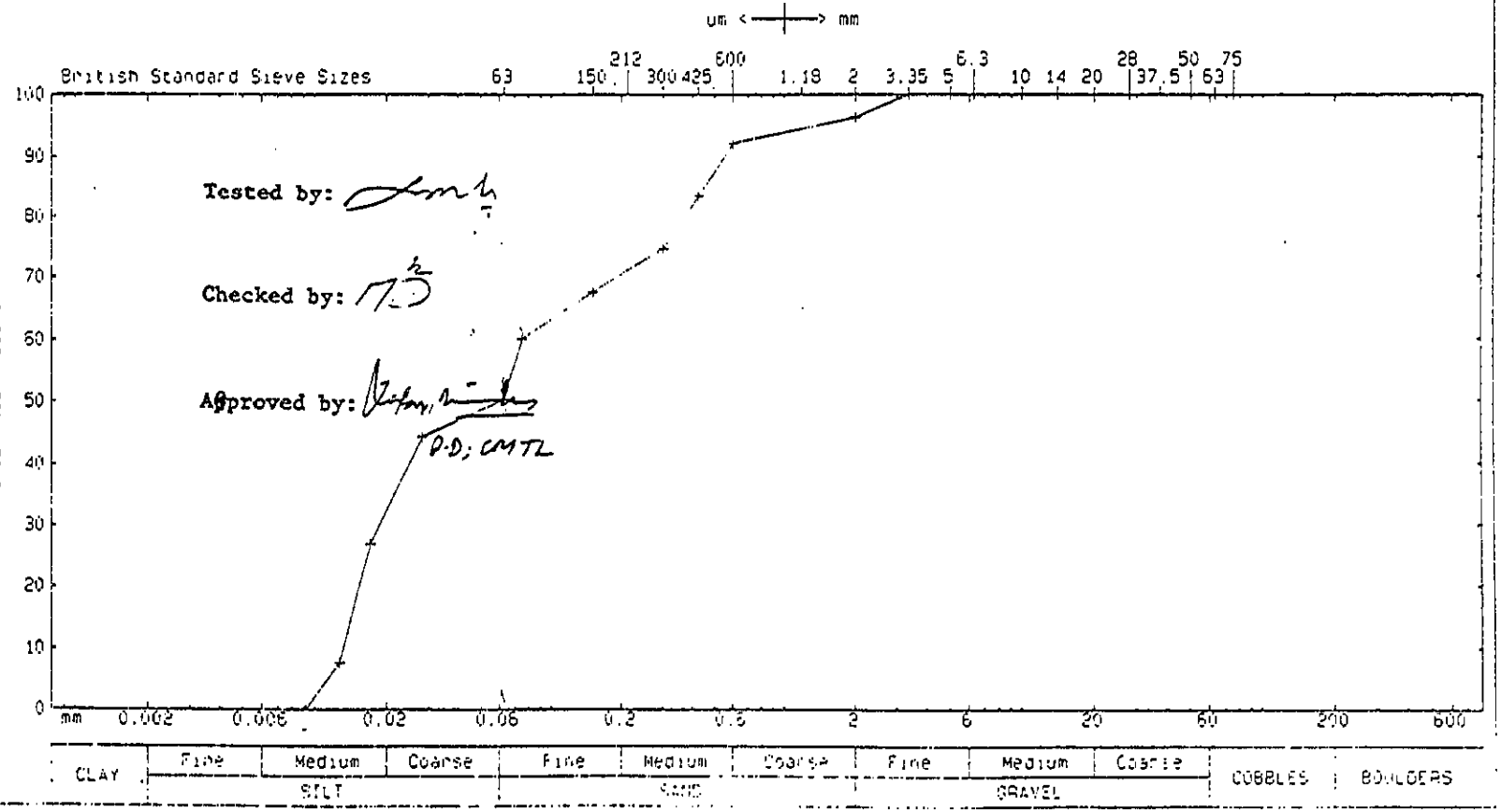
Fig. 23

Non Dispersive

LL = 30
PL = 24
PI = 6
Sp.Gr= 2.67
NMC = 6.3

SIEVING		SEDIMENTATION		PERCENTAGE PARTICLE SIZES				
Preperation	Mass g	Pretreatment	Mass g	Clay	Silt	Sand	Gravel	Cobbles
Wet BS1377	100.00	BS1377 9.5	40.00	0	50	46	4	

WITH DIST. WATER



PERCENTAGE PARTICLE SIZES
Clay Silt Sand Gravel Cobbles
14 40 42 4
SEDIMENTATION
Pretreatment Mass g
BS1377 9.5 40.00
SIEVING
Preperation Mass g
Wet BS1377 100.00
WITH CALGON
Non Dispersive
LL = 30
PL = 24
PI = 6
'Sp.Gr.= 2.67
NMC = 6.3
British Standard Sieve Sizes
um < mm
PERCENTAGE PASSING
CLAY
SILT
SAND
GRAVEL
COBBLES
BOULDERS
Tested by:
Checked by:
Approved by:
Particle Size Distribution
Borehole No. PIT-15/1 Depth 0.00 - 3.00 M
Sample No. OS/15536/A Date 23/01/99
CENTRAL MATERIAL TESTING LABORATORY.
Client JICA
Location Munda Dam Project
Loc No.
Fig. 24

NOTES:

1. Maximum particle size used 0.0 mm

Standard ASTM D-698-91

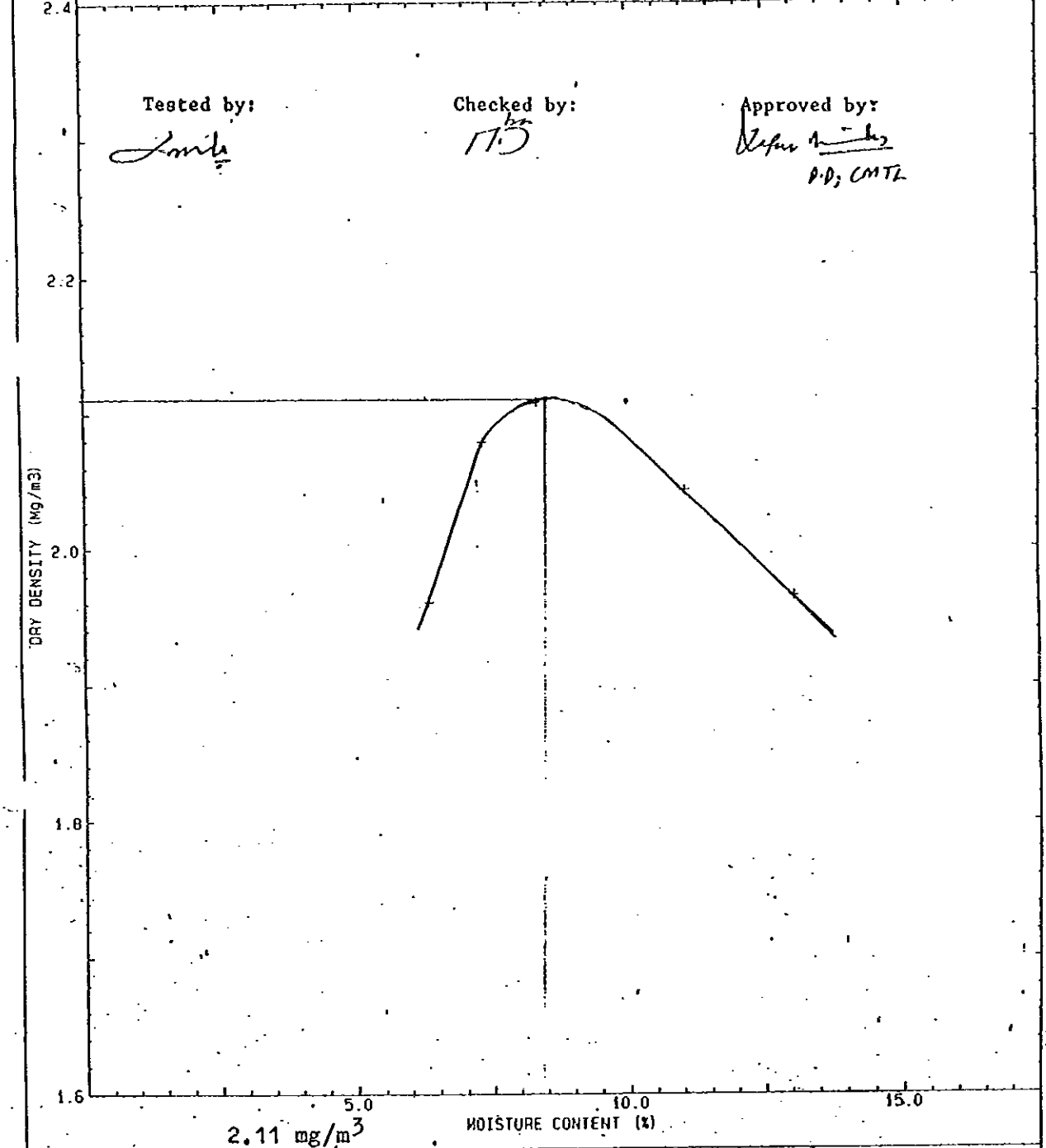
Method C

Container	ASTM		
Type of rammer	2.5kg	Height of drop	305 mm
No. of layers	3	Blows per layer	56
Particle Density 2.68 ASSUMED			
Material >37.5mm 0%		Material >20mm 0%	

Tested by: Smith

Checked by: MS

Approved by: P.D; CMTL



Maximum dry density: 2.11 mg/m^3

Optimum moisture content: 8.5%

Compaction Test

DENSITY/MOISTURE CONTENT CURVE

Borehole No. PIT 8/1 Depth 0.00 - 0.00 M

Sample No. OS/1/A Date 03/01/99

CENTRAL MATERIAL TESTING LABORATORY.

Client JICA

Location Munda Dam Project

Loc No.:

Fig. 25

NOTES:

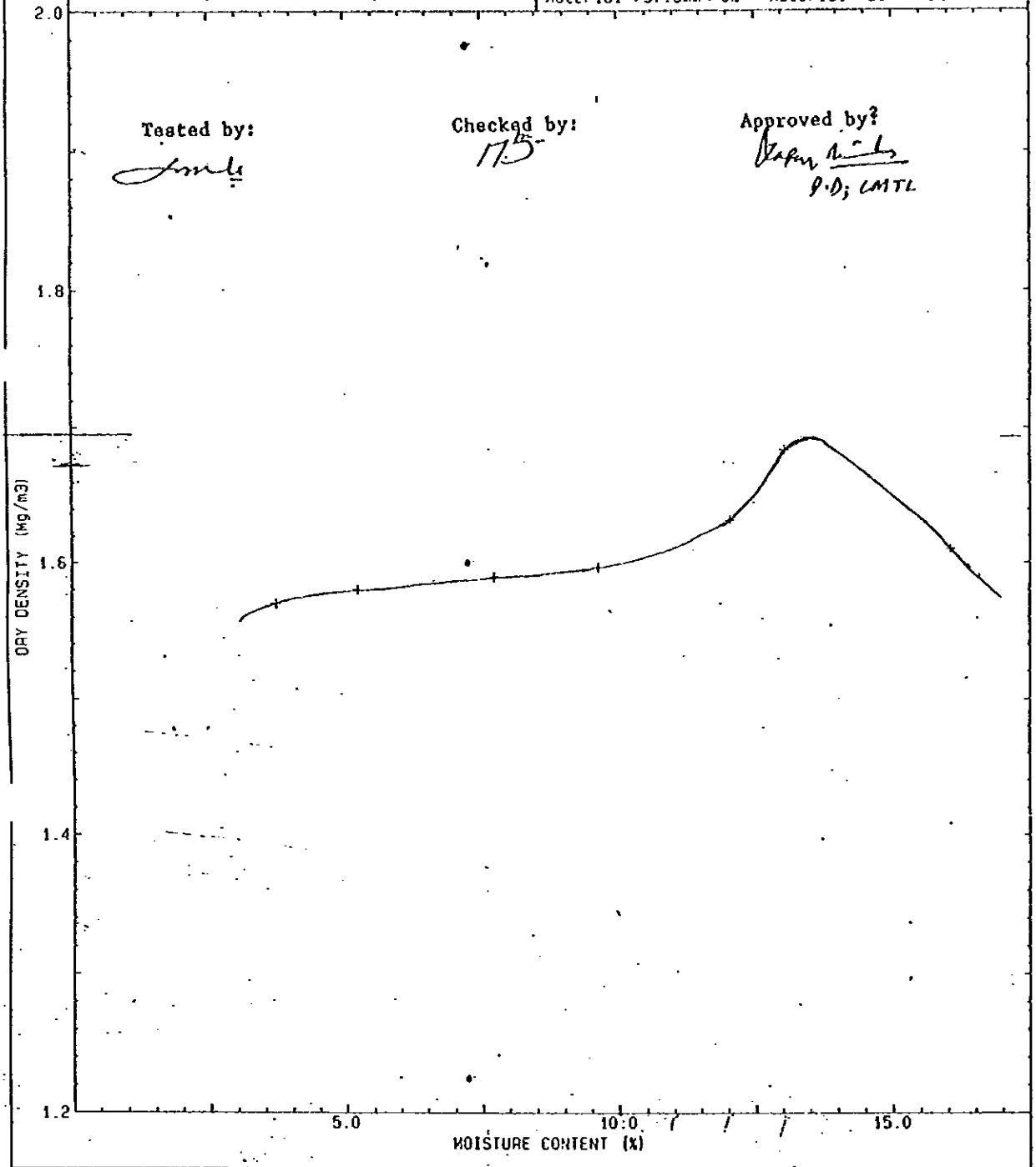
1. Maximum particle size used 0.0 mm

Container	0698/C		
Type of rammer	2.5kg	Height of drop	300 mm
No. of layers	3	Blows per layer	55
Particle Density 2.66 ASSUMED			
Material >37.5mm 0%		Material >20mm	0%

Tested by:

Checked by:

Approved by?
D.D; CMTL



Maximum dry density 1.689 Mg/m3 | Optimum moisture content 13.5%

Compaction Test
DENSITY/MOISTURE CONTENT CURVE

Borehole No. PIT-8/2 Depth 0.00 - 0.00 M
Sample No. DS/15538/A Date 11/01/99

CENTRAL MATERIAL TESTING LABORATORY.

Client JICA
Location EARTH EMBANKMENT

Loc No.

Fig. 26

NOTES:

1. Maximum particle size used 0.0 mm

Standard ASTM D-698-91

Method C

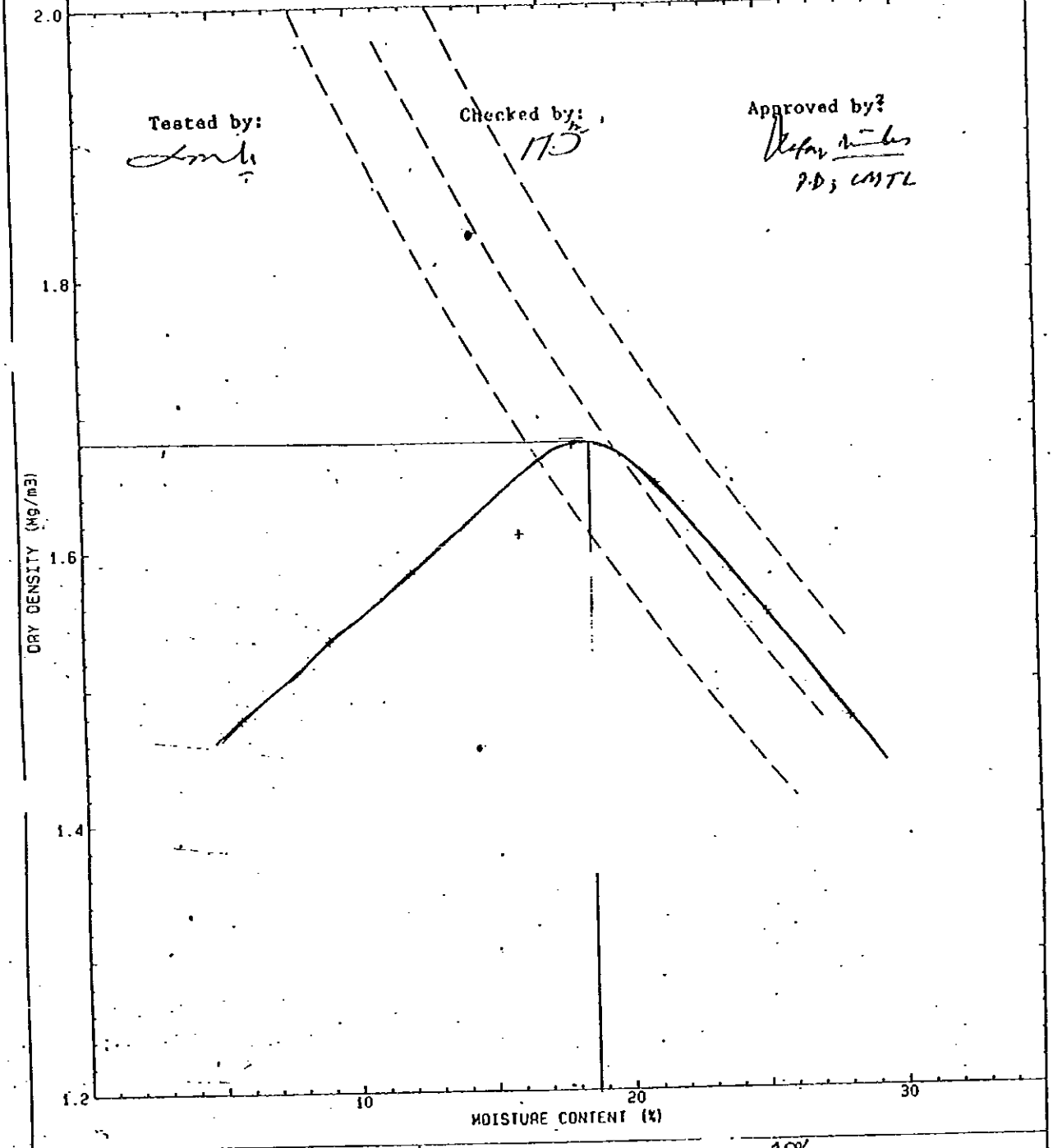
Container	ASTM		
Type of rammer	2.5kg	Height of drop	305 mm
No. of layers	3	Blows per layer	56
Particle Density 2.68 ASSUMED			
Material >37.5mm 0%		Material >20mm 0%	

Tested by:

Checked by:

Approved by?

P.D; CMTL



Maximum dry density	1.68	Optimum moisture content	19%

Compaction Test

DENSITY/MOISTURE CONTENT CURVE

Borehole No. PIT-9 / 1 Depth 0.00 - 1.00 M

Sample No. DS/1/A Date 06/01/99

CENTRAL MATERIAL TESTING LABORATORY.

Client JICA

Location Munda Dam Project

Loc No.

Fig 27

NOTES:

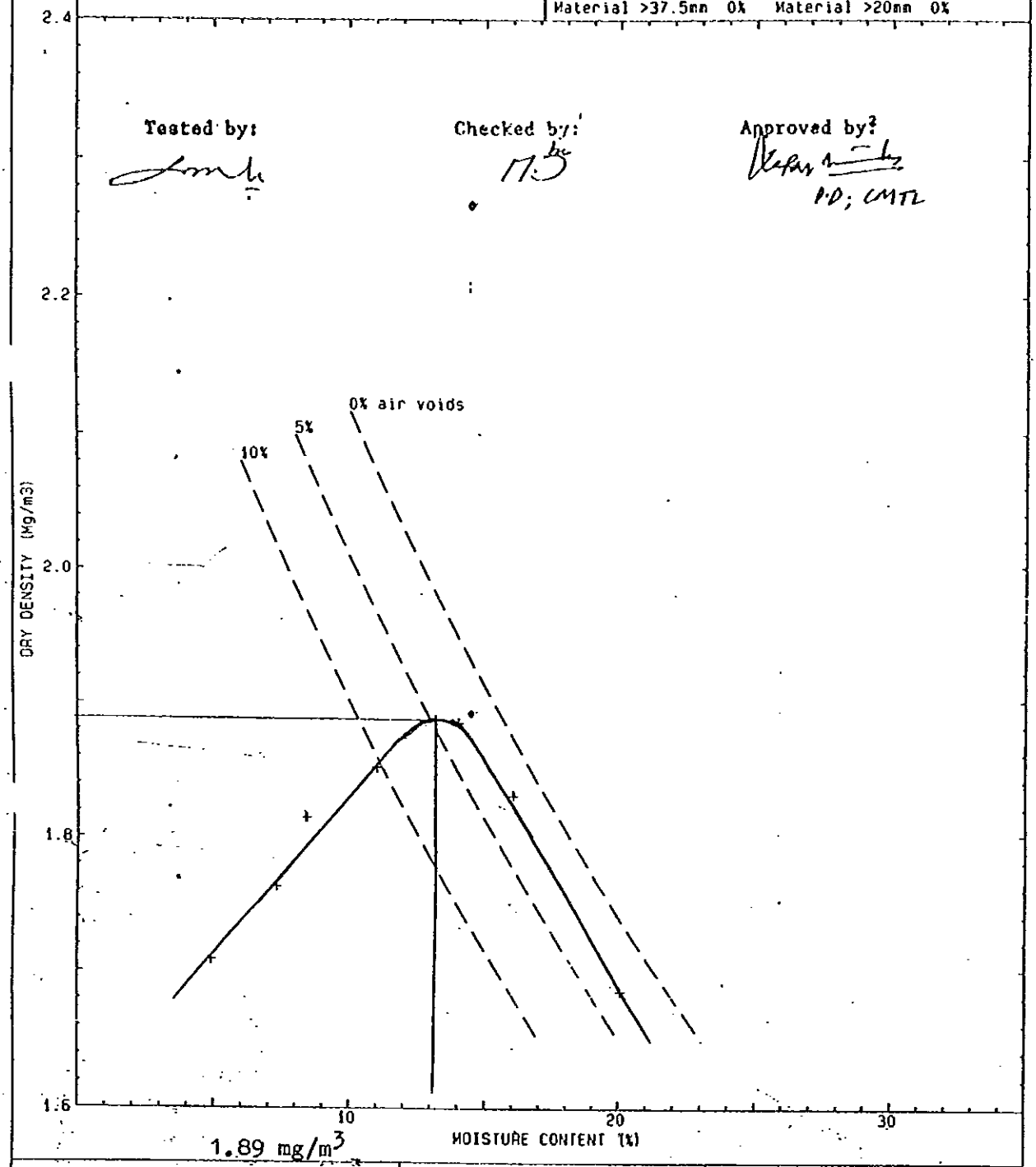
1. Maximum particle size used 0.0 mm

Container	ASTM		
Type of rammer	2.5kg	Height of drop	305 mm
No. of layers	3	Blows per layer	56
Particle Density	2.68 ASSUMED		
Material >37.5mm	0%	Material >20mm	0%

Tested by:

Checked by:

Approved by:
P.D; CMTL



Maximum dry density	Optimum moisture content 13%

Compaction Test
DENSITY/MOISTURE CONTENT CURVE

Borehole No. PIT-9 /2 Depth 0.00 - 4.00 M
Sample No. DS/2/A Date 03/01/99

CENTRAL MATERIAL TESTING LABORATORY.

Client JICA
Location Munda Dam Project

Loc No.

Fig. 28

NOTES

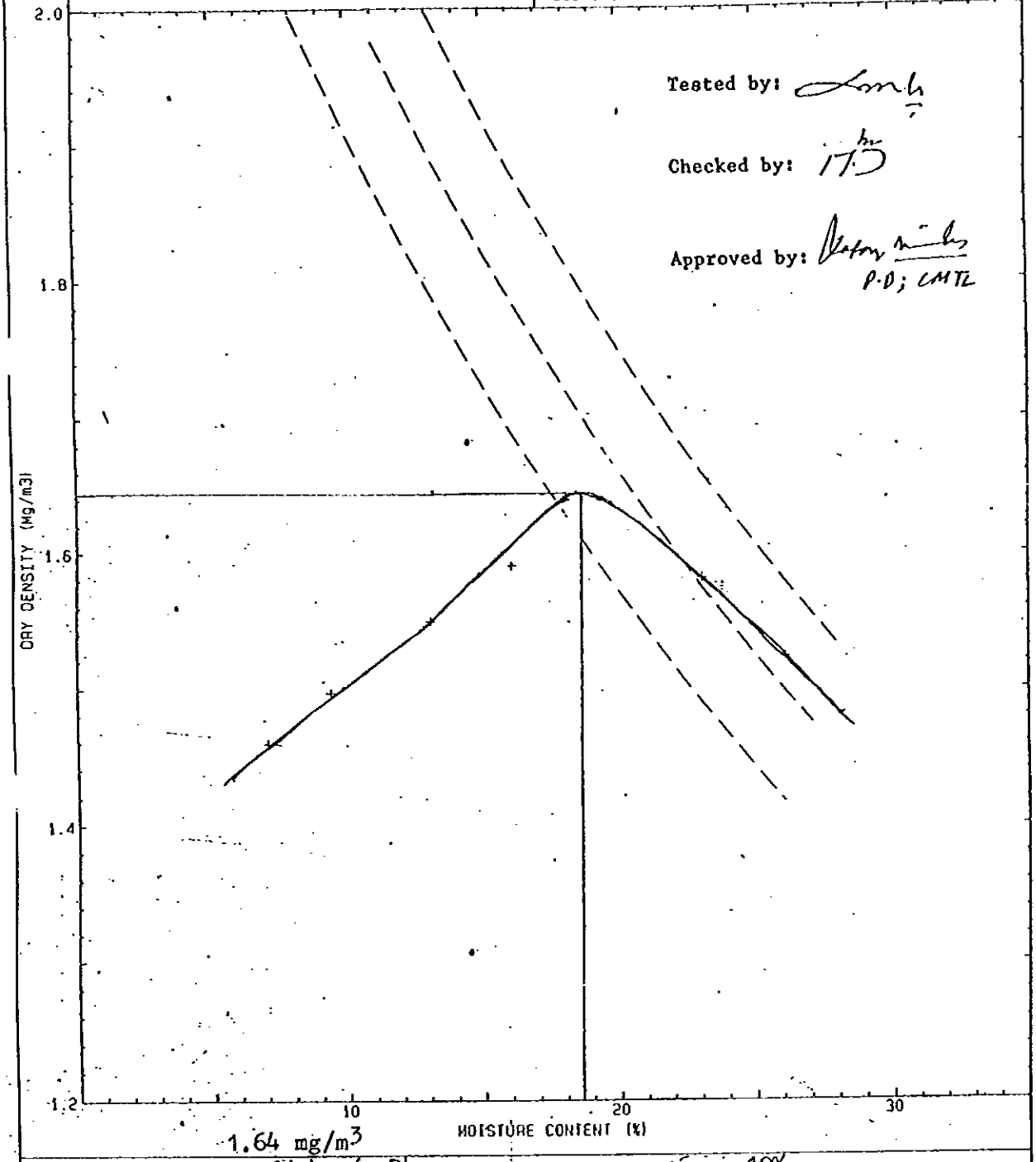
1. Maximum particle size used 0.0 mm

Container	ASTM		
Type of rammer	2.5kg	Height of drop	305 mm
No. of layers	3	Blows per layer	56
Particle Density	2.68 ASSUMED		
Material >37.5mm	0%	Material >20mm	0%

Tested by:

Checked by:

Approved by: P.D; CMTL



1.64 mg/m^3

Maximum dry density

Optimum moisture content : 19%

Compaction Test

DENSITY/MOISTURE CONTENT CURVE

Borehole No. PIT-10/1 Depth 0.00 - 0.00 M

Sample No. DS/15538/A Date 12/01/99

CENTRAL MATERIAL TESTING LABORATORY.

Client JICA

Location Munda Dam Project

Loc No.

Fig. 29

NOTES:

1. Maximum particle size used 0.0 mm

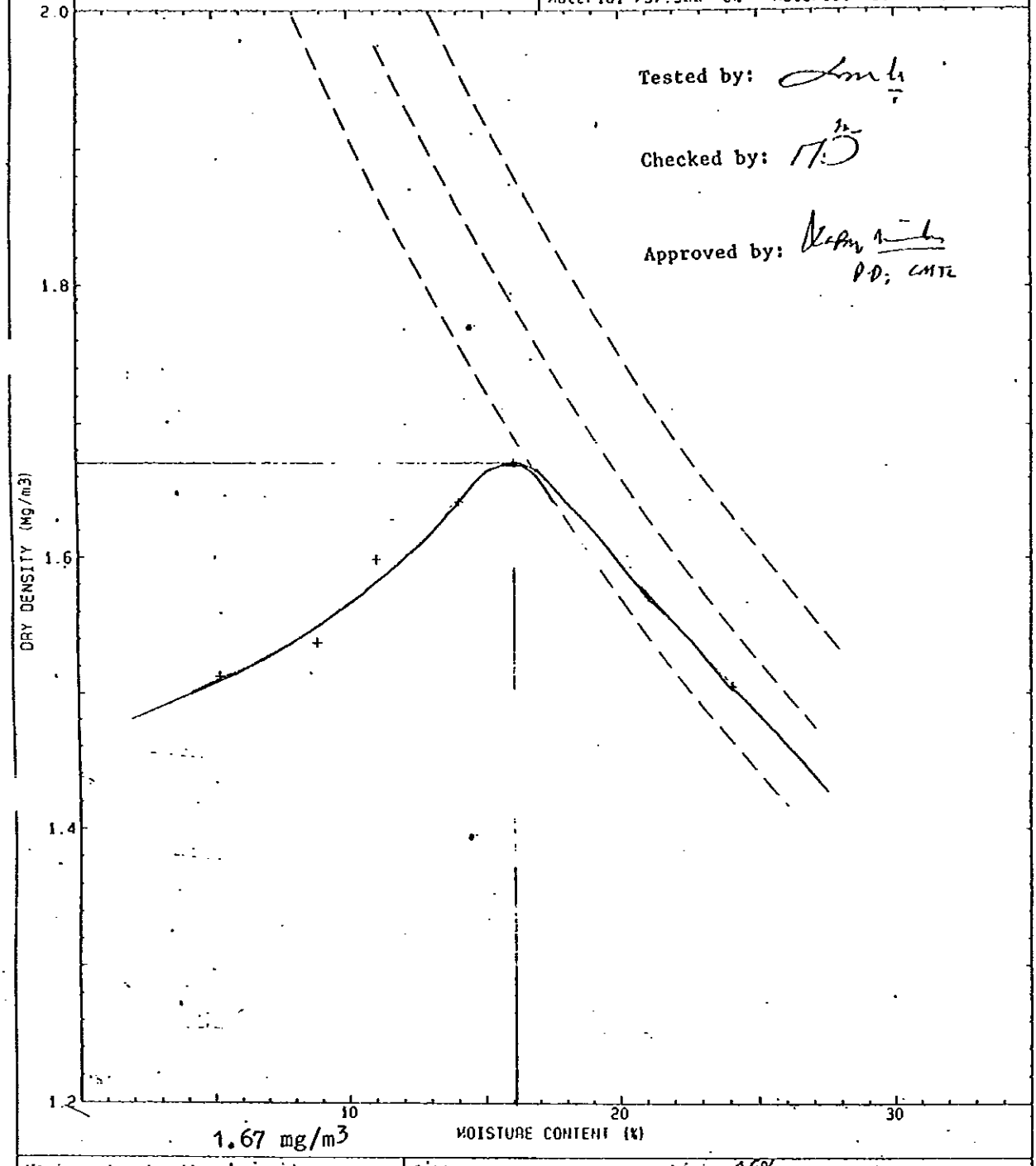
Container	ASTM		
Type of rammer	2.5kg	Height of drop	305 mm
No. of layers	3	Blows per layer	56
Particle Density 2.68 ASSUMED			
Material >37.5mm 0%		Material >20mm 0%	

Tested by:

Checked by:

Approved by:

P.D; CMTL



Maximum dry density	Optimum moisture content 16%

Compaction Test

DENSITY/MOISTURE CONTENT CURVE

Borehole No. PIT-10/2 Depth 0.00 - 0.00 M

Sample No. OS/15538/A Date 12/01/99

CENTRAL MATERIAL TESTING LABORATORY.	Client	JICA	Loc No.	Fig. 30
	Location	Munda Dam Project		

NOTES

1 Maximum particle size used 0.0 mm

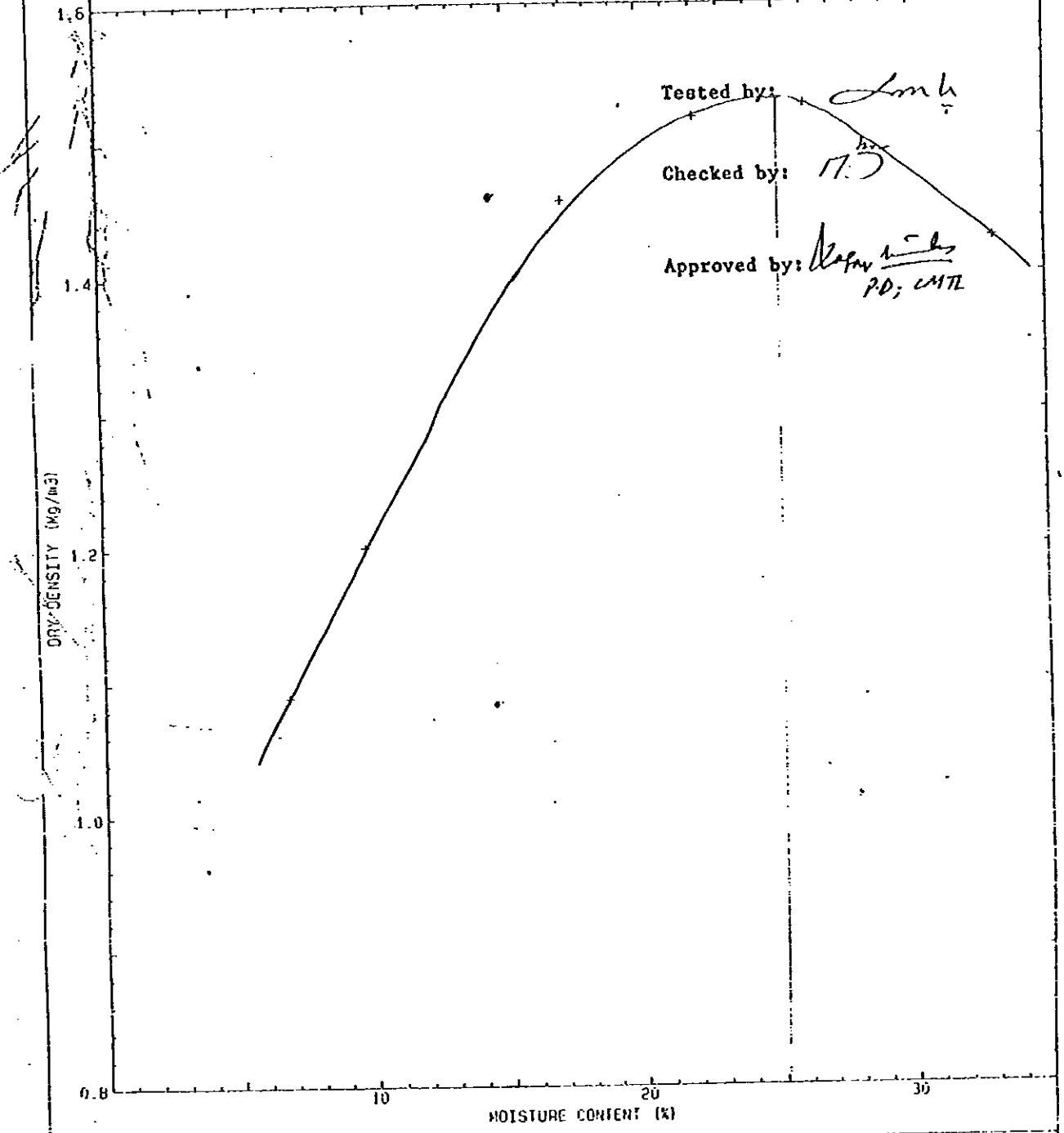
Pit-11 Sample-1

Container	ASTM	
Type of rammer	2.5kg	Height of drop 305 mm
No. of layers	3	Blows per layer 56
Particle Density 2.69 MEASURED		
Material >37.5mm 0%	Material >20mm 0%	

Tested by:

Checked by:

Approved by:
P.D; CMTL



Maximum dry density	1.43	Optimum moisture content	25%

Compaction Test
DENSITY/MOISTURE CONTENT CURVE

Borehole No. 15538 Depth 0.00 - 0.00 M

Sample No. DS/PIT/11/A Date 10/02/99

CENTRAL MATERIAL TESTING LABORATORY.	Client	JICA	Loc No. Fig. 31
	Location	Munda Dam Project	

NOTES

1. Maximum particle size used 0.0 mm

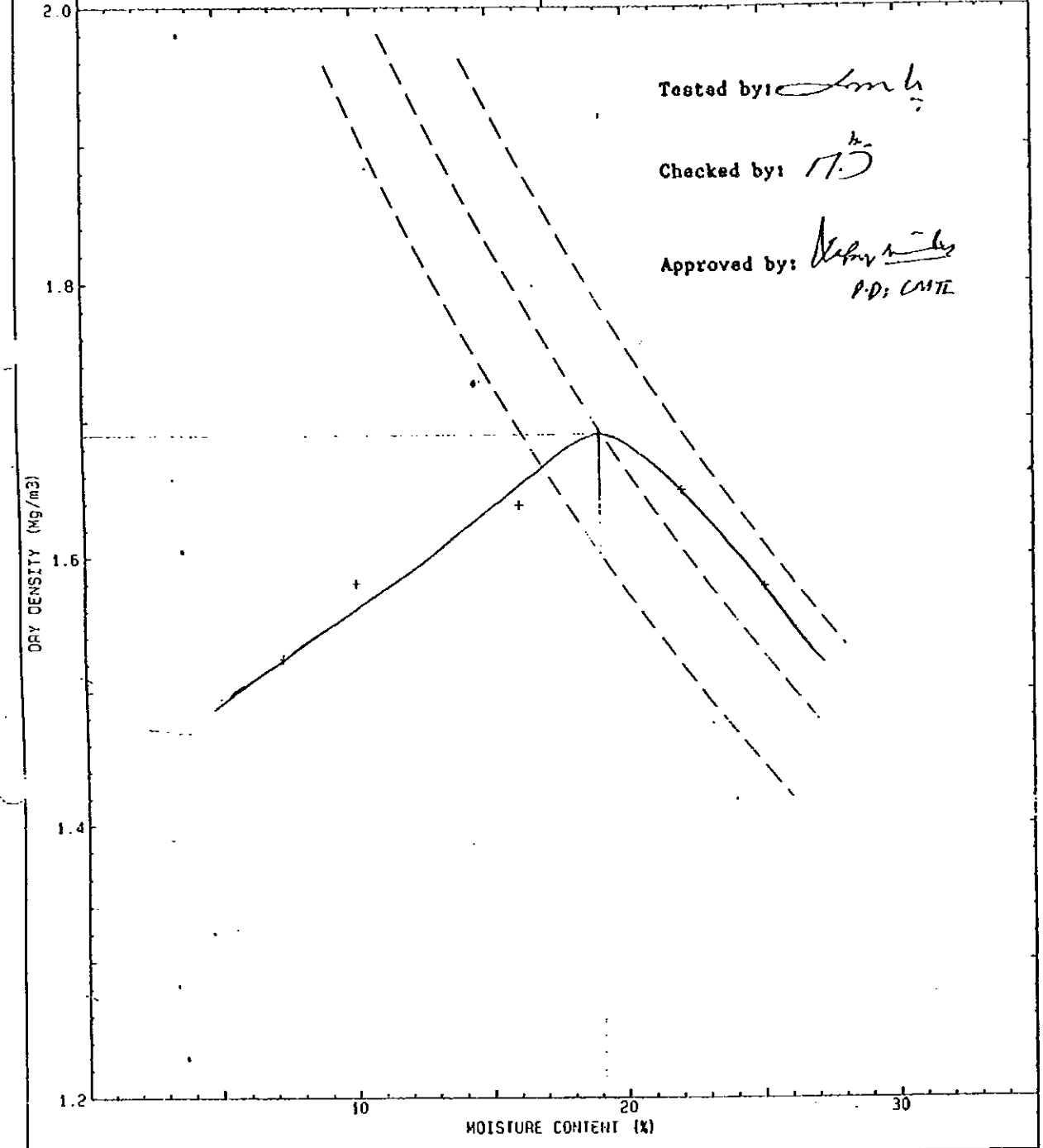
Pit 11/2

Container	ASTM		
Type of rammer	2.5kg	Height of drop	305 mm
No. of layers	3	Blows per layer	56
Particle Density	2.69 MEASURED		
Material >37.5mm	0%	Material >20mm	0%

Tested by:

Checked by:

Approved by:
P.D; CMTL



Maximum dry density	1.69	Optimum moisture content	19%

Compaction Test
DENSITY/MOISTURE CONTENT CURVE

Borehole No. 15538 Depth 0.00 - 0.00 M
Sample No. OS/PIT/11/A Date 10/02/99

CENTRAL MATERIAL TESTING LABORATORY.

Client JICA
Location Munda Dam Project

Loc No.

Fig. 32

NOTES:

1. Maximum particle size used 0.0 mm

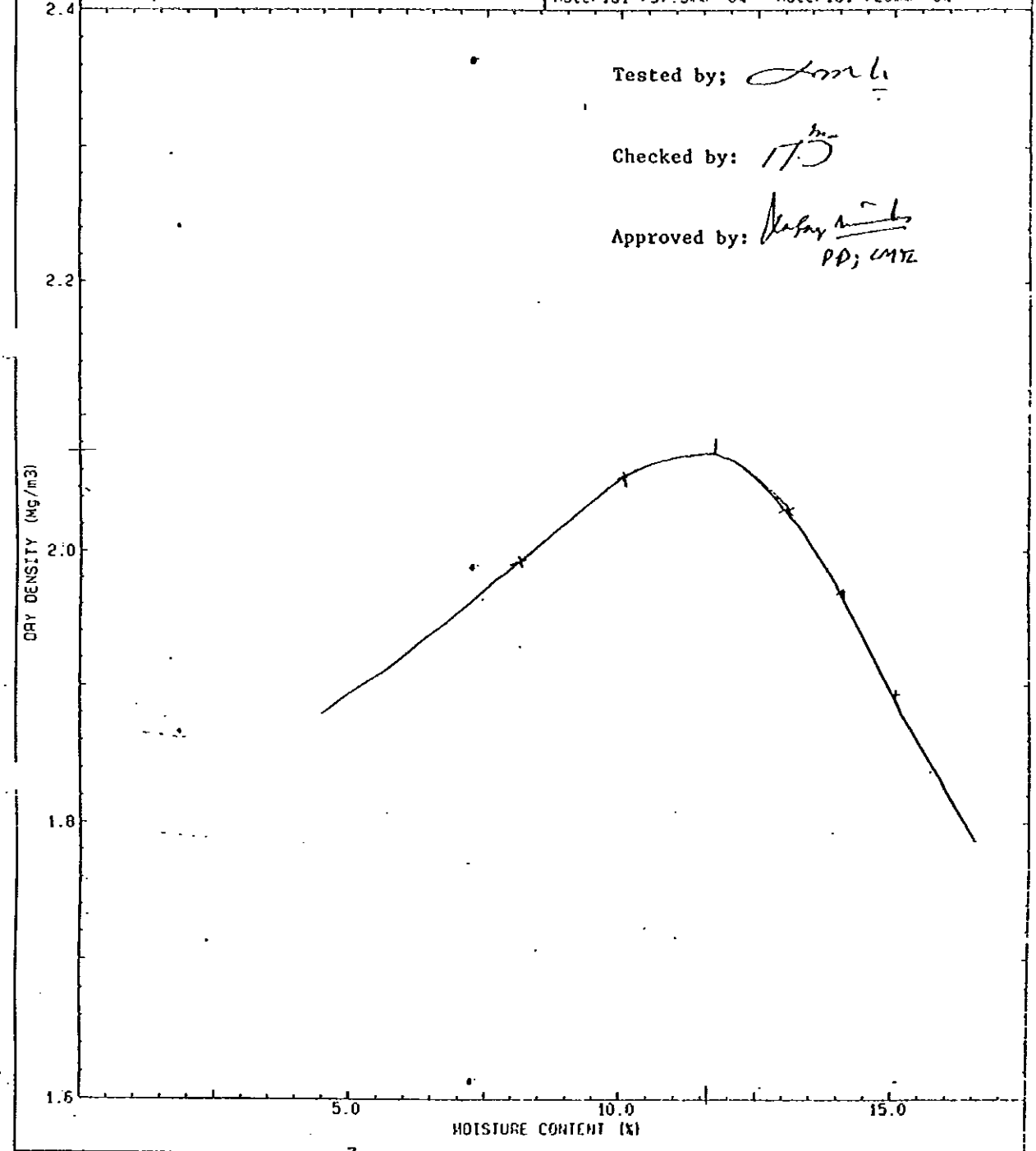
Pit 12/1

Container	ASTM		
Type of rammer	2.5kg	Height of drop	305 mm
No. of layers	3	Blows per layer	56
Particle Density	2.67 MEASURED		
Material >37.5mm	0%	Material >20mm	0%

Tested by:

Checked by:

Approved by:



Maximum dry density 2.07 mg/m^3 | Optimum moisture content 11.6%

Compaction Test
DENSITY/MOISTURE CONTENT CURVE

Borenole No. PIT-12/1 Depth 0.00 - 0.00 M
Sample No. DS/15538/A Date 26/01/99

CENTRAL MATERIAL TESTING LABORATORY

Client JICA
Location Munda Dam Project

Loc No.

Fig. 33

NOTES:

1 Maximum particle size used 0.0 mm

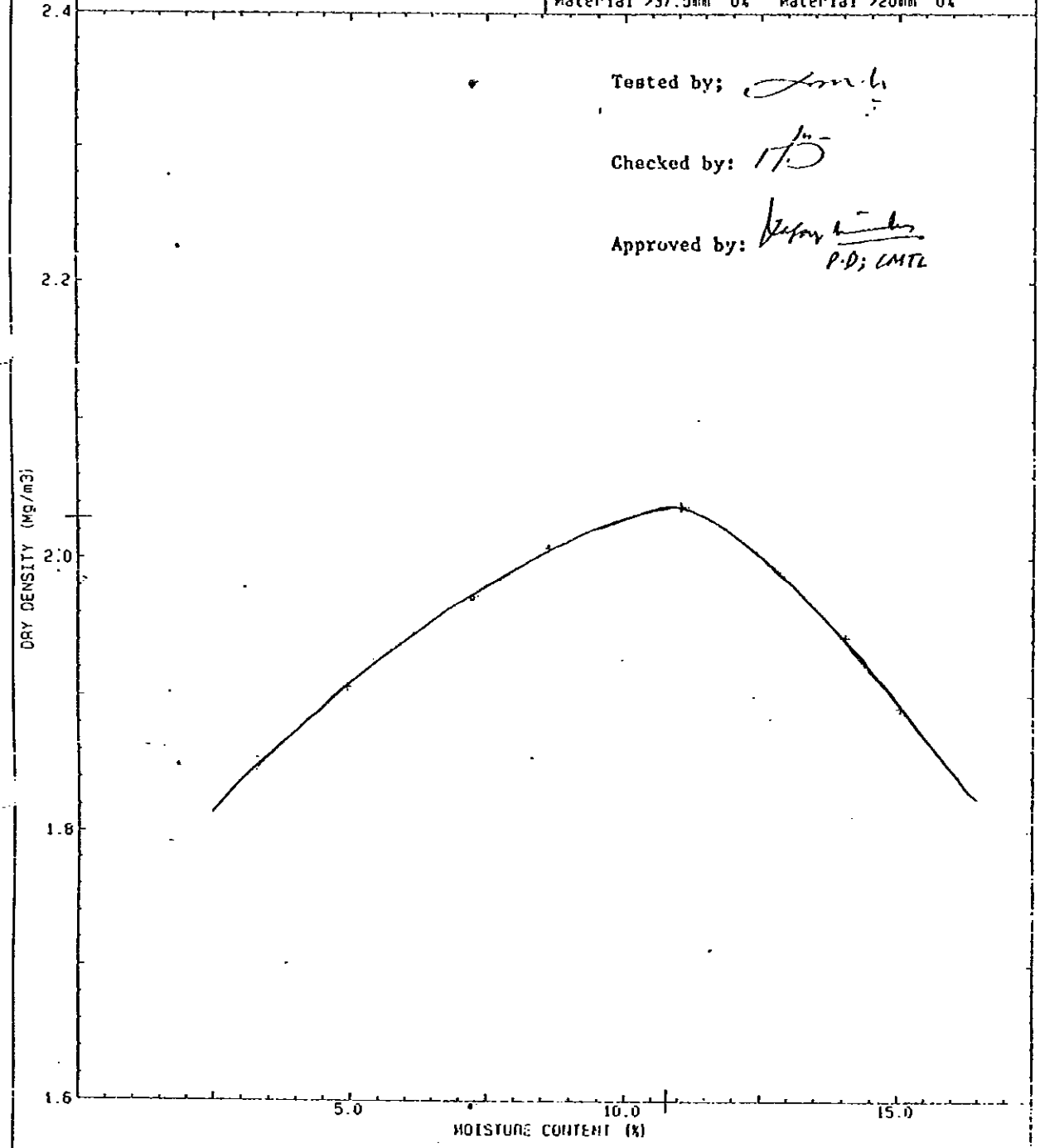
Pit 12/2

Container	ASTM	
Type of rammer	2.5kg	Height of drop 305 mm
No of layers	3	Blows per layer 56
Particle Density 2.75 MEASURED		
Material >37.5mm 0%	Material >20mm 0%	

Tested by:

Checked by:

Approved by:
P.D; CMTL



Maximum dry density 2.03 mg/m^3 | Optimum moisture content 10.7%

Compaction Test
DENSITY/MOISTURE CONTENT CURVE

Borehole No. PIT-12/2 Depth 0.00 - 0.00 M
Sample No. OS/15538/A Date 26/01/99

CENTRAL MATERIAL TESTING LABORATORY

Client JICA
Location Munda Dam Project

Loc No.

Fig. 34

NOTES:

1. Maximum particle size used 0.0 mm

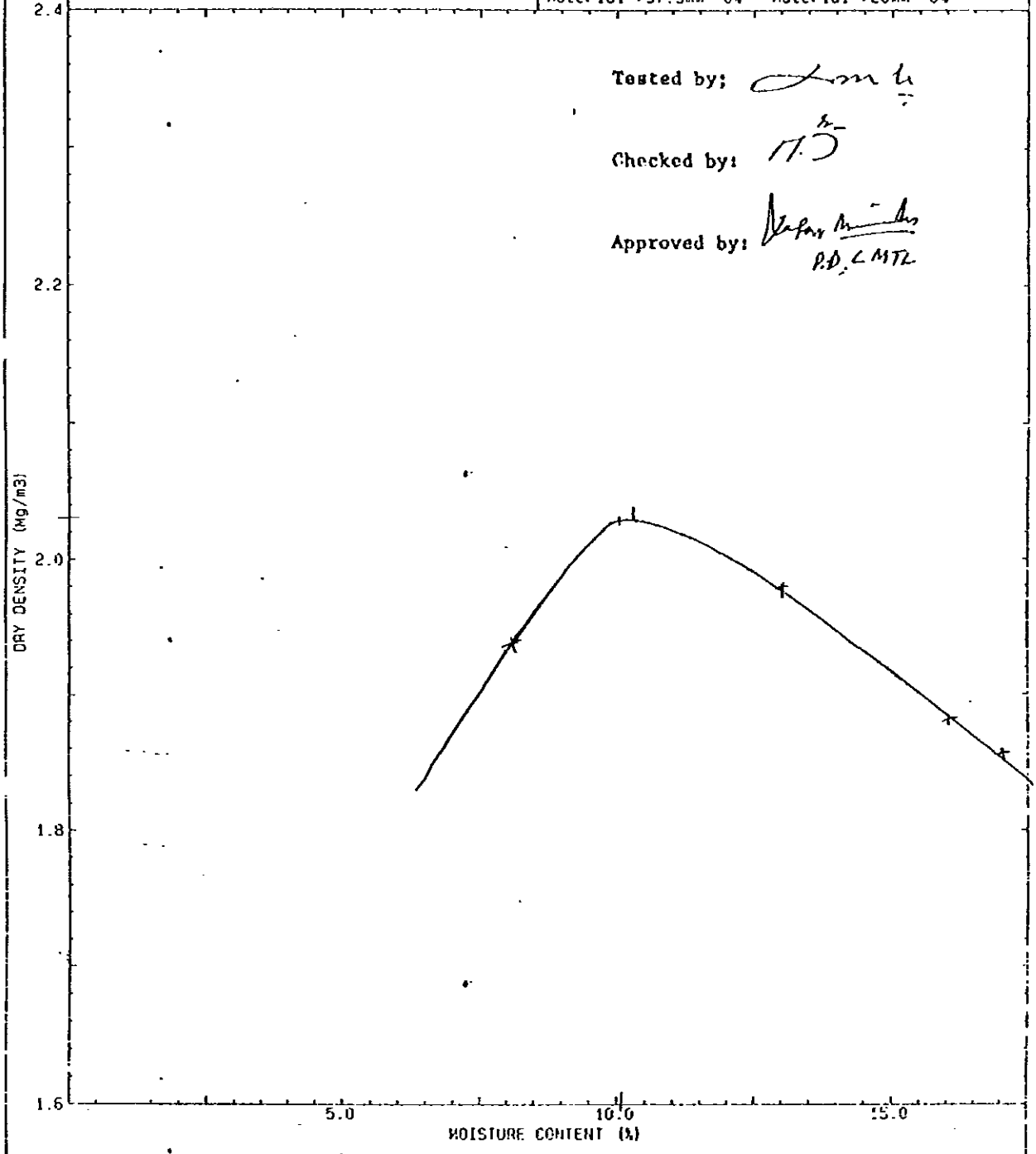
Pit 13/1

Container	ASTM		
Type of rammer	2.5kg	Height of drop	305 mm
No of layers	3	Blows per layer	56
Particle Density	2.69 MEASURED		
Material >37.5mm	0%	Material >20mm	0%

Tested by:

Checked by:

Approved by: P.D. C MTL



Maximum dry density 2.03 mg/m^3 | Optimum moisture content 10.2%

Compaction Test

DENSITY/MOISTURE CONTENT CURVE

Borehole No. PIT-13/1 Depth 0.00 - 0.00 M

Sample No. US/15538/4 Date 26/01/99

CENTRAL MATERIAL TESTING LABORATORY.

Client JICA

Location Munda Dam Project

Loc No.

Fig. 35

NOTES:

1. Maximum particle size used 0.0 mm

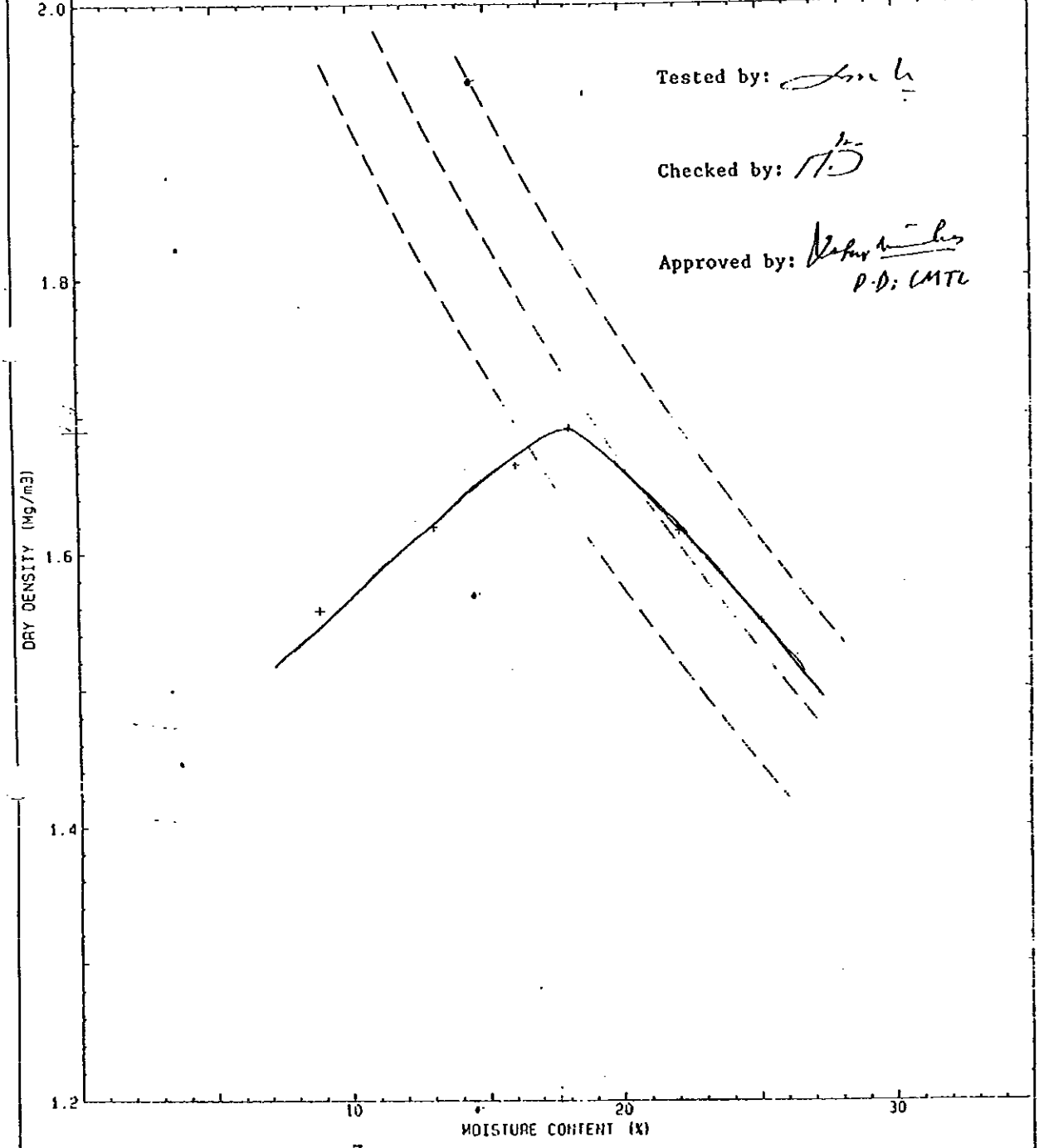
Pit 13/2

Container	ASTM		
Type of rammer	2.5kg	Height of drop	305 mm
No. of layers	3	Blows per layer	56
Particle Density	2.69 MEASURED		
Material >37.5mm	0%	Material >20mm	0%

Tested by:

Checked by:

Approved by:
D.D; CMTL



Maximum dry density	1.69 mg/m³	Optimum moisture content	17.7%

Compaction Test
DENSITY/MOISTURE CONTENT CURVE

Borehole No. PIT-13/2 Depth 0.00 - 0.00 M
Sample No. DS/15538/A Date 25/01/99

CENTRAL MATERIAL TESTING LABORATORY.

Client JICA
Location Munda Dam Project

Loc No.

Fig. 36

NOTES:

1. Maximum particle size used 0.0 mm

Pit 14/1

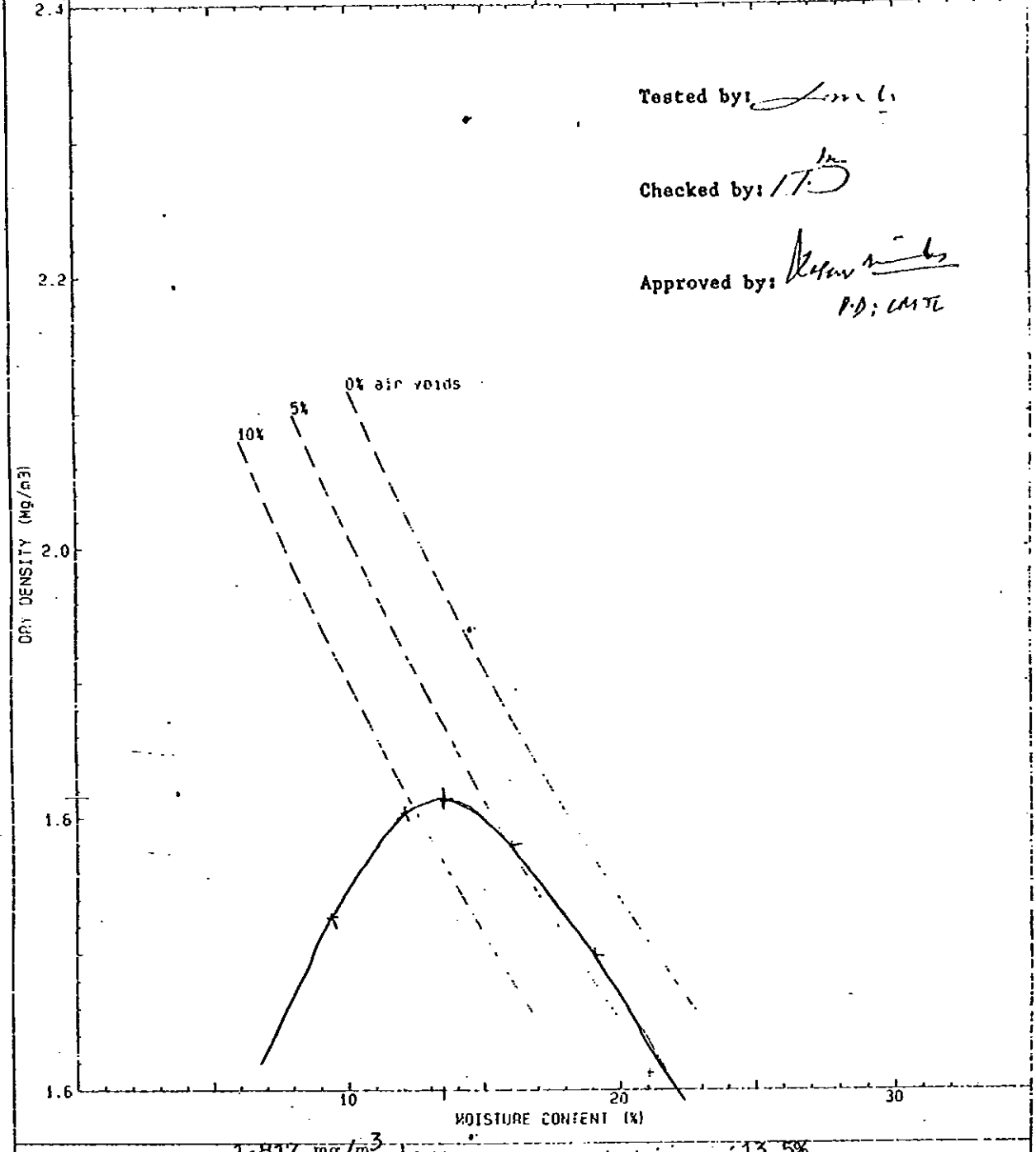
Container	ASTM		
Type of rammer	2.5kg	Height of drop	305 mm
No of layers	3	Blows per layer	56
Particle Density 2.68 MEASURED			
Material >37.5mm 0%		Material >20mm 0%	

Tested by:

Checked by:

Approved by:

P.D; CMTL



Maximum dry density 1.887 Mg/m^3 | Optimum moisture content 13.5%

Compaction Test

DENSITY/MOISTURE CONTENT CURVE

Borehole No. Pit-14/1 Depth 0.00 - 0.00 M

Sample No. DS/15538/A Date 25/01/99

CENTRAL MATERIAL TESTING LABORATORY.

Client JICA

Location Munda Dam Project

Loc No.

Fig. 37

NOTES

1. Maximum particle size used 0.0 mm

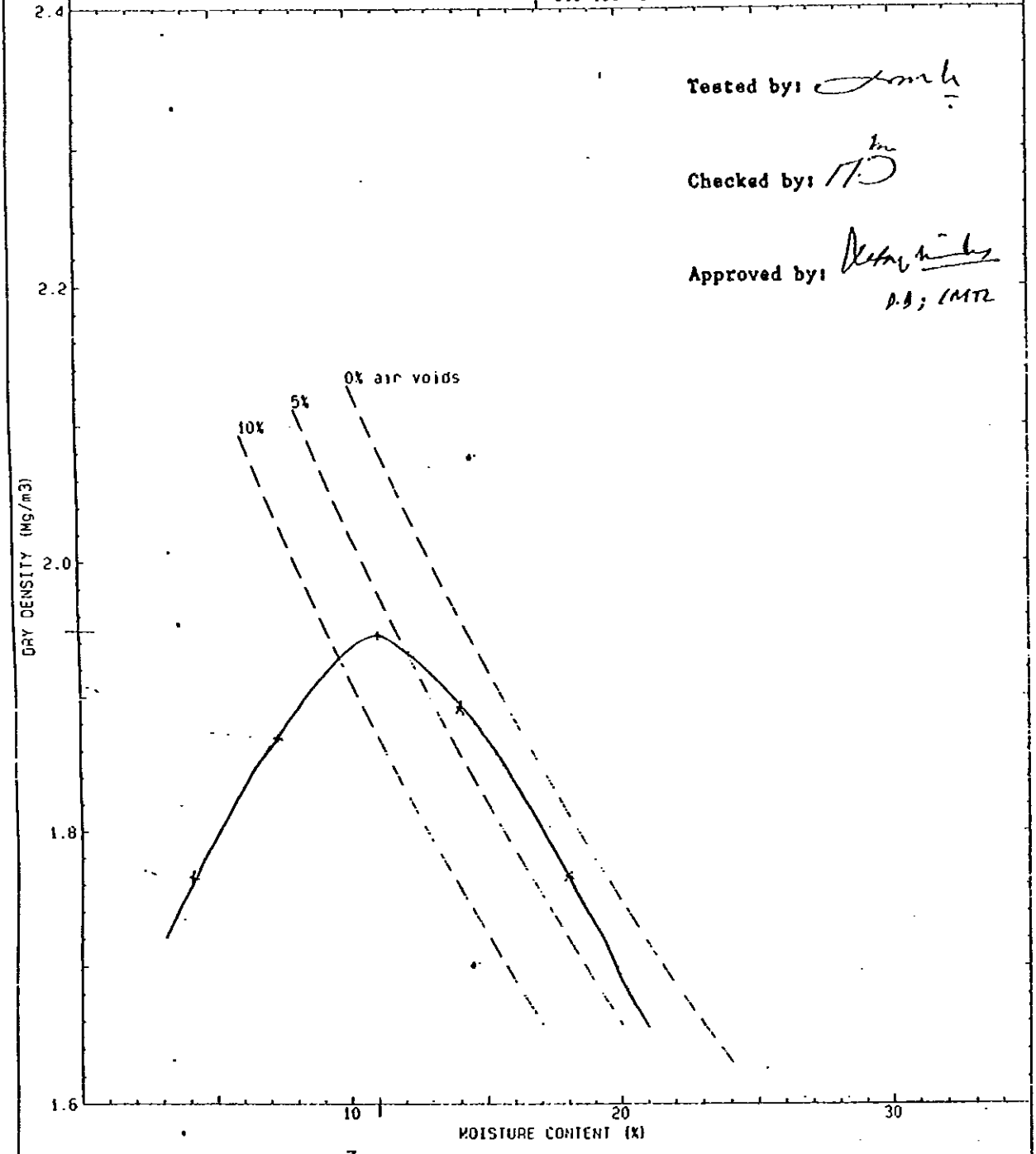
Pit 14/2

Container	ASTM		
Type of rammer	2.5kg	Height of drop	305 mm
No. of layers	3	Blows per layer	56
Particle Density	2.70 MEASURED		
Material >37.5mm	0%	Material >20mm	0%

Tested by:

Checked by:

Approved by:



Maximum dry density 1.95 mg/m^3	Optimum moisture content 11%

Compaction Test

DENSITY/MOISTURE CONTENT CURVE

Borehole No. PIT-14/2 Depth 0.00 - 0.00 M

Sample No. 05/15538/A Date 25/01/99

CENTRAL MATERIAL TESTING LABORATORY.	Client	JICA	Loc No.	Fig. 38
	Location	Munda Dam Project		

NOTES:

1. Maximum particle size used 0.0 mm

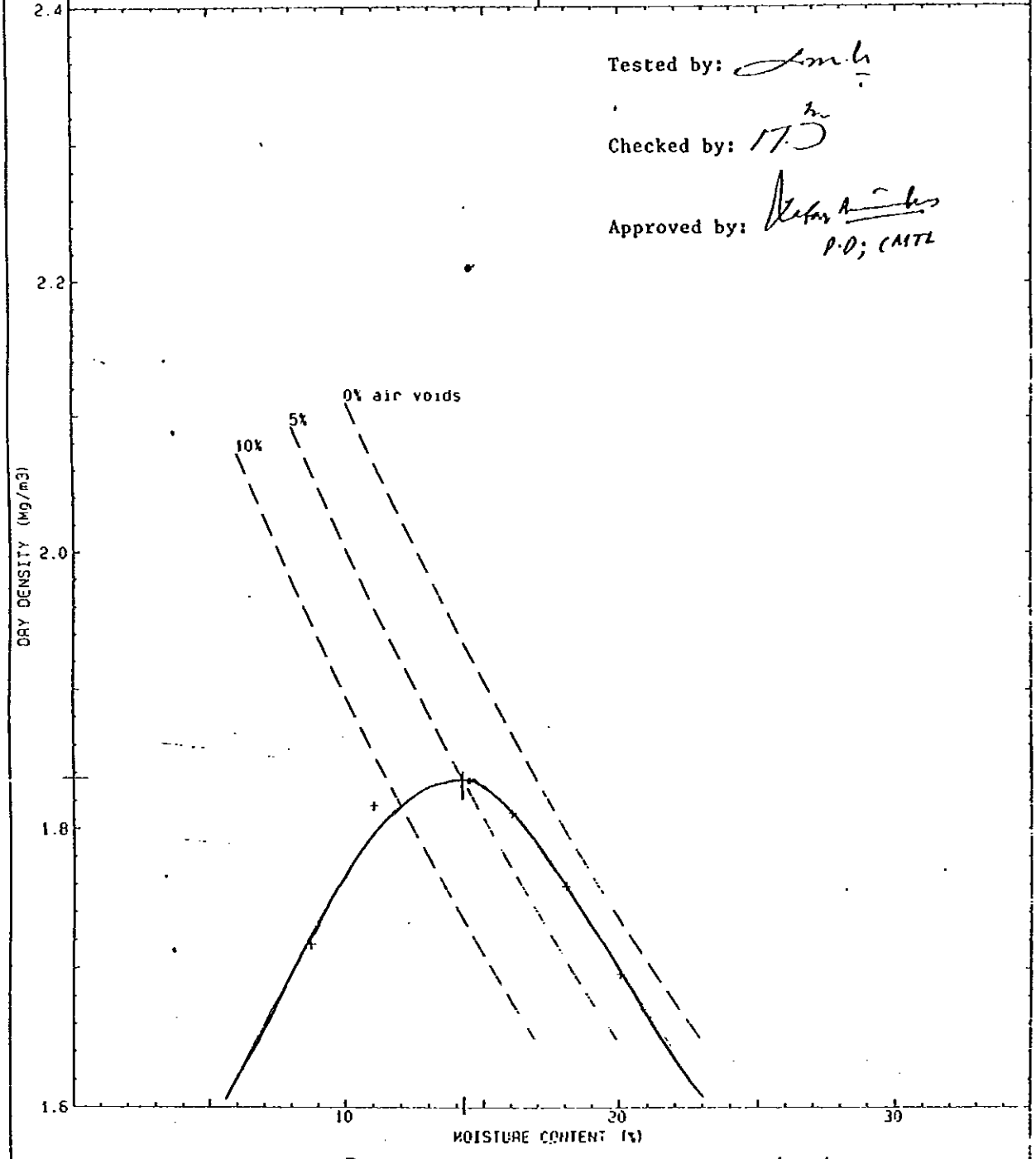
Pit 15/1

Container	ASTM		
Type of rammer	2.5kg	Height of drop	305 mm
No. of layers	3	Blows per layer	56
Particle Density 2.67 MEASURED			
Material >37.5mm 0%		Material >20mm 0%	

Tested by:

Checked by:

Approved by: P.O; CMTL



Maximum dry density 1.838 mg/m^3 | Optimum moisture content 14.3%

Compaction Test
DENSITY/MOISTURE CONTENT CURVE

Borehole No. PIT-15/1 Depth 0.00 - 0.00 M
Sample No. DS/15538/A Date 25/01/99

CENTRAL MATERIAL TESTING LABORATORY.

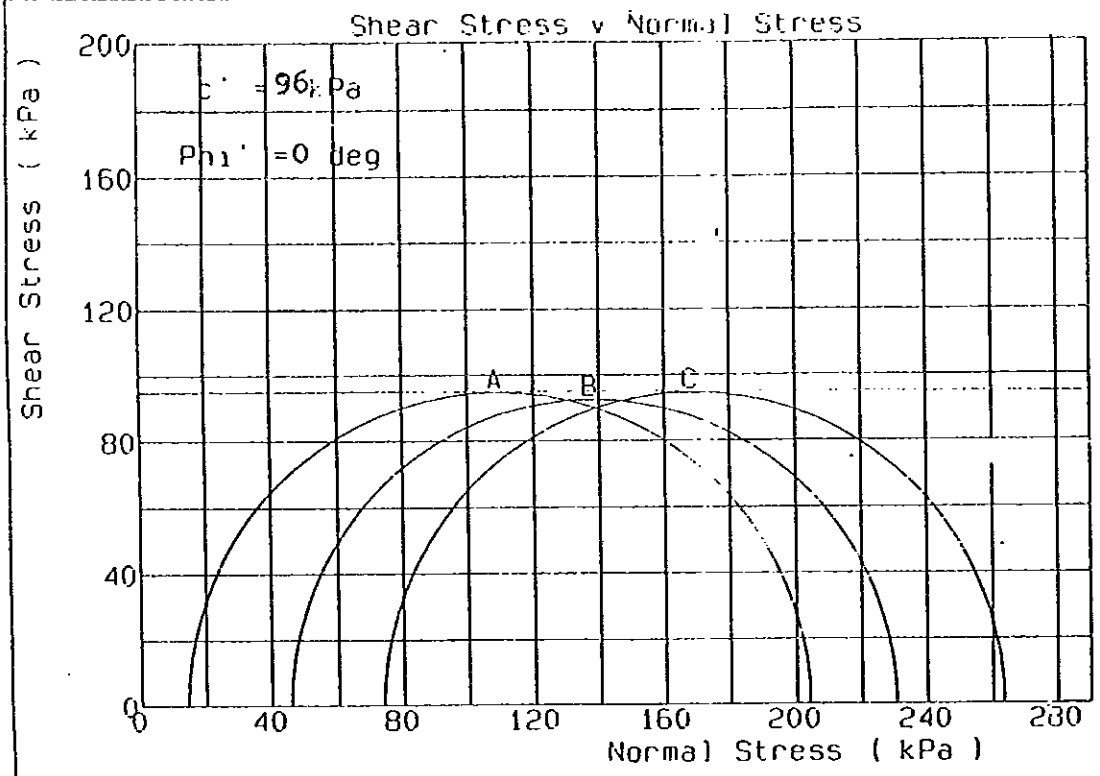
Client JICA
Location Munda Dam Project

Loc No.

Fig. 39

Job: MUNDA DAM PROJECT — Triaxial UnDrained Shear

BoreHole: PIT 9 Sample: SAMPLE 2/UU Depth: -



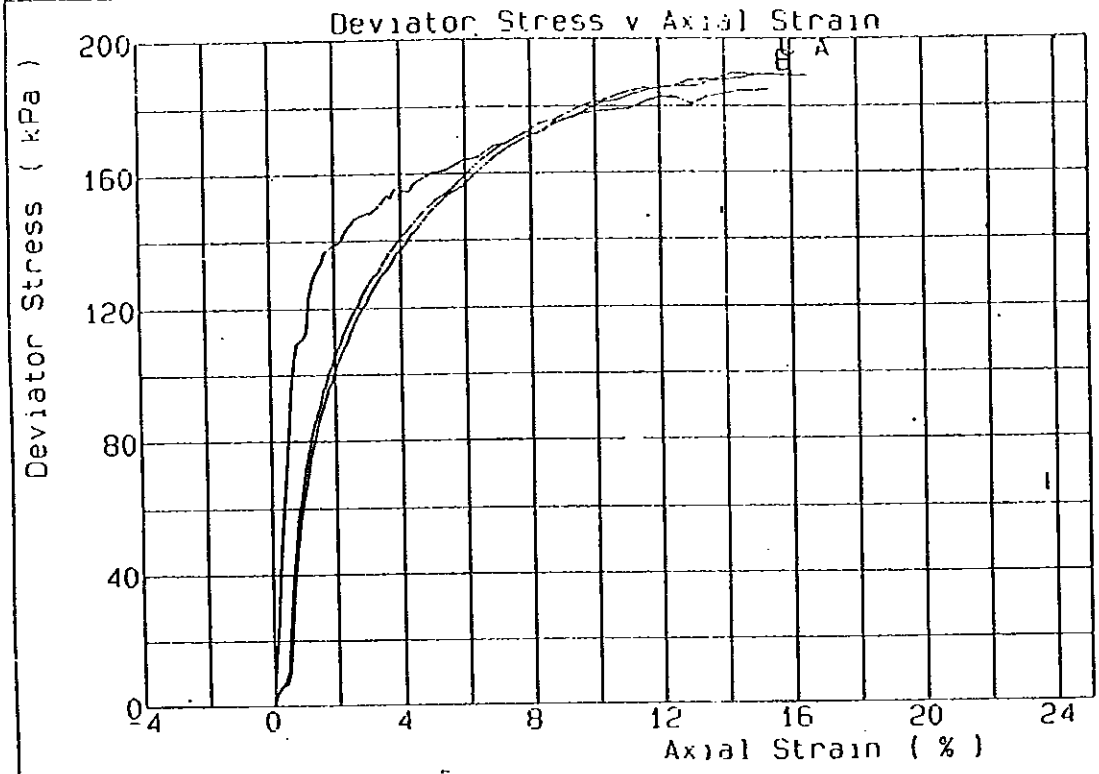
Reference		A	B	C
Initial B value		0.02	0.01	0.03
Final B value		1.19	0.96	1.13
At Start of Shear				
Pore Pressure	kPa	650	615	550
Effective stress	kPa	50.0	100.0	150.0
Loading rate	mm/min	0.0671	0.0660	0.0660
Failure criteria adopted. Max deviator stress				
At Failure				
Bulk density	Mg/cum	2.503	2.395	2.365
Moisture content	%	30.9	31.3	28.3
Dry density	Mg/cum	1.911	1.824	1.843
Pore pressure	kPa	694.7	669.4	634.0
Deviator stress	kPa	189.6	185.0	189.5
Major principle eff. stress	kPa	204.1	230.6	263.5
Minor principle eff. stress	kPa	14.5	45.6	74.0
Stress ratio		14.1	5.1	3.6
strain	%	14.23	15.35	15.50
Correction factors				
SideDrain	kPa	0.0	0.0	0.0
Membrane	kPa	0.8	2.0	1.9

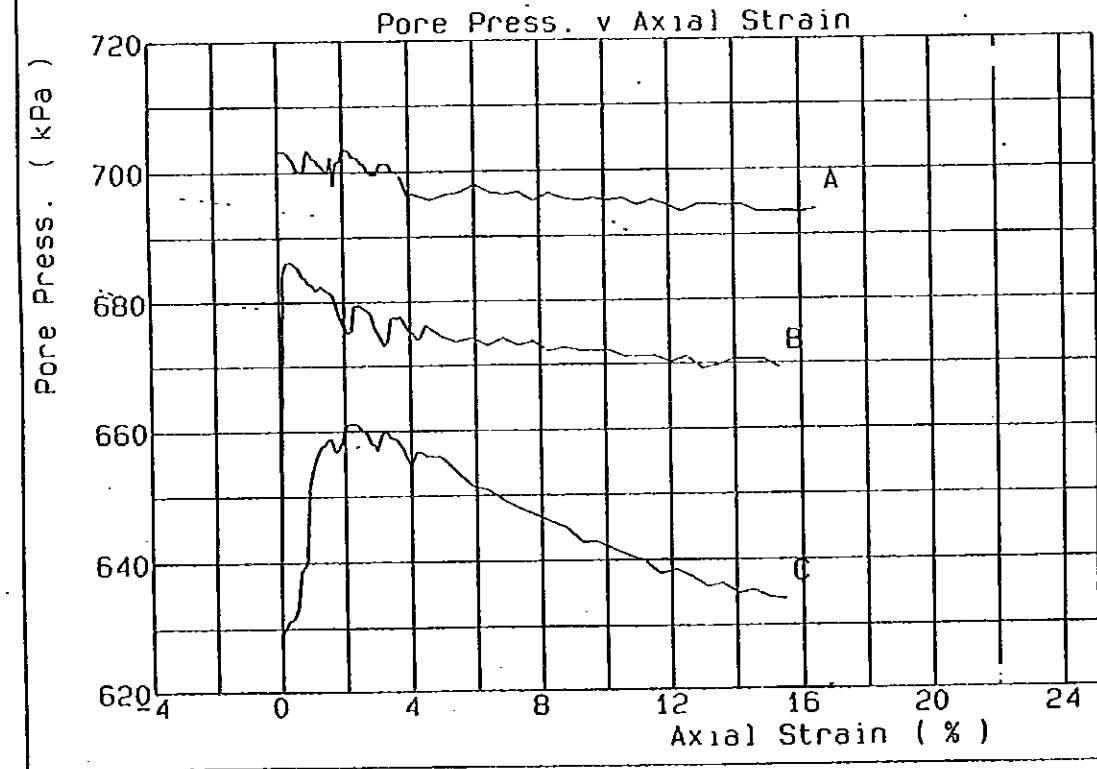
CENTRAL MATERIAL TESTING LAB.

Tested by: Checked by: Approved by:

Job: MUNDA DAM PROJECT — Triaxial UnDrained Shear

BoreHole: PIT 9 Sample: SAMPLE 2/UU Depth: -



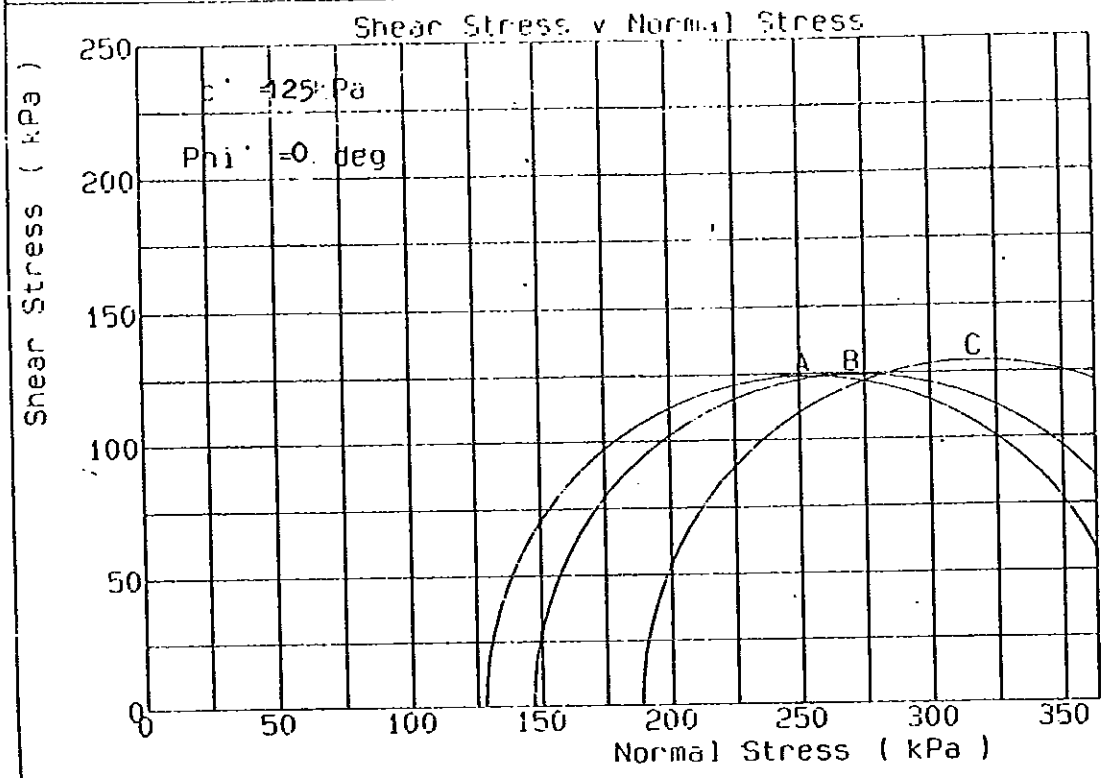


CENTRAL MATERIAL TESTING LAB.

Tested by: Checked by: Approved by:

Job: MUNDA DAM — Triaxial UnDrained Shear

BoreHole: PIT10 Sample: NO.2/UU Depth: -



Reference		A	B	C
Initial B value		0.13	0.12	0.09
Final B value		0.96	0.96	0.97
At Start of Shear				
Pore Pressure	kPa	514	490	491
Effective stress	kPa	71 4	140.0	200.0
Loading rate	mm/min	0.0173	0.0174	0.0173

Failure criteria adopted: Max deviator stress

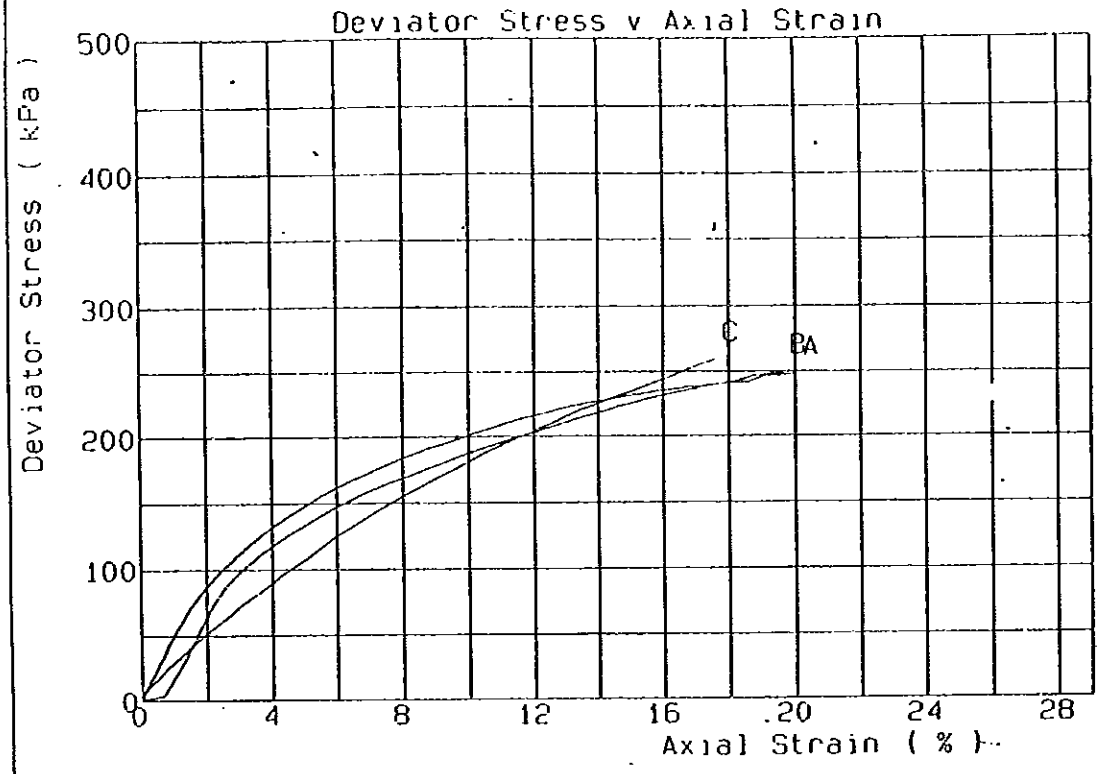
At Failure				
Bulk density	Mg/cum	2.111	2.136	2.187
Moisture content	%	26.2	26.4	27.3
Dry density	Mg/cum	1.672	1.690	1.718
Pore pressure	kPa	456.2	483.7	499.6
Deviator stress	kPa	248.3	249.3	259.1
Major principle eff. stress	kPa	376.6	396.1	447.4
Minor principle eff. stress	kPa	128.3	146.7	188.3
Stress ratio		2.9	2.7	2.4
strain	%	20.01	19.63	17.59
Correction factors				
SideDrain	kPa	0.0	0.0	0.0
Membrane	kPa	0.0	0.0	0.0

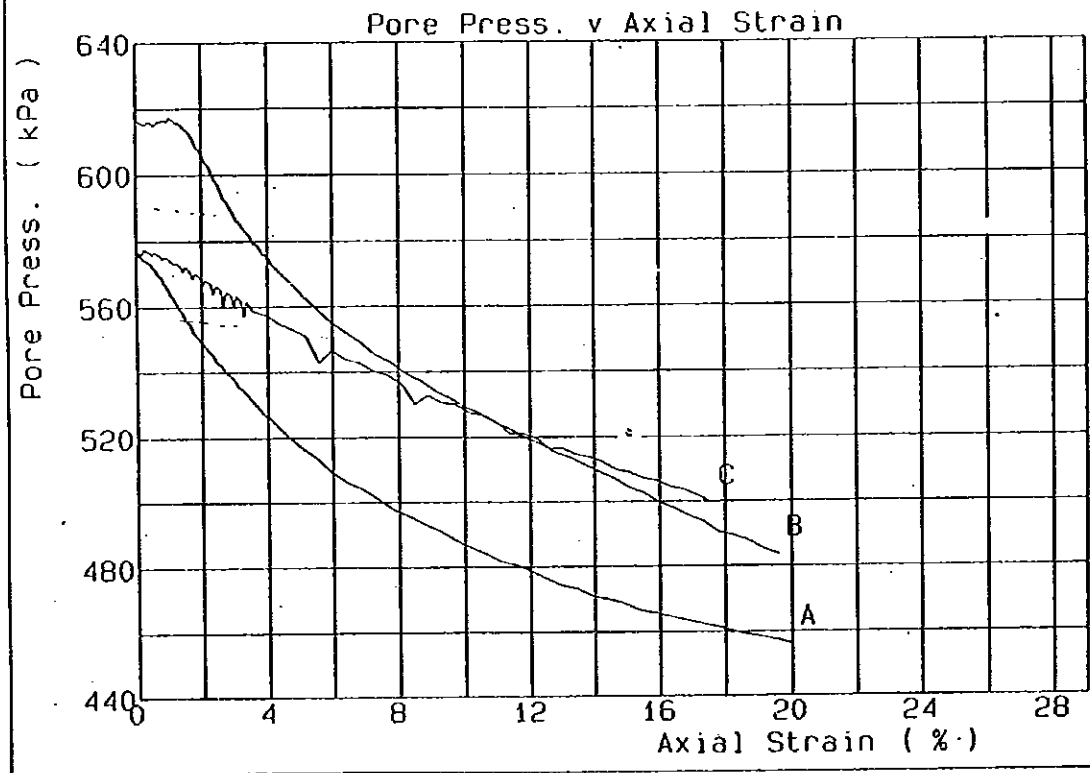
CENTRAL MATERIAL TESTING LAB.

Tested by: Checked by: Approved by:

Job: MUNDA DAM Triaxial UnDrained Shear

BoreHole: PIT10 Sample: NO.2/UU Depth: -



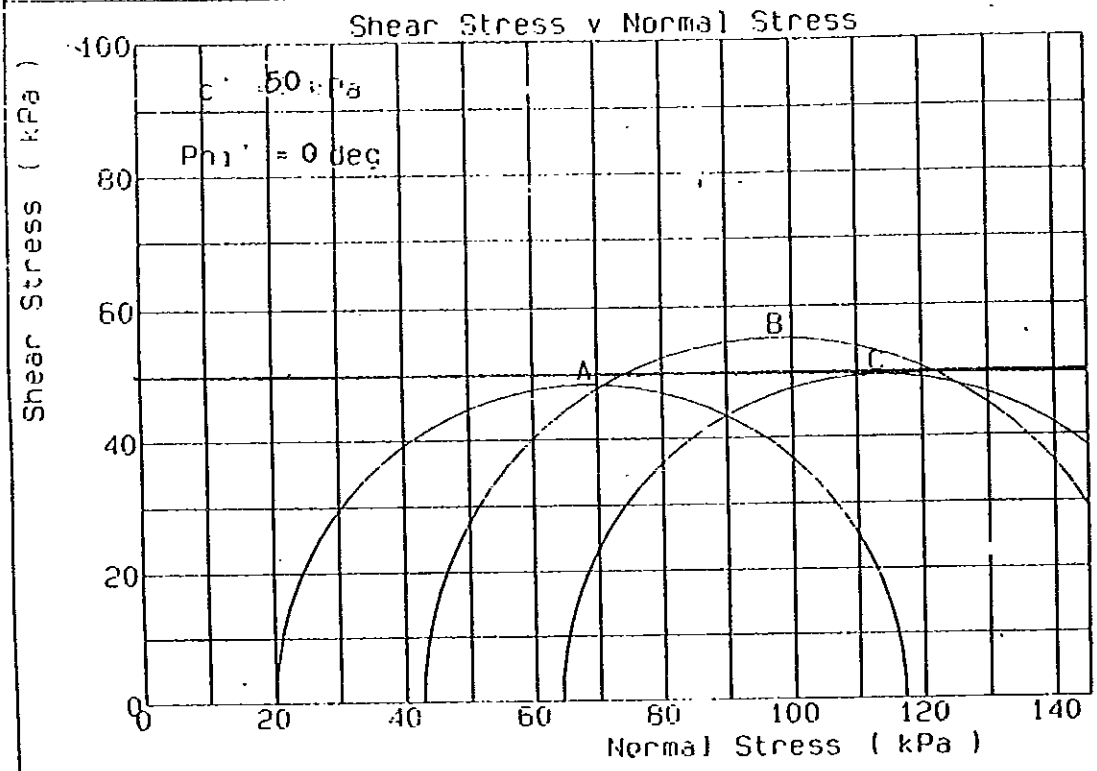


CENTRAL MATERIAL TESTING LAB.

Tested by: Checked by: Approved by:

Job: MUNDA DAM PROJECT. Triaxial UnDrained Shear

BoreHole: UU Sample: PIT-11 Depth: 15538/UU



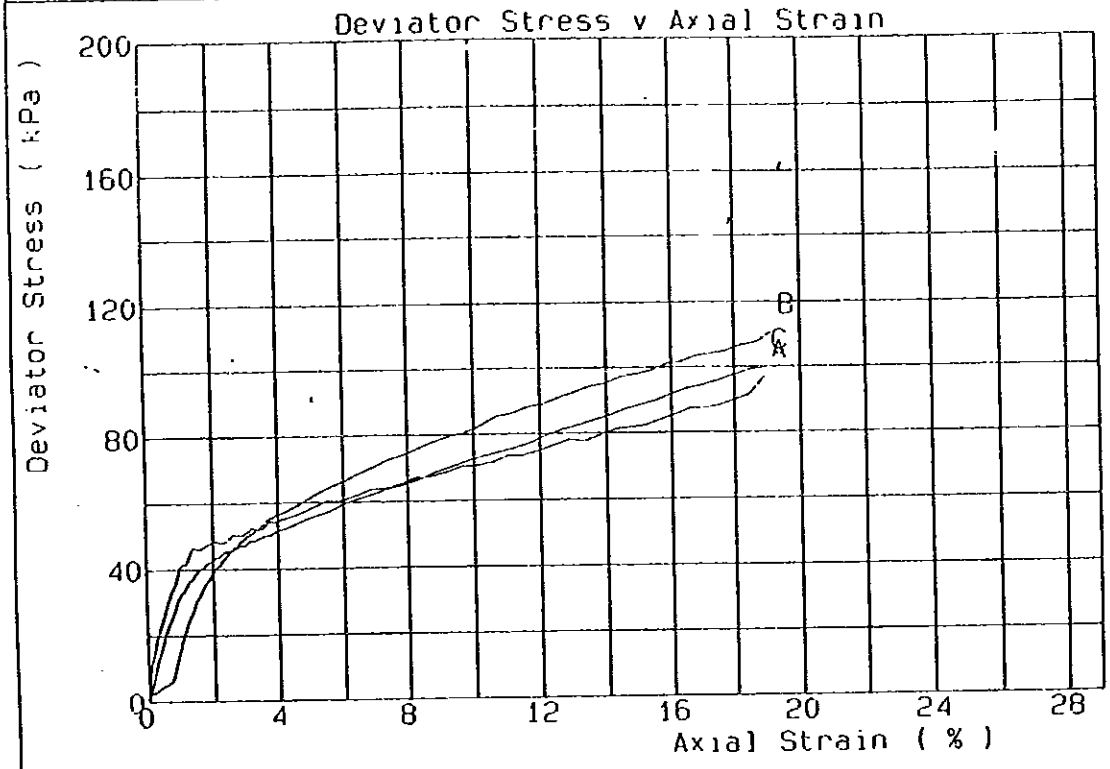
Reference		A	B	C
Initial B value		0.06	0.02	0.06
Final B value		0.96	0.96	0.97
At Start of Shear				
Pore Pressure	kPa	393	393	394
Effective stress	kPa	70.6	140.0	200.0
Loading rate	mm/min	0.0161	0.0162	0.0161
Failure criteria adopted:	Max deviator stress			
At Failure				
Bulk density	Mg/cum	2.174	2.229	2.266
Moisture content	%	32.7	31.3	32.5
Dry density	Mg/cum	1.638	1.698	1.709
Pore pressure	kPa	443.0	489.9	530.0
Deviator stress	kPa	96.9	110.6	99.0
Major principle eff. stress	kPa	117.0	153.3	163.1
Minor principle eff. stress	kPa	20.1	42.6	64.1
Stress ratio		5.8	3.6	2.5
strain	%	18.92	19.14	18.83
Correction factors				
SideDrain	kPa	0.0	0.0	0.0
Membrane	kPa	0.0	0.0	2.2

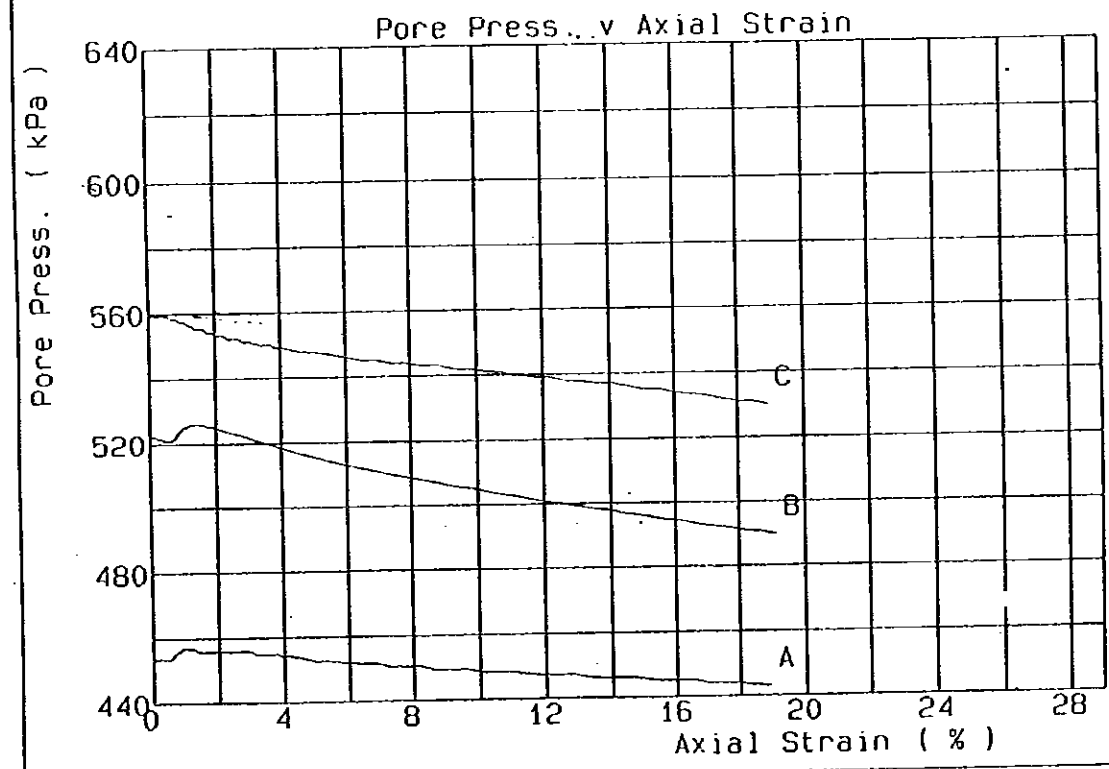
CENTRAL MATERIAL TESTING LAB.

Tested by: Checked by: Approved by:

Job: MUNDA DAM PROJECT. Triaxial UnDrained Shear

BoreHole: UU Sample. PIT-11 Depth: 15538/UU



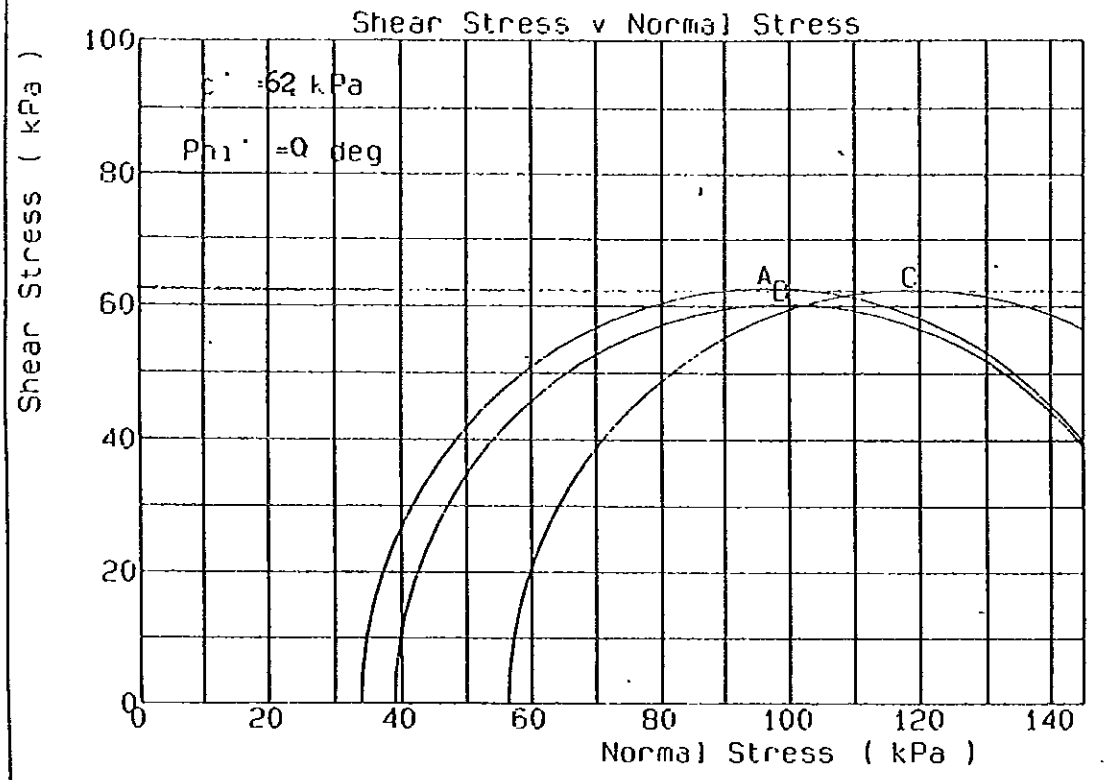


CENTRAL MATERIAL TESTING LAB.

Tested by: Checked by: Approved by:

Job: MUNDA DAM PROJECT — Triaxial UnDrained Shear

BoreHole: PIT13 Sample: 15538/UU Depth: SAMPLE-2



Reference		A	B	C
Initial B value		0.15	0.13	0.10
Final B value		1.00	0.96	0.96
At Start of Shear				
Pore Pressure	kPa	505	500	450
Effective stress	kPa	71.3	140.0	200.0
Loading rate	mm/min	0.0183	0.0184	0.0182

Failure criteria adopted: Max deviator stress

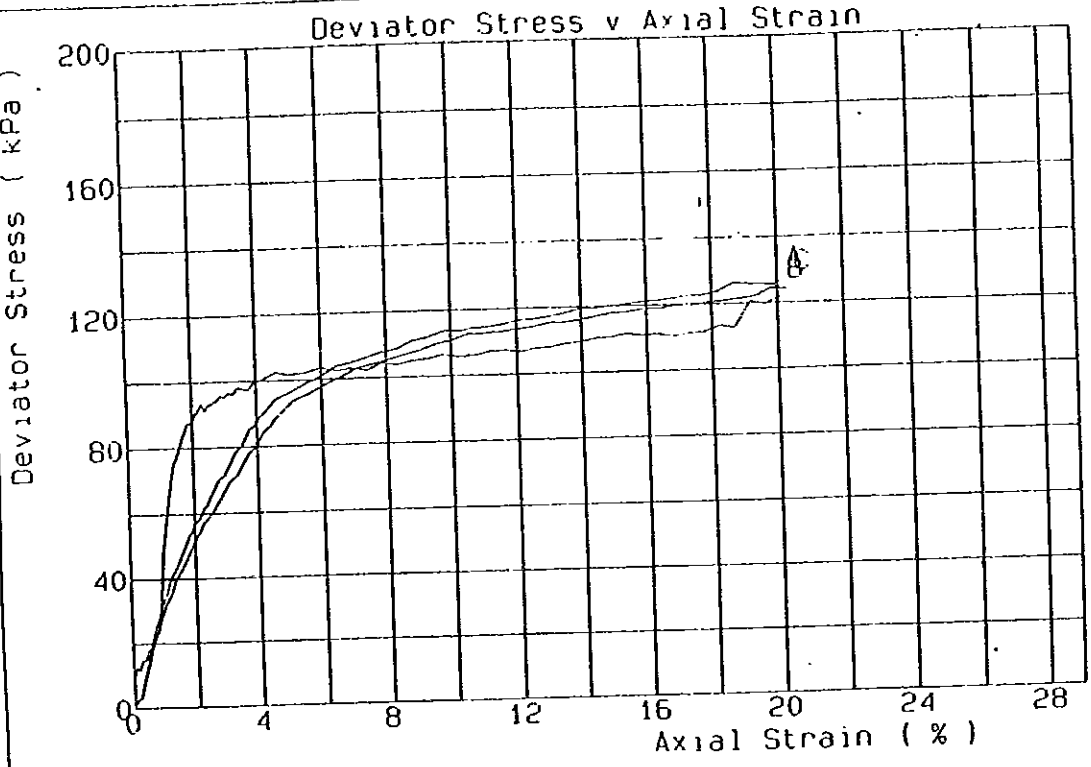
At Failure				
Bulk density	Mg/cum	2.041	2.023	2.028
Moisture content	%	30.6	29.7	28.0
Dry density	Mg/cum	1.562	1.559	1.584
Pore pressure	kPa	542.0	600.0	591.7
Deviator stress	kPa	125.4	120.6	124.9
Major principle eff. stress	kPa	159.4	159.6	181.4
Minor principle eff. stress	kPa	34.0	39.0	56.5
Stress ratio		4.7	4.1	3.2
strain	%	18.61	20.01	19.85
Correction factors				
SideDrain	kPa	0.0	0.0	0.0
Membrane	kPa	0.0	0.0	0.0

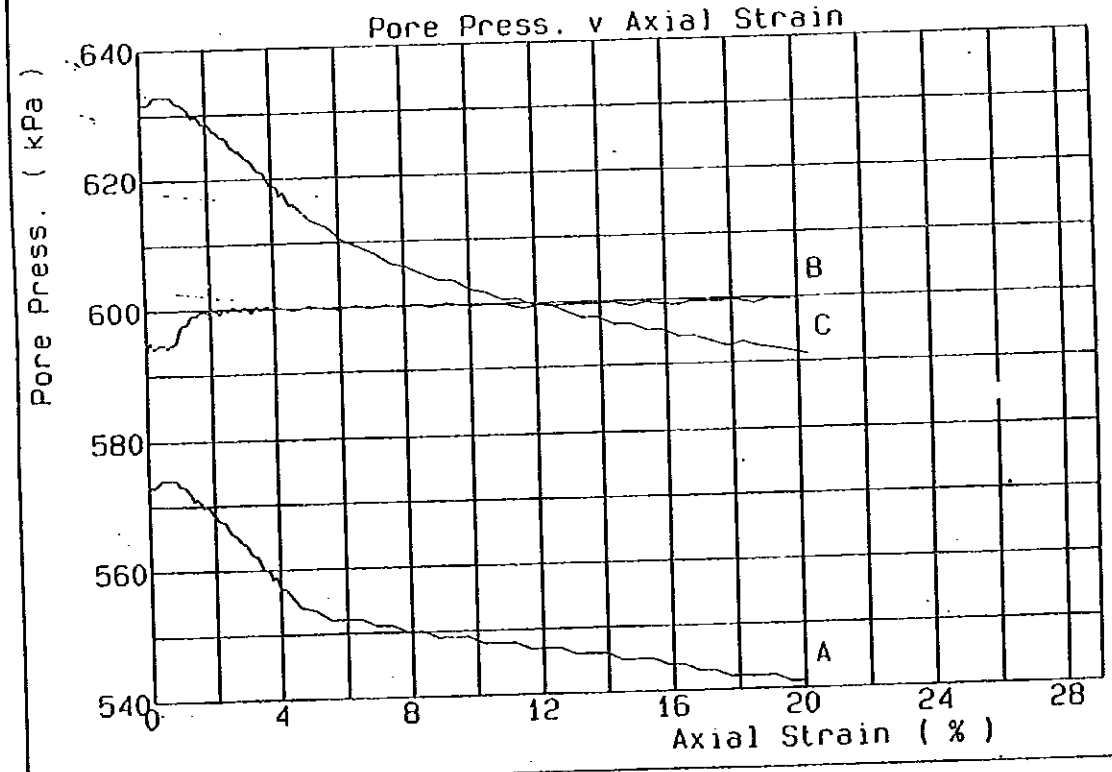
CENTRAL MATERIAL TESTING LAB.

Tested by; Checked by: Approved by:

Job: MUNDA DAM PROJECT — Triaxial UnDrained Shear

BoreHole: PIT13 Sample: 15538/UU Depth: SAMPLE-2



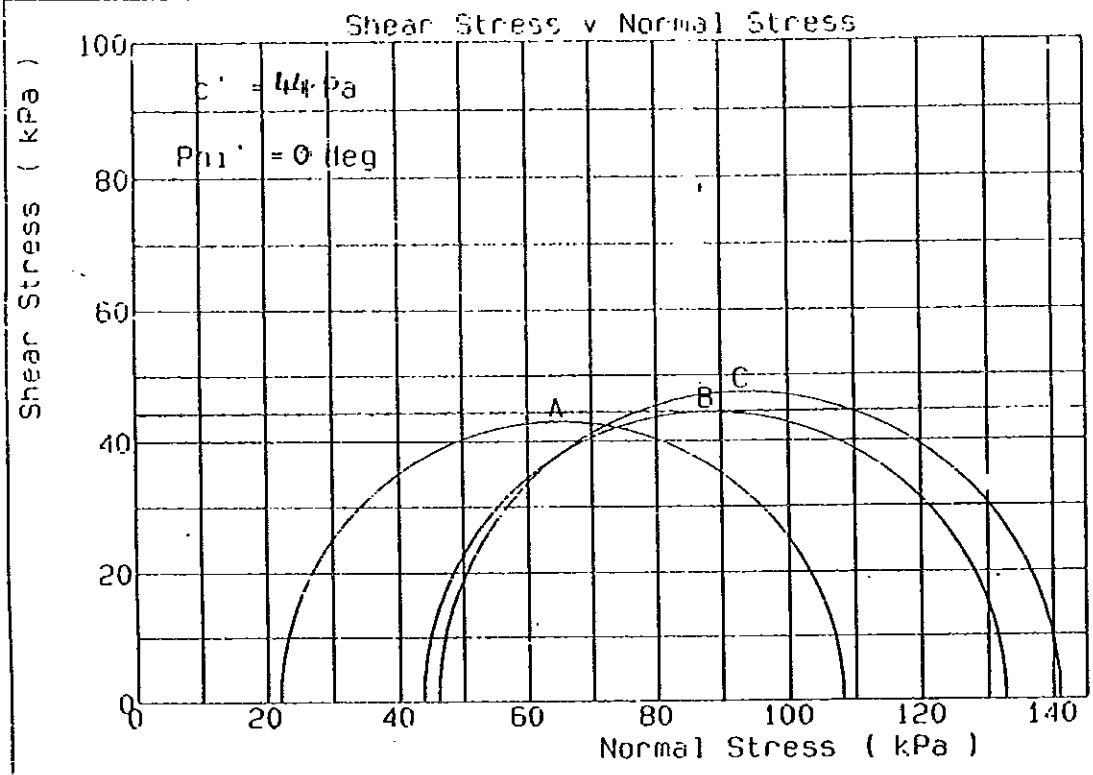


CENTRAL MATERIAL TESTING LAB.

Tested by: Checked by: Approved by:

Job: MUNDA DAM — Triaxial UnDrained Shear

BoreHole: PIT15 Sample: UU Depth: -



Reference		A	B	C
Initial B value		0.12	0.08	0.09
Final B value		1.00	0.96	0.96
At Start of Shear				
Pore Pressure	kPa	600	540	535
Effective stress	kPa	70.0	140.7	200.3
Loading rate	mm/min	0.0237	0.0210	0.0196

Failure criteria adopted: Max deviator stress

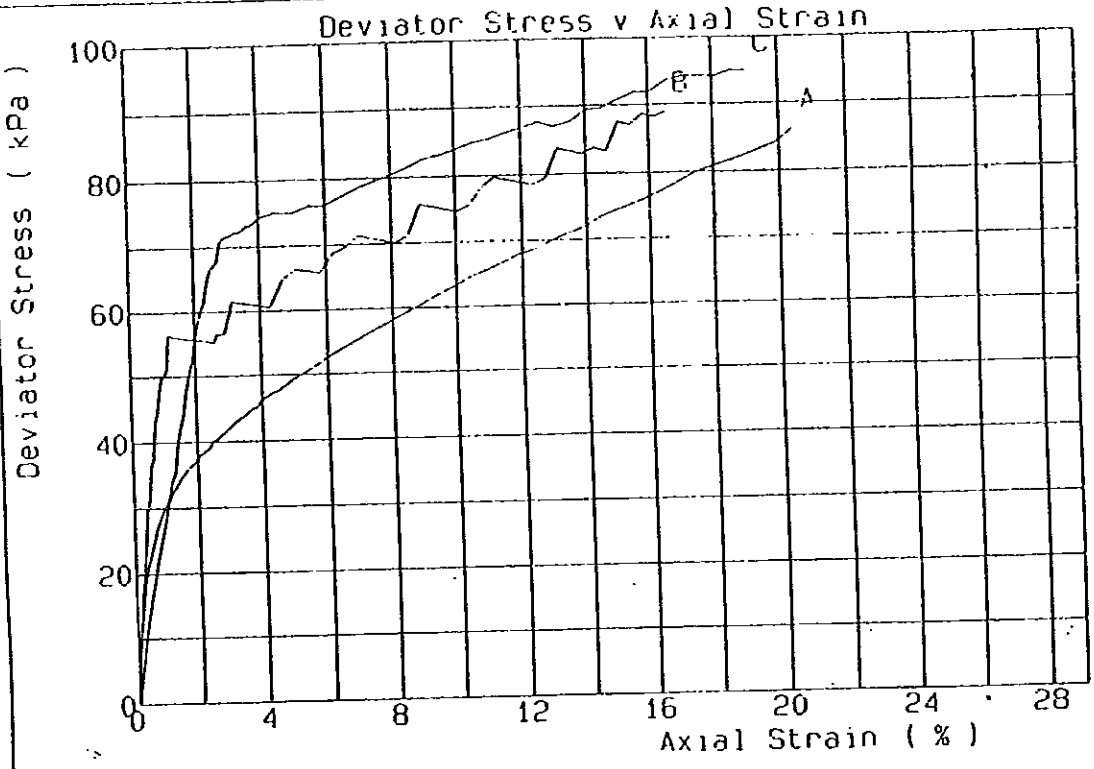
At Failure				
Bulk density	Mg/cum	3.157	2.197	2.216
Moisture content	%	26.5	23.2	21.4
Dry density	Mg/cum	1.705	1.783	1.825
Pore pressure	kPa	649.7	637.3	690.0
Deviator stress	kPa	86.2	89.0	95.0
Major principle eff. stress	kPa	108.1	132.7	141.0
Minor principle eff. stress	kPa	21.9	43.7	46.0
Stress ratio		4.9	3.0	3.1
strain	%	20.43	16.57	18.66
Correction factors				
SideDrain	kPa	0.0	0.0	0.0
Membrane	kPa	0.0	0.0	1.4

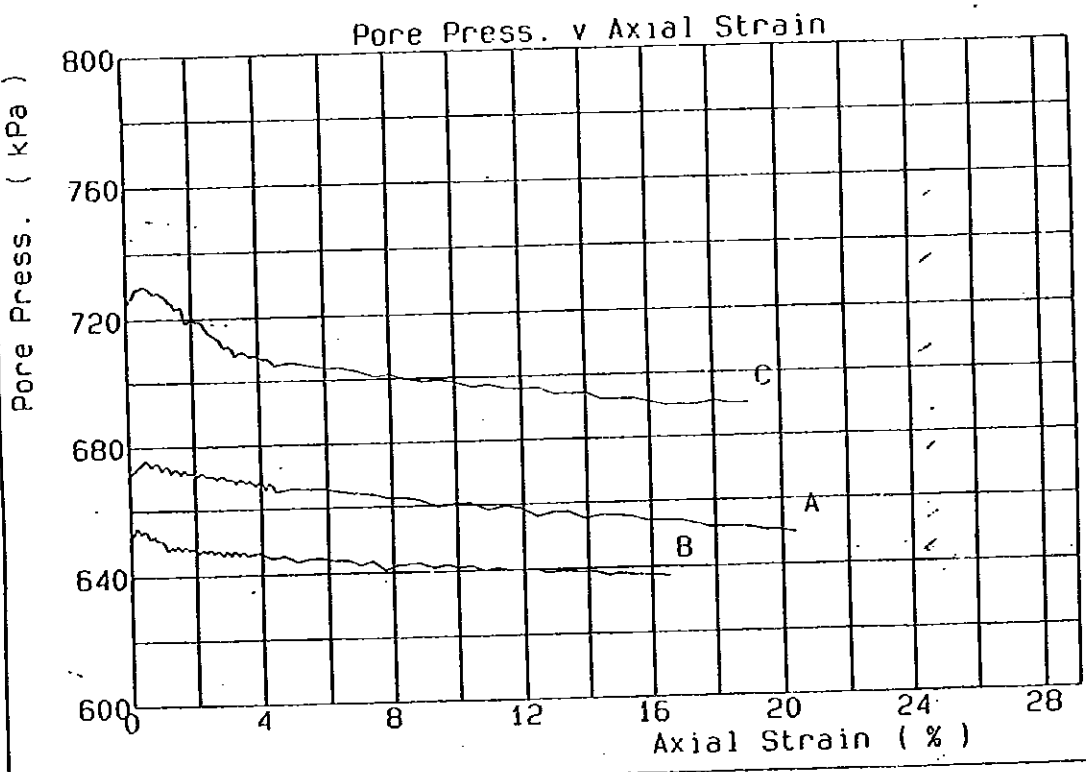
CENTRAL MATERIAL TESTING LAB.

Tested by: Checked by: Approved by:

Job: MUNDA DAM — Triaxial UnDrained Shear

BoreHole: PIT15 Sample: UU Depth: -



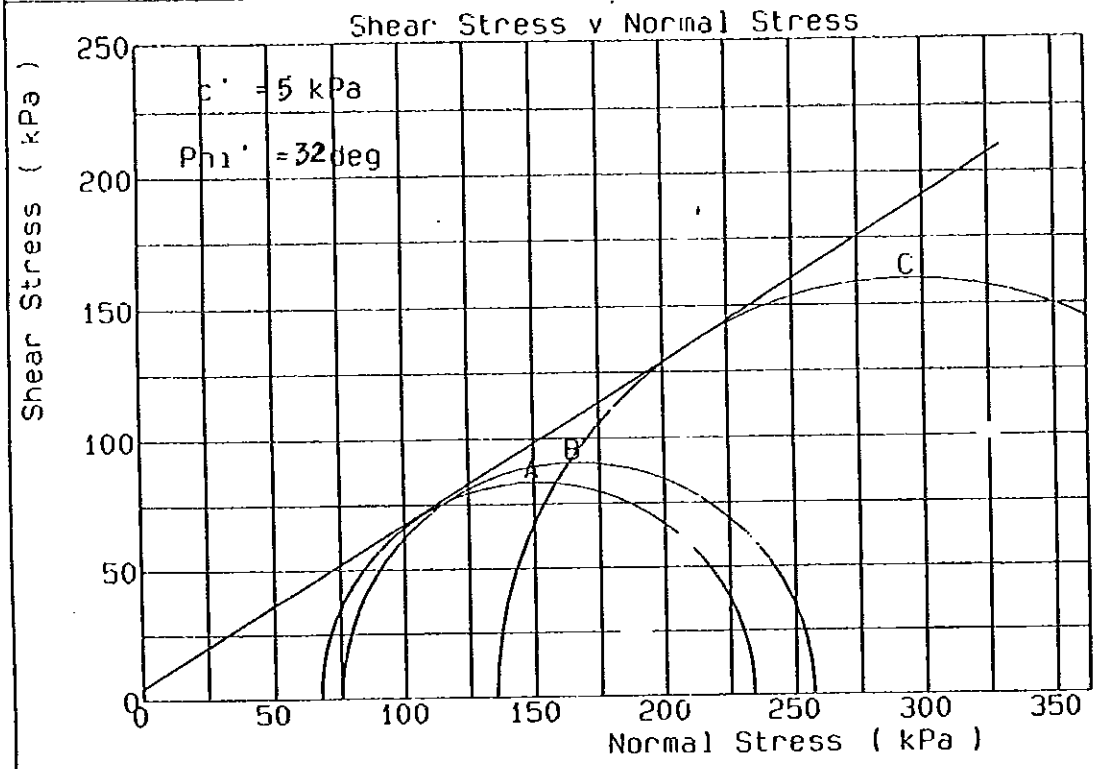


CENTRAL MATERIAL TESTING LAB.

Tested by: Checked by: Approved by:

Job: MUNDA DAM PROJ. Triaxial UnDrained Shear

BoreHole: PII-9 Sample: NO.2/CU Depth: -



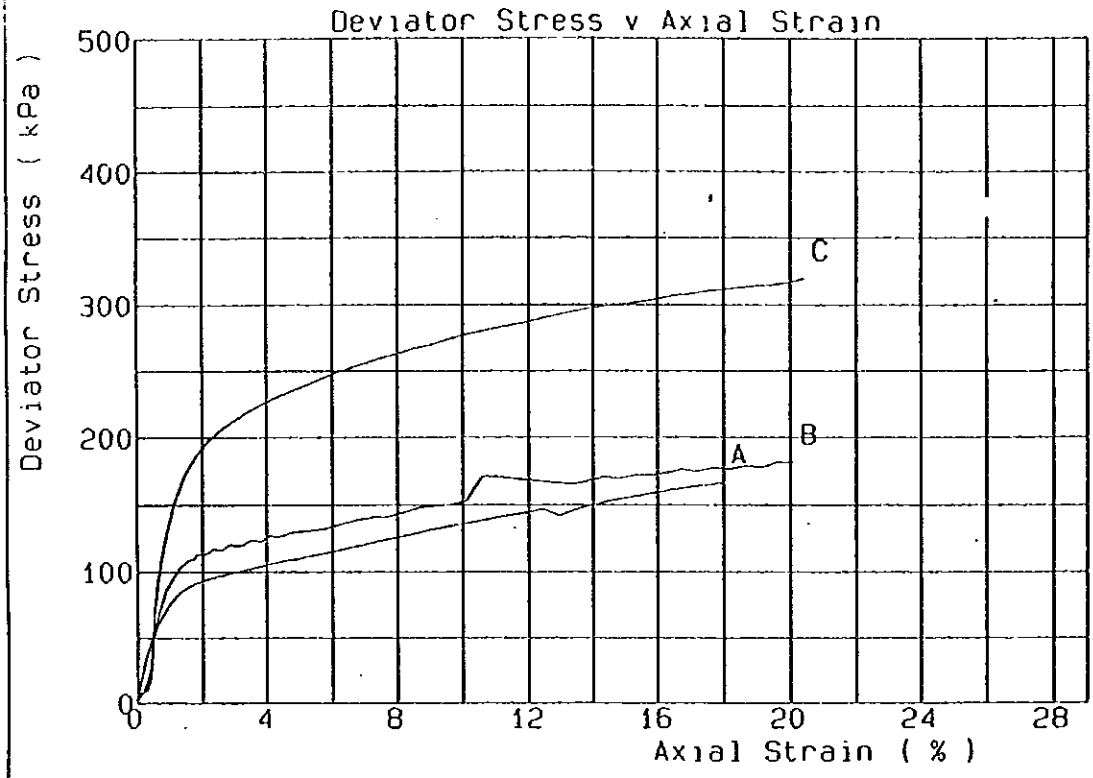
Reference		A	B	C
Initial B value		0.32	0.18	0.21
Final B value		0.96	0.96	0.96
At Start of Shear				
Pore Pressure	kPa	615	490	440
Effective stress	kPa	50.0	100.0	150.3
Loading rate	mm/min	0.0182	0.0289	0.0292
Failure criteria adopted:	Max deviator stress			
At Failure				
Bulk density	Mg/cum	2.213	2.251	2.330
Moisture content	%	25.6	21.9	21.8
Dry density	Mg/cum	1.763	1.846	1.912
Pore pressure	kPa	595 9	515.3	455.0
Deviator stress	kPa	166.5	181.5	319.7
Major principle eff. stress	kPa	233.8	256.9	454.9
Minor principle eff. stress	kPa	67.3	75.3	135.1
Stress ratio		3.5	3.4	3.4
strain	%	17.97	19.62	20,44
Correction factors				
SideDrain	kPa	0.0	0.0	0.0
Membrane	kPa	1.4	0.0	0.0

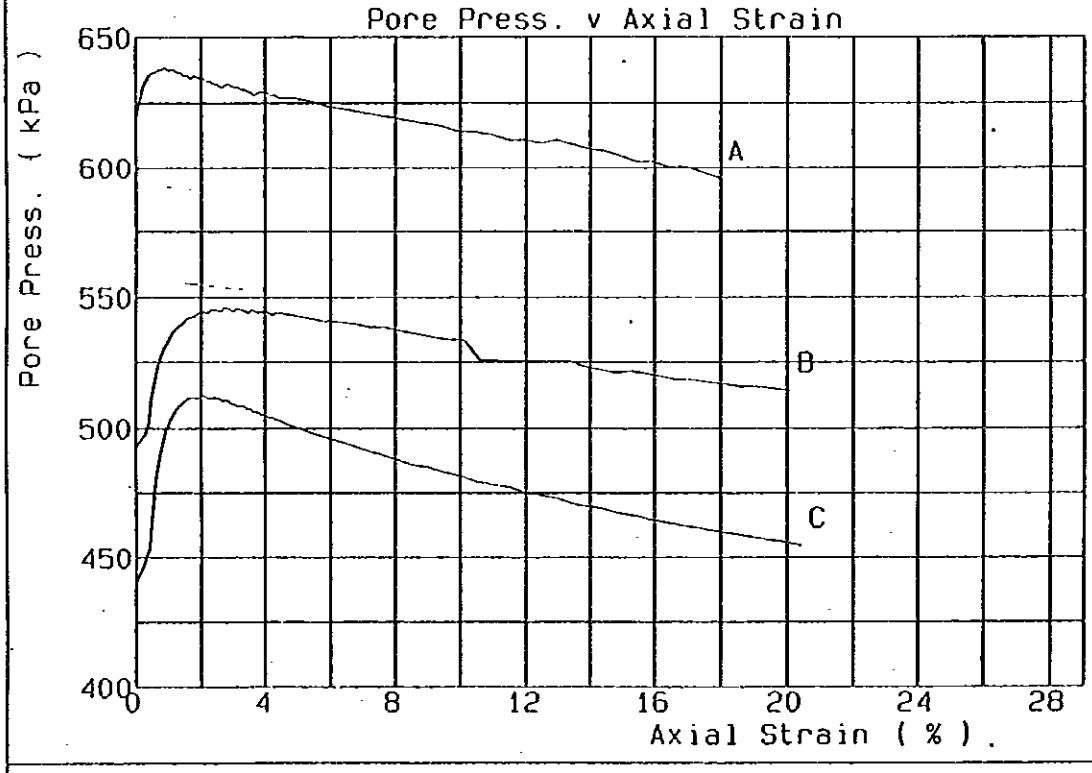
CENTRAL MATERIAL TESTING LAB.

Tested By: Checked By: Approved By:

Job: MUNDA DAM PROJ. Triaxial UnDrained Shear

BoreHole: PIT-9 Sample: NO.2/CU Depth: -



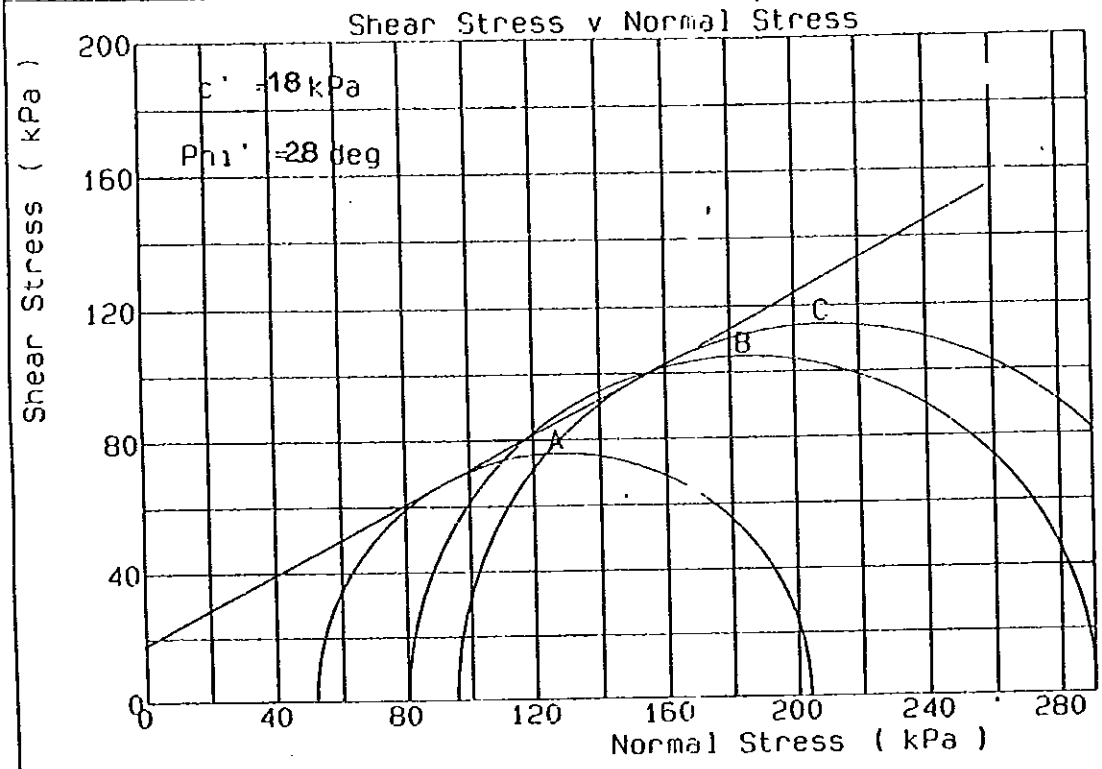


CENTRAL MATERIAL TESTING LAB.

Tested By: Checked By: Approved By:

Job: MUNDA DAM PROJ. Triaxial UnDrained Shear

BoreHole: PIT10 Sample: P-10/2/CU Depth: -



Reference		A	B	C
Initial B value		0.49	0.54	0.41
Final B value		1.00	0.98	0.97
At Start of Shear				
Pore Pressure	kPa	404	394	330
Effective stress	kPa	69.5	140.0	200.0
Loading rate	mm/min	0.0138	0.0140	0.0140

Failure criteria adopted: Max deviator stress

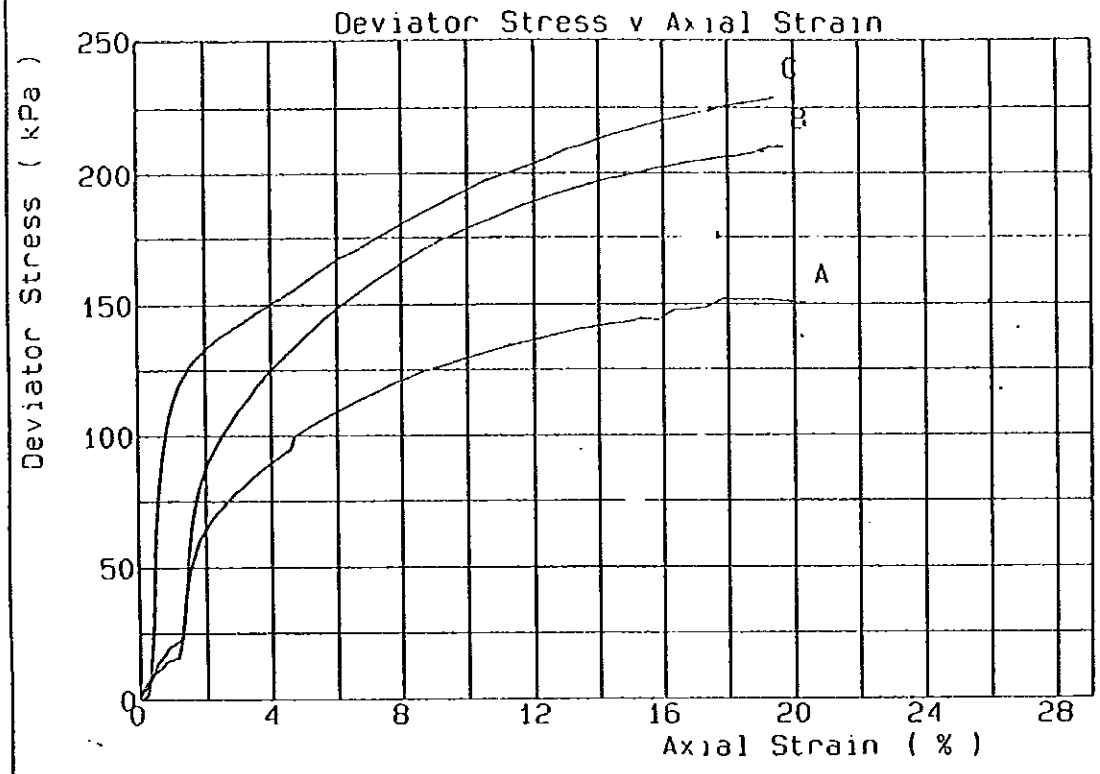
At Failure				
Bulk density	Mg/cum	2.236	2.152	2.146
Moisture content	%	34.0	31.9	31.9
Dry density	Mg/cum	1.669	1.632	1.627
Pore pressure	kPa	423.0	452.9	433.5
Deviator stress	kPa	152.0	210.1	229.0
Major principle eff. stress	kPa	203.8	290.3	324.2
Minor principle eff. stress	kPa	51.8	80.2	95.2
Stress ratio		3.9	3.6	3.4
strain	%	17.84	19.72	19.45
Correction factors				
SideDrain	kPa	0.0	0.0	0.0
Membrane	kPa	0.0	2.0	2.0

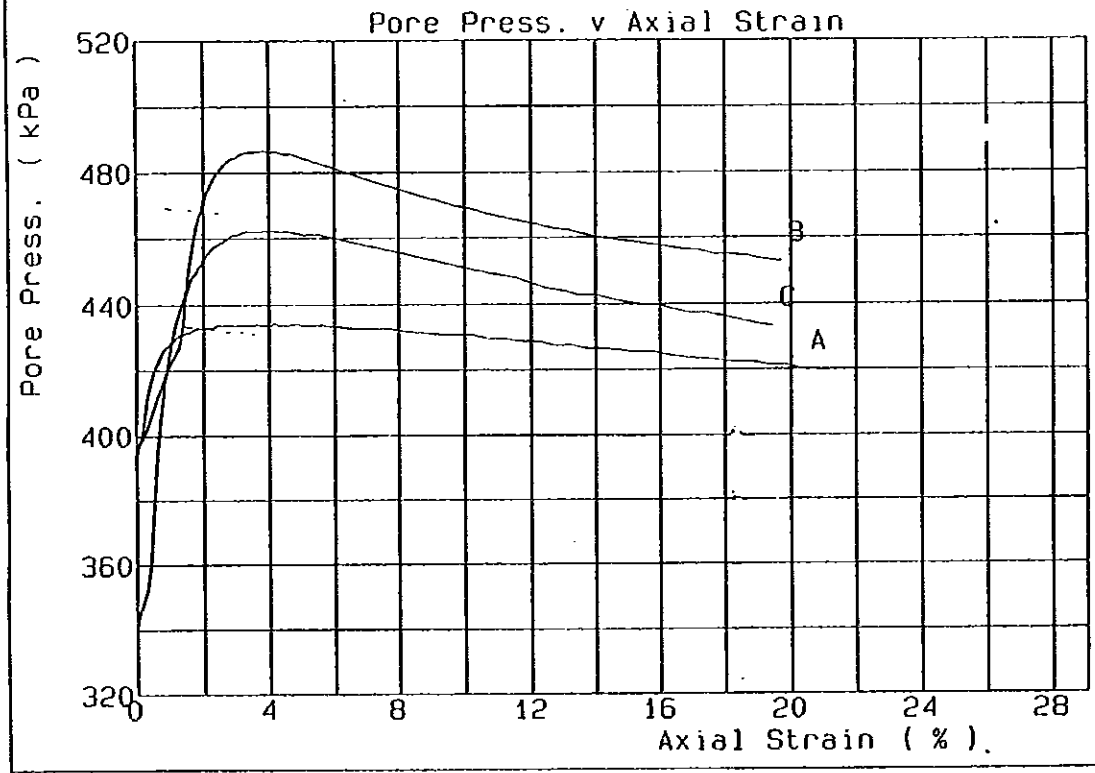
CENTRAL MATERIAL TESTING LAB.

Tested by: Checked by: Approved by:

Job: MUNDA DAM PROJ. Triaxial UnDrained Shear

BoreHole: PIT10 Sample: P-10/2/CU Depth: -



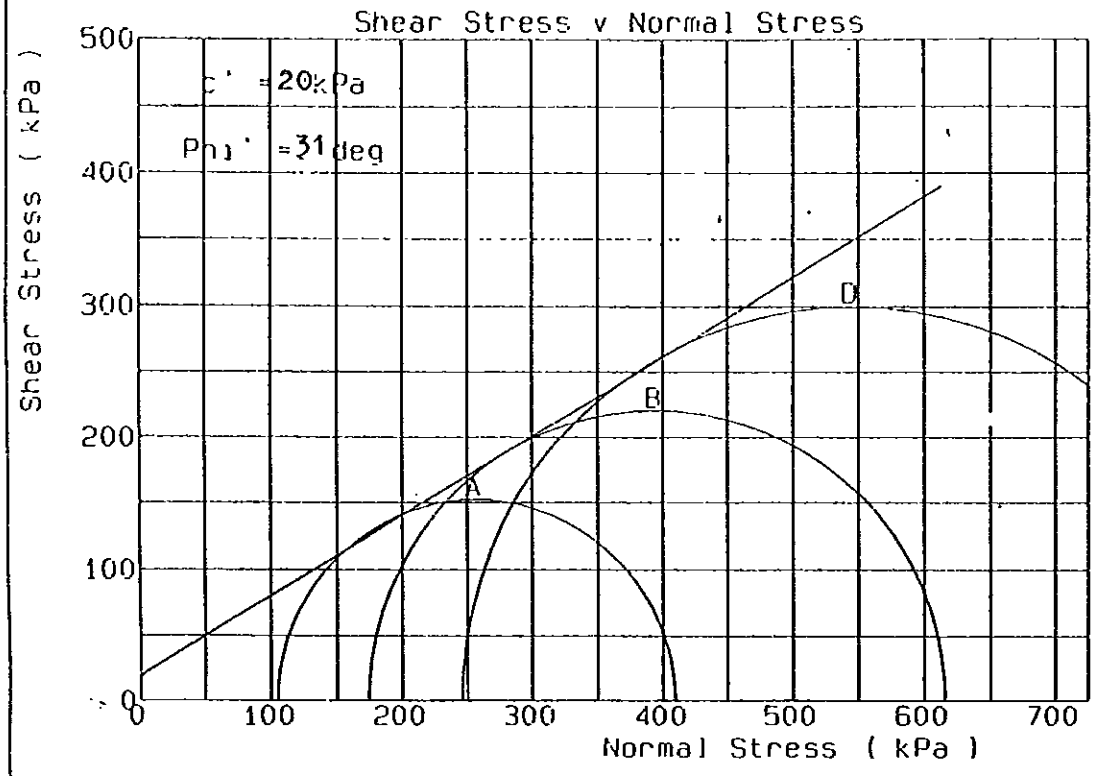


CENTRAL MATERIAL TESTING LAB.

Tested by: Checked by; Approved by:

Job: MUNDA DAM — Triaxial UnDrained Shear

BoreHole: PIT11 Sample: SAMPLE2/CU. Depth: -



Reference		A	B	D
Initial B value		0.13	0.13	0.12
Final B value		1.02	0.96	0.97
At Start of Shear				
Pore Pressure	kPa	460	490	440
Effective stress	kPa	70.0	139.4	200.0
Loading rate	mm/min	0.0154	0.0150	0.0148

Failure criteria adopted: Max deviator stress

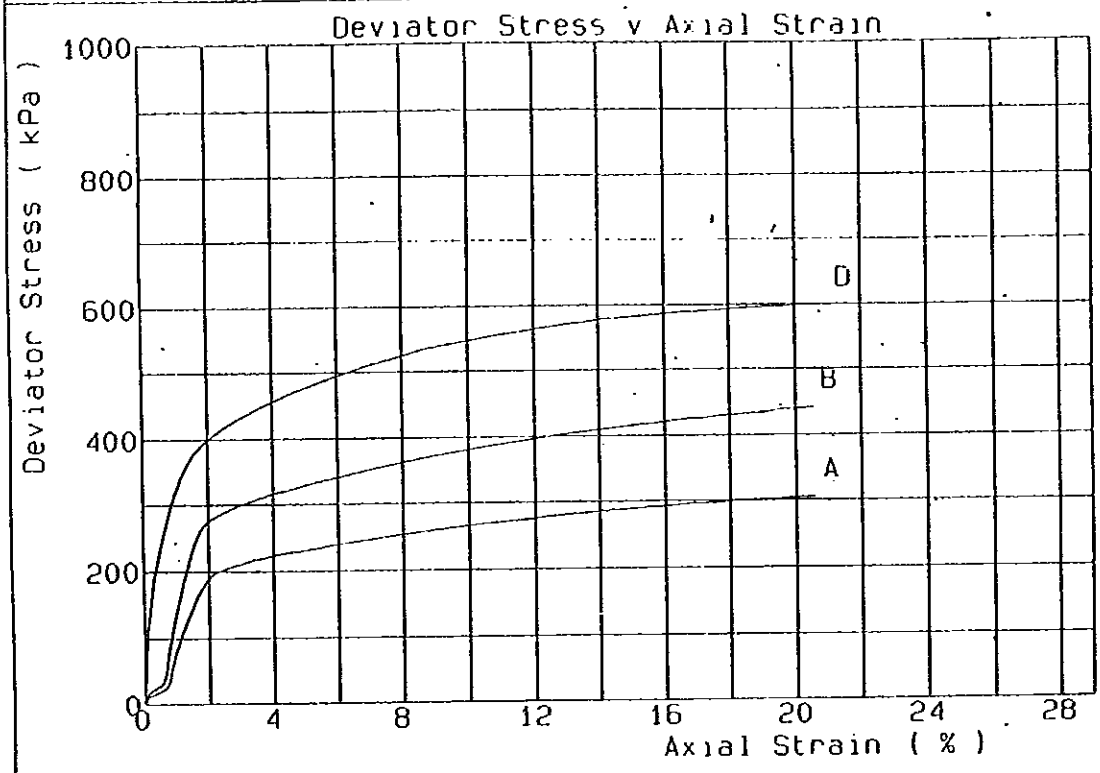
At Failure				
Bulk density	Mg/cum	2.177	2.190	2.286
Moisture content	%	31.0	27.1	26.9
Dry density	Mg/cum	1.662	1.723	1.802
Pore pressure	kPa	426.4	455.2	392.4
Deviator stress	kPa	304.6	441.6	600.1
Major principle eff. stress	kPa	409.2	615.8	845.7
Minor principle eff. stress	kPa	104.6	174.1	245.6
Stress ratio		3.9	3.5	3.4
strain	%	20.60	20.56	20.53
Correction factors				
SideDrain	kPa	0.0	0.0	0.0
Membrane	kPa	1.6	0.0	0.0

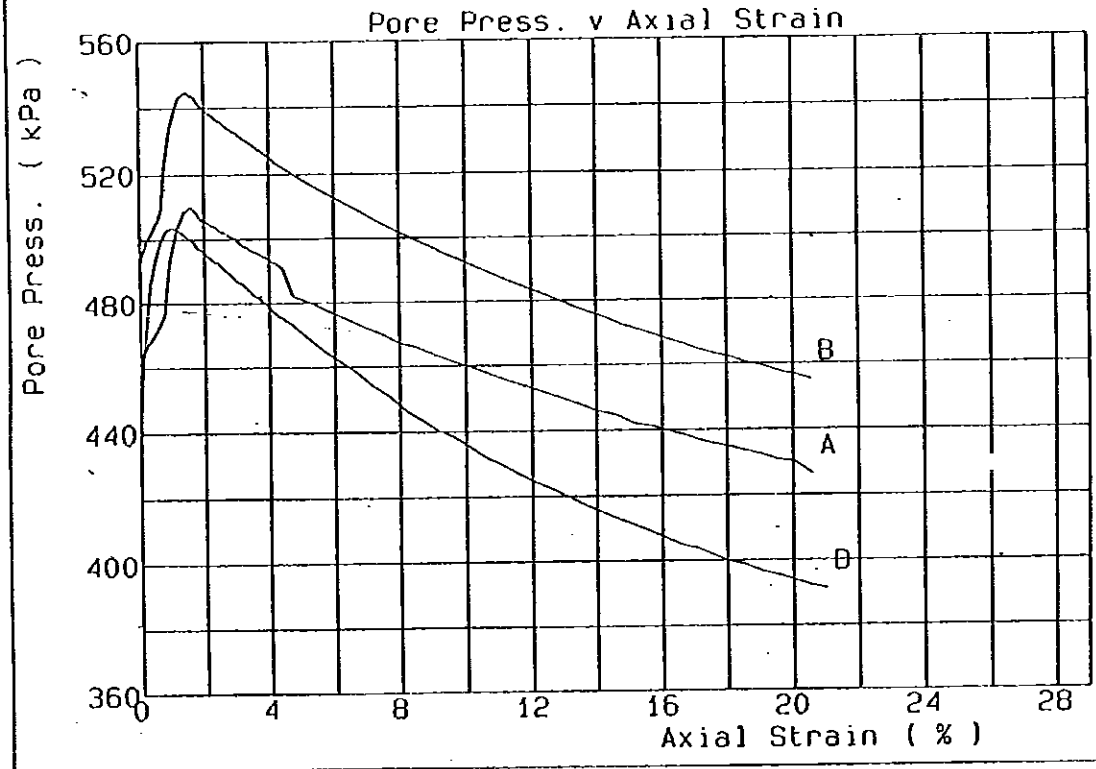
CENTRAL MATERIAL TESTING LAB.

Tested by: Checked by: Approved by:

Job: MUNDA DAM — Triaxial UnDrained Shear

BoreHole: PIT11 Sample: SAMPLE2/CU Depth: -



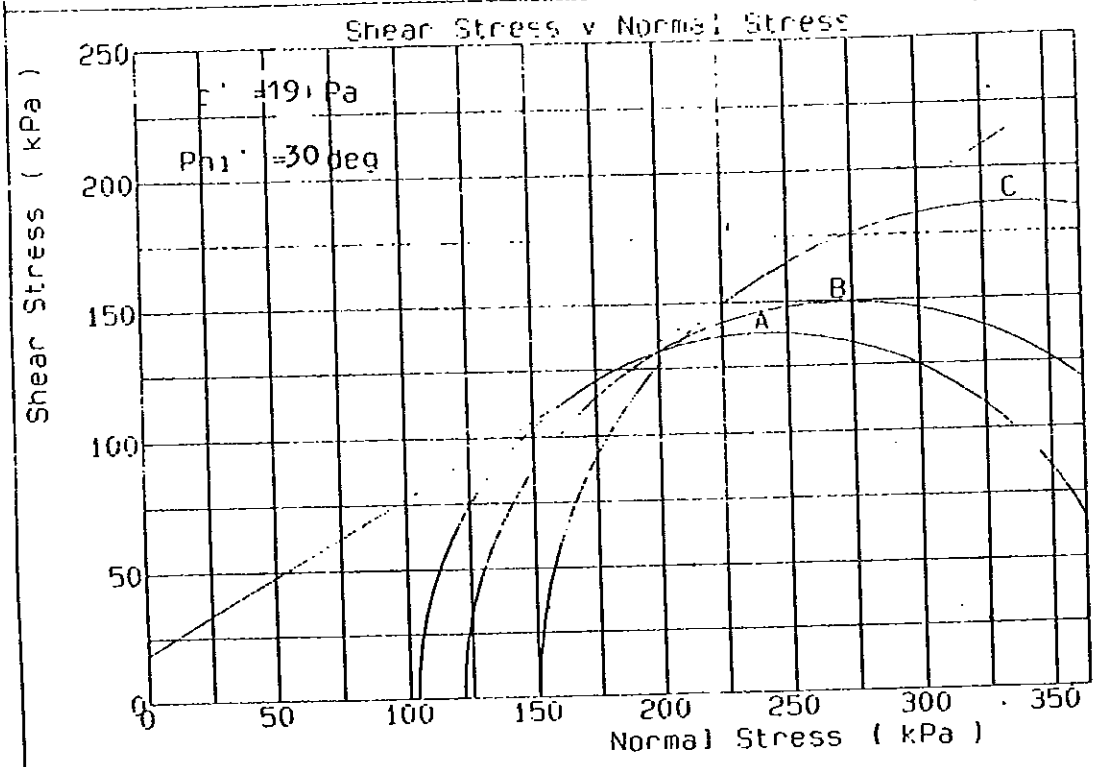


CENTRAL MATERIAL TESTING LAB.

Tested by: Checked by: Approved by:

Job: MUNDA DAM PROJECT — Triaxial UnDrained Shear

BoreHole: PIT13 Sample: 15538/CU Depth: SAMPLE/2



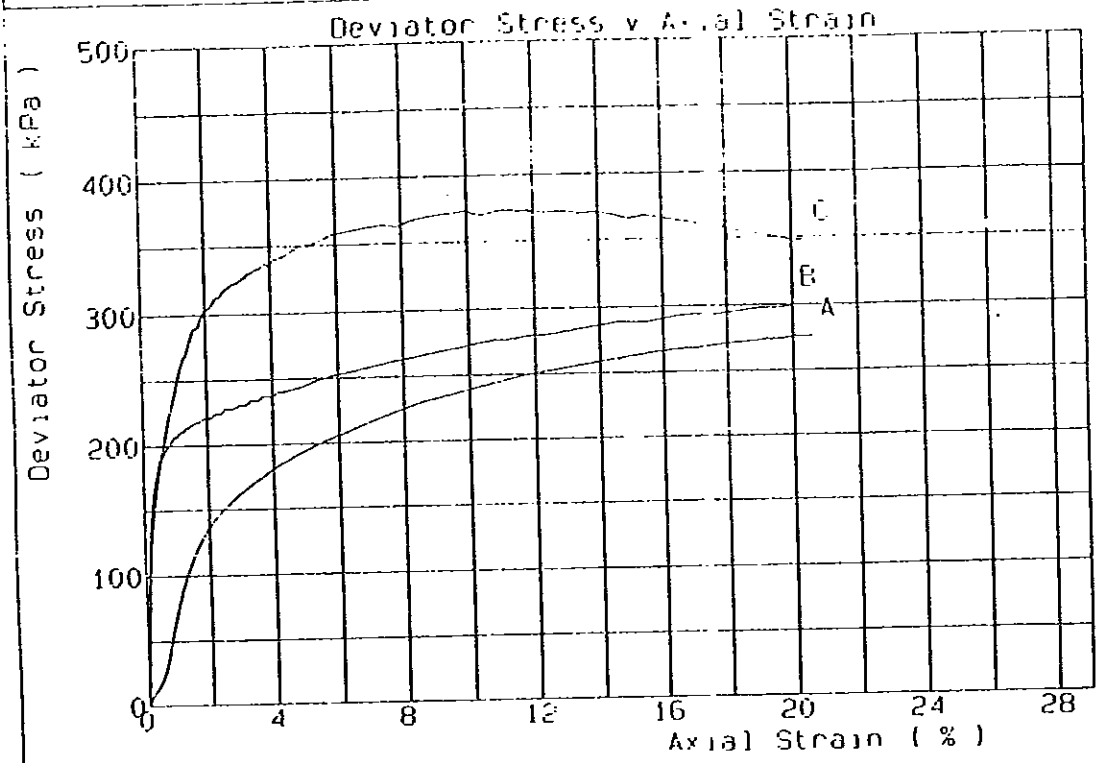
		A	B	C
Reference				
Initial B value		0.08	0.08	0.09
Final B value		1.00	0.96	0.96
At Start of Shear				
Pore Pressure	kPa	596	511	491
Effective stress	kPa	69.2	139.9	199.8
Loading rate	mm/min	0.0576	0.0578	0.0285
Failure criteria adopted:	Max deviator stress			
At Failure				
Bulk density	Mg/cum	2.175	2.058	2.101
Moisture content	%	24.3	25.1	24.2
Dry density	Mg/cum	1.750	1.646	1.692
Pore pressure	kPa	561.1	532.5	537.8
Deviator stress	kPa	275.9	299.2	373.6
Major principle eff. stress	kPa	379.1	420.6	524.0
Minor principle eff. stress	kPa	103.2	121.4	150.4
Stress ratio		3.7	3.5	3.5
strain	%	20.12	20.04	9.92
Correction factors				
SideDrain	kPa	0.0	0.0	0.0
Membrane	kPa	0.0	0.0	0.9

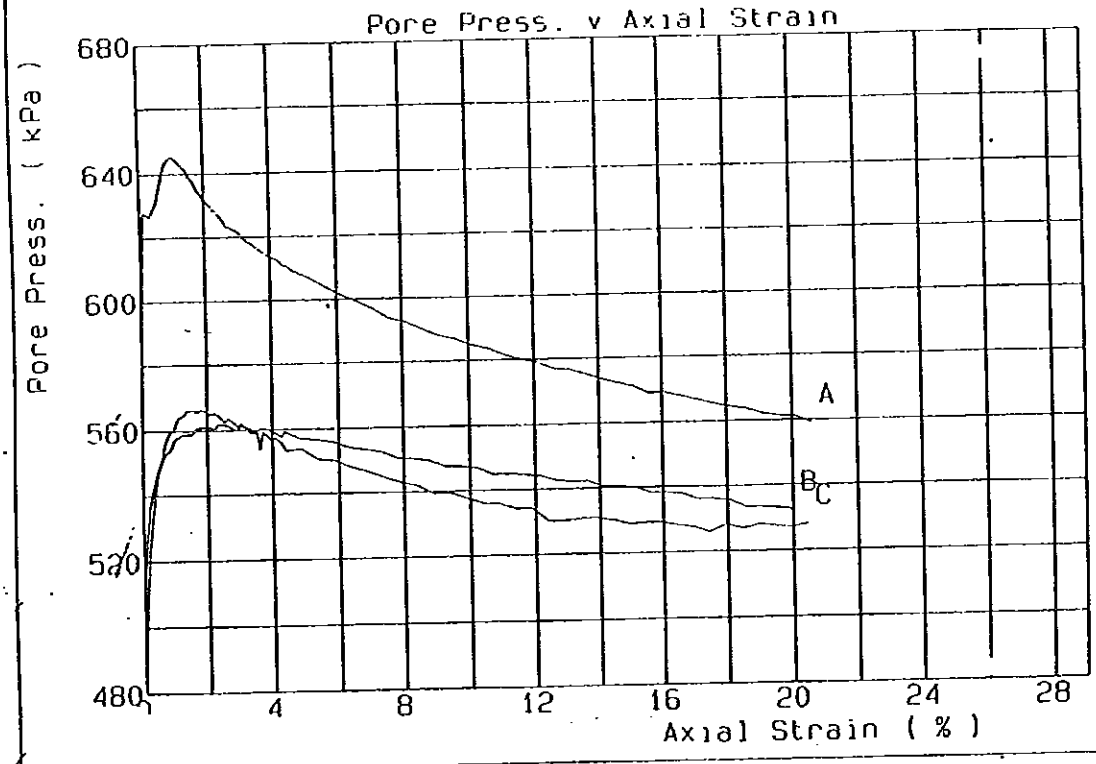
CENTRAL MATERIAL TESTING LAB.

Tested by: Checked by: Approved by:

Job: MUNDA DAM PROJECT — Triaxial UnDrained Shear

BoreHole: PIT13 Sample. 15538/C Depth: SAMPLE/2



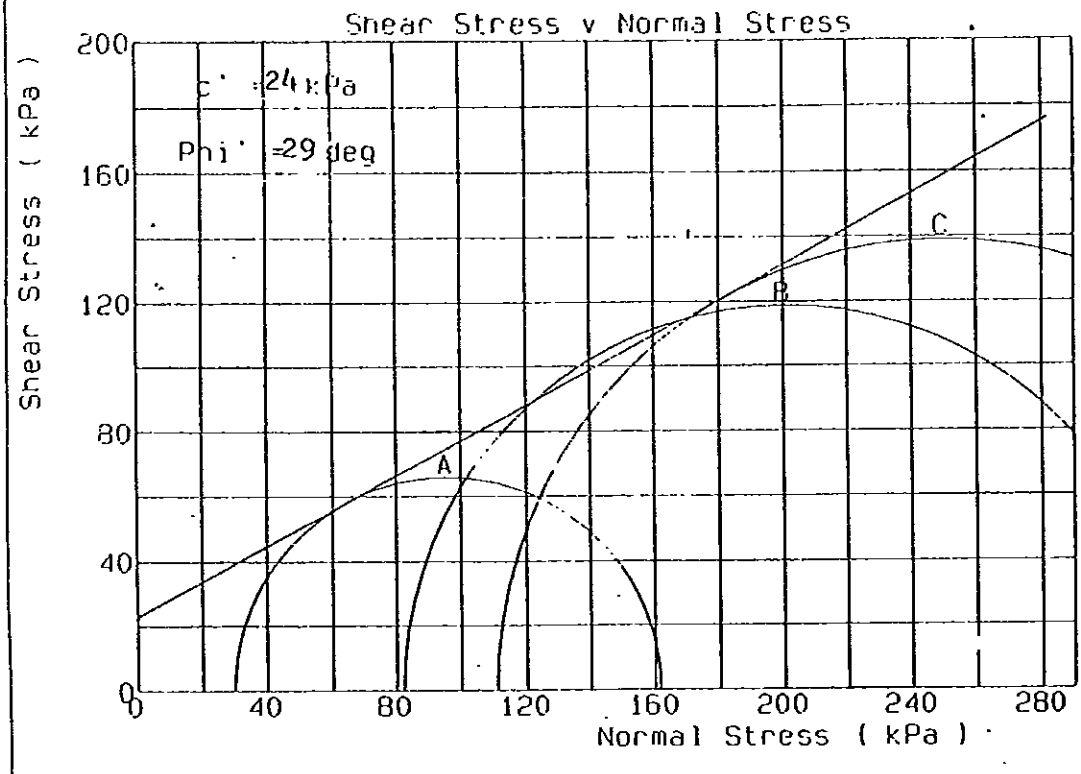


CENTRAL MATERIAL TESTING LAB.

Tested by: Checked by: Approved by:

Job: MUNDA DAM PROJ. Triaxial UnDrained Shear

BoreHole: P-15 Sample: CU Depth: -



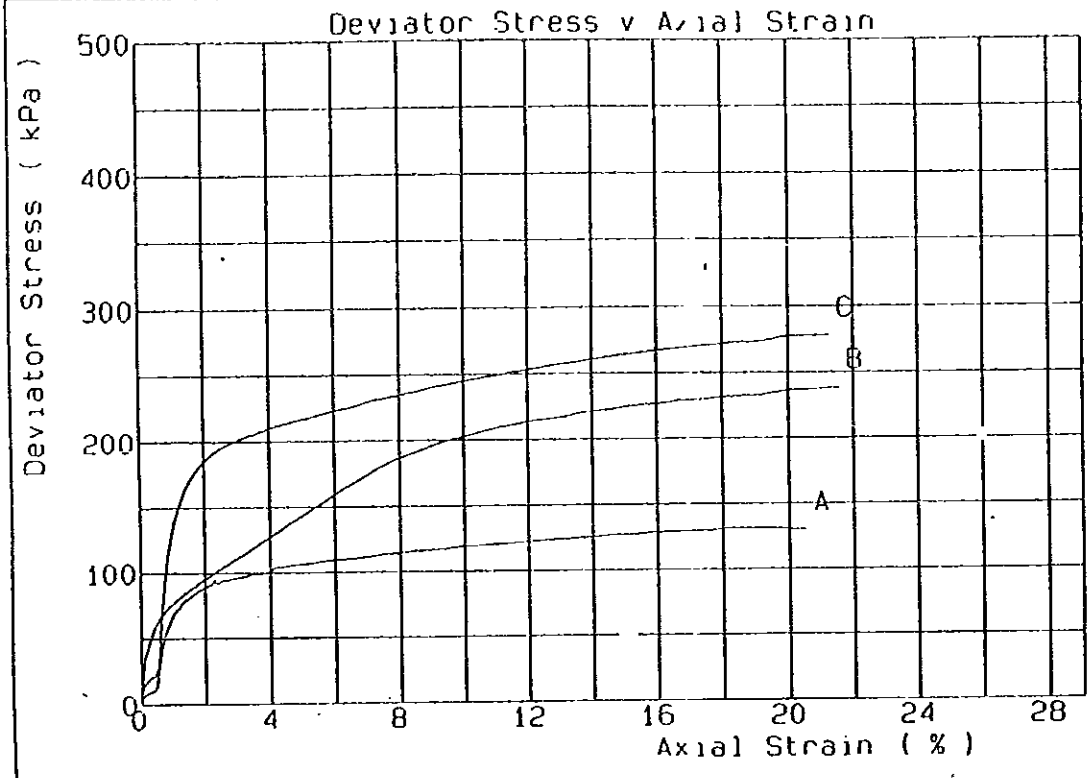
Reference		A	B	C
Initial B value		0.14	0.24	0.13
Final B value		1.09	0.98	0.96
At Start of Shear				
Pore Pressure	kPa	489	445	450
Effective stress	kPa	71.3	139.2	200.0
Loading rate	mm/min	0.0138	0.0139	0.0137
Failure criteria adopted.	Max deviator stress			
At Failure				
Bulk density	Mg/cum	2.276	2.220	2.247
Moisture content	%	21.7	18.7	19.8
Dry density	Mg/cum	1.871	1.870	1.875
Pore pressure	kPa	529.7	501.0	538.1
Deviator stress	kPa	131.8	237.5	278.6
Major principle eff. stress	kPa	161.6	319.5	389.5
Minor principle eff. stress	kPa	29.8	82.0	110.9
Stress ratio		5.4	3.9	3.5
strain	%	19.11	21.55	20.82
Correction factors				
SideDrain	kPa	0	0.0	0.0
Membrane	kPa	0.0	0.0	0.0

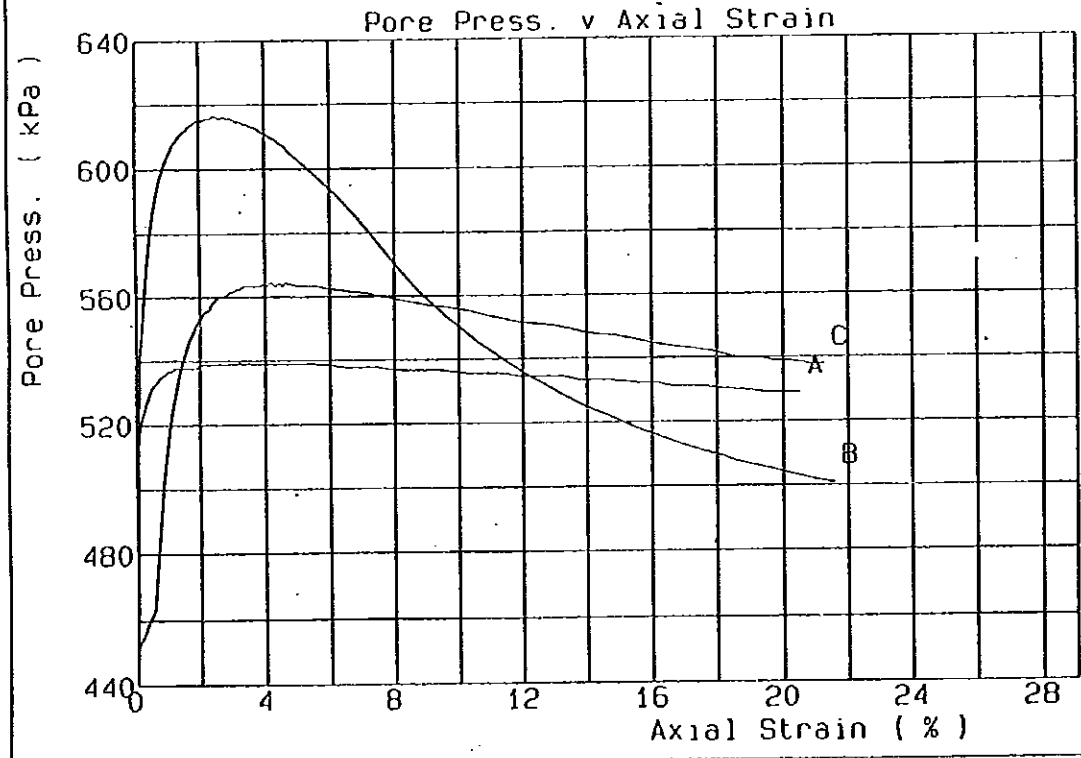
CENTRAL MATERIAL TESTING LAB.

Tested by: Checked by: Approved by:

Job: MUNDA DAM PROJ. Triaxial UnDrained Shear

BoreHole: P-15 Sample: CU Depth: -





CENTRAL MATERIAL TESTING LAB.

Tested by: Checked by: Approved by:

CENTRAL MATERIAL TESTING LABORATORY

2 Km off Riawind Road Lahore

Project: Munda Dam Multipurpose Project:

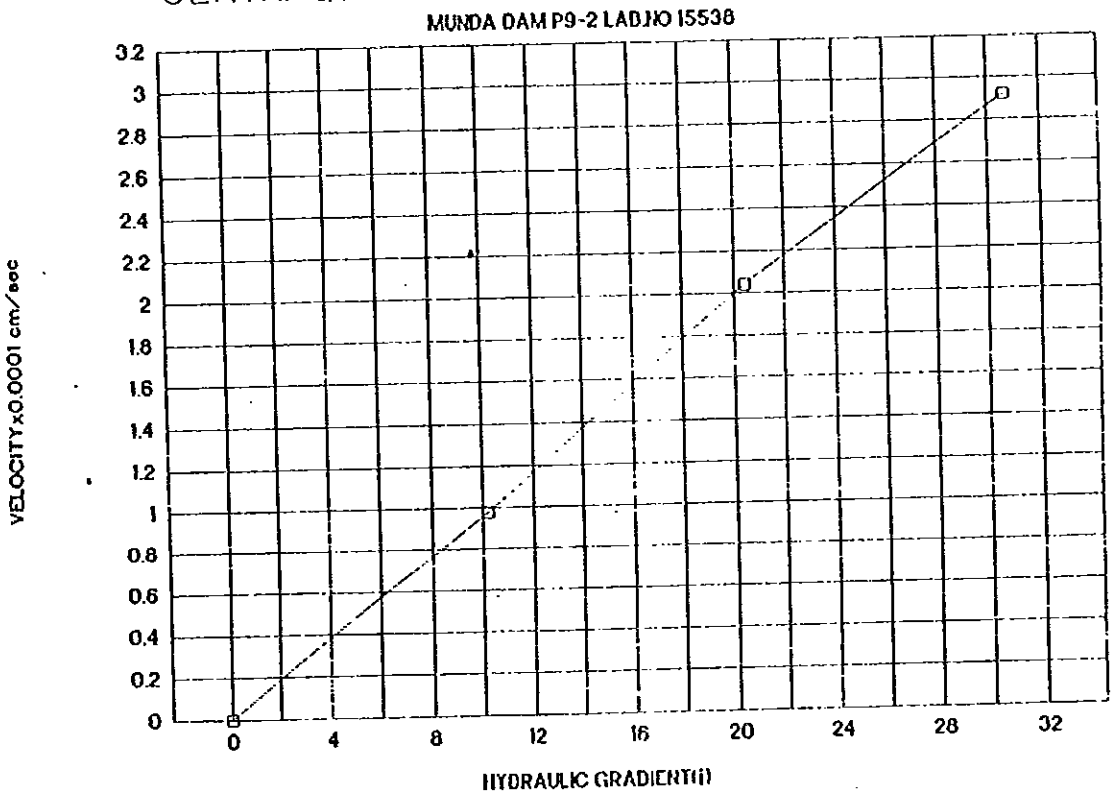
Table Initial Densities and Moisture data used in Triaxial Testing.

Sr. No.	Pit No.	Sample No.	Test Type	Specimen Dia. (mm)	Max. Dry Density gm/cm^3	OMC %	TXL Samples remoulded at 95% of MDD
1	9	2	UU	50	1.89	13.0	1.795
2	"	2	CU	70	"	"	"
3	10	2	UU	50	1.67	16	1.586
4	"	2	CU	50	"	"	"
5	11	2	UU	50	1.69	19	1.605
6	"	2	CU	50	"	"	"
7	13	2	UU	50	1.69	17.70	1.605
8	"	2	CU	70	"	"	"
9	15	1	UU	70	1.838	14.3	1.746
10	"	1	CU	50	"	"	"

PERMEABILITY TEST

CENTRAQL MATERIAL TESTING LAB LAHORE

MUNDA DAM P9-2 LADJO 15538



$V = 1.8 \times 10^{-4}$ cm/sec.

$i = 18$

$K = 1.00 \times 10^{-5}$ cm/sec.

Tested by;

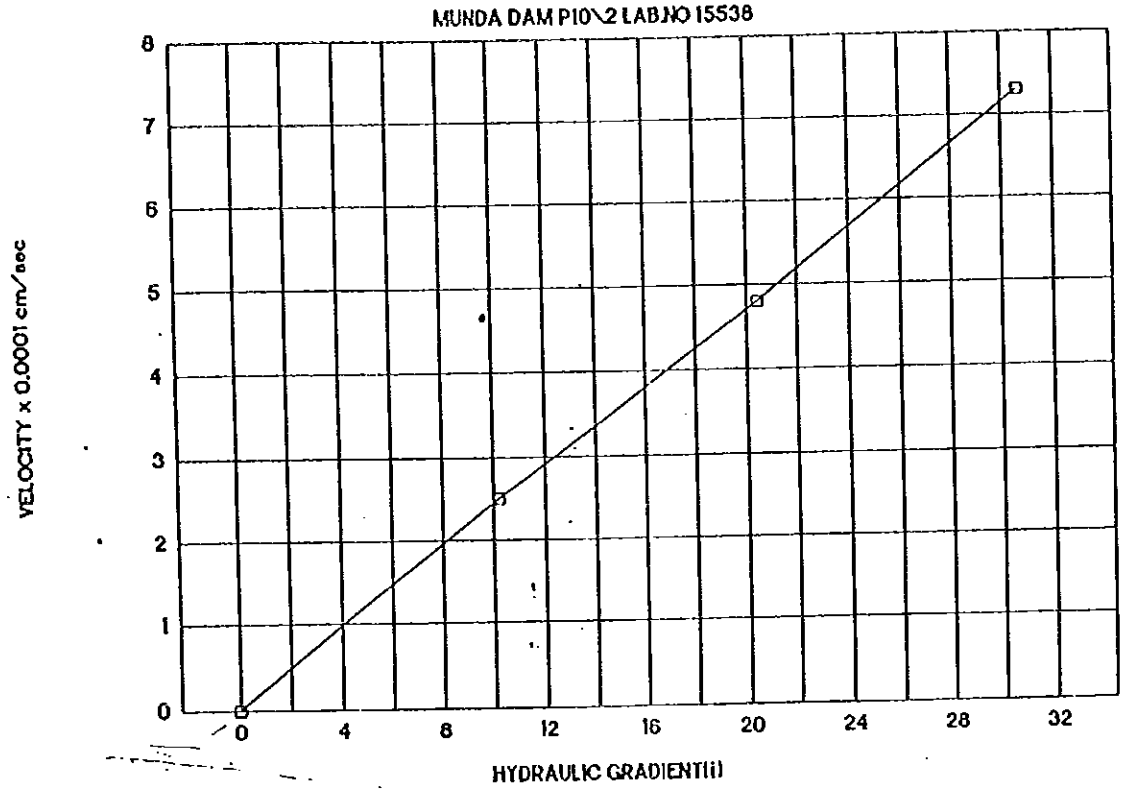
Checked by:

Approved by:

PERMEABILITY TEST

CENTRAL MATERIAL TESTING LAB LAHORE

MUNDA DAM P10\2 LAB.NO 15538



$V = 4.3 \times 10^{-4}$ cm/sec.

$i = 18$

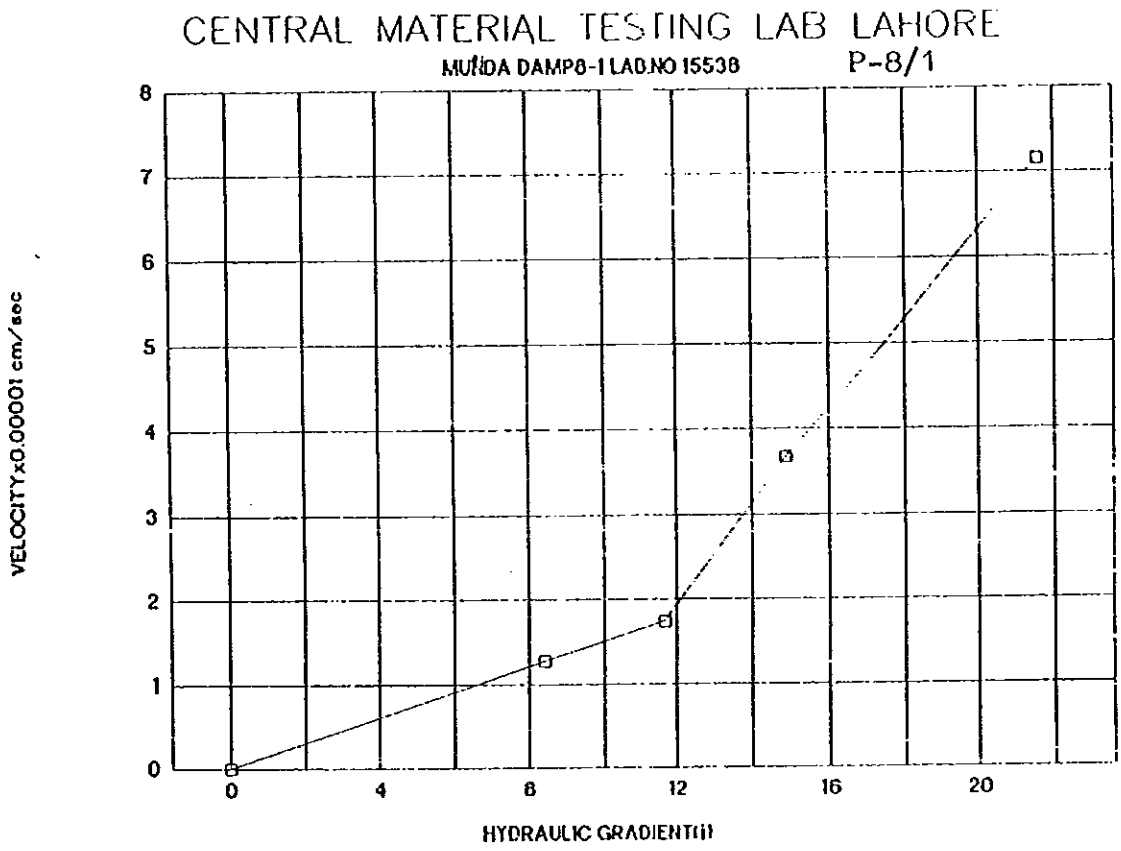
$K = 2.389 \times 10^{-5}$ cm/sec.

Tested by:

Checked by:

Approved by:

PERMEABILITY TEST



$V = 2.00 \times 10^{-5}$ cm/sec.

$i = 12.1$

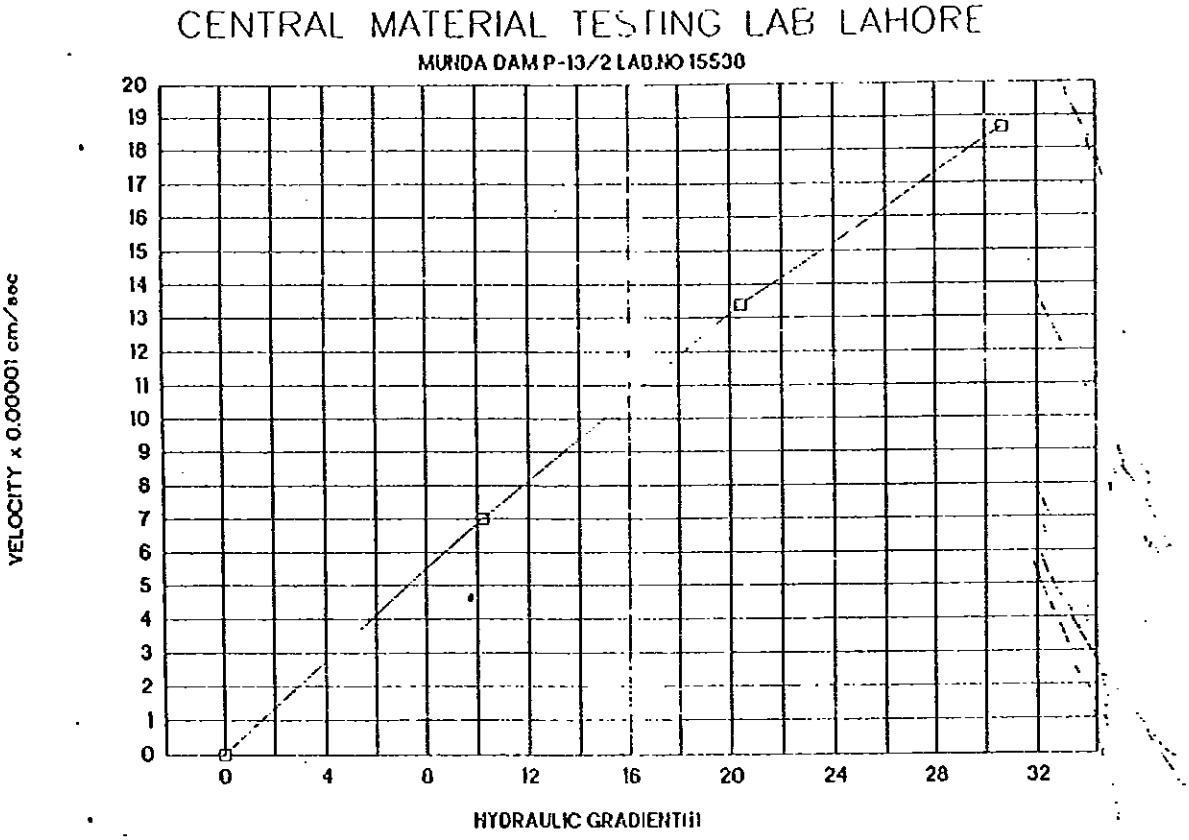
$K = 1.653 \times 10^{-6}$ cm/sec.

Tested by;

Checked by:

Approved by:

PERMEABILITY TEST



$V = 12.00 \times 10^{-5}$ cm/sec.

$i = 18.1$

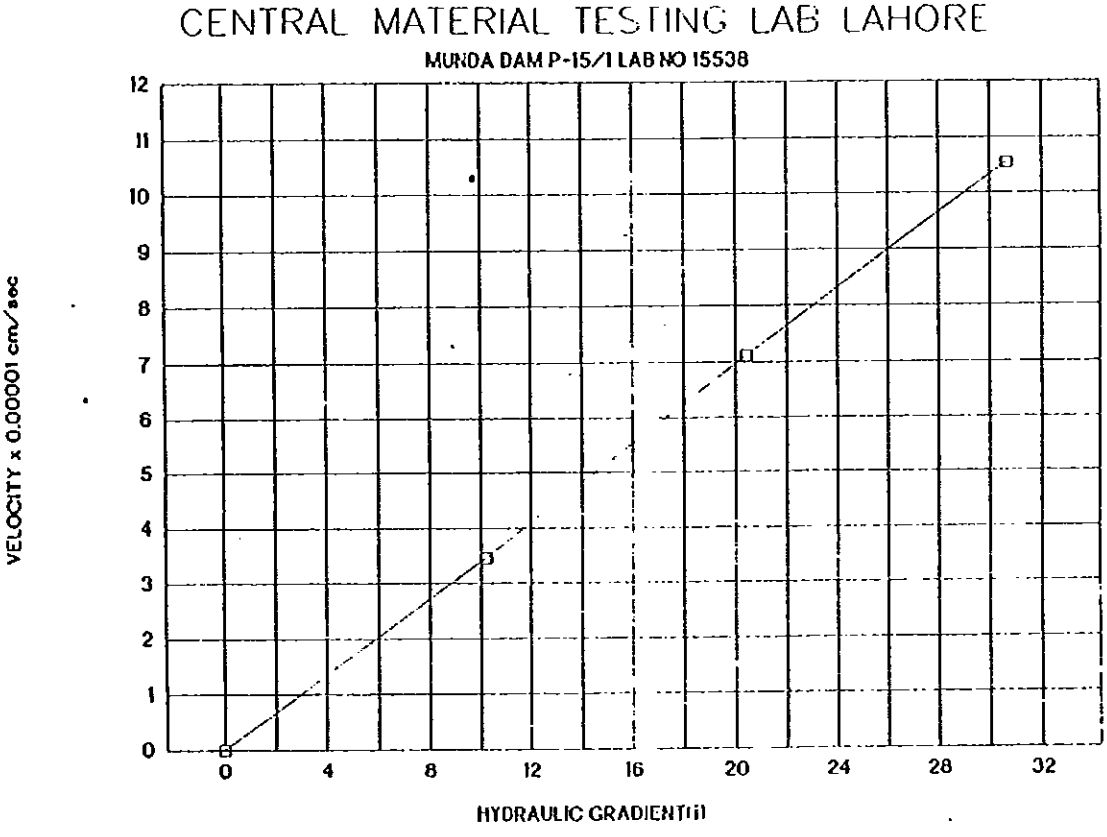
$K = 6.630 \times 10^{-6}$ cm/sec.

Tested by:

Checked by:

Approved by:

PERMEABILITY TEST



$V = 9.0 \times 10^{-5}$ Cm/sec.

$i = 26$

$K = 3.462 \times 10^{-6}$ cm/sec.

Tested by:

Checked by:

Approved by:

LABORATORY TEST ON CONCRETE AGGREGATES (SAND AND GRAVEL)

	Samples
Sieve analysis of aggregates (ASTM C136)	5
Specific gravity and water absorption of coarse aggregate (ASTM C128)	5
Specific gravity and water absorption of fine aggregate (ASTM C128)	5
Clay lumps and friable particles in aggregate (ASTM C142)	5
Soundness test by sodium sulfate (ASTM C88)	3
Abrasion test of coarse aggregate by Los Angeles machine (ASTM C535)	3
Chemical (alkali) reactivity test (ASTM C289)	5

Table-1

CENTRAL MATERIAL TESTING LABORATORY

SUMMARY OF TEST RESULTS

PROJECT: MUNDA DAM PROJECT

DESCRIPTION					TESTS PERFORMED											
Sr. No.	Pit No	Lab. No.	Type of Material	Source	SieveAnalysis			Specific Gravity of C.Agg.	Absorp-tion % of C Agg.	Specific Gravity of F.Agg.	Absorp-tion %of F Agg.	Sodium Sulphate Soundness Weighted % loss	Clay Lumps & Friable Particles weighted %	Los Angeles % of Wear	Los Angles Uniformity of Wear	Chemical Alkali Reactivity m.moles/lit	
					Cobbles%	Gravel%	Sand%									Sc	Rc
1	1	15538	Aggregate River bed	Swat River	20.6	62.5	16.9	2.89	0.31	2.90	1.68	0.19	0.21	6.0	0.19	21 15	80.0
2	2		"		-	-	-	2.78	0.46	2.90	1.49	-	0.20	-	-	24.31	90.0
3	3		"		28.4	44.2	27.4	2.77	0.30	2.89	1.55	0.31	0.19	5.0	0.19	12.32	40.0
4	5		"		19.1	65.9	15.0	2.77	0.52	2.88	1.21	0.77	0.19	5.0	0.15	17.65	72.5
5	5		Sand		-	-	F.M 2.04	-	-	2.88	1.21	-	-	-	-	-	-
6	7		Aggregate		31.5	44.5	24.0	2.68	2.34	2.53	4.93	-	6.61	-	-	18 15	105.0

TESTED BY: _____ CHECKED BY: _____ APPROVED BY: _____

GE5 - 63

SIEVING
Preparation
Mass
SEDIMENTATION
Pretreatment
Mass
PERCENTAGE PARTICAL SIZE
Clay
Silt
Sand
Gravel
Cobbles
16.9 %
62.5 %
20.6 %
British Standard Sieve Size
63
212
150
600
425
1.18
6.3
3.35
28
14
37.5
63
100
90
80
70
60
50
40
30
20
10
0
PERCENTAGE PASSING
1000
100
10
1
0.1
0.01
GRAIN SIZE IN(MM)
CLAY
Fine
Medium
Coarse
SILT
Fine
Medium
Coarse
SAND
Fine
Medium
Coarse
GRAVEL
COBBLE
BOULDER
Partical Size Distribution
Pit No. 1
sample No. P-1
Depth(m):
Date: 19-12-1998
C.M.T.L. LAHORE
Clint: JICA
Location: Mundo Dam Project:(River Bed Material)
Tested by:
M.A.Qurashi
Fig
P.D; CMTL

SIEVING		SEDIMENTATION		PERCENTAGE PARTICAL SIZE				
Preparation	Mass	Pretreatment	Mass	Clay	Silt	Sand	Gravel	Cobbles
						27.4 %	44.2 %	28.4 %

Partical Size Distribution	Pit No. 3 sample No. P -3	Depth(m): Date: 19-12-1998
C.M.T.L. LAHORE	Clint: JICA Location: Mundo Dam Project:(River Bed Material)	Tested by: M.A.Ouroshi ASM

Fig

P.D; CMTL

SIEVING		SEDIMENTATION		PERCENTAGE PARTICAL SIZE				
Preparation	Mass	Pretreatment	Mass	Clay	Silt	Sand	Gravel	Cobbles
						19.1 %	65.9 %	15 %

Partical Size Distribution	Pit No. 5	Depth(m):
	sample No. P -5	Date: 22-12-1998
C.M.T.L. LAHORE	Clint: JICA Location: Mundo Dam Project:(River Bed Moleriol)	Tested by: M.A.Ouroshi ARO

Fig

P.D; CMTL

SIEVING		SEDIMENTATION		PERCENTAGE PARTICAL SIZE				
Preparation	Mass	Pretreatment	Mass	Clay	Silt	Sand	Gravel	Cobbles
						100 %	%	%

Partical Size Distribution	Pit No. 5 sample No. P -5	Depth(m): Date: 22-12-1998	
C.M.T.L. LAHORE	Clint: JICA Location: Mundo Dam Project:(River Bed Material)	Tested by: M.A.Ouroshi	Fig

P.D, CMTL

SIEVING
Preparation
Mass
SEDIMENTATION
Pretreatment
Mass
PERCENTAGE PARTICAL SIZE
Clay
Silt
Sand
Gravel
Cobbles
24 %
44.5 %
31.5 %
British Standard Sieve Size
63
150
212
425
600
1.18
3.35
6.3
14
28
37.5
63
100
90
80
70
60
50
40
30
20
10
0
PERCENT PASSING
0.01
0.1
1
10
100
1000
GRAIN SIZE IN(MM)
CLAY
Fine
Medium
Coarse
SILT
Fine
Medium
Coarse
SAND
Fine
Medium
Coarse
GRAVEL
COBBLE
BOULDER
Partical Size Distribution
Pit No. 7
sample No. P -7
Depth(m):
Date: 31-12-1998
C.M.T.L. LAHORE
Clint: JICA
Location: Mundo Dam Project:(River Bed Materiol)
Tested by:
M.A.Quroshi
&M
Fig
P.D; CMTL

CENTRAL MATERIAL TESTING LABORATORY
LAHORE.

TEST RESULTS

ASTM C-127 & 128

AGENCY: JICA Study Team,Peshwar.

PROJECT: MUNDA DAM

REF: JM-101 Dated: 02/10/98

LAB. NO: 15538

SR. NO.	PIT NO.	SOURCE	TYPE OF MATERIAL	SPECIFIC GRAVITY OF COARSE AGGREGATES	ABSOR -PTION %	SPECIFIC GRAVITY OF FINE AGGREGATES	ABSOR-PTION %
1	1	Swat River	Agg, River bed	2.89	0.31	2.90	1.68
2	2	"	"	2.78	0.46	2.90	1.49
3	3	"	"	2.77	0.30	2.89	1.55
4	5	"	"	2.77	0.52	2.88	1.21
5	7	"	"	2.68	2.34	2.53	4.93

TESTED BY:

CHECKED BY

APPROVED BY:
P.D.CMTL

CENTRAL MATERIAL TESTING LABORATORY
LAHORE.

CLAY LUMPS & FRIABLE PARTICLES
ASTM-C-142

Agency: JICA Shidy Team, Peshwar.
Project: MUNDA DAM
Ref: JM-101 Dated:02/10/98
Location River Swat
Sample No: P-1
Material: Aggregate River Bed
Lab. No: 15538

TEST ON FINE AGGREGATE.

Sieve Size	Grading of Original Sample %	Wts of Fraction of Material remaining on sieve # 200 after test C-117.	Designated Sieve for after test sieving.	Percent of Clay Lumps & Friable Particles.	Weighted Percentage
Minus # 100					
No. 50 to No. 100					
No. 30 to No. 50					
No. 16 to No. 30					
No. 08 to No. 16 (25gms)			#20		
N0. 04 to No. 08					

Total:

TEST ON COARSE AGGREGATE

Over 1-1/2 in. (5000 g)	46.0	5067.1	# 4-5059.5	0.15	0.07
1-1/2 in. to 3/4 in. (3000 g)	21.0	3030.2	# 4-3025.2	0.17	0.04
3/4 in. to 3/8 in. (2000 g)	11.1	2007.4	# 4-2003.0	0.22	0.02
3/8 in. to No.4 (1000 g)	5.0	1000.8	# 8-997.4	0.34	0.02
Minus # 4	16.9	-	-	-	0.06

Total: 0.21

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