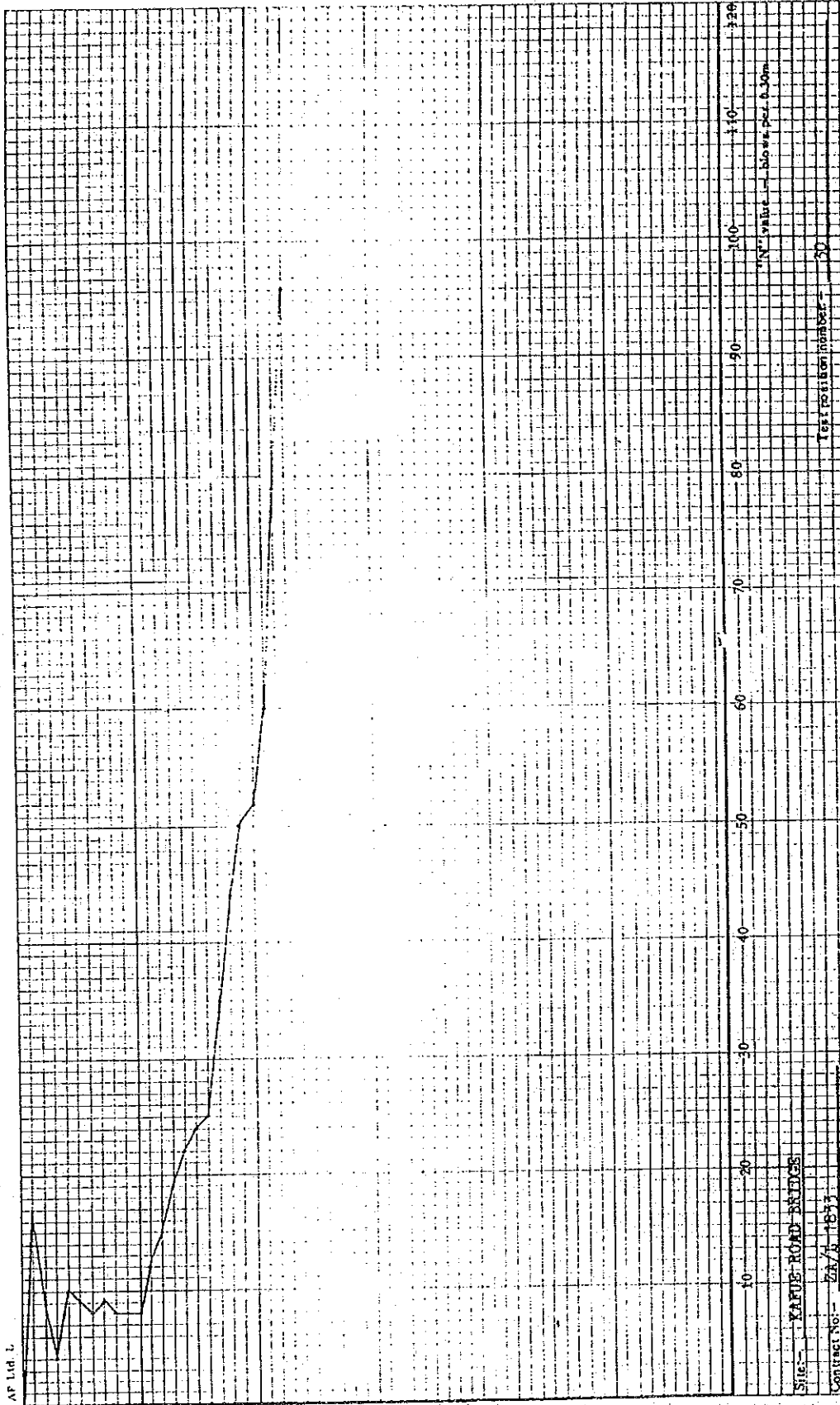


AF 101.1



Site: KARUB ROAD BRIDGE

Contract No: 233/1853

Test Position number: 30

100% value — blow per 3.0m

WADE ADAMS PILING AND FOUNDATIONS LTD. PENETROMETER TEST REPORT Date 6TH MARCH 1990

APPENDIX 4-6 Horizontal Loading Test Record

Project: Kafue Road Bridge

Pw = 0.05 (kg/cm²)

Boring Hole

Water Level

Location : 3

Depth: GL -0.50m

upon Surveyed: GL ± 0.00m

Ep = 2(1+ν) (Vc+Vm) dp/dv

= 2(1+0.3) (535+ 71) X 0.011

= 17.33 (kg/cm²)

P0 = 0.73 (kg/cm²)

Pf = 2.29 (kg/cm²)

Pl = (kg/cm²)

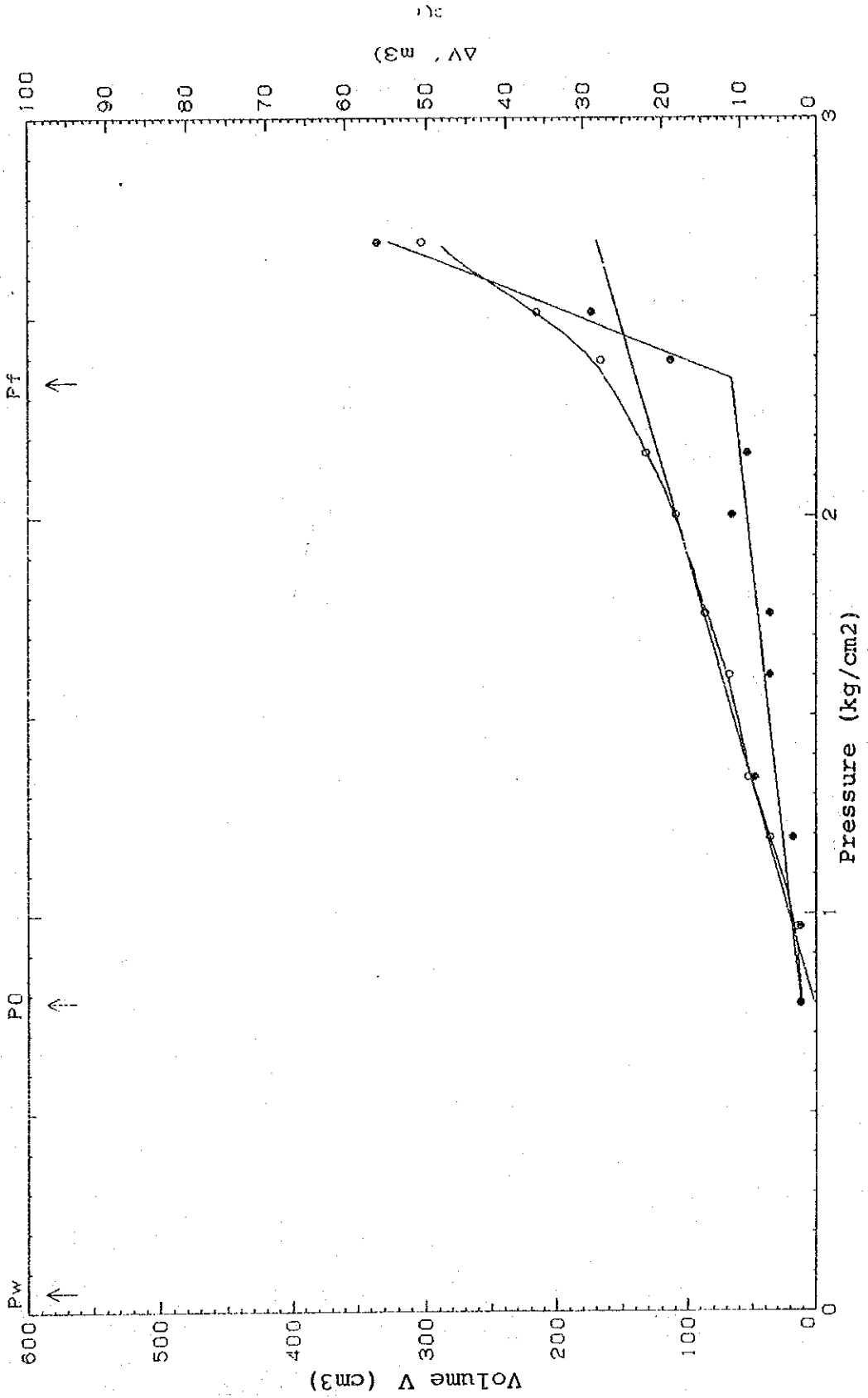


Fig. 1 Records of Horizontal Loading Test

Project: Kafue Road Bridge

Boring Hole

Location : 8

Depth: GL -2.50m

Water Level
upon Surveyed: GL -2.50m

$P_w = 0.00 \text{ (kg/cm}^2\text{)}$

$E_p = 2(1+\nu) (V_c + V_m) dp/dv$

$= 2(1+0.3) (535+309) \times 0.022$

$= 48.28 \text{ (kg/cm}^2\text{)}$

$P_0 = 2.44 \text{ (kg/cm}^2\text{)}$

$P_1 = 4.25 \text{ (kg/cm}^2\text{)}$

$P_f = 48.28 \text{ (kg/cm}^2\text{)}$

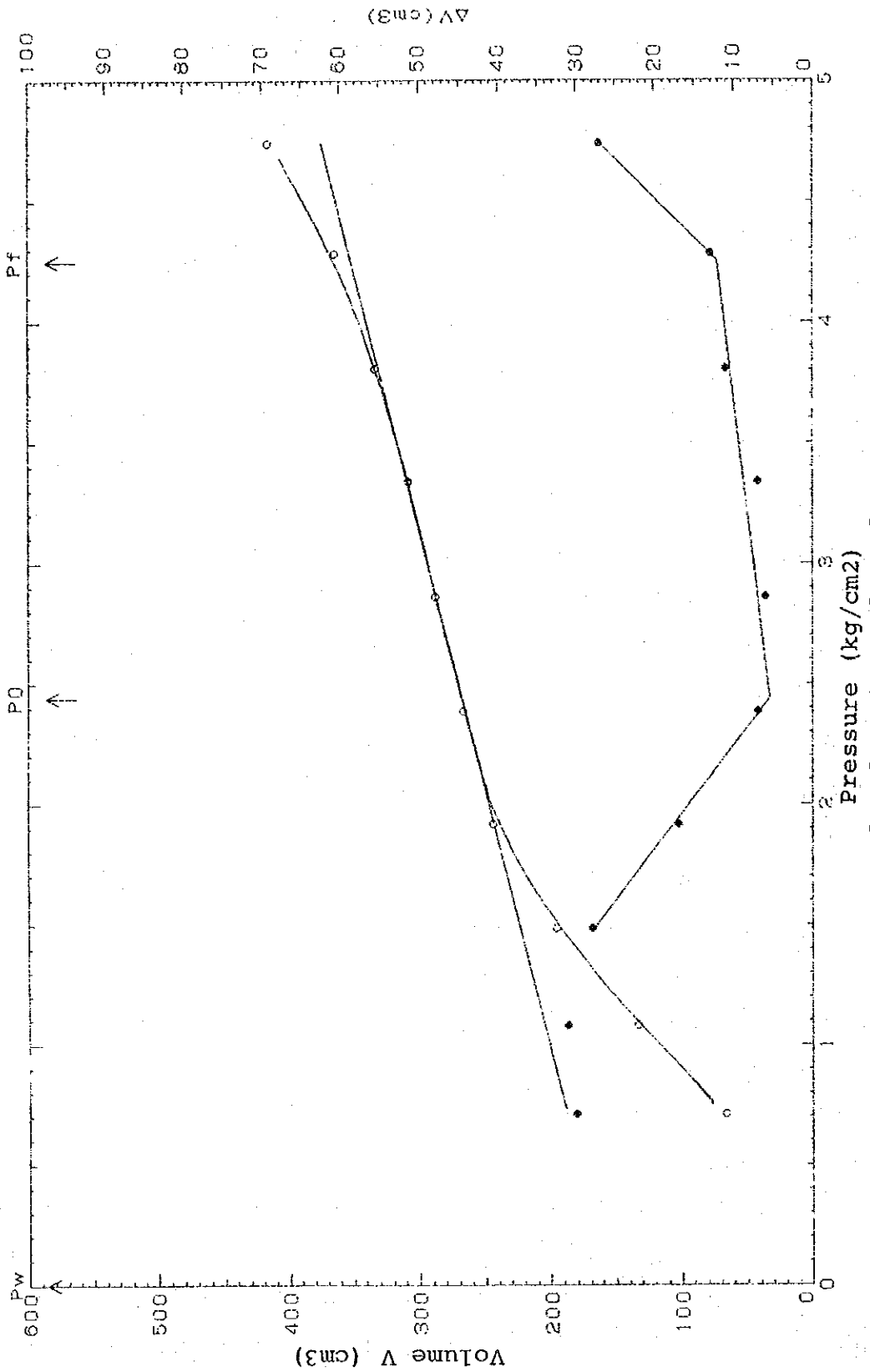


Fig. 2 Records of Horizontal Loading Test

Project: Kafue Road Bridge

$P_w = 0.15 \text{ (kg/cm}^2\text{)}$

Boring Hole : 8
 Location :

Depth: GL -3.50m
 upon Surveyed: GL -2.00m

$E_p = 2(1+\nu)(V_o + V_m) dp/dv$
 $= 2(1+0.3)(535+130) \times 0.055$
 $= 95.09 \text{ (kg/cm}^2\text{)}$

$P_o = 1.99 \text{ (kg/cm}^2\text{)}$ $P_f = 6.50 \text{ (kg/cm}^2\text{)}$ $P_i = \text{ (kg/cm}^2\text{)}$

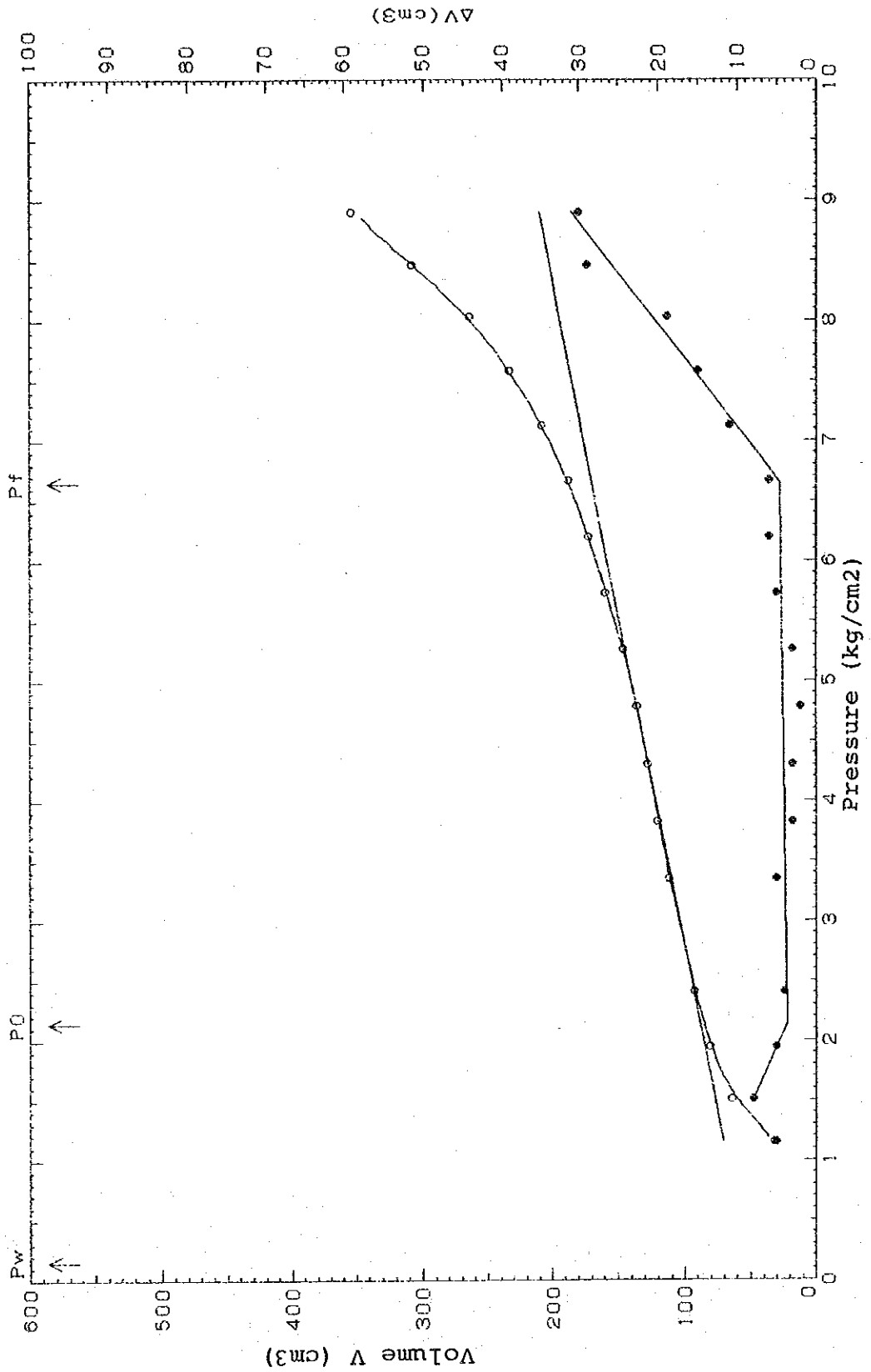


Fig. 3 Records of Horizontal Loading Test

Project: Kafue Road Bridge

Boring Hole : 8
Location

Depth: GL -1.50m

Water Level
upon Surveyed: GL -2.00m

$P_w = -0. \quad (\text{kg/cm}^2)$

$E_p = 2(1+\nu)(V_c + V_m) dp/dv$

$= 2(1+0.3)(535+261) \times 0.018$

$= 37.25 (\text{kg/cm}^2)$

$P_0 = 2.01 (\text{kg/cm}^2) \quad P_f = 4.00 (\text{kg/cm}^2) \quad P_1 = \quad (\text{kg/cm}^2)$

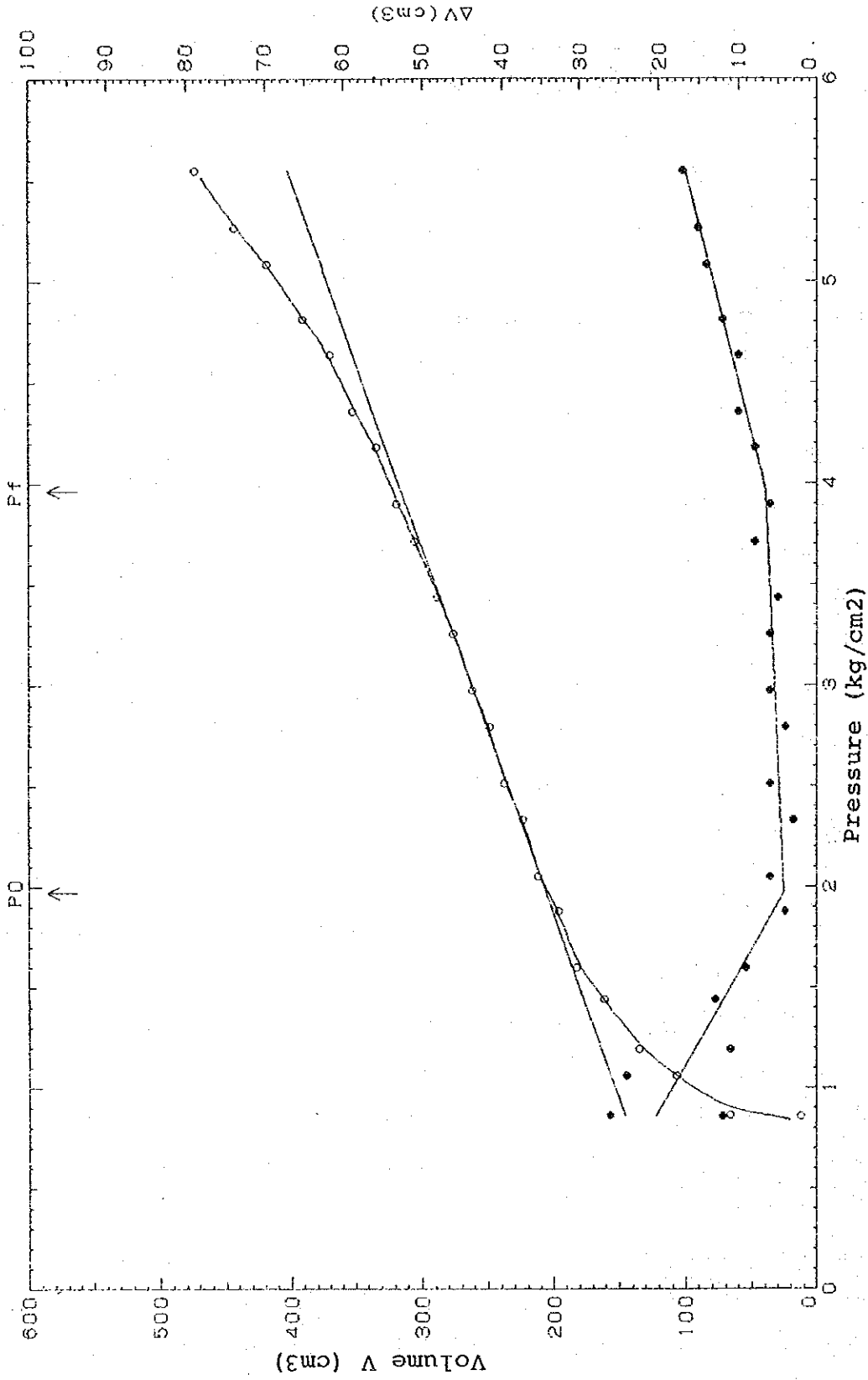


Fig. 4 Records of Horizontal Loading Test

Project: Kafue Road Bridge

Boring Hole Location : 11 Depth : GL -3.30m Water Level upon Surveyed : GL+ 4.20m

Pw = 0.75 (kg/cm²)

Ep = 2(1+ν) (Vc+Vm) dp/dv
 = 2(1+0.3) (535+126) X 0.033
 = 56.71 (kg/cm²)

P0 = 0.31 (kg/cm²) Pf = 7.93 (kg/cm²) P1 = (kg/cm²)

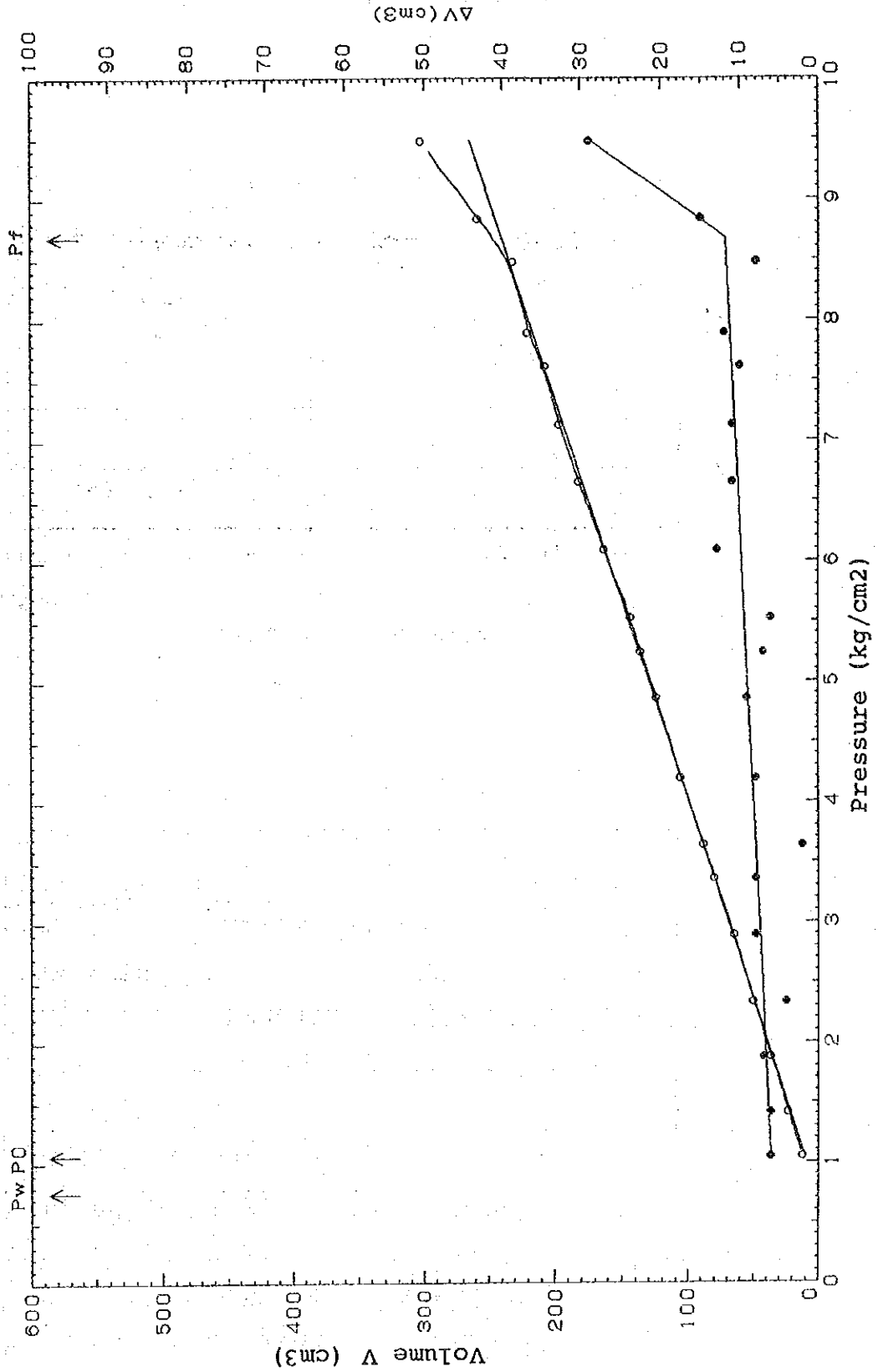


Fig. 5 Records of Horizontal Loading Test

APPENDIX 5-1 WATER LEVEL OF KAFUE

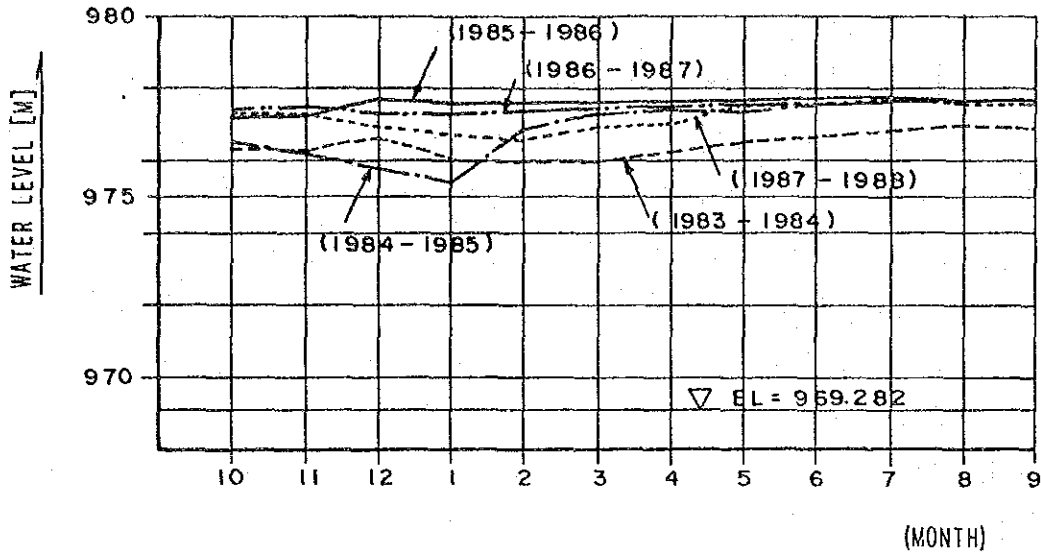


FIG. 1. MAXIMUM MONTHLY WATER LEVEL

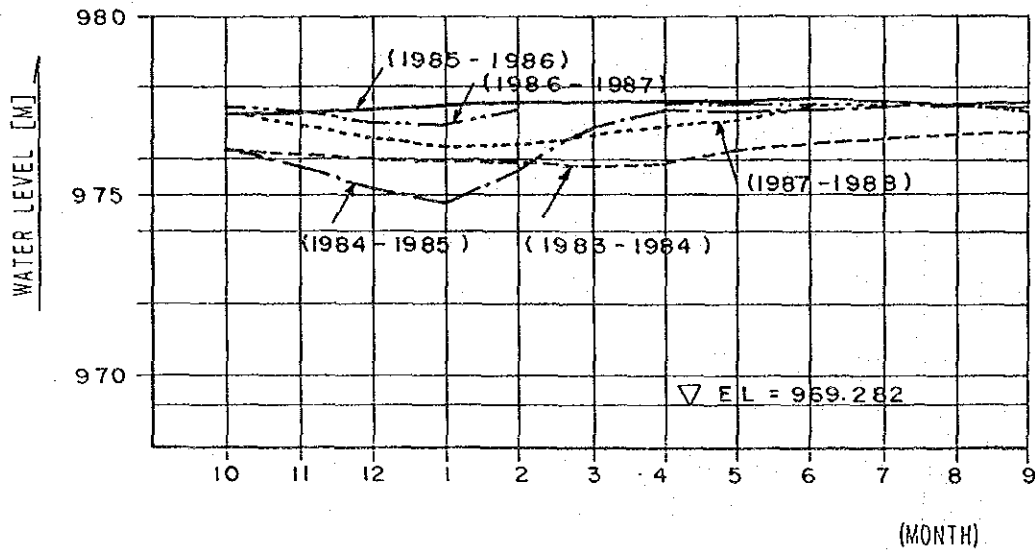
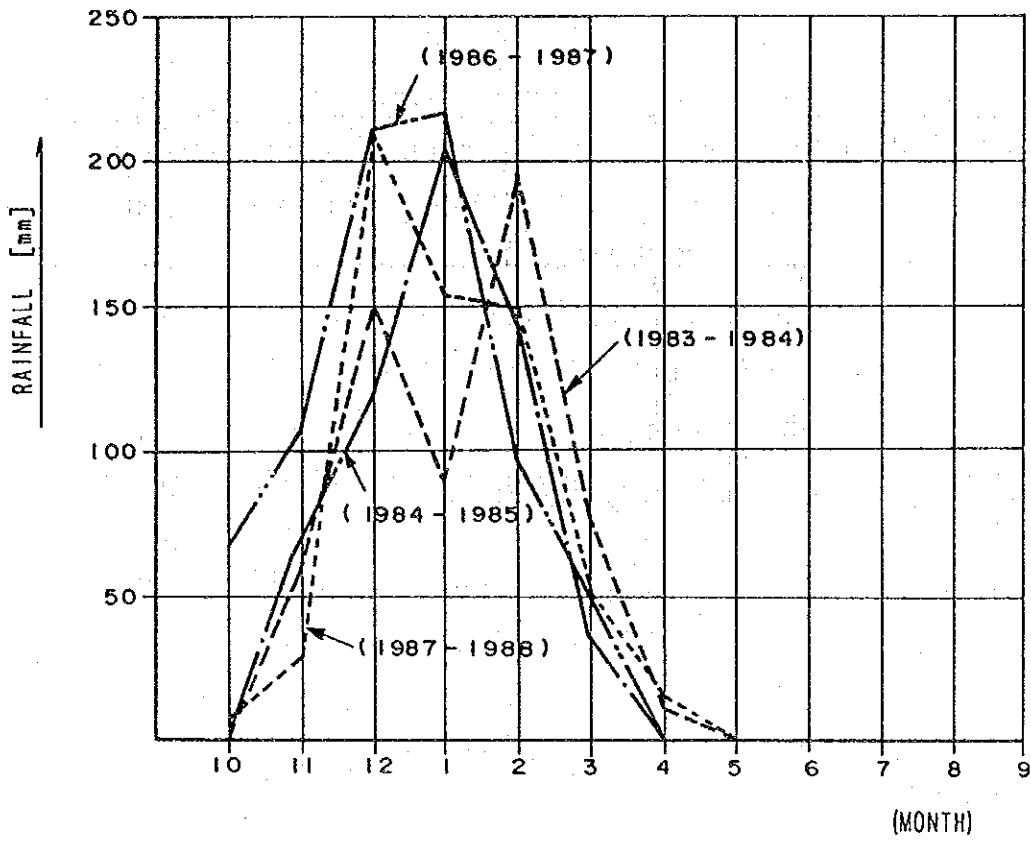
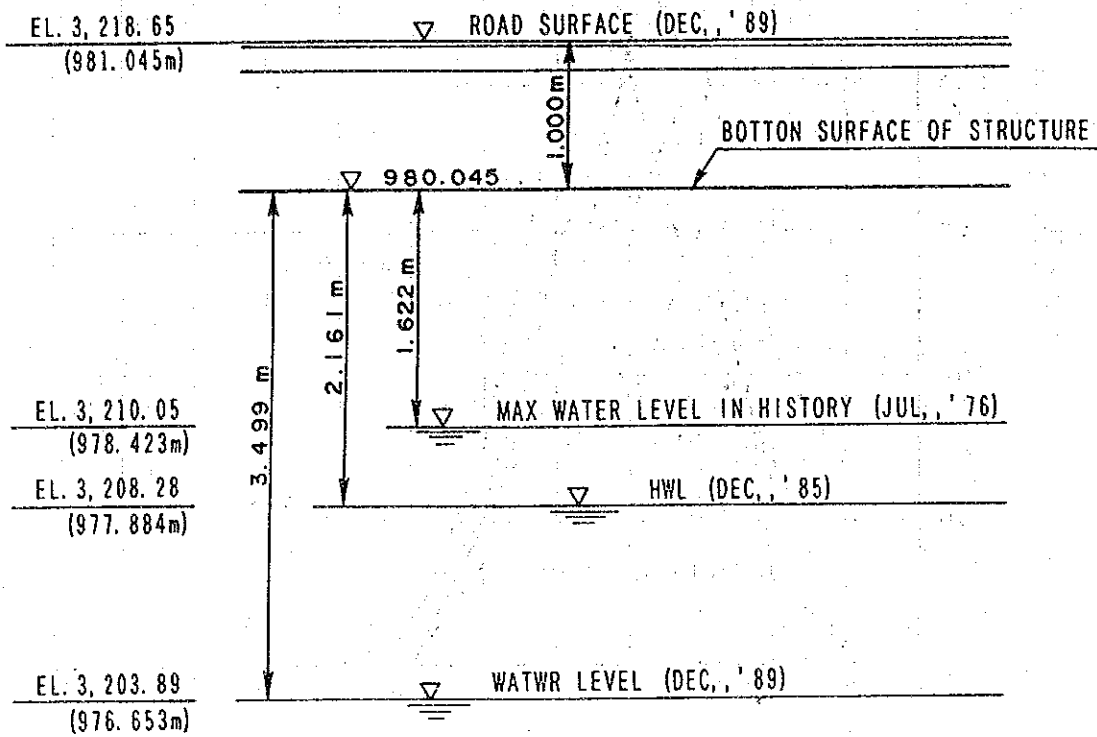


FIG. 2. MINIMUM MONTHLY WATER LEVEL

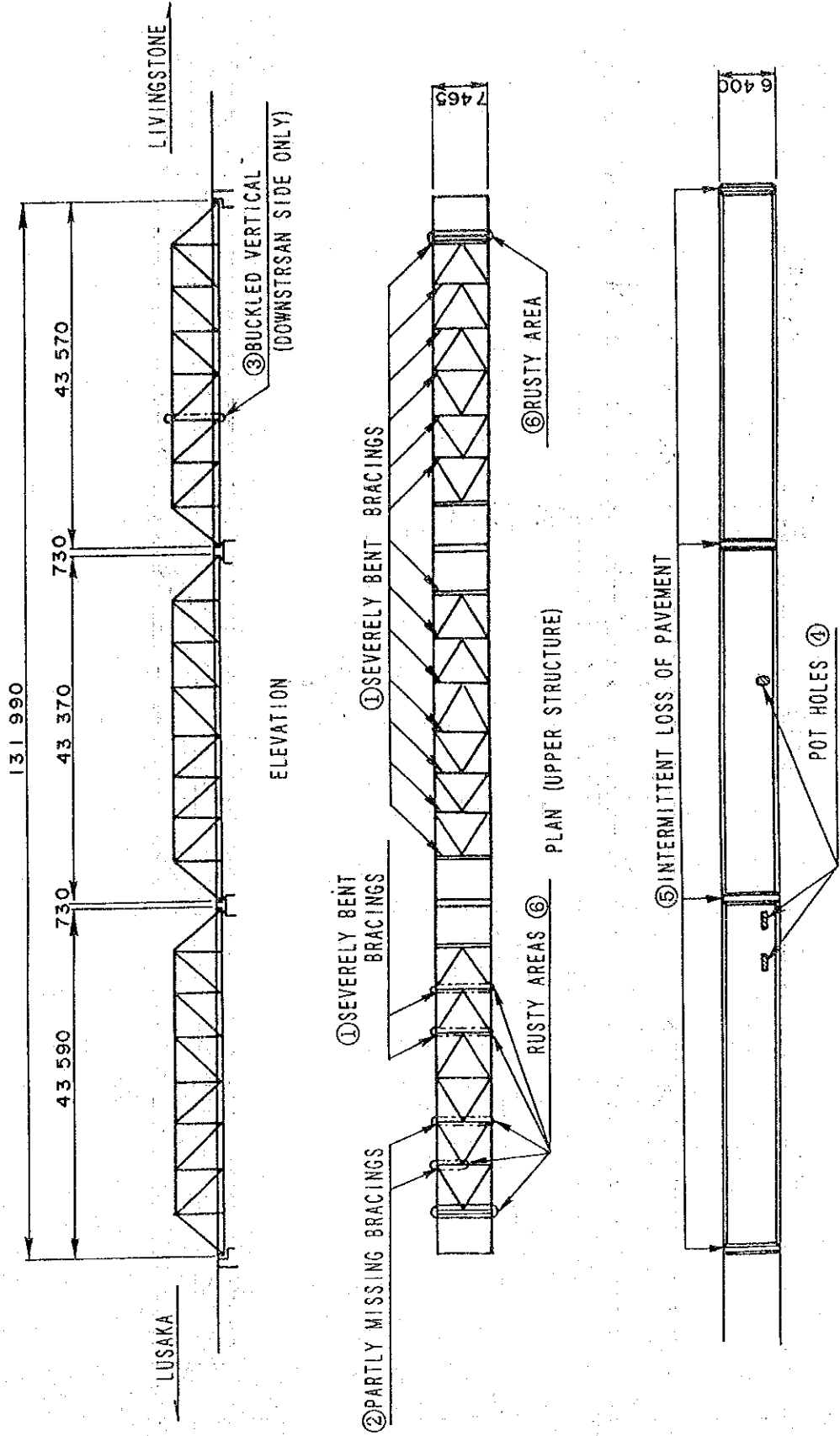
APPENDIX 5-2 RAINFALL RECORD AT KAFUE RAIL

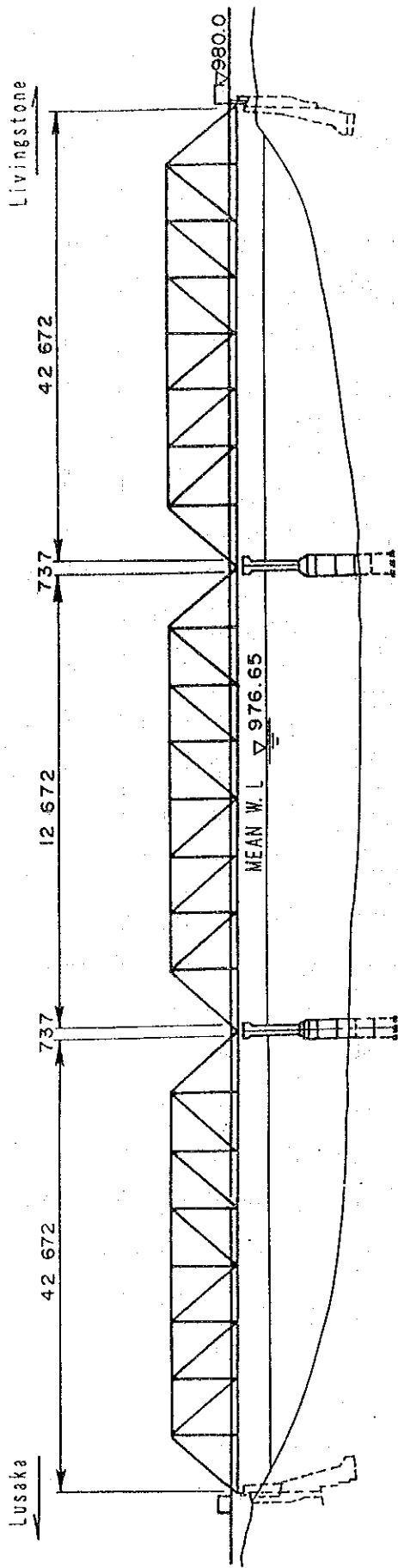


APPENDIX 5-3 CLEARANCE BENEATH THE KAFUE ROAD BRIDGE

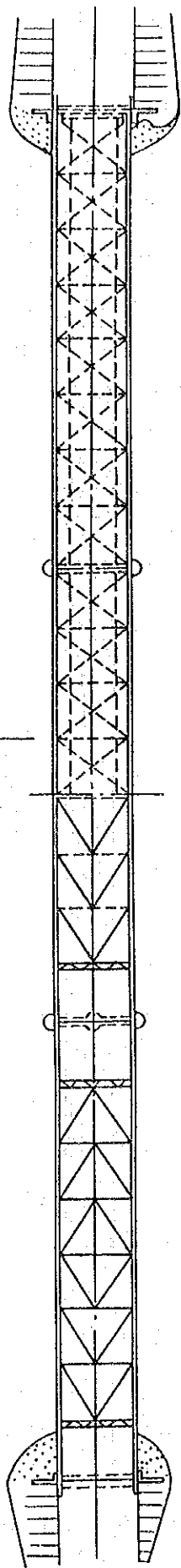


APPENDIX 5-4 IDENTIFICATION OF DAMAGES





Kafue River



Appendix 5-5 General Arrangement of the Kafue Road Bridge

APPENDIX 6-1 "ROAD CLASSIFICATION"

1. Summary of Road System

T	International Main Roads
M	Main Roads
D, RD	District Roads
B	Branch Roads
R	Rural Roads
E	Estate Roads

2. Road Classification

Class	Formation Width at Finished Surface Level (Meters)	Carriageway	
		Width (Meters)	Type of Surface
Class 1A	13.30	7.30	Bituminous
Class 1B	10.10 to 12.70 According to Traffic Needs	6.70	Bituminous
Class 1C	10.10	6.10	Bituminous
Class II	10.10	Minimum 6.10	Gravel
Class III	7.50	Minimum 5.50	Gravel where Necessary for All Weather Standard
Unclassified	Cleared and Stumped Track of 5.50 minimum Width and Skeleton Drainage		Earth with 3.50 Gravel Surface Where Essential

APPENDIX 6-2 GEOMETRIC DESIGN CONDITIONS

Road Classification		Class I A	Bituminous B	C	Class II Gravel	Class III Gravel
Average daily traffic estimated for nth year after construction (ADT)		1,500 to 5,000	500 to 1,500	Up to 500	Up to 500	20 to 50
Width of surfaced carriageway (metres)		7.30	6.70	6.10	Min. 6.10	Min. 5.50
Shoulder widths (metres)		3	2-3	2	2	1
Flat	Design Speed (km/h)	100	100	100	80-100	60-80
Topo- graphy	Limiting Grade (%)	4	5	6	6	8
Rolling to Hilly Topo- graphy	Design Speed (km/h)	100	80-100	80	60-80	50-60
	Limiting Grade (%)	6	6	7	8	10
	Maximum length of limiting grade (metres)	220	220	180	150	N.A.
Mountain- us Topo- graphy	Design Speed (km/h)	80	60-80	60	50-60	30-50
	Limiting Grade (%)	7	8	8	10	12
	Maximum length of limiting grade (metres)	180	150	150	150	N.A.

Notes: 1. Where difficulty is encountered in obtaining lengths of limiting grade less than the maximum length stated in Table 3.2., reference should be made to the Director of Works (Roads).

2. Shoulder widths for Class I B roads should be chosen according to traffic needs and economics.

APPENDIX 6-3 DESIGN VEHICLES DIMENSIONS

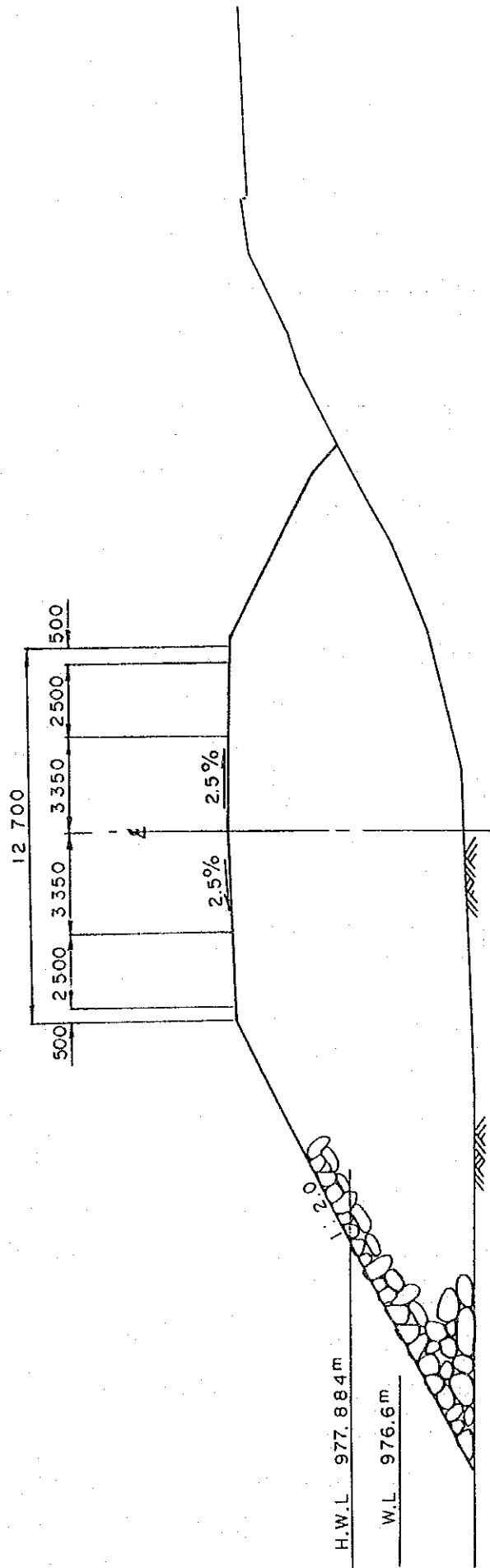
Design Vehicle		Dimensions in Metres				
Symbol	Wheel- base	Front Overhang	Rear Overhang	Overall Length	Overall Width	Height
Passenger P	3.3	1.0	1.5	5.8	2.1	-
Single Unit Trucks SU	6.1	1.2	1.8	9.1	2.5	4.1
Trailer WB-40	4.0+6.2 =12.2	1.2	1.8	15.2	2.5	4.1
Trailer WB-50	6.2+9.0 =15.2	1.0	0.6	16.8	2.5	4.1

APPENDIX 6-4 GEOMETRIC DESIGN STANDARD FOR KAFUE ROAD BRIDGE

Item	Unit	Design Standard
Design Classification	-	Class-1B
Design Speed	km/hr	100
Cross Section Elements		
Lane Width	m	3.35
Left Shoulder Width	m	2.00
Marginal Strip Width	m	0.30
Crossfall of Tavelled Way	%	2.5
Crossfall of Outer Shoulder	%	2.5
Vertical Clearance	m	5.0
Min. Stopping Sight Distance	m	160
Horizontal Alignment		
Min. Radius		
Absolute Min.	m	340
Desirable	m	700
Min. Radius Without Superelevation	m	5,000
(*) Min. Curve Length	m	1,200/a or 170
Max. Superelevation	%	10
Min. Transition curve Length	m	50
Min. Radius Without Transition Curve		1,500
Vertical Alignment		
Max. Grade		
Standard	%	3
Absolute Max.	%	6
Min. Vertical Curve Radius		
Crest, Standard	m	6,500
Crest, Desirable	m	10,000
Sag, Standard	m	3,000
Sag, Desirable	m	4,500
Min. Vertical Curve Length	m	50

Note:

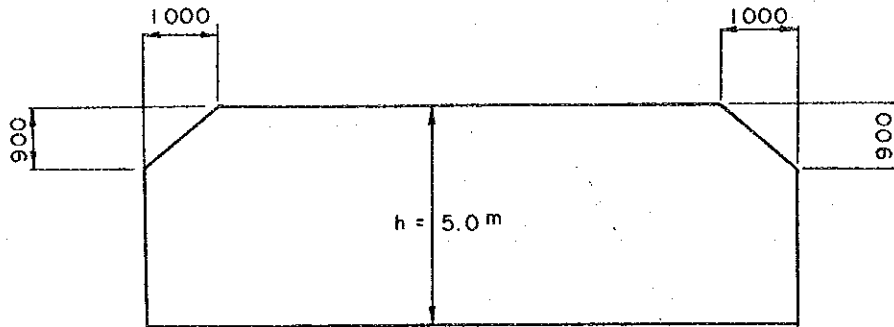
- 1) The above values are based on the "Standard Specifications for Geometric Design of Kafue Road Bridge."
- (*) 2) The value of "a" in minimum horizontal curve length shows an interesting angle in degrees (min. 2 degrees), when the angle is less than 7 degrees.



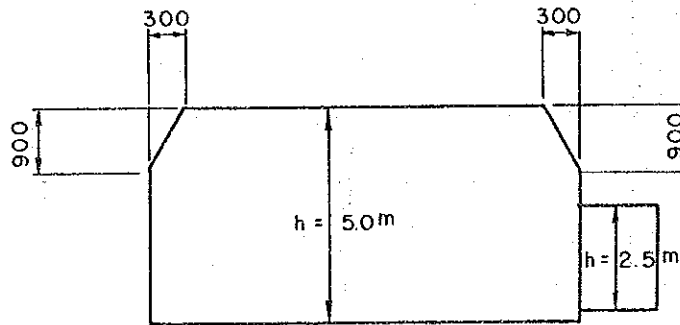
Appendix 6-5 TYPICAL CROSS SECTION
FOR APPROACH EMBANKMENT

All demensions are in mm, otherwise indicated

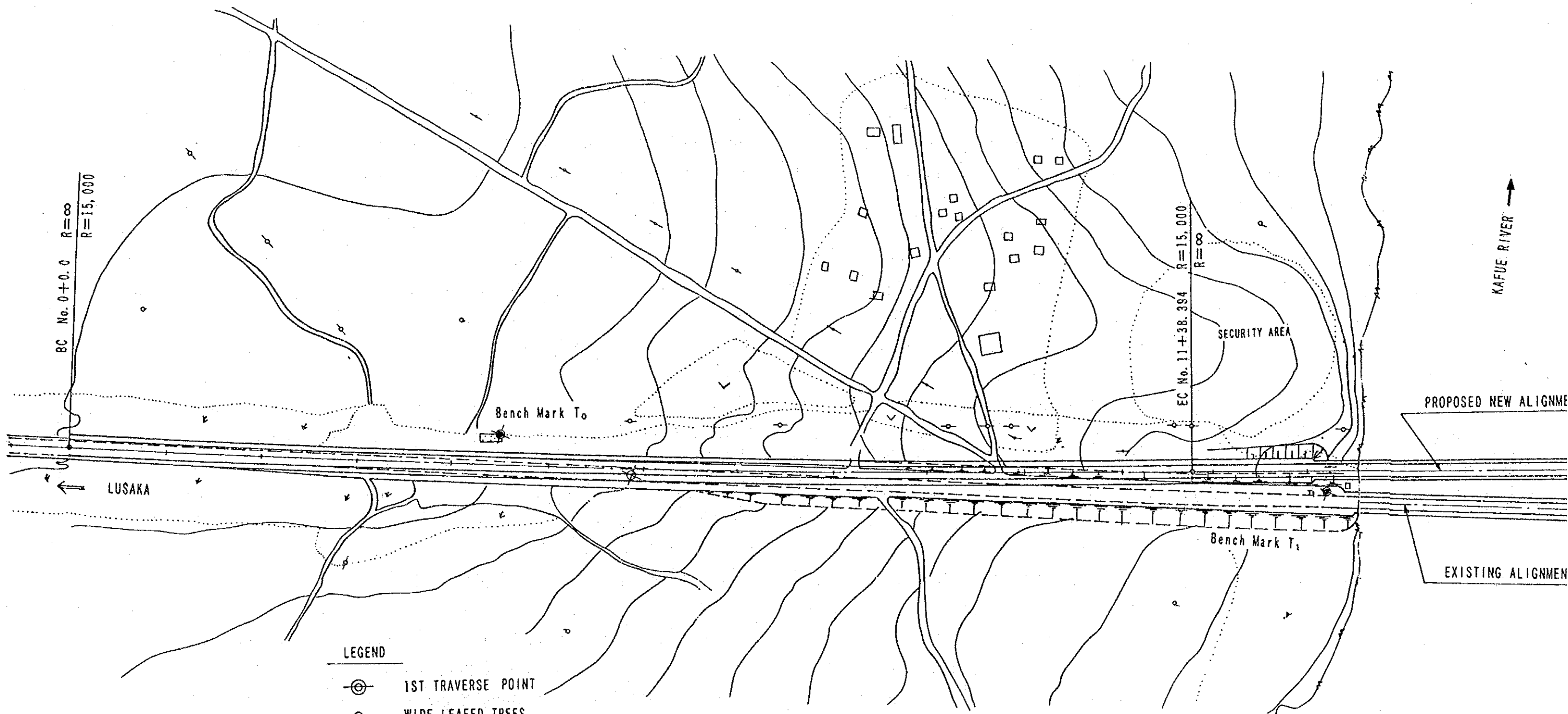
For Roadway Clearance on Embankment



For Roadway and Footpath no Bridge

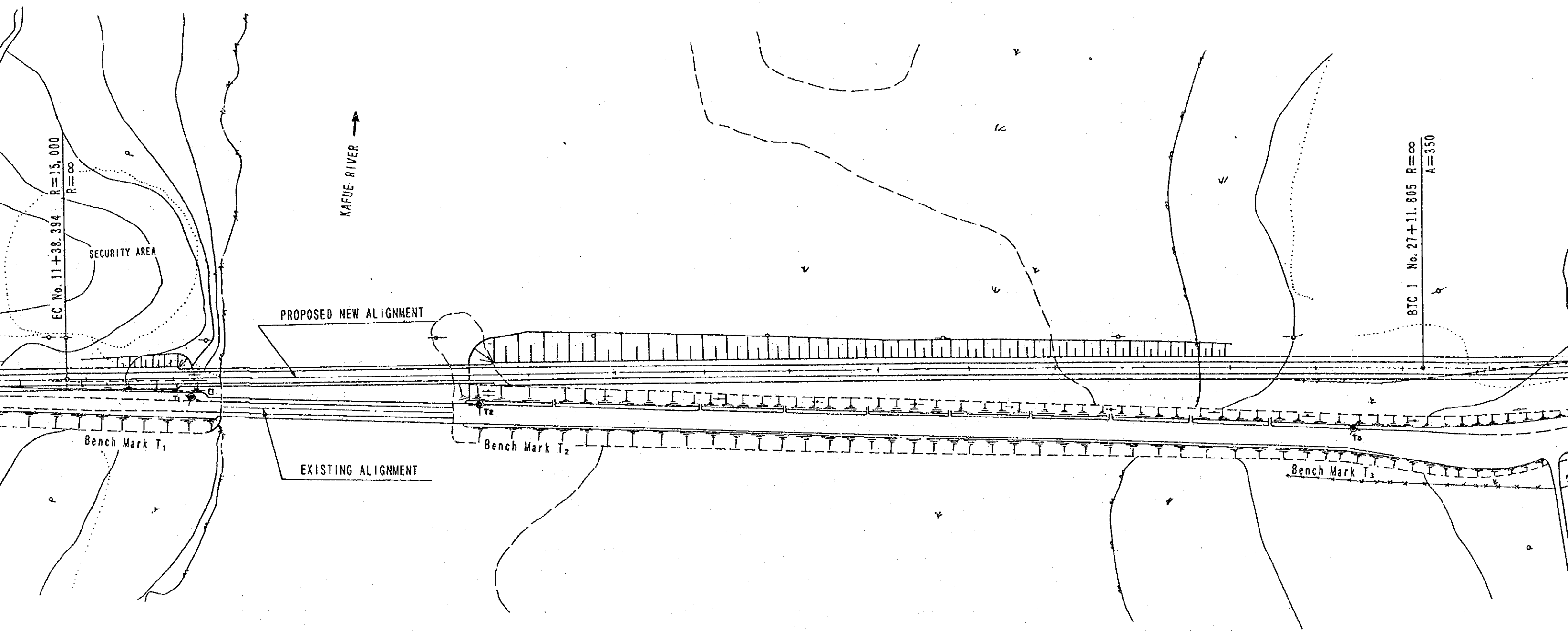


Appendix 6-6 CLEARANCE

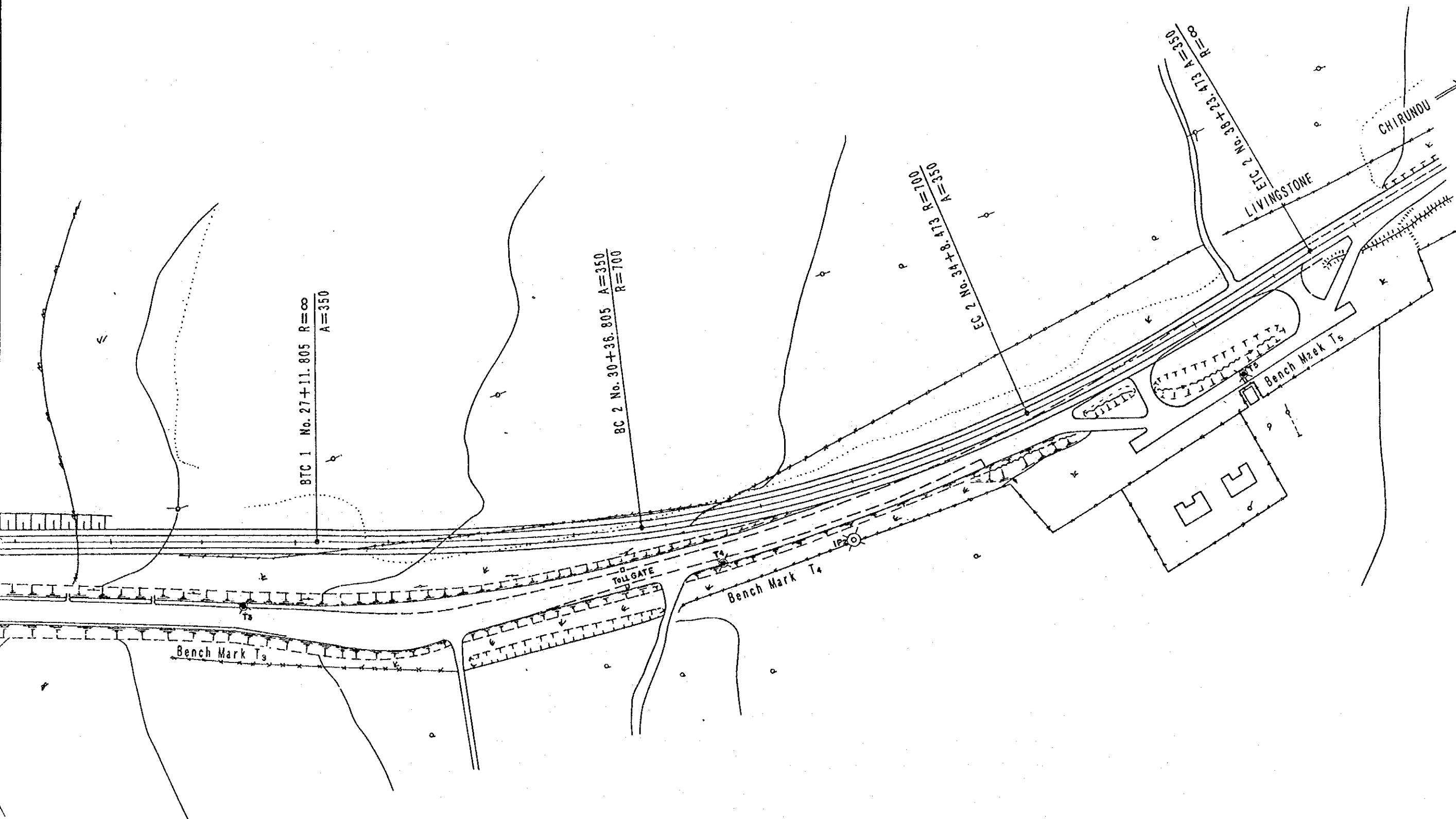


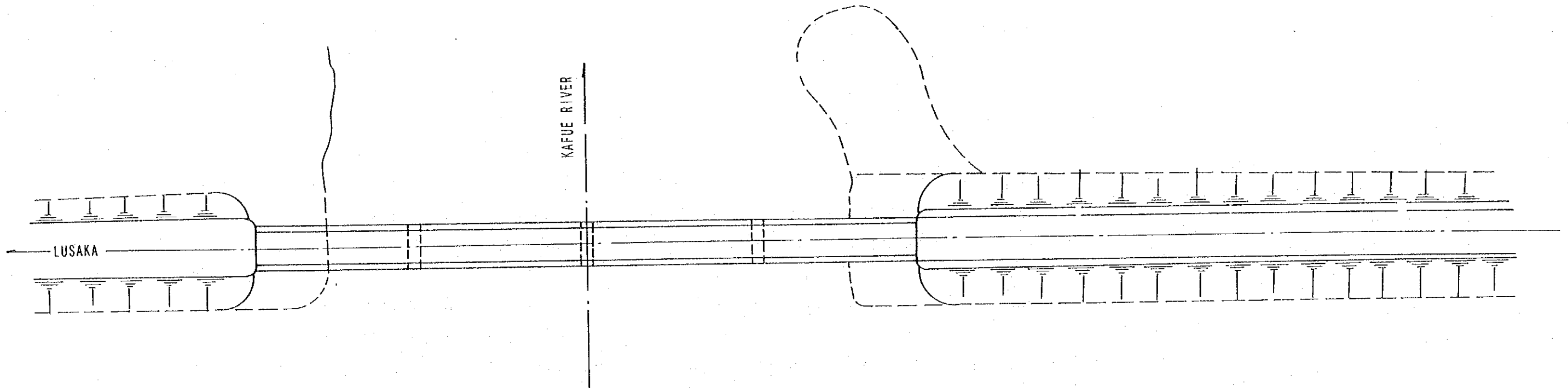
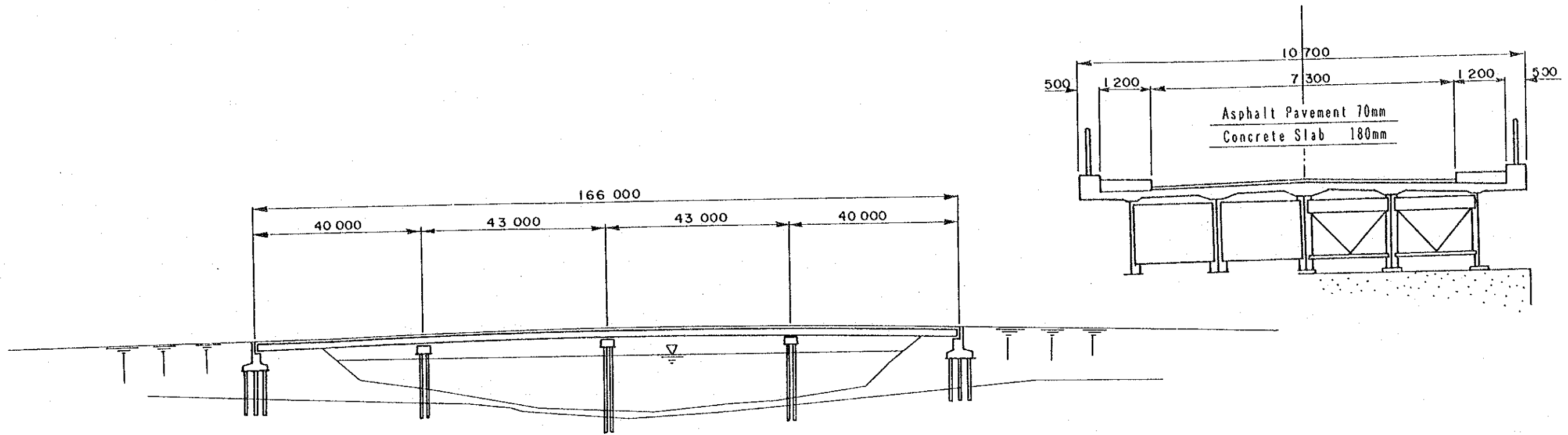
LEGEND

- ⊙ 1ST TRAVERSE POINT
- WIDE LEAFED TREES
- ∨ GRASSLAND
- POWERLINE
- TELEPHONE LINE
- BOUNDARY OF SAVANNAH
- | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|-------------------|
| <table border="0"> <tr><td>⌈</td><td>⌈</td><td>⌈</td></tr> <tr><td>⌋</td><td>⌋</td><td>⌋</td></tr> <tr><td>⌈</td><td>⌈</td><td>⌈</td></tr> <tr><td>⌋</td><td>⌋</td><td>⌋</td></tr> </table> | ⌈ | ⌈ | ⌈ | ⌋ | ⌋ | ⌋ | ⌈ | ⌈ | ⌈ | ⌋ | ⌋ | ⌋ | EMBARKMENT, SLOPE |
| ⌈ | ⌈ | ⌈ | | | | | | | | | | | |
| ⌋ | ⌋ | ⌋ | | | | | | | | | | | |
| ⌈ | ⌈ | ⌈ | | | | | | | | | | | |
| ⌋ | ⌋ | ⌋ | | | | | | | | | | | |

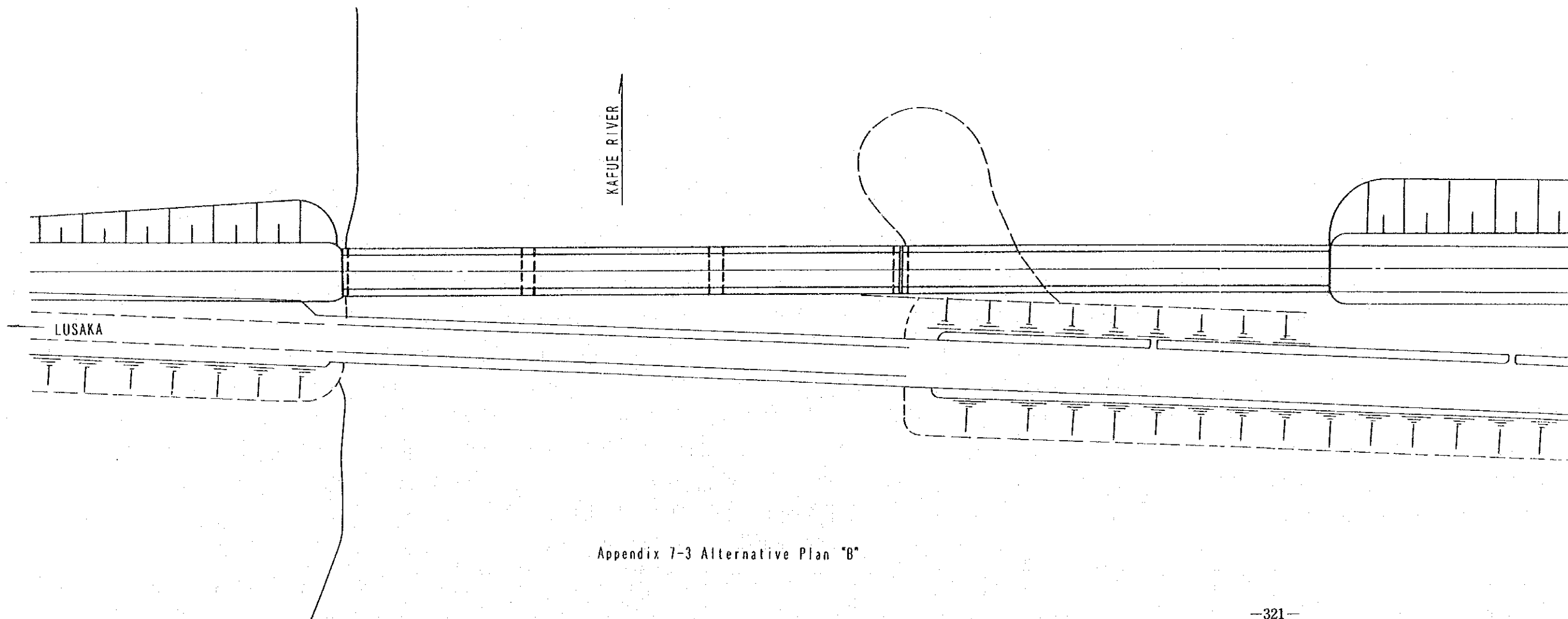
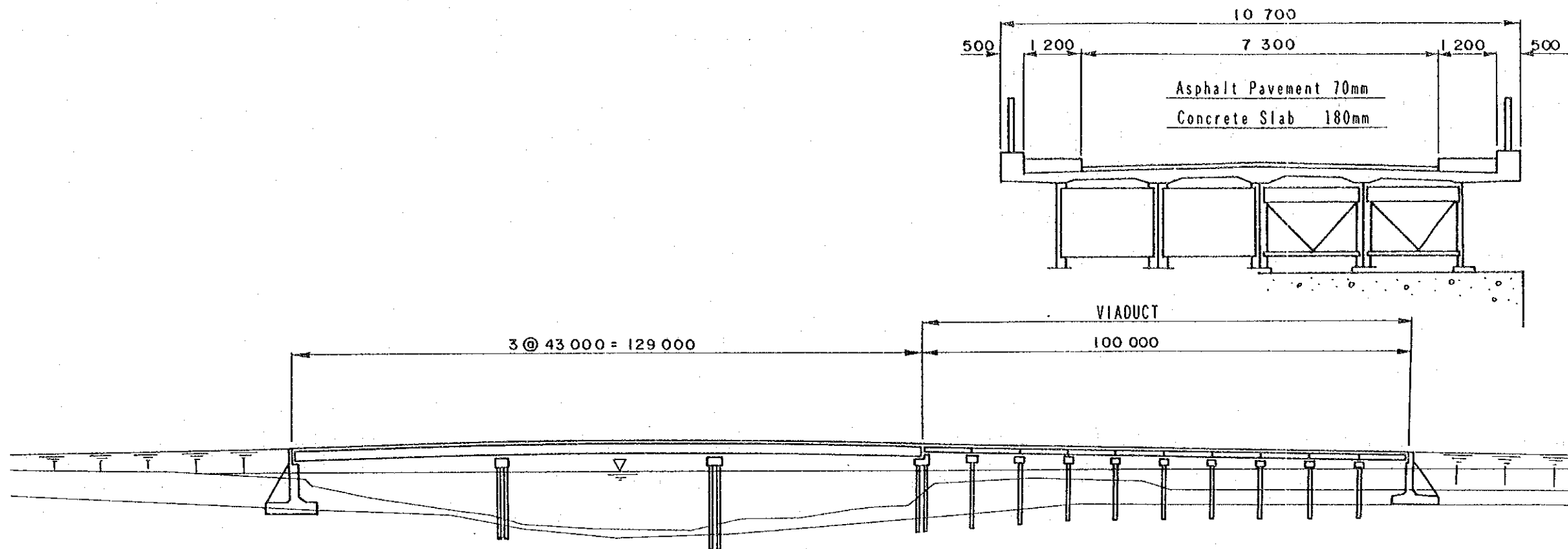


Appendix 7-1 PROPOSED ALIGNMENT

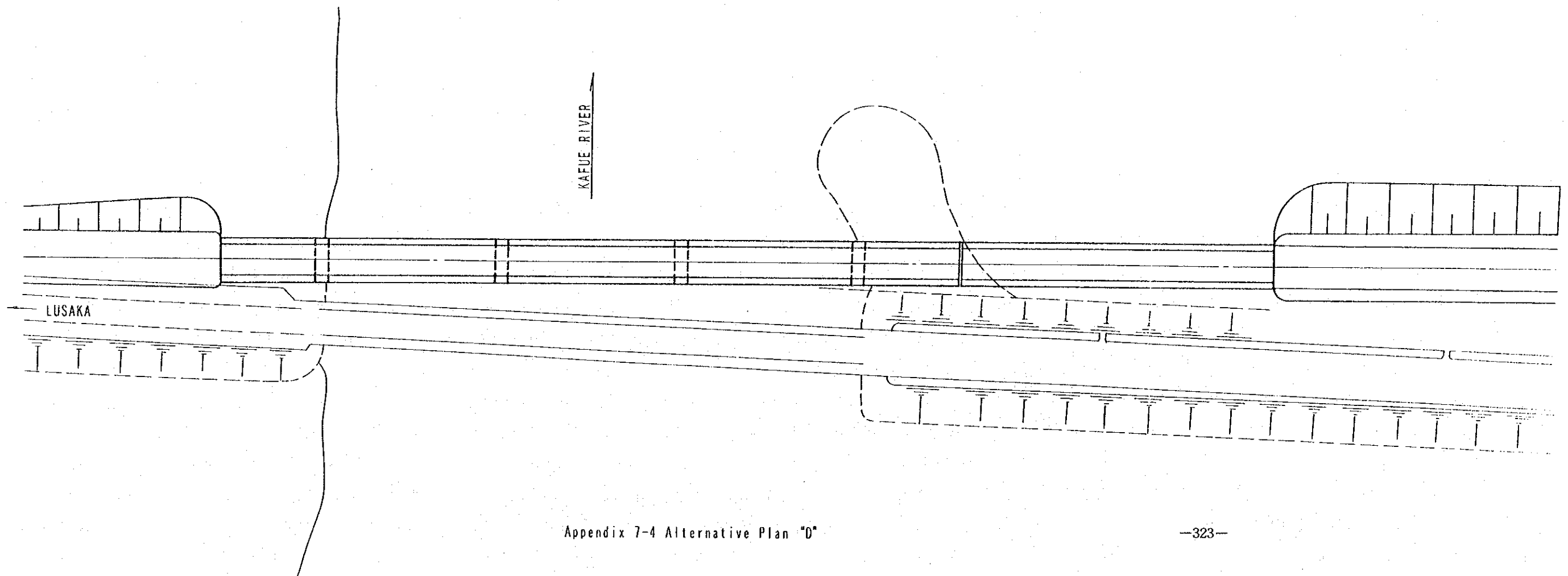
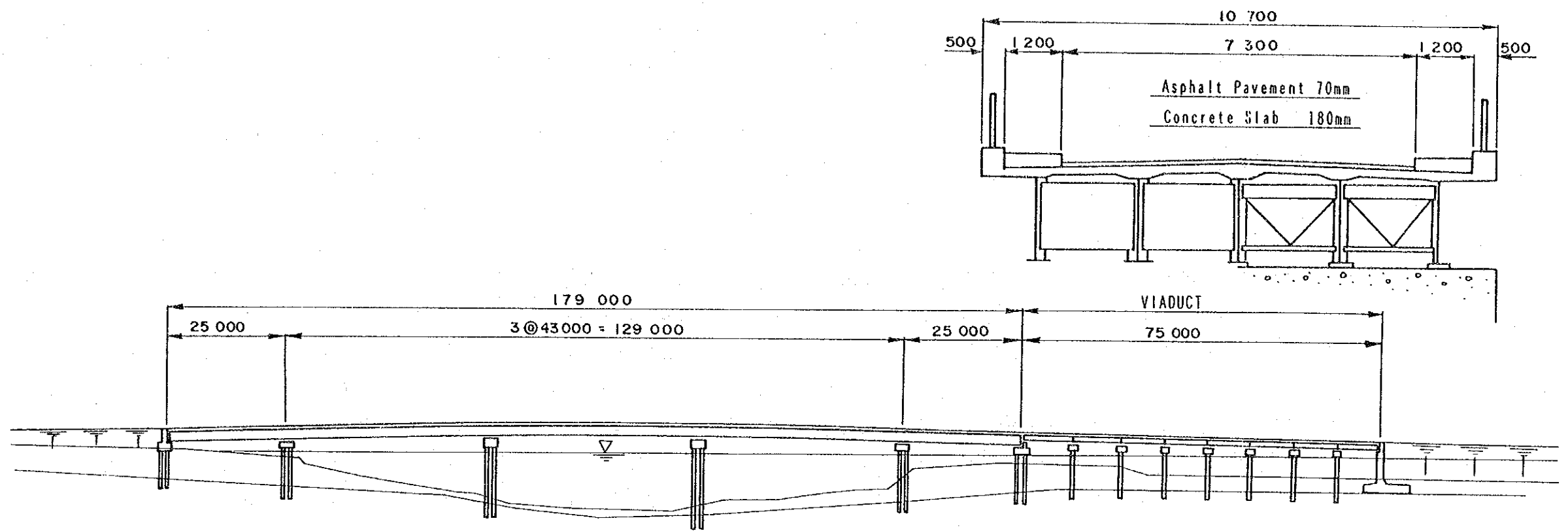




Appendix 7-2 Alternative Plan "A"



Appendix 7-3 Alternative Plan "B"



Appendix 12-1. Unit Price of Vehicle Operating Cost

		(Unit: Kwacha)	
(Type of Vehicle)		Passenger Car	Large Truck
(Representative Vehicle)		Toyota Cressida	Leyland 3-Axle Draw-Bar-Trailer
(1) Vehicle Price		598,800	1,356,000
Usage	Hour (/Year)	3000	3650
	Running (1000Km)	36	42
(2) Duration	Year	12	15
	Distance (1000Km)	432	630
	Salvage Value	20%	10%
(3) Depreciation	Time (Ratio/Year)	3%	3%
	Distance (Ratio/100000Km)	10%	7%
		44%	45%
(4) Tyre	Duration (1000Km)	60	60
	Unit Price	6,000	8,500
	Number of Tyre	4	4
	Total Price	24,000	153,000
(5) Fuel	Price (/l)	7.6	4.7
	Consumption (l/Km)	0.083	0.11
(6) Oil	Percentage for Fuel	6%	7%
(7) Maintenance	(/1000Km)	694	4638
(8) Insurance	(/Year)	80,000	22,300
(9) Personnel Cost		4,300	4,300
(10) Overhead		10%	20%
(11) Interest Rate		15%	15%
(A) Time (/Year)			
	Capital Cost	44,910	101,700
	Personnel Cost	4,300	4,300
	Insurance	80,000	22,300
	Depreciation	17,964	40,680
	(Subtotal)	147,174	168,980
	(Subtotal Converted to /1000Km)	4,088	4,023
(B) Distance (/1000Km)			
	Fuel	631	517
	Oil	38	36
	Tyre	400	2,550
	Maintenance	694	4,638
	Depreciation	610	969
	(Subtotal)	2,373	8,710
(C) Total		6,461	12,733
(D) Overhead		646	2,547
(E) Grand Total	(/1000Km)	7,107	15,280

Note : 1) Basic data are interviewed from car-dealers and trucking company.
 2) Data used are as of January, 1990.
 3) Exchange rate: US\$ 1 = Kwacha 40

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